DRAFT FINAL

FEASIBILITY STUDY REPORT

PARK-EUCLID WQARF SITE TUCSON, ARIZONA

Prepared for

Park-Euclid Group

April 28, 2016

URS

URS Corporation
6200 S. Quebec Street
Greenwood Village, CO 80111

Project No. 60405285

TABLE OF CONTENTS

Section 1 Introduction 1-1

1.1 Feasibility Study Purpose and Scope 1-1
1.2 Referenced Documents 1-1
1.3 Report Organization 1-2

Section 2 Site Background and History 2-1

2.1 Site Description and Physical Setting 2-1
2.2 Site Geology and Hydrogeology 2-1
2.3 Site Operational History 2-3
2.4 Site Contaminant Characteristics 2-3
2.5 Site Investigative Background 2-4
2.6 Site Remedial History and Early Response Actions 2-7
2.6.1 1982 – Removal of PCE-Containing Waste 2-8
2.6.2 1992 to 1994 – Production Well Abandonment 2-8
2.6.3 2001 – LNAPL Removal Pilot Testing 2-9
2.6.4 1999 to 2005 – Upper Vadose Zone Soil Vapor Extraction 2-9
2.6.5 2005 to 2014 – Multi-Phase Extraction 2-10
2.6.6 2005-2006 – Sewer Line Replacement 2-12
2.6.7 2014 to Present – Lower Vadose Zone Soil Vapor Extraction 2-12
2.6.8 2014 – Perched Aquifer Enhanced Reductive Dechlorination Bench Scale Testing 2-14
2.7 Project Remedial Objectives 2-15

Section 3 Site Contamination and Conceptual Model 3-1

3.1 Summary of Current Conditions and Contamination Extent 3-1
3.1.1 Upper Vadose Zone 3-1
3.1.2 Perched Aquifer 3-1
3.1.3 Lower Vadose Zone 3-2
3.1.4 Regional Aquifer 3-3
3.2 Conceptual Site Model and Exposure Pathways 3-4
3.2.1 Overview of Potential Exposure Pathways 3-4
3.2.2 Human Health Risk Assessment 3-6
3.2.3 Predictive Shallow Vapor Concentration Estimations 3-6
3.2.4 Potential for Transport from LVZ Soil to the RA 3-7
3.2.5 Transport of PCE to UA Production Wells 3-7
3.3 Regional Aquifer Groundwater Modeling 3-8
3.4 Feasibility Study Strategy and Assumptions 3-8
3.4.1 Upper Vadose Zone 3-8
3.4.2 Perched Aquifer 3-9
3.4.3 Lower Vadose Zone 3-10
3.4.4 Regional Aquifer 3-11

TABLE OF CONTENTS

Section 4 Identification and Screening of Remedial Technologies 4-1

4.1 Process Overview and Screening Criteria 4-1
4.2 Screening Remedial Measures and Strategies 4-1
4.3 Screening Technology Process Options 4-2
4.4 Technology Evaluation by Zone 4-2
4.4.1 Upper Vadose Zone 4-3
4.4.2 Perched Aquifer 4-4
4.4.3 Lower Vadose Zone 4-5
4.4.4 Regional Aquifer 4-5

Section 5 Development of Remedial Alternatives 5-1

5.1 Alternative Development 5-1
5.1.1 Upper Vadose Zone 5-1
5.1.2 Perched Aquifer 5-3
5.1.3 Lower Vadose Zone 5-6
5.1.4 Regional Aquifer 5-8
5.2 Summary of Remedies 5-21
5.2.1 Remedy 1 - Reference 5-21
5.2.2 Remedy 2 - Less Aggressive 5-22
5.2.3 Remedy 3 - More Aggressive 5-22

Section 6 Remedy Analysis 6-1

6.1 Comparison Criteria 6-1
6.2 Individual Analysis 6-2
6.2.1 Remedy 1 - Reference 6-3
6.2.2 Remedy 2 - Less Aggressive 6-4
6.2.3 Remedy 3 - More Aggressive 6-6
6.3 Comparative Analysis 6-8

Section 7 Proposed Remedy Description 7-1

7.1 Proposed Remedy Selection and Overview 7-1
7.2 Ex Situ Treatment Technology Selection 7-2
7.3 Permitting and Approvals 7-3
7.4 Individual Analysis 7-5
7.4.1 Practicability 7-5
7.4.2 Risk 7-5
7.4.3 Cost 7-6
7.4.4 Benefit 7-6

Section 8 References 8-1

TABLE OF CONTENTS

List of Tables

Table 4-1 Screening of Remedial Measures and Strategies

Table 4-2 Screening of Potentially Applicable Remedial Technology Process Options

Table 4-3A Technology Evaluation for the UVZ

Table 4-3B Technology Evaluation for the PA

Table 4-3C Technology Evaluation for the LVZ

Table 4-3D Technology Evaluation for the RA

Table 5-1 Alternatives and Remedy Development and Descriptions

Table 6-1 Practicability Evaluation of the Reference Remedy

Table 6-2 Practicability Evaluation of the Less Aggressive Remedy

Table 6-3 Practicability Evaluation of the More Aggressive Remedy

Table 6-4 Comparative Analysis and Scoring of Remedies

Table 7-1 Ex Situ Treatment Technology Evaluation for the Proposed Remedy

Table 7-2 Practicability Evaluation of the Proposed Remedy

List of Figures

Figure 1-1 Site Location Map

Figure 2-1 Well Locations and Existing Sampling Program

Figure 2-2 Plant Area Well Locations and Existing Sampling Program

Figure 2-3 Estimated Saturated Thickness Map of the Perched Aquifer

Figure 2-4 Structure Contour Elevation Map – Top of Upper Aquitard

Figure 2-5 Upper Aquitard Thickness Map

Figure 2-6 Contamination Migration Conceptual Site Model

Figure 2-7 MPE System VOC Mass Removal Rates as a Function of Time

Figure 2-8 SVE and/or MPE System Process Flow Diagram

Figure 3-1 Product Thickness and Distribution, February 2015

Figure 3-2 PCE and Degradation Components in Product, February 2015

Figure 3-3 Perched Aquifer Potentiometric Surface Map, February 2015

Figure 3-4 VC Distribution in Perched Groundwater, February 2015

Figure 3-5 Regional Aquifer Potentiometric Surface Map, February 2015

Figure 3-6 PCE Distribution in Regional Groundwater and Long-Term Trends, February 2015

Figure 3-7 Diagram of Park-Euclid Exposure Scenarios

Figure 5-1 UVZ Locations for Remedial Alternatives
Figure 5-2 PA Locations for Remedial Alternatives
Figure 5-3 LVZ Locations for Remedial Alternatives
Figure 5-4 RA Locations for the Reference Alternative
Figure 5-5 RA Locations for the More Aggressive Alternatives

List of Appendices

Appendix A MPE System As-Built Drawings
Appendix B LVZ ERA Information
B-1 LVZ SVE Pilot Test Tech Memo
B-2 LVZ ERA Work Plan
B-3 Air Quality Operating Permit 2144
B-4 LVZ ERA Operation and Maintenance Plan
Appendix C Perched Aquifer Groundwater Biotreatability Test Tech Memo
Appendix D Vapor Intrusion HHRA Evaluation
D-1 Vapor Intrusion HHRA Tech Memo
D-2 Vapor Intrusion HHRA Addendum
Appendix E Evaluation of Future Vapor Intrusion Risk Tech Memo
Appendix F Allowable Vapor Concentrations Back-Calculations
F-1 Using SRLs in the UVZ
F-2 Using GPLs in the LVZ
Appendix G Regional Aquifer Groundwater Modeling Report
Appendix H University of Arizona Water Supply Information
H-1 UA Response to Water Provider Questionnaire
H-2 Select Photographs of UA Water Supply Wells
H-3 UA Memorandum for Groundwater Pumping Rates
Appendix I PlumeStop™ Information
I-1 PlumeStop™ Product Information
I-2 PlumeStop™ Site Applicability Tech Memo
Appendix J Feasibility Study Cost Estimates
Appendix K Discharge to High School Wash Considerations

List of Acronyms

A.A.C.	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
ADWR	Arizona Department of Water Resources
AZPDES	Arizona Pollutant Discharge Elimination System
amsl	above mean sea level
ARS	Arizona Revised Statues
AWQSs	ADEQ Arizona Aquifer Water Quality Standards
bgs	below ground surface
cDCE	*cis*-1,2-dichloroethene
cm/s	centimeters per second
COCs	contaminants of concern
COPCs	contaminants of potential concern
CoT	City of Tucson
CVOCs	chlorinated volatile organic compounds
DEUR	Declaration of Environmental Use Restriction
Dhc	dehalococcoides
DMGP	De Minimis General Permit
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
ERA	Early Response Action
ERD	enhanced reductive dechlorination
FS	Feasibility Study
GAC	granular activated carbon
GPLs	groundwater protection levels
gpm	gallons per minute
HDPE	high density polyethylene
HGC	Hydro Geo Chem
HHRA	human health risk assessment
hp	horsepower
IDW	investigation derived waste
ISCO	in situ chemical oxidation

ISCR	in situ chemical reduction
J&E	Johnson & Ettinger
lb	pound
LNAPL	light non-aqueous phase liquid
LTM	long-term monitoring
LVZ	Lower Vadose Zone
µg/L	micrograms per liter
MCL	EPA maximum contaminant level
Mission	Mission Linen Supply
Mission Plant	301 South Park Avenue Mission Facility
MBE	Miller-Brooks Environmental, Inc.
MCLs	EPA maximum contaminant levels
MPE	multi-phase extraction
NFAD	no further action determination
NOI	Notice of Intent
NPV	net present value
NR-SRL	Non-Residential Soil Remediation Level
O&M	operation and maintenance
PA	Perched Aquifer
PA/SI	Preliminary Assessment/Site Investigation
PCE	tetrachloroethene
PCRWRD	Pima County Regional Wastewater Reclamation Department
PDEQ	Pima County Department of Environmental Quality
PLC	programmable logic controller
PIZB	permanganate impregnated zeolite beads
ppb	part per billion
ppmv	parts per million by volume
PQGWP	Poor Quality Groundwater Withdrawal Permit
PVC	polyvinyl chloride
RA	Regional Aquifer
RI	remedial investigation
RO	remedial objective

ROI	radius of influence
RSLs	EPA Regional Screening Levels
scfm	standard cubic feet per minute
SVE	soil vapor extraction
TCE	trichloroethene
the Site	Park – Euclid WQARF Site
tDCE	*trans*-1,2-dichloroethene
TTG	Tetra Tech GEO
UA	University of Arizona
URS	URS Corporation
USACE	US Army Corps of Engineers
UVZ	Upper Vadose Zone
VC	vinyl chloride
VOCs	volatile organic compounds
WOTUS	waters of the United States
WQARF	Water Quality Assurance Revolving Fund

Certification Page

This Feasibility Study Report for the Park – Euclid WQARF Site in Tucson, Arizona was prepared by URS Corporation on behalf of the Park – Euclid Group. This report has been prepared under the supervision of the undersigned and is consistent with the usual thoroughness and competence of the environmental and engineering professions. Interpretations are in accordance with generally accepted engineering principles and practices. No other warranty is expressed or implied.

Registered Professional Engineer (Chemical)
CERTIFICATE NO.
37331
JANET M.
WORKMAN
Date Signed 4-28-16
ARIZONA, U.S.A.
EXPIRES 03-31-2017

Janet M. Workman
Arizona Professional Chemical Engineer
Number 37331

Geoffrey G. Uhlemann
Environmental Engineer

Robert A. Boudra
Principal Hydrogeologist
Project Manager

Executive Summary

This Feasibility Study (FS) was developed in accordance with the Arizona Administrative Code (A.A.C.) Title 18, Chapter 16, Section 407 (A.A.C. R18-16-407) to identify a Reference Remedy and alternative remedies that are capable of achieving project remedial objectives (ROs) for the Park-Euclid Water Quality Assurance Revolving Fund (WQARF) Site (Site). The Site is located east of downtown Tucson, Arizona and includes facilities located at both 299 and 301 South Park Avenue, where laundry and dry cleaning operations began in the late 1930s. The Site contains soil, soil vapor, and groundwater contamination originating from releases of tetrachloroethene (PCE) used in dry cleaning operations at the 301 South Park Avenue facility (the Mission Plant). Dry cleaning operations were discontinued at the Mission Plant in 1985.

PCE and its degradation products have been observed in four zones including the upper vadose zone (UVZ) from 0 to 85 feet below ground surface (bgs), the Perched Aquifer (PA) from 85 to 95 feet bgs, the lower vadose zone (LVZ) from 110 to 200 feet bgs, and the Regional Aquifer (RA) located deeper than 200 feet bgs. A significant quantity of free product diesel fuel originating from upgradient offsite sources to the south of the Site is present on the water-table surface of the PA beneath the Mission Plant. The diesel fuel also contains dissolved PCE and its degradation products.

The ROs include restoration of soil conditions to the remediation standards and protection of the RA groundwater supply for the University of Arizona (UA) and the City of Tucson (CoT). Several early response actions (ERAs) have been implemented at the Site to reduce risk and decrease the remedial timeframe including soil vapor extraction (SVE) in the UVZ, multiphase extraction (MPE) in the PA, and SVE in the LVZ.

Presently soil concentrations in the UVZ are calculated to be below soil standards and no unacceptable risk is posed to potential receptors due to vapor intrusion. There is no anticipated risk of exposure to PA contamination as (1) PA groundwater is not used as a potable resource currently or in the foreseeable future; (2) there is no unacceptable risk posed from vapor concentrations in the UVZ; and (3) the upper aquitard immediately beneath the PA is an effective hydraulic barrier separating the UVZ and PA from direct migration of contaminants into the LVZ and RA.

Existing LVZ contamination beneath and downgradient of the Site is believed to be a residual source of contamination to the RA; therefore, SVE has been implemented in the LVZ as an ERA. Based on long-term monitoring (LTM), the RA PCE plume is approximately 1,200 feet wide, 3,200 feet long, and 130 feet deep (from approximately 200 feet to 330 feet below ground surface [bgs]). The migration of the RA groundwater plume is largely influenced by groundwater withdrawals by the UA potable supply wells and is estimated to travel approximately 60 feet per year toward the north-northeast under current groundwater extraction rates although downgradient LTM data suggests some stability in the distal RA PCE plume.

Remedial measures and strategies were evaluated for vapor, soil, and groundwater in the four zones (UVZ, PA, LVZ and RA) to achieve the ROs. A total of 68 individual technology process options were screened for applicability, of which 37 were carried forward for a more detailed evaluation against effectiveness, implementability, and relative cost to arrive at a retained subset of technologies and process options that are carried into further alternative development.

As required by A.A.C. R18-16-407, a Reference Remedy, a Less Aggressive Remedy, and a More Aggressive Remedy as summarized in the table below.

Zone	Reference Remedy	Less Aggressive Remedy	More Aggressive Remedy
UVZ	Pulsed SVE for 10 years, then MNA until Year 30	MNA until Year 30	SVE as vapor control to PA sparging for 5 years, then MNA until Year 35
PA	MNA until Year 200	MNA until Year 30 *includes contingency option*	In-well sparging for 5 years, then MNA until Year 35
LVZ	Implementing pulsed SVE for 10 years at 2 wells followed by expanded LTM until Year 30	Implementing pulsed SVE for 10 years at 2 wells followed by current LTM until Year 30	Implementing pulsed SVE at 2 wells for 1 year, then installing an additional SVE well and operating until Year 11, followed by expanded LTM until Year 31
RA	Installing a 775-foot long PlumeStop™ barrier from 200 to 330 feet bgs with LTM until Year 40	MNA with UA wellhead treatment for 200 years	Pump and treat at a single extraction well at 50 gallons per minute and (A) conveying treated water to UA, (B) discharging to High School Wash, or (C) reinjecting to the RA, for 30 years, followed by LTM until Year 40

The Reference Remedy and two alternative remedies were further evaluated against comparison criteria (practicability, risk, cost, and benefit) and with respect to one another. Based on the comparative analysis and numeric scoring given to the various alternatives, the highest scoring alternatives for each zone were assimilated to develop the Proposed Remedy, which utilizes a combination of alternatives from the reference, less aggressive, and more aggressive remedies. The Proposed Remedy includes:

- The Reference UVZ Alternative: Pulsed SVE for 10 years followed by MNA until Year 30;
- The Less Aggressive PA Alternative: MNA for 30 years with the potential for implementing a PlumeStop™ barrier contingency measure;
- The Reference LVZ Alternative: Implementing pulsed SVE at 2 wells for 10 years with an expanded LTM network for monitoring until Year 30; and
- The More Aggressive RA Alternative: Pump and treat with a single extraction well at 50 gallons per minute (gpm) and ex situ GAC treatment for 30 years, followed by LTM until Year 40. Several options were evaluated for use of the treated water including (A) conveyance to UA, (B) discharging to High School Wash, and (C) reinjecting to the RA. At this time, discharging to High School Wash is the recommended option.

The total estimated cost for implementing the Proposed Remedy in the first year (Year 0) is approximately $3,280,000, with an anticipated total remedy cost of $11,130,000 (current dollar) and $9,420,000 (net present value) by remedy completion. The Proposed Remedy is anticipated to meet the requirements of the Arizona Revised Statues (§49-282.06), as it will:

I. Protect public health and welfare, as well as the environment by:

   a. Reducing and monitoring UVZ vapors to levels below those presenting a vapor intrusion risk and reducing UVZ soil concentrations below non-residential soil remediation levels (SRLs) beneath the Mission Plant area and confirming they are below residential SRLs elsewhere via soil vapor monitoring;

   b. Monitoring PA contamination to confirm its stability and long-term attenuation, establish institutional controls for future drilling in this area, and identifying a contingency measure;

   c. Remediating LVZ soils to concentrations below groundwater protection levels (GPLs) that are protective of RA groundwater; and

   d. Capturing and treating the RA groundwater plume.

II. To the extent practicable, provide for the control, management or cleanup of the hazardous substances in order to allow the maximum beneficial use of the waters of the state by:

   a. Remediating LVZ soils to concentrations below GPLs that are protective of RA groundwater; and

   b. Capturing and treating the RA groundwater plume.

III. Be reasonable, necessary, cost-effective, and technically feasible by:

   a. Implementing only technically feasible and necessary actions, specifically with respect to MNA in the PA;

   b. Utilizing existing remedial infrastructure for SVE in the UVZ and LVZ; and

   c. Selecting a remedial technology with the lowest degree of risk, fewest complications and disruptions to the City and nearby residents.

A Feasibility Study (FS) is a process to identify a Reference Remedy and alternative remedies that are capable of achieving the Remedial Objectives (ROs) for a site. This FS report was prepared for the Park-Euclid Water Quality Assurance Revolving Fund (WQARF) study area (Site) in accordance with the FS Work Plan (WP) completed by URS Corporation (URS) on behalf of the Park-Euclid Group (the Group) in June 2013. The Site is located in Tucson, Arizona (Figure 1-1).

1.1 FEASIBILITY STUDY PURPOSE AND SCOPE

This FS was developed in accordance with the Arizona Administrative Code (A.A.C.) Title 18, Chapter 16, Section 407 (A.A.C. R18-16-407) to identify a Reference Remedy and alternative remedies that are capable of achieving project ROs. At least two alternative remedies shall be developed for comparison with the Reference Remedy, one of which must be more aggressive than the Reference Remedy, and one of which must be less aggressive than the Reference Remedy. The objectives of this FS include:

- Developing alternatives and remedies (Section 5) that are evaluated with respect to comparison criteria given in Arizona Revised Statues (ARS) §49-282.06 (Section 6).
- Recommending a Proposed Remedy (Section 7) capable of achieving the ROs.

According to ARS §49-282.06, the Proposed Remedy shall:

- Protect public health and welfare, as well as the environment;
- To the extent practicable, provide for the control, management or cleanup of the hazardous substances in order to allow the maximum beneficial use of the waters of the state; and
- Be reasonable, necessary, cost-effective, and technically feasible.

1.2 REFERENCED DOCUMENTS

Although there are numerous documents referenced as listed in Section 8, this FS summarizes and largely relies on information contained in the following documents:

- The Vadose Zone Confirmation Study (URS 2003a);
- The Remedial Objectives Report (Arizona Department of Environmental Quality [ADEQ] 2008);
- The Final Remedial Investigation Report (RI) (Tetra Tech GEO [TTG] 2011);
- The Baseline Report for Long-Term Monitoring and Remedial System Performance (URS 2011); and
- The 2015 Annual Report for Long-Term Monitoring (URS 2015).

The information contained in the FS is drawn from and, in some instances, quoted directly from the above-referenced documents without attribution other than that noted here.

1.3 REPORT ORGANIZATION

This FS report is presented according to the following sections:

1. **Introduction:** states the purpose and scope of the FS.
2. **Site Background and History:** discusses Site information including its hydrogeological conditions; operational, investigative, and remedial history; and the project ROs.
3. **Site Contamination and Conceptual Model:** summarizes the current Site conditions, presents the Site conceptual model including exposure pathways, and states the strategy and goals for each zone in achieving the ROs.
4. **Identification and Screening of Remedial Technologies:** identifies and screens potentially applicable remedial technologies beginning with a broad evaluation and moving to a more detailed evaluation for each zone.
5. **Development of Remedial Alternatives:** retained technologies from Section 4 are assimilated into alternatives, whose implementation details are described at a conceptual design level. The developed remedies are comprised of the individual alternatives from each zone.
6. **Remedy Analysis:** the three remedies (Reference, Less Aggressive, and More Aggressive) are analyzed on an individual basis with respect to comparison criteria and then with respect to each other.
7. **Proposed Remedy Description:** a Proposed Remedy is selected and described based on the analysis in Section 6.
8. **References:** presents literary sources and reports referenced during the preparation of this FS report.

This section describes the Site location, hydrogeological conditions, and Site history including its operational, investigative, and remedial history. Figures 2-1 and 2-2 depict well locations for the overall Site and Mission Linen Supply (Mission) facility (Mission Plant) area, respectively.

2.1 SITE DESCRIPTION AND PHYSICAL SETTING

The Park-Euclid Site is located east of downtown Tucson, Arizona and covers an area of approximately 255 acres generally located in the northwest quarter of Section 18, Township 14 South, Range 14 East of the Gila and Salt River Base and Meridian in Pima County, Arizona (TTG 2011). The Site is essentially flat with a very gradual northward slope (approximately 50 feet per mile) and is physically bounded by 8th Street to the north, 14th Street to the south, Park Avenue to the west, and Mountain Avenue to the east (Figure 1-1). The Site vicinity is urban and includes commercial businesses, light industry, warehouses, residential neighborhoods and apartments.

The Mission Plant is located at 301 South Park Avenue and a Mission-owned facility exists just to the north at 299 South Park Avenue. The 299 South Park Avenue property is partially leased to non-industrial tenants from Mission. The main campus for the University of Arizona (UA) is located approximately 0.5 miles north of the Mission Plant area bordering the Park-Euclid Site boundary (Figure 2-1).

The 301 South Park Avenue facility is currently owned and operated by Mission, which provides industrial laundry and linen supply services to the Tucson area, primarily for restaurants, service stations, hotels, and janitorial services. Products cleaned include uniforms, bed linens, towels, industrial shop rags, dust mops, and dust mats. Since June 1985, Mission's operations have not included dry cleaning or the use of any chlorinated solvents in its industrial laundry process.

2.2 SITE GEOLOGY AND HYDROGEOLOGY

This section describes Site-specific geology, but details on regional geology can be found in the RI (TTG 2011). Current groundwater flow conditions are discussed in Section 3.1. The Park-Euclid Site is located within the western portion of the Tucson Basin, which is drained by the Santa Cruz River (approximately 1.4 miles west of the Site) and several smaller tributaries including the Arroyo Chico that crosses the northern area of the Site from east to west.

With respect to environmental investigations, the subsurface beneath the Site has been divided into the following five hydrostratigraphic zones: the upper vadose zone (UVZ) from 0 to 85 feet below ground surface (bgs), the Perched Aquifer (PA) from 85 to 95 feet bgs, the upper aquitard from 95 to 110 feet bgs, the lower vadose zone (LVZ) from 110 to 200 feet bgs, and the Regional Aquifer (RA) located deeper than 200 feet bgs. Each of these zones is comprised of interbedded sands, silts, and clays. The sediments are largely unconsolidated, although thin intervals of partially indurated sediments were encountered during drilling.

Upper Vadose Zone

Lithologically, the UVZ is comprised of unconsolidated to partially indurated sediments, including fine to coarse sands and gravel, clayey sands, silty sands, and sandy clays, in a variety of combinations and textures. Individual lithologic units vary in thickness from inches to tens of feet. The fine-grained sediments generally have low plasticity and the coarser sands are

muscovite-rich. Larger gravels and cobbles are present at many borehole locations, especially within the uppermost 60 feet of the interval. Flexible wall parameter tests conducted on samples from the UVZ indicated hydraulic conductivities ranging from 0.001 to 4.3 feet per day (3.6×10^{-7} to 1.5×10^{-3} centimeters per second [cm/s]) (TTG 2011).

Perched Aquifer

The PA consists of diverse mixtures of sand, silty sand, clayey gravel, and clayey sand. Lithologically, the upper aquitard consists of clayey sand, sandy clays, clayey gravels, and occasionally thin clay units. It should be noted that it is difficult to observe the top of the upper aquitard when conducting field investigations based on a review of boring logs and field notes.

The PA is relatively thin and laterally discontinuous in extent, with the saturated thicknesses ranging from 1 to 8 feet (mean of 3.5 feet) based on drilling observations. The saturated thickness is greatest southwest of the Mission Plant and decreases to the northeast (Figure 2-3). Slug tests of select PA wells conducted by several firms (TTG 2011) indicated hydraulic conductivity values ranging from 0.074 to 14 feet per day (2.6×10^{-5} to 4.9×10^{-3} cm/s), which is within the expected range for the variety of aquifer materials (sandy clay to clayey gravel).

The PA extends horizontally at least 1,200 feet south of the Mission Plant, based upon the presence of floating free product that reportedly originates south of Aviation Parkway, and extends at least as far north as 9th Street based on the presence of groundwater in well PBP-7.

Upper Aquitard

A structure contour map of the top surface of the upper aquitard (Figure 2-4) was created using 32 data points and indicates that the upper aquitard elevation is highest east and northeast of the Site and dips to the west-northwest. The upper aquitard thickness ranges from approximately 4 to 27 feet (mean of 16.5 feet) based upon observations at 15 boring locations where the aquitard was observed and fully penetrated (Figure 2-5). The upper aquitard thickness is greatest southwest of the Mission Plant, and gradually thins toward the northeast. Flexible wall parameter tests conducted on two samples from the upper aquitard indicated hydraulic conductivities of 0.001 to 0.5 foot per day (3.2×10^{-7} to 1.7×10^{-4} cm/s) (TTG 2011).

The upper aquitard was not observed during drilling of wells UAM-1, UAM-2, and UAM-3, nor was water noted at a depth consistent with the PA in other areas while drilling at UAM-2B. This suggests that the upper aquitard pinches out moving northeast between 9th Street and UAM-2/2B located approximately 2,100 feet north-northeast from the Mission Plant. At this interpreted aquitard extent, the sediments at similar depths and elevations are coarser-grained with sufficient permeability to allow groundwater to migrate downward such that the PA is not present in the northeastern portion of the Site.

Lower Vadose Zone and Regional Aquifer

The LVZ is composed of multiple individual fining-upwards sequences where coarser sand and gravel (when present) are located at the base of the sequence and are overlain by various admixtures of poorly sorted sand, silty sand, clayey sand, and clay. The fine-grained portions of some of these deeper fining-upwards sequences could serve as lower confining layers for other perched zones, although there is no evidence of deeper perched zones in boring logs.

The RA is considered to be hydraulically connected throughout the Tucson Basin is a regional aquifer and produces most of the potable drinking water for the City of Tucson. The saturated thickness of the RA is several thousand feet thick and is composed of interbedded sands, silty sands, clayey sands, and clays. Miller-Brooks Environmental, Inc. (MBE) reported hydraulic conductivity and transmissivity values for the upper alluvium within the RA of 30 to 40 feet per day and 1,500 to 4,000 square feet per day, respectively, and a specific yield of approximately 0.15 (MBE 2004). Most of the RA monitoring wells at the Site are screened in the upper portion of the aquifer; however, UA production wells (located north of the site) extend into deeper portions of the RA (i.e., 400 to 680 feet bgs).

2.3 SITE OPERATIONAL HISTORY

The Mission Plant was originally owned and operated by Haskell Linen as early as 1938. The plant was purchased by Mission on February 16, 1983 and is currently owned and operated by Mission to provide industrial laundry and linen supply services to the Tucson area. Dry cleaning was conducted at this facility utilizing tetrachloroethene (PCE) from 1971 until June 11, 1985.

The 299 South Park Avenue property to the north of the Mission Plant is also owned by Mission and is partially leased to non-industrial tenants. This facility was originally owned and operated by Cascade Linen, recorded as early as 1949, until Haskell Linen purchased the property in the mid-1960s. Dry cleaning was conducted at the 299 South Park Avenue facility until approximately 1971 when the dry cleaning equipment was moved to 301 South Park Avenue.

The dry cleaning equipment consisted of two large dry cleaning machines and one 2,000-gallon aboveground PCE storage tank with aboveground piping. The machines and the storage tank were removed in 1985. Employee interviews that were conducted by Earth Tech (Earth Tech 1991) indicated that spills occurred in the former dry cleaning area of the Mission Plant. Releases reportedly included accidental overfills of PCE tanks and accidental spills from the dry cleaning machines. These spills likely moved through joints and cracks in the floor of the building to underlying soils and also likely reached sewer lines through floor drains and sumps (TTG 2011). The sewer line was later discovered during the Remedial Investigation to be in disrepair and leaking and was subsequently abandoned and replaced.

2.4 SITE CONTAMINANT CHARACTERISTICS

As discussed above, PCE spills occurred in the former dry cleaning area of the Mission Plant. These spills likely moved through joints and cracks in the floor of the building to underlying soils and also likely reached sewer lines through floor drains and sumps (TTG 2011). Leaks from the sewer lines are likely a former pathway for PCE to migrate to the subsurface. Releases reportedly included accidental overfills of PCE tanks and accidental spills from the dry cleaning machines.

Sampling activities performed during previous investigations identified elevated concentrations of chlorinated solvents including PCE and degradation products, such as trichloroethene (TCE), *cis*-1,2-dichloroethene (cDCE), trans-1,2-dichloroethene (tDCE), and vinyl chloride (VC), in both the upper and lower vadose zones and perched and regional groundwater beneath the Site. Previous investigations suggest that residual PCE may have been adsorbed on the clayey shallow soils and low permeability layers within the UVZ. A significant thickness of free product diesel

fuel (product or light non-aqueous phase liquid [LNAPL]), originating from upgradient offsite petroleum release(s) to the south of the Site, is present on the water-table surface of the PA immediately underlying the UVZ. The diesel fuel contains dissolved PCE and its degradation products in groundwater samples collected during the remedial investigation beneath the Mission Plant.

The annular spaces surrounding two former water-supply wells at the Mission Plant are the presumed conduits allowing vertical contaminant migration through the upper aquitard extending to the deeper RA at approximately 200 feet bgs. Historically, the decreasing elevation of the RA water table, subsequent to petroleum product migrating down these conduits to the RA, also is interpreted to have resulted in contaminant smearing in the LVZ as the regional water table declined. The former supply wells, Old Well and MP-1, were abandoned in 1992 and 1994, respectively (EMCON 1994). Following well abandonment, dissolved PCE and TCE concentrations in the RA began decreasing. Figure 2-6 depicts the Site Conceptual Model where:

- PCE and its degradation products are present in soil and as soil vapor within the UVZ beneath the Mission Plant.
- PCE and its degradation products are dissolved in LNAPL (diesel) overlying the PA.
- PCE and its degradation products are also dissolved within the PA groundwater.
- Diesel fuel, PCE, and PCE degradation products are present in soil within the LVZ as a result of Old Well and MP-1 likely acting as conduits from the PA to the RA. As the elevation of the RA water table decreased, these contaminants were believed to have smeared through the LVZ.
- Dissolved PCE and TCE are present in the RA.

2.5 SITE INVESTIGATIVE BACKGROUND

The WQARF Site encompasses soil and groundwater that have been impacted by chlorinated volatile organic compounds (CVOCs). The contaminants of concern (COCs) related to the Site are the dry cleaning chemical PCE and its biological breakdown products TCE, cDCE, tDCE, and VC. Well locations within the Site and Mission Plant are depicted in Figures 2-1 and 2-2, respectively. The site investigative background is summarized below, but activities are described in more detail in the RI (TTG 2011).

- **1990** – ADEQ sampled a well on Mission's property, identified as MP-1, as part of a study referred to as "The Downtown Tucson Study Area." ADEQ collected a sample of green liquid from the top of the water table, which was subsequently identified as diesel fuel containing concentrations of PCE at 2,700 micrograms per liter (µg/L) and TCE concentrations of greater than 15 µg/L. Analysis of a groundwater sample collected from beneath the LNAPL (diesel) layer in MP-1 indicated a PCE concentration of 11,000 µg/L.
- **March-June, 1991** – The first groundwater monitoring at the Site was performed by Earth Technology under contract to ADEQ in 1991 (Earth Technology 1991). Three RA monitoring wells (MLR-1, MLR-2, and MLR-3) were installed and sampled, and samples

from these wells contained diesel and PCE. The PA was not identified during this investigation (Earth Tech 1991). The activities also included an on-site soil vapor survey and an assessment of the on-site production wells MP-1 and Old Well, both of which indicated elevated concentrations of PCE and the presence of diesel product containing PCE.

- **1992** – EMCON, contracted to Mission, conducted an on-site investigation (Phase 1) of soil and groundwater impacts on the 299 and 301 South Park Avenue properties including a shallow soil vapor survey, geophysical logging and abandonment of Old Well, LNAPL removal, depth-specific sampling at MP-1, and groundwater monitoring and sampling of the three RA monitoring wells. The soil vapor survey indicated that PCE was present at concentrations of 7,837 to 11,900 parts per million by volume (ppmv) in soil vapor beneath the former dry-cleaning area at 301 South Park Avenue. The PA was first identified during the Phase 1 investigation (EMCON 1994).
- **1993** – EMCON was contracted to Mission for a Phase 2 RI and installed three PA monitoring wells (MLS-4, MLS-5, and MLS-6) and four soil vapor extraction (SVE) wells (SVE-1 through SVE-4). Following well installation, four wells (MLS-4, MLS-5, SVE-101, and SVE-103) were observed to contain LNAPL (EMCON 1995).
- **1993 to 1994** – EMCON performed Phase 3 RI activities including additional evaluations of liquid and sediments within MP-1, removal of LNAPL from MP-1, and abandonment of MP-1. RA well MLR-7 was installed and an aquifer test performed. A thin layer of LNAPL was observed in MLR-7. PCE was measured at 630 µg/L in a groundwater sample collected from MLR-7.
- **1998** – The United States Environmental Protection Agency (EPA) conducted activities in support of a Preliminary Assessment/Site Investigation (PA/SI) including installation of two upgradient PA monitoring wells, MLS-12 and MLS-13. Although LNAPL was observed within the two new wells, PCE was not detected above the reporting limit in groundwater samples collected from these wells.
- **1998 to 1999** – Following the Phase 3 investigation, Mission retained URS (formerly Dames & Moore) to continue investigation of the Site. URS' Phase 4 investigation included an investigation of the sanitary sewer, a vadose zone contaminant characterization, and a shallow aquifer investigation. Quarterly monitoring of the existing PA and RA monitoring wells was conducted for one year. Based on these monitoring results, the Phase 4 report (Dames & Moore 2000) concluded that the product plume and chlorinated solvent concentrations in the PA were relatively stable, and that the PA plume did not extend beyond the Arroyo Chico Wash. Concentrations of PCE in the RA beneath the Site generally decreased after the abandonment of the onsite production wells. Mission installed an SVE system to extract VOCs from the UVZ, as described in Section 2.6.
- **1999** – The Site was placed on the WQARF registry with a score of 51 out of a possible 120. ADEQ assumed the lead role in the RI and began sampling UA water supply wells.
- **2000** – ADEQ installed three sentinel RA wells (UAM-1, UAM-2, and UAM-3) between the Park-Euclid Site and the downgradient UA water supply wells. Monthly sampling of

the sentinel wells began in 2000 and continued through 2009. ADEQ also began sampling the Agriculture (Aggie), Architecture, Huachuca, Martin Street, and Optical supply wells on a monthly basis continuing through 2009. ADEQ also installed seven PA monitoring wells (PEP-8 through PEP-11, and PEP-16 through PEP-18) and two RA monitoring wells (PER-14 and PER-15) in 2000.

- **2001** – ADEQ performed an assessment to identify historical land uses and potential users of PCE, chlorinated compounds, and diesel fuel in the vicinity of the Park-Euclid Site. A pilot study was conducted to remove diesel LNAPL from the PA.
- **2002 to 2003** – ADEQ installed two PA monitoring wells (PEP-19 and PEP-24) and six RA monitoring wells (PER-21, PER-22, PER-23, PER-25, PER-26, and PER-27). In addition, ADEQ installed two LVZ vapor monitoring wells (VML-01 and VML-02) and one LVZ vapor extraction well (VEL-03).
- **2003**– Mission collected soil vapor samples at various depths. Four borings were completed inside the Mission Plant, and 16 remaining borings were completed outside the plant on Mission property and in the surrounding area. Mission completed four of the borings as nested vapor/vacuum monitoring wells (VW-04, VW-05, VW-06, and VW-07) with two-foot screened intervals located at approximately 5 feet bgs, 30 feet bgs, 55 feet bgs, and 85 feet bgs. ADEQ also installed three nested vapor monitoring wells (VW-01, VW-02, and VW-03) within the City of Tucson (CoT) right-of-way with screened intervals corresponding to the vapor monitoring wells installed by Mission. Mission also installed a multi-phase extraction (MPE) well (MPE-1) and a monitoring point (MPM-1) located east of the Mission laundry building within the PA for the purpose of testing MPE as a method to remove LNAPL containing CVOCs.
- **2004** – ADEQ evaluated health risks to residents adjacent to the 301 South Park Avenue facility and to on-site workers from soil vapors potentially volatilizing from subsurface soils into indoor air. Vapor flux testing was conducted at five locations within the Mission laundry facility and at eight ground surface locations near the property boundary. A screening health risk assessment indicated that VOCs and polycyclic aromatic hydrocarbons did not pose a significant risk to current and future residential receptors north and south of the facility, but potentially posed a risk to on-site industrial workers.

  URS performed quarterly vapor monitoring at a series of seven multi-depth well clusters screened in the UVZ to evaluate changes in chlorinated solvent concentrations in soil gas over time in response to ongoing SVE. Soil vapor monitoring was performed for a period of five quarters. The reports of these monitoring events concluded that average concentrations of chlorinated solvents decreased dramatically in nearly all wells and depths during this five-quarter period (May 2004 to April 2005).
- **2008** – ADEQ's contractor, TTG, installed sentinel well UAM-2B and RA monitoring well PER-14A. Well UAM-2B was screened beneath the screened interval for UAM-2 to assess the vertical extent of CVOCs. Well PER-14A was drilled near the existing well PER-14 and was screened across the top of the aquifer (180 to 250 feet bgs), while well PER-14 is screened in a deeper portion of the aquifer (i.e., 473 to 523 feet bgs) and consistently exhibits higher water levels than the surrounding wells. Groundwater

concentrations within PER-14A exhibited PCE concentrations of 1.2 to 12 µg/L following installation. TTG concluded that the PCE plume had not migrated vertically downward near the distal plume extent based on data from UAM-2B and that the deeper RA is confined below the Mission Plant based on vertical gradients observed between PER-14 and PER-14A (TTG 2011). Semiannual groundwater monitoring was performed by TTG through the second half of 2008, after which groundwater monitoring temporarily ceased due to ADEQ budget constraints.

- **2008** – ADEQ finalized the Remedial Objectives Report for the Park-Euclid WQARF Site (ADEQ 2008).
- **2008 to 2009** – Mission installed five MPE wells (MPE-2 through MPE-6) in the PA in preparation for installation of a multi-phase extraction remediation system (See Section 2.6). An MPE system was constructed with pilot phase operation occurring from April 16, 2008 to June 3, 2009 (see Section 2.6).
- **2011** – TTG published the Final RI for the Park-Euclid WQARF Site (TTG 2011).
- **2011 to 2014** – The Group completed periodic monitoring and sampling activities at the Site including soil vapor sampling, PA LNAPL and groundwater monitoring and sampling, and RA groundwater monitoring sampling The MPE system was re-started in August 2011 and operated through April 2014 at which time the system was shut down pending results of the FS. MPE system operation is described further in Section 2.6.
- **2014 to Present** – The Group has continued ongoing long-term monitoring (LTM) of the UVZ, PA, LVZ, and RA.

2.6 SITE REMEDIAL HISTORY AND EARLY RESPONSE ACTIONS

An early response action (ERA) is an action initiated prior to selecting a remedy under A.A.C. R18-16-410 and is implemented if the action is necessary to:

1. Address current risk to public health, welfare, and the environment;
2. Protect or provide a supply of water;
3. Address sources of contamination; or
4. Control or contain contamination where such actions are expected to reduce the scope or cost of the remedy needed at the site.

Several remedial activities and ERAs have occurred at the Park-Euclid WQARF Site including:

- 1982 – Removal of PCE-Containing Waste;
- 1992 to 1994 – Production Well Abandonment;
- 2001 – LNAPL Removal Pilot Testing;
- 2001 to 2005 – UVZ Soil Vapor Extraction;
- 2005 to 2014– Multi-Phase Extraction;
- 2005 to 2006 – Sewer Line Replacement;

- 2014 to Present – LVZ Soil Vapor Extraction; and
- 2014 – PA Enhanced Reductive Dechlorination (ERD) Bench Scale Testing.

These activities are discussed in detail below.

2.6.1 1982 – Removal of PCE-Containing Waste

The removal of PCE-containing waste occurred prior to the identification of contamination at the Park-Euclid Site, but is included here for completeness. As described in the RI Report (TTG 2011):

> "The Pima County Health Department noted waste on the vacant lot east of the Haskell/Mission Linen Facility across Fremont Avenue in 1980 and instructed Haskell Linen to "Clean up and remove all industrial wastes from the lot east of Fremont, and refrain from disposing of further wastes there, or elsewhere, in the future." In March 1982, ADHS, in response to a complaint, instructed Haskell Linen to "… remove from the lot all perchloroethylene (PCE) contaminated material/soil to a concentration level of 20 mg/kg or lower …"
>
> In March 1982, Haskell Linen collected samples from the source of the waste (not from the vacant lot). A drum of still bottom waste contained 11.8 percent PCE and a hot oil floor-cleaning machine sample contained 18.1 milligrams per kilogram (mg/kg) PCE. Two samples collected from the waste on the vacant lot were found to contain 10.6 mg/kg and 200 mg/kg PCE."
>
> "In April 1982, Haskell Linen collected seven soil samples after removal of the waste and soil (21.06 tons) to a hazardous waste landfill (BKK in California), and three samples from a pile of mixed soil and oily diatomaceous earth that was later removed to a local landfill in Tucson. Analysis reported that no sample contained PCE above the laboratory detection limit. Haskell Linen collected duplicate samples from the pile of soil and diatomaceous earth, which were reported to contain 0.112 mg/kg and 0.056 mg/kg PCE. A duplicate soil sample collected from dark-colored material remaining after removal of the waste contained 0.0047 mg/kg PCE. On April 26, 1982, ADHS notified Haskell Linen that "Haskell Linen has satisfactorily completed the perchloroethylene cleanup."
>
> "The exact location of the waste disposal area is not known, but is assumed to be on and adjacent to the unpaved 13th Street right-of-way. The soil samples collected by Haskell Linen indicate the waste was distributed over an area approximately 100 feet by 150 feet. The entire area appears to be within or on the edge of the proposed area of excavation for Arroyo Chico Detention Basin One."

2.6.2 1992 to 1994 – Production Well Abandonment

Remedial investigations (see Section 2.5) at the Site indicated that the production wells, Old Well and MP-1, created a conduit for LNAPL and groundwater from the PA to migrate through the aquitard from the LVZ to the RA. Groundwater monitoring results showed elevated PCE and diesel concentrations in MP-1 and the Old Well.

In September 1992, Old Well was abandoned by cutting the casing at 44-foot depth intervals from the base of the well up to 21 feet bgs. The upper 21 feet were "continuously" perforated by

cutting a series of four holes every foot from 21 feet bgs to the ground surface. The entire well casing was then filled with cement grout by pumping using a tremie pipe at the base of the well (TTG 2011).

In June 1994, MP-1 was abandoned by perforating the casing over the entire depth. The well was then filled with sand/cement slurry via tremie from the total depth to 240 feet bgs, and then with neat cement to the ground surface (TTG 2011). A soil sample collected from native soil below the base of the well (at a depth ranging from 511 to 515 feet bgs) did not contain any VOCs (TTG 2011). This sample was collected after reaming so that the knifing tools and tremie tube could be lowered to the total well depth for abandonment by grouting.

Subsequent to well abandonment, the water table in the RA continued its long-term decline potentially perching diesel product on or smearing it within lower permeability layers in the LVZ above the RA. Onsite concentrations of PCE in the RA were noted to be generally decreasing as a result of abandoning the onsite production wells (URS 2015).

2.6.3 2001 – LNAPL Removal Pilot Testing

A pilot study was conducted to remove diesel fuel LNAPL from the PA. Two portable free product recovery units were designed and installed by Mission in SVE-101 and SVE-103, and ADEQ conducted joint testing with Mission for six weekends in September and November 2001. The units were moved to the wells during the weekend and stored away during the work week. Operation of the portable units resulted in limited LNAPL recovery and pilot testing of the units ceased in 2002.

2.6.4 1999 to 2005 – Upper Vadose Zone Soil Vapor Extraction

Using the results of the Phase 4 UVZ site characterization, URS performed an Engineering Evaluation/Cost Analysis (EE/CA) in accordance with the EPA Non-Time Critical Removal Action guidance document. The final EE/CA report (Dames & Moore 1999) evaluated a number of options for removing soil contamination beneath the Site and recommended SVE as the preferred alternative. Design and construction of the SVE system was performed during the summer and fall of 1999. The SVE system consisted of four extraction wells (SVE-101, SVE-102, SVE-103, and SVE-104) screened across the vadose zone from 30 feet to a depth of 90 feet bgs. These wells were plumbed to a manifold where a vacuum pump and four granular activated carbon (GAC) canisters containing 6,400 pounds (lbs) of carbon were located.

After permitting of the system was completed in early 2000, normal operation of the SVE system was initiated on June 26, 2000. Normal operation consisted of a 12-hour operational day. Approximately 6,000 lbs, or 430 gallons, of VOCs were removed from the subsurface at the site by the SVE system between June 26, 2000 and July 2002. During that operational period, influent PCE concentrations declined from initial values of up to 6,000 ppmv to less than 100 ppmv during July 2002. 1,000 lbs of permanganate impregnated zeolite beads (PIZB) were added to one of the 2,000-lb carbon vessels on July 2, 2002, resulting in a total of 4,400 lbs of GAC in three vessels. The system hoses were reconfigured so that the PIZB vessel was the last vessel in series.

Monitoring results indicated that vapor concentrations reached asymptotic conditions and minimal additional PCE mass would be removed, using the existing vapor extraction well

system. During this ERA, there were several extended periods during which the system was not operating. Monitoring events following the longest shutdown period (December 2001 through April 2002) indicated minimal rebound in contaminant concentrations. Therefore, system operation was discontinued at the end of July 2002 pending a confirmation study.

The confirmation study (URS 2003a) concluded the following:

- Operating the SVE system resulted in a significant reduction in magnitude and extent of the soil vapor plume in the UVZ;
- PCE concentrations were reduced by approximately 90 percent;
- The interval above 30 feet indicated a smaller magnitude reduction in PCE concentration in soil vapor; and
- Degradation products of PCE including TCE, cDCE, tDCE, and VC were observed, indicating that reductive dechlorination was occurring beneath the Mission Plant.

Based on recommendations from the confirmation study, Mission re-initiated SVE in the UVZ in August 2004, eventually adding a fifth extraction well (SVE-105) screened in the interval between 5 and 30 feet bgs and adjacent to SVE-103. Operation with SVE-105 began on November 16, 2004 and continued through February 2006. The SVE system removed a total of 7,982 lbs of VOCs or about 584 gallons during the life of the SVE system (i.e., June 2000 through February 2006). The SVE system was shut down on February 15, 2006.

2.6.5 2005 to 2014 – Multi-Phase Extraction

This section discusses the MPE ERA operation from 2005 to 2014.

MPE Pilot Testing

In 2003, Mission installed MPE-1 and MPM-1 within the PA for the purpose of testing MPE as a remedial technology to remove LNAPL containing CVOCs from the PA. MPM-1 was constructed using 4-inch Schedule 40 polyvinyl chloride (PVC) with 0.020-inch slot installed from 89 to 99 feet bgs. MPE-1, located about 14 feet from the monitor well MPM-1, was constructed using 4-inch-diameter Schedule 80 PVC with 0.020-inch slotted screen installed in the interval from 89.5 to 99.5 feet bgs (URS 2003b).

Pilot testing activities consisted of bail-down testing, vapor extraction testing, and MPE testing. MPE testing commenced on September 10, 2003 and continued through September 16, 2003. Based on the results of the pilot test, URS concluded that MPE was a technically feasible option for the removal of the LNAPL containing PCE from the surface of the PA beneath the Mission Plant. The capture zone for vapor and for liquids was estimated to be 60 and 14 feet, respectively. Vapor flow rates ranged from 15 to 29 standard cubic feet per minute (scfm). Water flow rate averaged about 0.15 gallons per minute (gpm). LNAPL represented about 30 percent of the total liquid recovery. VOC concentrations in extracted vapor were similar to those concentrations observed in extracted from the SVE system at the conclusion of SVE activities in 2002 (i.e., PCE concentrations from 40 to 130 ppmv).

Full-Scale MPE System Operation

Based on the results of the pilot test, Mission began design and installation of a full-scale MPE system. Mission installed four MPE wells (MPE-2 through MPE-5) within the footprint of the

Mission Plant. An additional well, MPE-6 was installed adjacent to the facility. The well locations were selected based on the highest observed PCE concentrations in LNAPL and PA groundwater, inferred radius of capture, and adjusted for surface obstructions. The wells were constructed of 6-inch-diameter Schedule 80 PVC with 0.020-inch slotted screen installed in the interval from 86 to 96 feet bgs for MPE-2, MPE-3, and MPE-5, from 85 to 95 feet bgs for MPE-4, and from 89.5 to 99.5 feet bgs for MPE-6.

Construction of the MPE system began on December 12, 2007 and was completed on April 11, 2008. Initial system start-up occurred on April 16, 2008. The original design plans were developed by URS. The system was constructed by Environmental Response Inc., under the supervision of URS.

The MPE system consists of six multi-phase extraction wells (locations shown on Figure 2-2), a 60 horsepower (hp) liquid ring vacuum pump, a vapor-liquid separation vessel, a vapor treatment train, and a liquid treatment system. The vapor treatment system consists of an air-cooled heat exchanger and condensate knockout vessel, followed by three 2,000-lb GAC vessels, one 500-lb PIZB vessel, and the vapor discharge location. The vapor system also maintains a separate discharge point which conveys vented vapors from the liquid system oil/water separator and product storage tank through a 200-lb GAC vessel and discharges to atmosphere. The liquid treatment system consists of an oil/water separator, product storage tank, and groundwater particulate filters followed by clay vessels intended to remove excess product from the separated groundwater. The water is then conveyed through liquid phase 200-lb GAC vessels to a 6,500-gallon treated water storage tank. The discharge from the storage tank is routed to either the facility's hot water supply or to Mission's onsite industrial pre-treatment facility. The as-built drawings for the treatment system are included as Appendix A.

The pilot phase of MPE system operation began on April 16, 2008 and was completed on June 3, 2009. A detailed description of the pilot phase of operation can be found in URS' 2009 report titled "Multi-Phase Extraction System Operation Summary" (URS 2009). Mass removal rates for the pilot phase of operation are summarized below:

- The total mass of VOCs removed as vapor was about 1,400 lbs, inclusive of 586 lbs of PCE and 577 lbs of TCE;
- The total volume of groundwater removed from the PA was 38,851 gallons;
- The total mass of dissolved VOCs removed in groundwater was about 0.4 lb; and
- The total volume of LNAPL removed was 750 gallons containing about 0.4 lb of VOCs.

Mission's consultant, URS, concluded that the MPE system (1) reduced VOC concentration in the diesel in the subsurface; (2) reduced diesel LNAPL thickness in the vicinity of the extraction wells; and (3) removed VOC mass from groundwater in the PA (URS 2009). URS recommended preparation of an ERA Work Plan for MPE system operation, re-initiation of MPE system operation in the current configuration for continued VOC mass removal from diesel and PA groundwater, and development of criteria to establish an endpoint for MPE operation.

MPE operation was re-initiated following ADEQ approval (ADEQ 2011) of the Multi-Phase Extraction System Early Response Action Work Plan (URS 2011). The MPE system was re-started on August 19, 2011 and operation continued through April 11, 2014. During that time

the system removed VOC mass of about 2,250 lbs as vapor, 1.22 lbs dissolved in water, and about 49 lbs dissolved in diesel. The MPE system removed approximately 6,500 gallons of diesel and 71,600 gallons of water. Cumulatively, the MPE system removed about 3,700 lbs of VOCs, primarily as vapor. The MPE system was shut down in April 2014 pending completion of the FS.

Since startup of the MPE system in 2008, the concentration of PCE in extracted vapor has decreased with time as may be observed in Figure 2-7. In addition, the concentration of degradation product TCE has decreased, while the concentrations of degradation products cDCE, tDCE and VC have remained relatively constant. Figure 2-7 depicts the mass removal rate of PCE and its degradation products as a function of time since re-initiation of MPE system operation in 2011. Because the degradation products cDCE and VC do not readily adsorb to GAC, and because these compounds now make up a higher percentage of the total VOCs extracted by the MPE system, and because the adsorption capacity of the GAC decreases with decreasing concentrations, the vapor-phase GAC usage rate has increased substantially. Thus, the cost effectiveness of the MPE system operation has decreased with time due to reduced mass removal rates and increased GAC usage.

2.6.6 2005-2006 – Sewer Line Replacement

Pursuant to an agreement between Mission and Pima County, Mission replaced the Pima County 8-inch-diameter sanitary sewer main located beneath the Mission Plant at 301 South Park Avenue. Pima County paid Mission to conduct the sewer replacement work. PCE was believed to have entered this sewer line through miscellaneous spills that were broomed into the floor drain and by other means (TTG 2011). The County had previously conducted a video survey of the sewer main and determined that the main was unsatisfactory for continued service, as it appeared to be deteriorated to the point of showing perforations.

Mission abandoned a floor sump that discharged to the Pima County main sewer, constructed new sewer lines, connected existing laterals to the new lines, and connected the new sewer lines to existing sewer mains on East Manlove Street and 13th Street. The abandoned sewer line was filled with grout. During construction, Mission performed vapor monitoring and tested excavated soil for VOCs in accordance with a Site Health & Safety Plan.

2.6.7 2014 to Present – Lower Vadose Zone Soil Vapor Extraction

This section discusses SVE in the LVZ, including its pilot testing in January 2014 and initiation as an ERA in February 2015.

Pilot Testing

As discussed in Section 2.5, ADEQ installed two LVZ vapor monitoring wells (VML-01 and VML-02) and one LVZ vapor extraction well (VEL-03) in 2002. ADEQ's contractor, Hydro Geo Chem (HGC) performed soil gas sampling on the three LVZ wells in January 2003 (HGC 2003). Based on the sampling, HGC concluded that elevated concentrations of VOCs existed in the LVZ above the RA. Analytical results indicated the presence of PCE and its degradation products TCE, cDCE, and VC. HGC concluded that soil vapor concentrations at 167 feet bgs were sufficiently high to cause exceedances of Arizona Aquifer Water Quality Standards (AWQSs).

As part of the FS, URS conducted LVZ pilot testing consisting of a Pneulog test on the screened intervals of RA well PER-14A and the LVZ vapor extraction well VEL-03 and an SVE pilot test on VEL-03. The pilot test was conducted in January 2014 with follow-up rebound vapor sampling occurring in February 2014. The results and conclusions from the LVZ SVE Pilot Test are detailed in a Technical Memorandum from URS to ADEQ dated June 2, 2014 (URS 2014a) which is presented in Appendix B-1 to this FS Report.

Notable findings from the LVZ SVE pilot test include:

- SVE was believed to be a feasible technology to effectively remove VOCs from the LVZ.
- The contamination source within the LVZ was estimated to be relatively limited (i.e., approximately 36,400 cubic yards of soil) based on VOC vapor concentration decreases during the test and a lack of rebound during the 30 days following cessation of the SVE pilot test.
- The radius of influence (ROI) for the test extraction well (VEL-03) varied by depth interval and was estimated from observed vacuums and concentration changes in observation points. The ROI was calculated to be approximately 66 feet and greater than 150 feet at depth intervals of 170 and 190 feet bgs, respectively.
- Implementation of SVE was anticipated to improve groundwater quality near PER-14A.
- The operational life for LVZ SVE was estimated to be about 9 months to remove the VOC mass in the LVZ estimated from the pilot test, based on predictive modeling.

ERA Implementation

Based on the 2014 pilot test results, URS implemented SVE in the LVZ as an ERA. URS prepared a Work Plan (URS 2014b), which ADEQ approved with comments on July 7, 2014 (ADEQ 2014). URS applied to the Pima County Department of Environmental Quality (PDEQ) to include SVE as a permitted operation in the renewal of Air Permit Number 2144, which is included as an appendix to the Work Plan (Appendix B-2). The final permit conditions allow operation of either the MPE blower or the SVE blower with emissions controlled by the three existing GAC vessels and the PIZB vessel. A process flow diagram is provided in Figure 2-8. The revised permit 2144 allows a 5-year operation and was issued on October 28, 2014, as included in Appendix B-3.

The SVE system consists of a 1 hp regenerative blower connected to wells PER-14A and VEL-03. The discharge of the SVE blower is connected to the piping leading to the MPE system vapor treatment equipment (i.e., GAC and PIZB). The SVE system was tested on January 19, 2015 and started for continuous operation on February 2, 2015. The expected operational period was 9 months followed by a shutdown period to evaluate potential rebound of soil vapor concentrations in the LVZ. The system was shut down on November 9, 2015, having removed a total of approximately 1,933 lbs of volatile hydrocarbons from the LVZ, of which approximately 254 lbs were PCE. Monthly sets of rebound vapor samples have been collected in January, February, and March 2016 and the decision whether to resume operation has not yet been made. However, rebounding concentrations have been observed, as discussed further in Section 3.4.3. The operation and maintenance plan for the MPE/SVE system is included as Appendix B-4.

2.6.8 2014 – Perched Aquifer Enhanced Reductive Dechlorination Bench Scale Testing

LTM of the PA indicates that the concentrations of dissolved PCE and TCE in groundwater and in LNAPL have been decreasing with time (URS 2015 and see Attachment D of Appendix C for time series graphs). These decreases are concurrent with an increase in cDCE and, in several wells, detectable VC concentrations. Based on the observed degradation of the chlorinated ethenes, reductive dechlorination could potentially be enhanced by the addition of an electron donor or dehalococcoides (Dhc) bacteria to promote complete degradation of PCE and its degradation products to ethene and/or ethane.

In accordance with the FS Work Plan, URS collected groundwater samples from the PA on January 22, 2014 for the purpose of testing for the Dhc bacteria and for the VC reductase gene trait that have been shown to promote the complete degradation of PCE and its degradation products to ethene and ethane. Overall, Dhc was present (or quantifiable) in five of the nine samples collected. The greatest Dhc population was represented in the sample collected from SVE-103, which corresponds to the elevated VC and ethene concentrations observed in this well. SVE-103 is the only location where VC concentrations are greater than cDCE concentrations indicating that biodegradation processes at this location have progressed past the dechlorination of cDCE. Results of laboratory analyses are included in Appendix C (Attachment C).

In addition to laboratory analysis, combined groundwater and diesel samples were collected for the purpose of bench-scale testing ERD as a remedial technology for the PA. The samples were shipped to SiREM Laboratory for analysis and assessment. Lactate was selected as the electron donor for microcosm testing. Five microcosms were constructed in triplicate consisting of the following:

- An anaerobic sterile control
- An anaerobic active control
- Lactate amended treatment
- KB-1® (a cultured Dhc used for bioaugmentation) amended treatment
- Lactate and KB-1® amended treatment

Following construction, the microcosms were amended with PCE and cDCE to achieve target concentrations of 1.0 and 50 mg/L, respectively, which are representative of PA concentrations beneath the Mission Plant. The TCE concentration in the microcosms was equivalent to the target concentration of 1.0 mg/L without amendment. The specified microcosms were amended with lactate to a target concentration of 366 mg/L and bench scale testing began on January 31, 2014. The specified microcosms were bioaugmented with KB-1® bacteria on February 28, 2014, when the microcosms were confirmed to be anaerobic. The control and treatment microcosms were sampled approximately every other week throughout the bench scale test. Due to slow degradation rates, the electron donor (lactate) amended microcosms were amended with lactate again on May 8, 2014 and again on July 3, 2014, and the bioaugmented microcosms were bioaugmented again on May 30, 2014.

Overall, the total ethenes (PCE, TCE, cDCE, tDCE, VC, and ethene measured in moles) did not decrease in any of the control or treatment microcosms throughout the duration of the study, nor was ethane produced in any of the microcosms. The study ended upon receipt of analytical

results from July 15, 2014, because it was determined that since complete anaerobic degradation could not be achieved in a controlled microcosm with several amendment events, that the field application of bioaugmentation would not be feasible or effective. The technical memorandum summarizing the sampling and bench-scale testing results is presented as Appendix C to this report.

Therefore, complete anaerobic biodegradation appears to be a localized phenomenon (such as in the vicinity of SVE-103) that could not feasibly be replicated elsewhere in the PA, and therefore, bioaugmentation is likely not a viable groundwater remedy for the entire PA beneath the site. Product thicknesses have historically varied considerably at SVE 103, but have remained at or below 0.03 foot for the last two years, which may have enabled biodegradation processes to progress with less hindrance from direct contact with free-phase diesel product. The field-scale pilot testing of bioaugmentation in the PA as proposed in the FS Work Plan was not conducted.

Based on the results of the bench scale testing, bioaugmentation was not considered as a viable remedial strategy in the development of this FS, as further discussed in Section 4.3.

2.7 PROJECT REMEDIAL OBJECTIVES

A remedial objective is a goal established through the process in A.A.C. R18-16-406 to be achieved by a selected remedy and includes the following elements:

- Protecting against the loss or impairment of identified uses of land and waters of the state;
- Restoring, replacing, or otherwise providing for identified uses of land and waters of the state;
- Time-frames when action is needed to protect against or provide for the impairment or loss of the use; and
- The projected duration of the action needed to protect or provide for the use.

ADEQ prepared a Remedial Objectives Report in 2008. The ROs, as stated in the Final RI Report (TTG 2011), for land and groundwater use at the Park-Euclid WQARF Site are:

> "To restore soil conditions to the remediation standards for non-residential use specified in A.A.C. R18-7-203; specifically background remediation standards prescribed in R18-7-204, predetermined remediation standards prescribed by R18-7-205, or site-specific remediation standards prescribed by R18-7-206 that are applicable to the hazardous substances identified (tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cDCE) and trans-1,2-dichloroethene (trans-1,2-DCE), and vinyl chloride)."
>
> "To protect for the use of the groundwater supply by the University of Arizona (UA) near the Park-Euclid WQARF site from contamination from the site. This action is needed for the present time and for as long as the UA wells are used for potable purposes, the resource remains available, and their use is threatened as a result of contamination from the Park-Euclid WQARF site. This action is also needed to protect potential future use of the groundwater supply for the City of Tucson, which is not expected within the next five to ten years."

The above ROs were used as the basis for remedial alternative evaluation in the FS. The following bullets further detail what is required for soil remediation by the ROs:

- A.A.C. R18-7-203 requires that soil concentrations (1) are protective of surface water quality and aquifer water quality, not resulting in a violation of water quality standards; (2) do not exhibit hazardous waste characteristics beyond toxicity; (3) do not threaten ecological receptors. UVZ and LVZ soils do not exhibit hazardous waste characteristics beyond toxicity, nor are they believed to threaten ecological receptors based on land use. The potential for leaching to groundwater is evaluated in Section 3.2.4.
- A.A.C. R18-7-204 allows soil concentrations to be remediated to background conditions above soil standards; however, for this Site, the COCs are not naturally occurring in the environment and background concentrations are not applicable.
- A.A.C. R18-7-205 requires that soil concentrations (1) meet residential standards on any property where there is residential use at the time remediation is completed; (2) meet a 10^{-6} excess lifetime cancer risk for known human carcinogens and a 10^{-5} excess lifetime cancer risk for other carcinogens, except for properties containing a child care facility or school a 10^{-6} excess lifetime cancer risk must be used. Therefore, non-residential standards are considered for the Mission Plant area, but residential standards are used elsewhere. Of the Site COCs, VC is a known human carcinogen while the remaining are other carcinogens.
- A.A.C. R18-7-206 states that site-specific remediation standards for soil may be derived by risk assessment considering exposure pathways and land use.

Therefore, soils in the UVZ must be remediated to non-residential levels in the Mission Plant area and residential levels elsewhere; as well as to levels that do not present an unacceptable vapor intrusion risk or impact water quality above applicable groundwater standards. Due to the depth of the LVZ soils and the overlying aquitard, contaminated soil does not pose a significant risk to humans via exposure or vapor intrusion; thus, only the migration to groundwater pathway is considered.

The second RO pertains to protecting the RA groundwater supply for UA and CoT, but does not require that numeric standards be met in groundwater or that contaminant mass be destroyed. Because the second RO pertains to RA water quality, the RO relates to the PA only with regards to whether PA contamination would inhibit achieving the ROs for soil remediation and/or RA water quality. Exposure pathways and the conceptual site model are discussed further in Section 3.2.

This section summarizes the current Site conditions, presents the Site conceptual model including exposure pathways, and states the strategy and goals for each zone in achieving the ROs.

3.1 SUMMARY OF CURRENT CONDITIONS AND CONTAMINATION EXTENT

This section summarizes current conditions and contaminant distribution for each of the zones based on the most recent analytical results from the annual sampling event conducted in January and February 2015 and utilizes figures from the 2015 Annual LTM report (URS 2015). Sampling activities were conducted in late March/early April 2016; however, results were not available for reporting during the preparation of this FS.

3.1.1 Upper Vadose Zone

A relatively small number of soil samples have been collected from the UVZ, from which PCE was detected at concentrations between 0.0047 and 3.1 mg/kg, TCE was detected in one sample at a low concentration (0.02 mg/kg), and all other degradation products were not detected. None of the UVZ soil sample concentrations exceeded ADEQ's Non-Residential Soil Remediation Level (NR-SRL) of 13 mg/kg. However, PCE concentrations detected in two soil samples from SVE-102 (3.1 mg/kg and 1.4 mg/kg at 60 and 70 feet bgs, respectively) exceeded ADEQ's minimum Groundwater Protection Level (GPL) of 1.3 mg/kg (TTG 2011).

Overall, the maximum VOC vapor concentrations observed in the UVZ have historically been at cluster VW-07 located nearest to the primary source area at each of the four depth intervals (5, 30, 55, and 85 feet bgs) (URS 2015). In general, VOC vapor concentrations have decreased and remained at low levels since the baseline sampling event (July 2011) as a result of MPE system operation, which was shut down on April 11, 2014. Vapor samples were collected from UVZ wells in February 2015 to assess whether rebound had occurred and VOC concentrations remained fairly consistent with the exception of considerable increases at each of the four depth intervals of VW-07 and the 85 foot interval for VW-05. These increases likely reflect the presence of residual contamination, with the exception of the deepest interval which may reflect CVOC contamination contained in the diesel fuel. Each of the four intervals at VW-07 had PCE concentrations greater than 10 ppmv, while all other locations had VOC vapor concentrations were below 1 ppmv (except for PCE at 3.1 ppmv at VW-05-85) in 2015 (URS 2015).

3.1.2 Perched Aquifer

In February 2015, petroleum product was observed at 14 PA wells, each of which have historically contained product, including at only 1 of the 6 MPE wells, which is unusually low. The horizontal extent of the product does not appear to have significantly changed since 2006. In wells where product was observed in April 2014, product thickness ranged from 0.01 foot at SVE-103 to 3.41 feet at WR-347A, for an average thickness of approximately 1.38 feet. The average decrease in product thickness from April 2014 to February 2015 is likely attributed to the Site wide increase in PA groundwater elevations spreading the product through the smear zone and trapping the product in a residual phase within the saturated zone thereby resulting in decreased product accumulations within monitoring wells. Historically, the LNAPL thickness has decreased since the operation of the MPE system.

Regarding product chemistry, cDCE is the most prevalent component, which has gradually increased in proportion over the years (February 2015 conditions are reflected in Figure 3-2). Long-term decreases in PCE and TCE concentrations at several PA wells, accompanied by increases in cDCE and VC concentrations, indicate that natural biodegradation by reductive dechlorination is occurring in the PA. The presence of LNAPL along with dissolved phase contamination has created anaerobic conditions that promote reductive dechlorination of the target VOC compounds. This interpretation is consistent with studies conducted by UA students, faculty and others (Carreón-Diazconti et. al. 2009). However, bench scale testing (described in Section 2.6.8) suggested that this diesel layer inhibits achieving complete degradation past cDCE.

Depth to groundwater in the PA ranged from approximately 85 to 97 feet bgs during the February 2015 event, with groundwater elevations ranging from 2320.96 to 2326.09 feet above mean sea level (amsl) and an average elevation of 2323.83 feet amsl. The PA saturated thickness generally ranges from 1 foot to 8 feet and is underlain by a clayey aquitard ranging in thickness from 14 to 26 feet (Figures 2-3 and 2-5, respectively). In general, the February 2015 groundwater flow direction in the PA varied from west-southwest to west-northwest with a gradient ranging from approximately 0.0025 to 0.004 foot per foot. Groundwater elevations are generally highest near the Arroyo Chico, reflecting infiltration, and no longer reflect localized depressions beneath the Site as the MPE system has not operated since April 2014. Lateral groundwater flow under perched conditions is largely dictated by geologic conditions including permeability contrasts and structure of the underlying aquitard, which is described in Section 2.2.

In general, the PA groundwater VOC plumes extend to the northwest, which is generally consistent with groundwater flow direction excepting the area northeast of the Mission Plant. The highest observed total VOC concentrations are located near the center of the Mission Plant area. The PA PCE and TCE groundwater plumes are smaller, having footprints of approximately 400 and 500 feet longitudinally and 300 and 400 feet laterally, respectively. The cDCE and VC groundwater plumes are larger, interpreted to have footprints of approximately 850 and 1,150 feet longitudinally by 650 feet laterally, respectively (the February 2015 VC distribution is reflected in Figure 3-4). The VC plume extends beyond the most downgradient well in the PA (PEP-10). However, the concentration in this well has been declining for several years suggesting that the VC plume is contracting.

3.1.3 Lower Vadose Zone

The LVZ was characterized by ADEQ and its consultants during the RI (TTG 2011), which included completing three LVZ soil vapor wells (i.e., VML-01, VML-02, and VEL-03). In addition to soil vapor samples from the three vapor wells, discrete soil samples were collected from the LVZ for laboratory analysis in VML-01 and VML-02 and from RA groundwater monitoring wells PER-14, PER-14A, and WR-347B during drilling. The RI analytical results documented significant PCE concentrations (up to 170 milligrams per kilogram [mg/kg]) in the LVZ above the RA in the immediate vicinity of the Mission Plant, particularly in the interval from 165 to 190 feet bgs (TTG 2011). Routine vapor sampling has been conducted at VML-01 and VML-02 since 2012 and has identified PCE and its degradation products TCE and cDCE in soil vapor at both soil vapor monitoring wells, with typically greater concentrations at VML-02.

Two LVZ well clusters (VML-1 and VML-2) with four individual wells each comprise the LVZ LTM monitoring network. VML-1 generally exhibits low vapor concentrations, whereas elevated vapor concentrations at VML-2 have indicated a residual contaminant source, which prompted the pilot testing and ERA described in Section 2.6.7 to mitigate this potential source to RA groundwater. Prior to the implementation of SVE in the LVZ, vapor concentrations at VML-2 generally were one to two orders of magnitude higher than those measured at VML-1.

3.1.4 Regional Aquifer

Depth to groundwater in the RA ranges from approximately 181 to 231 feet bgs, with elevations ranging from about 2201.5 to 2216.4 feet amsl. Groundwater is estimated to flow at 0.3 foot per day generally toward the north-northeast with a gradient between approximately 0.004 and 0.006 (February 2015 conditions are reflected in Figure 3-5). Groundwater monitoring data shows there is a strong upward hydraulic gradient in the RA beneath the Mission Plant that transitions to a slight downward vertical gradient further downgradient (by PER-15, PER-21, and PER-22).

Groundwater samples collected during the February 2015 event from 19 RA wells included 10 samples that exceeded the AWQS for PCE, and 1 location (PER-14A) that also exceeded the AWQS for TCE and cDCE. tDCE and VC were not detected in any RA groundwater samples. With the exception of results from PER-14A, concentration trends in RA wells suggest continuing detachment from the source area and shifting of the center of the VOC plume downgradient from the Mission Plant, where the highest PCE concentration in the RA is believed to be located between PER-26 and PER-28. PCE, TCE, and cDCE concentrations continue to remain elevated at PER-14A but, overall, have exhibited a decreasing trend since February 2012. VOC concentrations in the four downgradient UAM “sentinel” wells remain below reporting limits (<1 µg/L) with the exception of consistently low PCE detections at UAM-2 below the AWQS (5 µg/L).

The dissolved VOCs within the RA extend to the north-northeast, which is generally consistent with the interpreted groundwater flow direction. The migration of the RA groundwater plume is largely influenced by groundwater withdrawals by the UA potable supply wells and is estimated to travel approximately 60 feet per year toward the north-northeast under current groundwater extraction rates based on groundwater modeling as described in Section 3.3. The RA PCE groundwater plume is approximately 1,200 feet wide, 3,200 feet long, and 130 feet deep (from approximately 200 feet to 330 feet bgs). The TCE and cDCE plumes are constrained to the vicinity of PER-14A having footprints of approximately 100 feet in diameter. The interpreted February 2015 PCE plume is shown on Figure 3-6, which also displays long-term PCE concentration trends.

The RA groundwater plume is anticipated to reside mostly within a 130-foot thick interval between the water table at approximately 200 feet bgs and 330 feet bgs. The lower vertical extent of 330 feet is assumed based on the presence of lower permeability materials beneath the Mission Plant beginning at approximately 330 feet bgs (particularly with plastic clay layers between 345 and 395 feet bgs) that create a confining layer and induce a strong upward gradient in this region. However, the lower permeability layer pinches out between the Mission Plant and PER-15/21/22 cluster (located approximately 750 feet to the north-northeast of PER-14/14A), where a slight downward hydraulic gradient has been historically observed.

The lower extent of the PCE plume has not been fully delineated. Samples from the deepest well in the cluster, PER-21 screened from 339 to 389 feet bgs, have historically contained PCE concentrations with a maximum of 52 µg/L observed in July 2011. Furthermore, results from depth-specific sampling conducted at PER-28, installed in July 2014 with a screen from 195 to 285 feet bgs and located approximately 2,100 feet to the north-northeast of PER-14/14A, has shown increasing PCE concentrations with depth. Samples collected at 220, 250, and 280 feet bgs in September 2014 contained PCE concentrations of 21, 49, and 65 µg/L, respectively, and this trend continued in February 2015 with PCE concentrations of 49, 71, and 79 µg/L, respectively, and in November 2015 with PCE concentrations of 48, 48, and 74 µg/L, respectively, at these depths (URS 2015). Therefore, it is possible that the plume extends below 330 feet bgs, which should be confirmed prior to final remedy design, as discussed in Section 5.1.4.

Physical attenuation processes such as volatilization, dilution, dispersion, and adsorption appear to be occurring in the RA. Although some degree of natural biodegradation is likely also occurring in the RA, the degradation rate is much slower than in the PA where the petroleum hydrocarbon contamination enhances anaerobic biodegradation. There is little analytical evidence of long-term biodegradation in the RA, and the predictive modeling assumed no biodegradation (see Appendix G and Section 5.1.4.2 for additional discussion regarding this uncertainty).

3.2 CONCEPTUAL SITE MODEL AND EXPOSURE PATHWAYS

This section identifies exposure pathways for potential current and future receptors. The purpose of this exposure assessment was to estimate the type and magnitude of exposure to humans.

3.2.1 Overview of Potential Exposure Pathways

For risk to occur, a complete exposure pathway must exist, which requires:

- A source and mechanism for release of contamination;
- A transport medium;
- A point of potential human contact; and
- An exposure route at the exposure point.

If any one of the pathway items is missing, the pathway is considered incomplete. In addition, potentially complete pathways may be eliminated from the evaluation based on any of the following:

- The exposure resulting from the pathway is much less than that from another pathway involving the same medium and the exposure point;
- The potential magnitude of exposure for the pathway is low;
- The probability of exposure occurring is very low, and the risks associated with the occurrence are not high (if a pathway may have catastrophic consequences, it is evaluated even if its probability is very low); and

- Uncertainties associated with the exposure estimates are too large to justify an assessment.

Potentially exposed populations were considered when selecting pathways for inclusion in the assessment. Despite the current land use as a commercial business, land use in the future could potentially change from commercial to residential, which could require a Declaration of Environmental Use Restriction (DEUR) for the Site property to be recorded. Construction workers, laundry employees, site visitors, adjacent residents, and employees and students at the UA are considered to be potential receptors to Site contaminants.

An exposure scenario evaluates the sources, pathways, and receptors at a specific location during a specified exposure period. An exposure route is the manner in which a chemical comes in contact with the human body. The following exposure routes were considered as potential routes of exposure due to contact with surface soil (0 to 15 feet bgs), subsurface soil (greater than 15 feet bgs) in the UVZ, the PA, subsurface soil in the LVZ, and/or RA groundwater:

- Ingestion;
- Dermal Contact; and
- Inhalation.

A schematic depicting affected media and the associated potential exposure scenarios for the Park Euclid site is provided as Figure 3-7. The exposure scenarios considered for the Site are:

- Future exposure to dust and vapors resulting from soil exposed as a result of future construction or excavation activities in the source area of the Site. It should be noted that based on soil sampling conducted at the 301 South Park facility, none of the UVZ soil sample concentrations exceeded ADEQ's NR-SRL of 13 mg/kg (TTG 2011). Because SVE was conducted as an ERA, soil and soil vapor concentrations are expected to be less than those measured during remedial investigation activities reducing the risk of exposure.
- VOC migration from UVZ soil and/or the PA to indoor air is considered to be a potentially complete pathway that could affect current and/or future on-site (employees, visitors) and off-site (adjacent residents) receptors. This potential exposure pathway has been evaluated based on soil vapor sampling and analysis and is discussed further in Sections 3.2.2 and 3.2.3.
- Contaminant leaching from LVZ soil to the RA is considered to result in minor transport, as described in Section 3.2.2. LVZ vapors presently are believed to be in communication with RA groundwater via the filter pack and well screen at PER-14A.
- Dissolved VOC migration in groundwater to the UA production wells is considered to be a future exposure pathway that could result in exposure to UA employees and students through inhalation, dermal contact, and ingestion. The potential migration of VOCs is discussed further in Section 3.2.5.

3.2.2 Human Health Risk Assessment

URS collected soil vapor samples in 2014 from 13 shallow vapor sampling locations across the Site for the purpose of evaluating the potential for vapor intrusion to indoor air. Each of the samples was analyzed for PCE, TCE, cDCE, tDCE, and VC. The method used to evaluate the potential for vapor intrusion to indoor air and the accompanying human health risk assessment (HHRA) are presented in a technical memorandum titled "Human Health Risk Assessment for Feasibility Study and Associated Activities" dated November 17, 2014 (URS 2014c) and the Technical Memorandum is provided herein as Appendix D-1.

Using a screening process, PCE and TCE were selected as contaminants of potential concern (COPCs) and the indoor air modeled using the Johnson & Ettinger (J&E) model. Predicted indoor air concentrations of PCE and TCE as determined with the J&E model were then compared to the EPA Regional Screening Levels (RSLs) for residential indoor air. The RSLs were developed based on an excess cancer risk of 1 per million and a non-cancer hazard quotient of 1. Exposure of residents or commercial/industrial workers to PCE and TCE (predicted indoor air concentrations less than residential RSLs), and tDCE and VC (not detected) would not pose an unacceptable threat to human health. Based on the conditions at the time of sampling (April 2014), vapor intrusion to indoor air does not pose a risk to human health under a residential exposure scenario.

Because the February 2015 UVZ vapor results were higher than those previously used to evaluate the potential for vapor intrusion to indoor air, the 2014 vapor intrusion risk assessment was revisited using February 2015 results as described in Appendix D-2. The February 2015 data were split into two datasets representative of potential residential and industrial receptors, as opposed to a single dataset for residential receptors as was done with the 2014 data. Using current indoor air Regional Screening Levels (RSLs) (January 2015) for a cancer risk of 10^{-6} and a hazard quotient of 0.1, PCE exceeded its screening level in the commercial dataset (e.g., beneath the Plant). Therefore, the Johnson and Ettinger model was used to calculate a predicted indoor air concentration that was compared to the industrial RSLs, resulting in a hazard quotient of 1 and a cancer risk of 4×10^{-6}. Because the other Site-related vapor intrusion chemicals were either not detected, were present at low levels relative to their RSLs (the target cancer risk for Arizona workers is 10^{-5}), or cannot be evaluated quantitatively, the February 2015 UVZ vapor results do not suggest an unacceptable risk assuming the Plant area remains as commercial use.

There is uncertainty associated with estimating potential impacts from human exposure to cDCE in indoor air because there are no toxicity values or screening levels for inhalation of cDCE. An additional point of uncertainty in the risk assessment is the potential for long-term rebound of soil vapor concentrations following shut-down of the MPE system at the Site, resulting in elevated COC concentrations and associated risk.

3.2.3 Predictive Shallow Vapor Concentration Estimations

Because UVZ vapor concentrations were likely reduced during ERA implementation and have the potential to rebound due to underlying PA contamination, a predictive analysis was conducted to evaluate the potential for future vapor intrusion based on numerical modeling of contaminant mass present in the perched aquifer groundwater and product, as documented in

Appendix E. Overall, it was estimated that the timeframe to reach steady state shallow vapor concentrations due to PA contamination would be between 20 and 30 years. Based on the available lines of evidence and median groundwater concentrations from April 2014, PA contamination is not anticipated to pose an unacceptable vapor intrusion risk or hazard in the future.

No soil samples have been collected following the implementation of the SVE and MPE ERAs, which have likely reduced soil concentrations from those discussed in Section 3.1.1. Therefore, URS assessed the need for a DEUR by evaluating the likelihood that shallow soil concentrations are below residential SRLs using recent soil vapor concentration data. Per A.A.C. R18-7-203(C), soil vapor concentrations may be used to estimate the contaminant concentration in soil; therefore, allowable soil vapor concentrations were back-calculated from residential SRLs to estimate vapor concentrations for which residential SRLs would be met assuming equilibrium conditions. It is reasonable to assume that vapor concentrations are in equilibrium outside of the anticipated zone of influence from the MPE ERA, but vapor concentrations may still be equilibrating within the MPE zone of influence.

These allowable vapor concentrations were compared to April 2014 and February 2015 UVZ vapor concentrations as shown in Appendix F-1. Overall, vapor concentrations (if in equilibrium) at 26 of the 28 individual wells indicate that soils would likely meet residential SRLs. Vapor concentrations at the lower two depth intervals of VW-07 exceeded residential SRLs; however, at these depths (e.g., greater than 50 feet) human exposure pathways to soil would be eliminated. The results of the vapor intrusion study indicated that while commercial standards are met, residential levels would be exceeded, thus necessitating a DEUR based on current site conditions. It is assumed that a remedy will be implemented to remove additional contaminant mass from the UVZ (see Section 5.1.1) such that soil and soil vapor concentrations are reduced to a level such that a DEUR would not be required.

3.2.4 Potential for Transport from LVZ Soil to the RA

Per A.A.C. R18-7-203, soil concentrations must be protective of surface water and aquifer water quality, not resulting in a violation of water quality standards. Based on the ROs presented in Section 2.7, the potential additional water quality impacts from UVZ contamination leaching to the PA are not of concern for reasons described in Section 3.4.2. However, contamination in the LVZ is believed to serve as a source to RA groundwater, necessitating the LVZ SVE ERA. As a reference for LVZ remediation, allowable vapor concentrations were back-calculated from groundwater protection levels (GPLs) (assuming equilibrium conditions) that would likely be protective of RA groundwater preventing a violation of aquifer water quality standards. These allowable vapor concentrations could be used as an action threshold for when to stop or resume active remediation in the LVZ and are presented in Appendix F-2. PCE vapor concentrations indicated that soil concentrations likely exceed calculated GPLs in portions of the LVZ, justifying the implementation of SVE as an ERA.

3.2.5 Transport of PCE to UA Production Wells

Groundwater modeling simulations (see Section 3.3) predict that with no action, the concentration of PCE will not exceed the EPA maximum contaminant level (MCL) of 5 µg/L in any UA production well in the long term (i.e., more than 30 years in the future), but that PCE

concentrations would exceed the action threshold of 2.5 µg/L in two UA production wells (i.e., Aggie and S-Hospital). Furthermore, depending on the UA pumping rates simulated in the long-term, there are up to four UA production wells whose PCE concentrations are predicted to exceed 2.5 µg/L, reaching a maximum concentration greater than 9 µg/L.

Overall, this exposure route is not considered to be complete under current conditions, but is likely to be complete in the future. Although some degree of natural biodegradation is likely occurring in the RA at a very slow rate, the groundwater modeling assumes that no biodegradation occurs (see Appendix G and Section 5.1.4.2 for additional discussion regarding this uncertainty).

3.3 REGIONAL AQUIFER GROUNDWATER MODELING

Groundwater modeling of the RA was conducted in support of the FS to evaluate the effectiveness and feasibility of various remedial alternatives used to address the RA groundwater contaminant plume, as well as improving the understanding of the conceptual site model (e.g., flow conditions). Model simulation results and conclusions were used primarily for screening technology process options in the RA (Section 4.4.4) and in developing viable alternatives (Section 5.1.4). Details beyond those found in these sections are included in the Groundwater Modeling Report, included as Appendix G. Interim results regarding model construction and calibration were also presented in a technical memorandum from URS to ADEQ on March 21, 2014 (URS 2014d).

The RA groundwater flow and transport models were developed based on review of the site hydrogeological conceptual model (URS 2011; TTG 2011; URS 2013) and review of the previous numerical groundwater flow and transport models (GeoTrans 2008). Groundwater migration in the RA is largely influenced by regional pumping, particularly from UA production wells. Assumptions regarding future pumping rates were developed in coordination with UA facilities personnel to most appropriately reflect anticipated future conditions. UA groundwater use, future planning, and water use considerations are summarized in Section 3.4.4 and detailed in Appendix H.

3.4 FEASIBILITY STUDY STRATEGY AND ASSUMPTIONS

This section summarizes the strategy and priorities in addressing environmental risks presented by each zone to achieve the Site ROs. The description of risk by zones is discussed in the subsections below and provides a foundation for the technology screening process and remedy development discussed in Sections 4 and 5, respectively. Additional requirements or considerations, such as UA water use and planning, are also discussed herein. For each zone, generic objective(s) are presented as steps or components in achieving the project ROs (Section 2.7).

3.4.1 Upper Vadose Zone

The historic implementation of SVE as an ERA and operating the MPE in the PA as an ERA for several years cumulatively have removed considerable amounts of contamination from the UVZ. Therefore, SVE and MPE as ERAs have reduced risk by reducing contaminant mass.

Presently soil concentrations in the UVZ are understood to be below soil standards and no unacceptable risk is posed to potential receptors due to vapor intrusion under current land use conditions (see Sections 3.2.2 and 3.2.3). However, there is the potential for vapor concentrations to rebound over time to levels presenting an unacceptable risk. Although the RO is driven by soil concentrations, another objective is to confirm via monitoring or control by remediation that vapor concentrations remain below concentrations posing an unacceptable vapor intrusion risk.

3.4.2 Perched Aquifer

PA groundwater is not currently used as a potable resource nor is it anticipated to be in the foreseeable future. Therefore, it is reasonable to conclude that the contamination in PA groundwater and the LNAPL layer overlying the PA does not pose an unacceptable risk due to consumption. Potential exposure pathways of PA contamination to receptors include (1) vapors volatizing from the PA migrating and accumulating in shallow soils at hazardous concentrations that pose a vapor intrusion risk; and (2) contaminant migration through the upper aquitard into the LVZ and ultimately leaching to the RA at levels that impact groundwater, which is then eventually extracted and consumed. If these two exposure pathways can be eliminated or adequately controlled, the ROs can still be achieved with PA contamination remaining in place.

Concerning the vapor pathway, results from the vapor intrusion modeling (Appendix E) indicate that present PA conditions are not anticipated to pose an unacceptable risk to residential receptors. Should VC concentrations in groundwater increase significantly, there is the potential for VC vapors to accumulate at levels that would pose an unacceptable vapor intrusion risk due to its characteristics of diffusing rapidly and having higher toxicity. Diffusivity calculations estimate that it takes approximately 20 to 30 years for the COCs to reach steady-state conditions in the shallow depths of the UVZ as a result of PA contamination. Outside of the influence of any active remedies (where vapors were extracted during SVE and MPE ERAs), the shallow vapor concentrations should already be at steady state and are not expected to present an unacceptable risk. In the event that unacceptable vapor concentrations accumulate, vapor mitigation measures could be implemented.

Concerning the migration pathway to the LVZ and ultimately to RA groundwater, the upper aquitard is believed to effectively protect RA groundwater in the long term for the following reasons:

- The source and pathway for residual contamination remaining in the LVZ and RA contamination was via the two former water supply wells (Old Well and MP-1) that penetrated the upper aquitard creating a conduit for vertical contaminant migration to the RA. These wells were abandoned in 1992 and 1994, respectively, thus eliminating further contaminant migration.
- The upper aquitard thickness ranges from 14 to 26 feet beneath much of the PA plume and then thins out to 4 feet at UAM-2B, approximately 2,000 feet downgradient to slightly crossgradient from the distal portion of the plume. The hydraulic conductivity of the upper aquitard is generally lower than the Subtitle D landfill requirement of hydraulic conductivities no greater than 1×10^{-5} cm/sec (Interstate Technology & Regulatory Council [ITRC] 2003). Furthermore, many landfills effectively operate in compliance

employing considerably thinner clay liners (i.e., 3 to 6 feet) than the aquitard underlying the PA.

- There is no evidence of contaminant migration through the upper aquitard in the vicinity of the Mission Plant based on analytical results from nested LVZ vapor wells. If contamination were slowly leaching through the aquitard, one would expect to observe the greatest concentrations in the shallowest intervals. However, the highest concentrations are observed at 170 feet bgs, followed by lower concentrations at 150 and 190 feet bgs, with the lowest concentrations at 130 feet bgs. Vapor contamination in the upper LVZ intervals (e.g., at 130 and 150 feet bgs) likely reflect volatilization from residual contamination in lower intervals (e.g., below 160 feet bgs) that originated from contaminant smearing with the decreasing water table, rather than contamination migrating through the overlying aquitard. Furthermore, analysis of soil samples collected from PER-14 in the upper LVZ (from 105 to 160 feet bgs) did not detect PCE or degradation products, but considerable concentrations were detected in samples from 165 to 170 feet bgs, which is the likely depth at which LNAPL floated on the historical groundwater table. This pattern reflects the presence of residual contamination in the LVZ originating from the former water supply wells and does not support ongoing vertical contaminant migration through the upper aquitard.

Nevertheless, even if contamination hypothetically did migrate through the upper aquitard, it would likely be in very small quantities and unable to reach the RA located 90 feet deeper due to low permeability lenses present throughout the LVZ. Furthermore, if any contamination did eventually migrate through the upper aquitard and LVZ and reach the uppermost RA groundwater, it would likely occur at such an insignificant mass flux that groundwater concentrations would remain below MCLs across a monitoring well screen. Therefore, the objective is to confirm that PA contamination is not posing an unacceptable vapor intrusion risk, nor migrating through the upper aquitard at rates resulting in impacted RA groundwater. The contaminant mass has been reduced by implementing MPE as an ERA for the last several years, which has removed considerable amounts of contamination from the LNAPL layer and groundwater. Furthermore, operating the MPE system has assisted in degrading much of the contaminant mass from PCE to its less toxic daughter product, cDCE.

3.4.3 Lower Vadose Zone

Residual contamination in the LVZ appears to be an ongoing source of contamination to the RA, particularly in the vicinity of PER-14A, and unless addressed is anticipated to continue impacting groundwater via soil vapor. The abandonment of the old supply wells and the presence of the aquitard prevent current contaminant migration from the LVZ reaching the RA. Contaminant mobilization via leaching from contact with infiltrating water from above is not considered a viable mechanism due to the presence of the aquitard above the LVZ that prevents water infiltration. However, in the event that the groundwater elevation of the RA increases over time, the potential exists for groundwater to contact and saturate contaminated soil intervals. An ERA of SVE in the LVZ was initiated in early February 2015, as described in Section 2.6.7, to prevent further delay or inhibition to achieving ROs, particularly in the RA.

LVZ soil also needs to meet soil standards, specifically for GPLs. Estimated allowable vapor concentrations were back-calculated from GPLs assuming equilibrium conditions and compared

to measured vapor concentrations in April 2014 and January 2015 (see Section 3.2.4 and Appendix F-2). Estimated PCE concentrations in soil did exceed calculated GPLs, further justifying the implementation of SVE as an ERA. Upon completion of the ERA, a similar comparison to GPLs will be conducted to verify compliance.

Vapor concentrations in samples collected from the LVZ from January through March 2016 have displayed increasing trends for PCE and its degradation products. Presently, concentrations do not exceed the estimated allowable vapor concentrations back-calculated from GPLs; however, if trends continue as observed, it is likely that further remedial action will be necessary. Another consideration in shutting down the system in November 2015 was the rapid consumption of GAC due to elevated concentrations of total volatile hydrocarbons despite decreased PCE concentrations. Analytical results from samples collected following system startup showed rapidly increasing concentrations in total volatile hydrocarbons to levels significantly higher than what had been observed during MPE operation in the UVZ (e.g., up to 1,800 ppmv in the LVZ compared to a maximum observed concentration of approximately 130 ppmv in the UVZ). The increasing concentration trend over time in LVZ samples during startup is strong evidence that a nearby contamination source exists outside the immediate project vicinity. These elevated volatile hydrocarbon concentrations quickly consumed the GAC, increasing treatment costs. The Group assumes that ADEQ will evaluate this information and take appropriate action to investigate and, if possible, identify the party or parties responsible for that nearby contamination source and require appropriate and necessary remedial action to achieve source control so as to avoid negative impacts to the Site. Therefore, future potential remedies in the LVZ need to account for this increased contamination load and whether ADEQ is able to identify the responsible party or parties and effectuate timely source control.

3.4.4 Regional Aquifer

The RA PCE groundwater plume is approximately 1,200 feet wide, 3,200 feet long, and 130 feet deep (from approximately 200 feet to 330 feet bgs). Potential receptors include production wells operated by the UA, as well as potential future groundwater withdrawals by the CoT or other end users. The nearest UA production well is approximately 2,300 feet north of the distal portion of the plume. CoT does not currently operate any production wells near the plume, nor does it have plans to do so in the near future. However, groundwater in the RA is considered a potable resource that must be protected.

The RA plume is migrating to the north-northeast at approximately 60 feet per year and, if not addressed, is anticipated to reach the first UA production well (Aggie) in approximately 30 years if left unmitigated based on projected pumping rates. Based on a Site visit with the UA Facilities superintendent and discussions with UA utilities and engineering staff, there are several considerations that need to be taken into account as they affect the project objectives and remedy development. Appendix H-1 includes the UA's response to a water provider survey, Appendix H-2 includes photographic documentation of the setup and space associated with select UA production wells, and Appendix H-3 includes a memorandum describing their future pumping projections.

This section presents remedial measures and strategies to address vapor, soil, and groundwater in the four zones and believed to be capable in achieving the ROs. Potentially applicable remedial technologies and process options are identified and screened to arrive at a retained subset of technologies and process options that are carried into alternative development.

4.1 PROCESS OVERVIEW AND SCREENING CRITERIA

A screening process is used to evaluate remedial strategies and remedial measures starting from a broad screening of technology types proceeding to general screening of individual process options. Retained remedial technologies from the screening process are further evaluated in greater detail with respect to each of the corresponding target intervals (i.e., UVZ, PA, LVZ, and RA). Retained technologies are then incorporated into alternatives and ultimately are combined into remedies that will address the four intervals (i.e., UVZ, PA, LVZ, and RA), as discussed in Section 5.

In developing a remedy, it must be capable of achieving ROs per A.A.C. R18-16-407(A). A Reference Remedy and alternative remedies, pursuant to A.A.C. R18-16-407(E), must be developed and described in sufficient detail to allow evaluation using the comparison criteria. Remedies were developed based on professional engineering, geological and/or hydrogeological judgment, and following scientific standards of practice. Information built into the Site Conceptual Model and in evaluating technologies includes information from the RI report, ongoing monitoring and investigation efforts, best available information on remedial methods and technologies, a remedy analysis consistent with A.R.S. § 49-282.06.

Each of the subsections below summarizes the various levels of technology screening; however, a majority of the rationale is presented in Tables 4-1 through 4-3.

4.2 SCREENING REMEDIAL MEASURES AND STRATEGIES

This section discusses potential remedial strategies and measures considered acceptable by ADEQ for achieving the ROs and to comply with the requirements of A.A.C. R18-16-407. A remedial strategy is an approach or combination of approaches to address contamination to achieve the ROs. A remedial measure does not address contamination directly, but provides a means of attaining a clean water supply.

As stipulated by A.A.C. R18-16-407(F), the following strategies were considered in development of the reference and alternative remedies:

- Plume remediation to achieve water quality standards for COCs in waters of the state throughout the Site;
- Physical containment to contain contaminants within specific boundaries;
- Controlled migration to control the direction or rate of migration, but not preventing migration;
- Source control to eliminate or mitigate a continuing contamination source;
- Monitoring to observe and evaluate Site contamination over time; and
- No action.

As stipulated by A.A.C. R18-16-407(G), remedial measures may include but are not limited to:

- Well Replacement;
- Well Modification;
- Water Treatment;
- Provision of Replacement Water Supplies; and
- Engineering Controls.

Table 4-1 provides a summary of screened technology types within each of the six remedial strategies based on their applicability to each of the four zones. The applicability of remedial measures was also evaluated. If any process option within a technology type had the potential to possibly be applicable to at least one of the four zones, it was retained and carried forward to Table 4-2. From this level of screening, only one remedial strategy (Controlled Migration) was completely eliminated.

4.3 SCREENING TECHNOLOGY PROCESS OPTIONS

Individual technology process options within retained technology types from Table 4-1 were described and screened in Table 4-2. Screening included whether the specific process option was (1) applicable to the COCs; and (2) feasibly implemented in one or more of the four zones considering their characteristics, contamination distribution, and geology. Of the 68 individual technology process options evaluated in Table 4-2, 31 were eliminated from further consideration and 37 were carried forward for further evaluation with respect to the four zones in Tables 4-3A through 4-3D (Section 4.4).

Overall, general information was used at this level of screening, with a more detailed evaluation summarized in Tables 4-3A through 4-3D; however, site-specific information from pilot testing and previous site experience was used to effectively screen technologies in Table 4-2. SVE was retained as a potentially effective technology to address LVZ contamination based on results from field-scale pilot testing conducted in January 2014, as discussed in Section 2.6.7 (Appendix B-1). As discussed in Section 2.6.8, bioremediation was rejected as a viable technology for the PA as the diesel LNAPL layer is believed to inhibit biological activity of the Dhc based on laboratory bench-scale testing using site-specific groundwater-diesel mixtures in microcosms (Appendix C).

4.4 TECHNOLOGY EVALUATION BY ZONE

Individual technology process options retained in Table 4-2 were evaluated against effectiveness, implementability, and relative cost for their respective zones, as summarized in Tables 4-3A through 4-3D and discussed in the following subsections. A description of these criteria is provided below.

- Effectiveness addresses whether the technology would reduce risk and/or achieve the objectives for contaminants in the targeted zone. Data and information to evaluate effectiveness is derived from current literature, historical case studies, similar ongoing

projects, hands-on technology experience, vendor/subcontractor data, and the bench-scale treatability studies.

- Implementability (technical and administrative) addresses the degree of difficulty in carrying out the technology or process option. Data and information to evaluate implementability are obtained from historical case studies, similar ongoing projects, hands-on technology experience, vendor/subcontractor data, and pilot studies. At the Park-Euclid Site, a key implementability factor is restricted Site access due to the densely developed project vicinity. Access restrictions will limit the implementability of many technologies, particularly those dependent on injection on closer well spacing. Another influential factor for implementability in the LVZ or RA is the depth of contamination and institutional controls to prevent cross contamination while drilling through the upper aquitard where overlying contamination is present.
- Relative costs (capital and operation and maintenance [O&M]) were considered for this level of screening. Technologies and process options that were screened ranged from having little to no capital and O&M cost to significant capital (construction, equipment, materials) and O&M costs for ongoing operation of a system. Data and information to evaluate cost is derived from historical case studies, similar ongoing projects, hands-on technology experience, and vendor/subcontractor data.

Technologies or process options were evaluated relative to each other and those determined to be the most effective, implementable, and cost effective are retained for the development of remedial alternatives.

Ex situ treatment technologies to address extracted groundwater and vapor were not individually evaluated with respect to each of the four zones because their suitability (effectiveness, implementability, and relative cost) would vary based on the chosen remedial strategy combining alternatives across multiple target intervals. Influential factors in selecting the appropriate ex situ treatment include the average values and variations (anticipated ranges) in contaminant concentrations and flow rates, as well as end use for treated water (e.g., offsite disposal, discharge to surface water, storm sewer, reinjection, conveyance to the UA, etc.). Furthermore, technologies employed across various intervals (i.e., the UVZ, PA, LVZ, and/or RA) may benefit from sharing a common ex situ treatment, whereas if they were evaluated individually, different options may have been selected. For example, if SVE were implemented at only one location in the LVZ, it may not extract enough contamination or have a sufficient flow rate to economically select a catalytic oxidizer and GAC may be more suitable; however, if extracted flow from the LVZ were joined with extracted flows from SVE in the UVZ, GAC may be less economical.

Commonly implemented ex situ technologies were assumed for each of the alternatives and remedies, but without a detailed evaluation. The ex situ treatment technologies were evaluated against effectiveness, implementability, and relative cost only for the Proposed Remedy (see Section 7.1) rather than for separate intervals (alternatives) and each of the three remedies.

4.4.1 Upper Vadose Zone

Six technology process options were evaluated for the UVZ and two options were retained as follows (Table 4-3A):

- Rejected: no action, bioslurping, MPE, and anaerobic bioventing
- Retained: MNA and SVE

Soil concentrations in the UVZ are calculated to meet residential standards based on vapor concentrations measured in April 2014 and do not pose an unacceptable risk to potential receptors due to vapor intrusion; therefore, no active remedial action is deemed necessary at this time. However, the risk for vapor intrusion is possible from rebound in shallow vapor concentrations and potentially from long-term diffusion from the PA (though unlikely per Section 3.2.3), and UVZ vapor concentrations should be monitored until steady-state conditions from volatilization from COCs remaining in low permeability soil intervals or from "PA off-gassing" (diffusion) are confidently established and understood. Therefore, the no action option was eliminated while MNA was retained.

In the event that an active remedy is triggered by elevated shallow vapor concentrations, pulsed operation of SVE is the most suitable option for the UVZ. In areas where SVE cannot be implemented, individual vapor mitigation systems (e.g., those used for radon mitigation in homes) could be installed in a localized manner on an as-needed basis.

4.4.2 Perched Aquifer

Twelve technology process options were evaluated for the PA and six options were retained as follows (Table 4-3B):

- Rejected: no action, skimmer pumps, SVE, PlumeStop™ with ERD, in situ chemical oxidation (ISCO), and in situ chemical reduction (ISCR).
- Retained: MNA, bioslurping, MPE, PlumeStop™ with MNA (contingency), air sparging, and in-well stripping.

As discussed in Section 3.4.2, an unacceptable risk to potential receptors is not anticipated to result from PA contamination because (1) PA groundwater is not a potable resource, (2) PA contamination is not anticipated to result in elevated steady-state shallow vapor concentrations; and (3) the upper aquitard is believed to be an adequate hydraulic barrier preventing contaminant downward migration. Although it is possible that the project ROs could be achieved without further action in the PA, reducing the monitoring network and monitoring frequency is appropriate until concerns of vertical migration and diffusion into shallow soils have been thoroughly addressed. Therefore, the no further action option was rejected while MNA is retained.

Implementing an active remedy would be desirable if PA contamination conditions were to change such that contamination would migrate through the upper aquitard in meaningful quantities or if VC concentrations were to significantly increase and pose a vapor intrusion risk from upward diffusion. In this event, the present remedial equipment could be utilized to implement bioslurping or MPE in existing wells or an expanded network to address source area contamination in the diesel layer and PA groundwater. Air sparging wells could also be installed in lines, or fences, downgradient of the source area. Although these active technologies would be well suited to address the source area, they would not be economical or feasibly implemented to address the larger PA groundwater plume.

If continued horizontal migration of the PA groundwater plume became a concern as MNA progressed, active remedies could be evaluated and implemented at that date. If the distal portion of the plume encroached on the interpreted extent of the upper aquitard or migrated beneath sensitive properties, an active remedy could be implemented near the downgradient portion of the PA groundwater plume. If VC concentrations increased to significant concentrations and posed vapor intrusion risks, an active remedy could be implemented in a localized area. One contingency option is to inject a PlumeStop™ barrier along a portion of the PA that would effectively sorb contamination and significantly enhance any naturally-occurring biodegradation. This contingency option is further described in Section 5.1.2. PlumeStop™ is an injectable colloid containing micro-sized GAC used to stop plume migration and enhance biodegradation, as further described in Sections 5.1.4.1 and Appendix I.

4.4.3 Lower Vadose Zone

Three technology process options were evaluated for the LVZ and one option was retained as follows (Table 4-3C):

- Rejected: MNA and anaerobic bioventing.
- Retained: SVE.

Because SVE is already underway as an ERA for the LVZ, MNA and anaerobic bioventing were rejected as alternatives and SVE was retained. Following the conclusion of the SVE ERA, LTM will be implemented for a time to (1) assess potential rebound in vapor concentrations from residual soil contamination; and (2) evaluate whether contamination is migrating through the upper aquitard.

4.4.4 Regional Aquifer

Ten technology process options were evaluated for the RA and five options were retained as follows (Table 4-3D):

- Rejected: well modification, provision of replacement water supplies, anaerobic bioremediation via amendments, ISCO, and ISCR.
- Retained: wellhead treatment, MNA, groundwater extraction, PlumeStop™ with MNA, and PlumeStop™ with ERD (contingency).

As discussed in Section 3.3, groundwater modeling was conducted to evaluate the effectiveness and feasibility of various remedial alternatives used to address the RA groundwater plume. For the purposes of this FS evaluation, a threshold of 2.5 ppb was used for PCE. This concentration threshold is half of the MCL and is assumed to be conservatively protective for groundwater users and provide a sufficiently early warning to implement wellhead treatment. As summarized in Table 4-3D and detailed in Appendix G, results from model simulations were used in conjunction with other effectiveness concerns or implementability limitations as a basis to reject ERD (anaerobic bioremediation via amendments) and ISCO/ISCR from further consideration.

As mentioned at the beginning of this section, there are several implementability factors that complicate remediating RA groundwater contamination. The densely developed land use with homes, businesses, and streets occupying most of the surface area, considerably limits points of

access to drill. Options requiring numerous injection points on a grid or multiple lines, such as ERD, ISCO, and ISCR, become impractical as not enough locations are available to install injection points to adequately address the plume. Implementing these technologies would require repeat injections across a few "barriers," lines, or zones, which even then may not result in adequate groundwater residence time within the injected material to accomplish the desired treatment. Further complicating matters, is the depth and thickness of the contaminated interval, from approximately 200 to 330 feet bgs. Injecting across a single interval of such length would result in little to no distribution in lower permeability strata and preferential distribution in high permeability strata. Therefore, individual injection intervals would need to be established. Additional complexity is introduced in requiring drilling precautions to prevent cross-contamination when drilling through the upper aquitard.

Due to the aforementioned limitations, only MNA, groundwater extraction, and PlumeStop™ were retained for incorporation into alternatives. Each of these three technologies could potentially be implemented to achieve ROs and they have their own respective strengths and weaknesses. MNA would be accompanied with wellhead treatment on an as-needed basis dependent on monitoring results and is readily implemented and effective; however, it involves a very lengthy remediation timeframe, which introduces considerable uncertainty as conditions and the regulatory environment could change significantly over a couple centuries. Groundwater extraction would involve installing a single extraction well downgradient of the plume's core and pumping to capture the contaminated interval. Attaining access for a single well location downgradient of the upper aquitard's extent would not be difficult to implement; however, the water would require continual treatment and reuse for a few decades. PlumeStop™ is more difficult to implement in the short-term, as it would involve injecting and extracting across multiple intervals via a line of multiple injection and extraction wells. There is also some uncertainty in the degree of distribution that would be achieved; however, once implemented, the alternative would be essentially complete with little long-term involvement.

This section describes the development of the remedial alternatives from retained technologies and then their incorporation into remedies. Three remedies were developed including a Reference Remedy and two alternative remedies, one of which is less aggressive and the other more aggressive. "More aggressive" relative to the Reference Remedy is understood to require fewer remedial measures, to achieve the ROs in a shorter period of time, and/or to be more certain in the long term requiring fewer contingencies. These remedies are developed at a conceptual level and described in sufficient detail to allow evaluation using the comparison criteria, but not with sufficient detail for planning construction and implementation.

5.1 ALTERNATIVE DEVELOPMENT

This section develops and incorporates retained technology process options from Tables 4-3A through 4-3D (see Section 4.4) into alternatives that, if implemented, would address the remedial goals/objectives specified for each of the four zones (see Section 3.4). Although this step is not required per Section 407 in Chapter 16 of Title 18 in the A.A.C., individual alternatives were developed for each zone that could be combined into remedies given the nature of the Site (each zone presenting its own unique challenges), rather than solely developing remedies without this "interim alternative step," which helps facilitate discussion and analysis.

To borrow terminology from the remedies, a reference alternative (Alternative 1), a less aggressive alternative (Alternative 2), and a more aggressive alternative (Alternative 3) were developed for each of the zones. This readily facilitates their incorporation into remedies, as the four reference alternatives are assimilated into a single Reference Remedy, and so forth. Table 5-1 summarizes the developed alternatives by zone.

The components, approach, and anticipated duration of each alternative are described in the subsections below. Uncertainties and contingencies are also described for each alternative; however, for the purposes of the FS, it is assumed that the alternatives described are adequate and the contingency measures are not included in the cost estimates (Appendix J). As mentioned in Section 4.4, the alternatives assume commonly implemented ex situ technologies, but ex situ treatment technologies are not evaluated or selected except for the Proposed Remedy (see Section 7.1). Additional information regarding implementation details and durations is reflected in the cost estimates included as Appendix J.

5.1.1 Upper Vadose Zone

This section discusses the three alternatives developed for the UVZ to control or confirm that shallow vapors remain below concentrations posing an unacceptable vapor intrusion risk. Figure 5-1 illustrates the locations of proposed additional shallow UVZ monitoring points for the three alternatives, which is based on the existing monitoring network and underlying VC groundwater plume. Each of the three UVZ alternatives assumes that two additional shallow monitoring locations (e.g., screened from 4 to 5 feet bgs) and two replacement wells (assuming two are damaged over the project duration) would be installed for monitoring vapor intrusion risk, for a total of 36 UVZ individual wells comprising the initial monitoring network (Figure 5-1).

Uncertainties and Contingencies

As discussed in Section 3.1.1, soil samples have not been collected from the UVZ since implementing several years of ERAs; therefore, soil vapor concentration data have been used to

back-calculate estimated soil concentrations as discussed in Section 3.2.3 and Appendix F-1. Based on historic soil samples, ERA implementation, and recent vapor concentration data, it is assumed that soil concentrations meet non-residential levels beneath the Mission Plant Area and residential standards elsewhere. However, if additional contamination were to be encountered above acceptable levels, several remedial options could be implemented including SVE, excavation, or in situ treatment (e.g., ISCO) depending on the nature and extent of the material. Due to the number of monitoring points installed across the Site, it is unlikely that significant additional soil contamination remains that has not already been encountered or reflected in LTM vapor data.

One contingency measure that can be readily implemented under each alternative at the Mission Plant or neighboring properties, in the event that unacceptable vapor intrusion risk arises, is to install sub-slab vapor mitigation systems (e.g., similar to those used for radon mitigation) at each impacted property. This is a non-invasive, readily implemented, and inexpensive measure to protect receptors from exposure to vapor-phase COCs.

5.1.1.1 Alternative 1 - Reference

The reference alternative for the UVZ involves pulsed SVE operation for 10 years to address residual contamination, followed by MNA until Year 30. Based on approximate calculations of vapor in the subsurface subject to extraction, it is assumed that the SVE blower would be in operation for one week each quarter to extract accumulated vapors and then allow for rebound. This alternative assumes that four of the five existing former SVE wells could be retrofitted and utilized for focused SVE in the source area.

This alternative includes soil vapor monitoring at each location on an annual basis during SVE and for the first year following SVE completion, after which the network would be refined (assumed reduction to 25 locations) and the frequency reduced to biannual until Year 15, and once every 5 years thereafter. Implementation details, durations, and assumptions for this alternative are reflected in Appendix J, Sheet J-3.1.

Uncertainties and Contingencies

In the event that vapor concentrations continue to rebound, (1) the system could continue episodic operation with longer shutdown periods allowing rebound; (2) new horizontal shallow SVE wells could be installed via directional drilling or trenching; and/or (3) individual sub-slab vapor mitigation systems could be installed at impacted properties.

5.1.1.2 Alternative 2 - Less Aggressive

The less aggressive alternative for the UVZ involves MNA for 30 years with the assumption that residual contamination does not result in rebounded soil concentrations to unacceptable levels unable to naturally attenuate within a reasonable timeframe. A period of 30 years was chosen as a conservative timeframe by which steady-state shallow vapor concentrations would be established and could be evaluated for vapor intrusion risk once more prior to discontinuing monitoring (no unacceptable risk is anticipated based on soil gas diffusion modeling – see Section 3.2.3 and Appendix E).

This alternative shares a MNA component similar to the reference alternative in its implementation, except that annual monitoring is conducted for 5 years and biannual monitoring

is conducted for 10 years. No further action is assumed after Year 30. Implementation details, durations, and assumptions for this alternative are reflected in Appendix J, Sheet J-3.2.

Uncertainties and Contingencies

In the event that vapor concentrations do rebound to unacceptable levels, (1) SVE could be implemented episodically at existing SVE wells; and/or (2) individual sub-slab vapor mitigation systems could be installed at impacted properties.

5.1.1.3 Alternative 3 - More Aggressive

The more aggressive alternative for the UVZ involves continuously operating SVE to address residual contamination and/or serve as a vapor capture control for an active mechanical remedy in the PA (e.g., air sparging). The operational time-period would be contingent upon analytical results and influences from PA remedial efforts. The system could also operate in a pulsed or episodic manner. For the purposes of this FS, it is assumed that SVE would continuously operate for 5 years, after which pulsed SVE would ensue until Year 10, followed by MNA until Year 30 per the same program described in the less aggressive UVZ remedy. Therefore, this alternative assumes no further action takes place after Year 35. Implementation details, durations, and assumptions for this alternative are reflected in Appendix J, Sheet J-3.3.

Uncertainties and Contingencies

Similar to Alternative 2, if vapor concentrations do rebound, (1) SVE could be implemented episodically at existing SVE wells; and/or (2) individual sub-slab vapor mitigation systems could be installed at impacted properties.

5.1.2 Perched Aquifer

This section discusses the three alternatives developed for the PA to monitor or confirm that PA contamination does not pose an ingestion risk, nor does it result in accumulating vapors in shallow soils at concentrations posing an unacceptable vapor intrusion risk. Figure 5-2 presents the locations of proposed additional PA groundwater monitoring wells for the three alternatives. Each of the three PA alternatives assume that an additional seven PA groundwater monitoring locations would be installed to enhance plume delineation and analysis, particularly near the distal portion of the VC plume, for an initial monitoring network containing 30 PA wells (Figure 5-2). Furthermore, select PA monitoring wells would be analyzed for dissolved gasses (i.e., methane, ethene, and ethane by Method RSK-175) to assess whether complete reductive dechlorination is occurring from VC to ethene.

Uncertainties and Contingencies

Each of the alternatives includes enforcing administrative controls related to drilling through contaminated portions of the PA to reduce the risk of inadvertently creating a conduit for PA contamination to vertically migrate through the upper aquitard. The Arizona Department of Water Resources (ADWR) and ADEQ have established a process that restricts drilling or specifies well construction requirements in contaminated areas as communicated when processing a notice of intent (NOI).

In the unlikely event that PA contamination does migrate through the upper aquitard and into the LVZ (as detected by LVZ monitoring), SVE would be implemented in the upper portion of the LVZ to remove contamination prior to it reaching the RA. If sustained meaningful long-term

contaminant migration is suspected, an active remedy could be implemented in the PA to prevent periodic SVE operation in the LVZ in perpetuity. Considering that this is not anticipated based on currently available knowledge, an "active" contingency PA remedy for the entire plume or source area was not evaluated in this FS.

An "active" contingency PA remedy was, however, conceptually considered and costed for implementation at the distal portion of the plume for plume migration control. The proposed PA contingency option is strictly hypothetical at this stage and is not necessarily believed to be required in the future based on currently available knowledge of Site conditions and project objectives. However, given the anticipated longevity of the PA contamination, there is the potential for continued lateral migration beyond the existing footprint. The decision of whether to implement an active remedy would be based on ongoing evaluation of future monitoring data and Site conditions. If additional remedial action were deemed necessary many years in the future, Site conditions and available technologies may have changed considerably from what they are presently, which could significantly influence technology selection and costing. However, for the purposes of this FS, a conceptual implementation of installing a PlumeStop™ barrier at the distal portion of the plume to limit lateral migration was evaluated as discussed below.

Contingency PlumeStop™ Barrier in the PA

This contingency option assumes the barrier would be implemented once the distal portion of the plume has migrated beneath a sensitive environment or to a portion where the integrity and effectiveness of the upper aquitard is questionable. Although it is uncertain when or where this might occur, if at all, it is assumed for cost estimating purposes that an 800-foot barrier would be installed along a side street at Year 25. The assumed location is not shown on a map as its actual location, if implemented, would be evaluated on an as-needed basis given land-use considerations at that time. However, wherever it would be located, it would likely parallel a street edge to avoid disruptions to traffic and homes. The width of the current configuration of the cDCE and VC plumes spans approximately 600 feet; however, because the plume is not oriented perpendicular to the street network, the barrier would have to be approximately 800 feet in length to adequately span the plume's width.

For conceptual design purposes, it is assumed that cDCE and VC concentrations would be near 100 and 25 µg/L, respectively, when entering the barrier with a groundwater Darcy flux of approximately 80 cubic feet per day, assuming a saturated thickness of 4.5 feet for the PA. Due to the low hydraulic conductivity of the PA and small saturated thickness, it is anticipated that the PlumeStop™ material would be most efficiently delivered to the subsurface gradually via gravity draining into injection wells, as opposed to pressurized injections or groundwater circulation. It is assumed that injection wells would be screened from 90 to 95 feet bgs and spaced 30 feet apart (assuming a 15-foot ROI); however, the ROI should be determined through pilot testing. Therefore, the barrier would require approximately 27 flush-mounted injection wells constructed with 2-inch PVC. Assuming two drill crews, the well installation effort would likely require three weeks to complete.

Approximately 1,200 gallons of PlumeStop™ solution diluted to 4% is roughly estimated to be required at each injection well to achieve adequate distribution across the barrier. This could also be achieved by applying concentrated PlumeStop™ solution initially and chasing it with

unamended water to push it out into the formation. Assuming a passive injection (formation reception) rate of 0.5 gpm across the screened interval, each well would require approximately 40 hours of passive injection; however, this rate could vary significantly and should be derived through pilot testing. Assuming that 9 wells could be gravity fed simultaneously and that setups were moved every other day (48 hours), the injection effort would likely require a full week. Pre- and post-injection geophysical surveys would aid in delineating the distribution of the injected PlumeStop™ and pre-injection results could be used to assist in identifying well depths and locations. Additional implementation details, durations, and assumptions for this contingency option are reflected in Appendix J, Sheet J-4.2. This contingency is assumed to be applicable only for the less aggressive PA alternative and is only reflected in its costs.

5.1.2.1 Alternative 1 - Reference

The reference alternative for the PA involves MNA as long as significant contamination is present in the PA, stable conditions have not been met, and vertical migration is still a concern. Considerable contamination will remain in the PA for many years without active remediation, however; it was assumed that the contaminant migration will be minimal and does not pose an unacceptable risk nor prevent achieving ROs for reasons discussed in Section 3.4.2. However, for the purposes of comparative evaluation, the reference alternative for the PA would involve MNA for a very long duration (i.e., 200 years) prior to receiving a no further action determination (NFAD). This alternative further assumes that each location would be monitored on an annual basis for the first 5 years, after which the network would be refined (assumed reduction to 20 locations) and the frequency reduced to biannual for the next 10 years, and once every 5 years thereafter. Implementation details, durations, and assumptions for this alternative are reflected in Appendix J, Sheet J-4.1.

Uncertainties and Contingencies

It is likely that a NFAD would be issued or that a remedial action would be required before 200 years have passed. However, given the uncertainty in when a NFAD would be granted or what type of remedial action would be implemented, this option evaluates MNA for 200 years. Potential changes to this alternative from its present assumptions include differing monitoring locations and sampling frequency.

5.1.2.2 Alternative 2 - Less Aggressive

This alternative is similar to the PA reference alternative in its implementation, except that no further action is conducted after Year 30. Similar to the less aggressive alternative for the UVZ, a period of 30 years was chosen based upon the time to establish steady-state vapor concentrations in shallow soil and confirm what is anticipated to not present a vapor intrusion risk (Appendix E) prior to discontinuing monitoring. Implementation details, durations, and assumptions for this alternative are reflected in Appendix J, Sheet J-4.2.

Uncertainties and Contingencies

Potential changes to this alternative from its present assumptions includes extending the MNA timeframe, as well as changes to the number of locations and sampling frequency. Although unlikely, it is possible that a PlumeStop™ barrier would need to be installed at the distal portion of the plume in the future. For the purposes of cost estimating, it is assumed that the 800-foot barrier is installed at Year 25, as previously discussed.

5.1.2.3 Alternative 3 - More Aggressive

The more aggressive alternative in the PA involves air sparging in the source area for focused mass reduction for 5 years, followed by MNA for 30 years. This alternative assumes some form of vapor capture technology would be implemented in the UVZ (i.e., SVE) for the duration of sparging in the PA. Sparging would be conducted at the base of the PA (along the top of the upper aquitard) allowing air bubbles to spread laterally, rise vertically, and strip VOCs out of the groundwater and overlying diesel layer where they would be captured in the lower UVZ via SVE. For the purposes of this FS, the MPE wells are proposed to be retrofitted for sparging at the base of the well screens with flanges or sealing disks inserted at the top of the well screen to prevent short-circuiting. The MNA component of this alternative is identical to the less aggressive alternative for the PA, except that its timing initiates 5 years later and no further action is assumed after Year 35. Implementation details, durations, and assumptions for this alternative are reflected in Appendix J, Sheet J-4.3.

Uncertainties and Contingencies

Although this alternative does include active remediation, it is only implemented in the existing MPE wells with the objective of reducing contaminant mass within a portion of the source area. Therefore, there is still the potential need to implement an active remedial action addressing the remaining portion of the plume contingent on LTM results in the PA and upper LVZ. Potential changes to the present alternative include extending the sparging timeframe, installing additional sparging locations, and changes to the LTM program.

5.1.3 Lower Vadose Zone

This section discusses the three alternatives developed for the LVZ to remediate residual contamination potentially providing a long-term contamination source to RA groundwater and to evaluate the potential for vertical migration of PA contamination through the upper aquitard. Figure 5-3 illustrates proposed additional LVZ locations associated with the reference and more aggressive alternatives. Under Alternatives 1 and 3, four additional LVZ monitoring well clusters would be installed with similar completion intervals as the two existing clusters (i.e., screens at 130, 150, 170, and 190 feet bgs). These four clusters are shown on Figure 5-3 and are purposed to better delineate LVZ contamination and monitor the upper portion of the LVZ for the potential of contaminant migration from the PA through the upper aquitard. Surface conductor casing would need to be installed into the top of the upper aquitard prior to advancing to the LVZ to prevent cross contamination during the installation of new locations. Alternative 2 does not include any new locations as it only utilizes the existing network.

Per the discussion in Section 3.4.3, each of these LVZ remedies assumes that the vapor concentrations continue to rebound and that the estimated allowable vapor concentrations back-calculated from GPLs are exceeded such that additional remediation is required beyond the SVE ERA as planned. Evaluation of the effectiveness of the LVZ ERA is still ongoing and additional consideration will need to be given to developing the specifics of the LVZ remedies as monitoring data continues to be collected. Further evaluation also is required of recent increasing total volatile hydrocarbon concentration trends that strongly suggest the existence of a nearby contaminant source outside the immediate project vicinity as discussed in Section 3.4.3. For the purposes of this FS, it is assumed that the LVZ SVE system would be operated in a similar pulsed manner as the UVZ SVE system with operation for about one week per quarter.

For project efficiencies, it is likely that a shared blower would be sized to adequately operate vapor extraction wells in both the UVZ and LVZ simultaneously and vapors would pass through a shared treatment train (e.g., GAC vessels).

5.1.3.1 Alternative 1 - Reference

The reference alternative for the LVZ involves operating pulsed SVE operation for 10 years to address residual contamination, followed by MNA until Year 30, with the addition of the four new monitoring clusters. The SVE blower would be in operation for approximately one week per quarter to extract accumulated vapors and then allow for rebound the remaining 11 or 12 weeks. The assumed LTM network would include 6 clusters (4 new plus 2 existing) each with 4 individually nested wells under an annual frequency during operation and for 5 years following shutdown for rebound (until Year 15). After 15 years, only the uppermost well locations (6 wells) would be monitored, assuming the residual soil contamination has been remediated, on a biannual basis until Year 20 and then once every 5 years thereafter. No further action is assumed after Year 30. Implementation details, durations, and assumptions for this alternative are reflected in Appendix J, Sheet J-5.1.

Uncertainties and Contingencies

The primary uncertainties to this alternative include (1) encountering additional contamination upon installing additional vapor monitoring clusters; (2) the treatment timeframe takes longer than anticipated to reach target levels; and (3) vapor concentrations either increase resulting from an unknown source in the LVZ or rebound to unacceptable levels that continue to impact RA groundwater. Potential contingency responses include (1) installing an additional SVE well to address the newly encountered soil contamination (as planned in Alternative 3); and (2) increasing the SVE system operational duration. Another consideration is to abandon or seal off the upper portion of the PER-14A screened interval that enables lower LVZ vapors to readily diffuse into upper RA groundwater.

5.1.3.2 Alternative 2 - Less Aggressive

The less aggressive alternative for the LVZ involves operating pulsed SVE for 10 years to address residual contamination, followed by MNA until Year 30 using the existing network without installing additional monitoring locations. This alternative assumes MNA using the 8 existing individual wells (2 clusters of 4 wells) using the same frequency/program as the reference alternative (annual through Year 15, biannual through Year 20, and once every 5 years until Year 30). No further action is assumed after Year 30. Implementation details, durations, and assumptions for this alternative are reflected in Appendix J, Sheet J-5.2.

Uncertainties and Contingencies

The primary uncertainties to this alternative include (1) the treatment timeframe takes longer than anticipated to reach target levels; and (2) vapor concentrations either increase resulting from an unknown source in the LVZ or rebound to unacceptable levels that continue to impact RA groundwater. As no additional LVZ locations are installed under this alternative, there is no potential to encounter additional contamination. Potential contingency responses include running the SVE system longer and under a pulsed approach following rebound. The upper portion of the screened interval at PER-14A could also be sealed off to hinder diffusion of lower LVZ vapors to upper RA groundwater.

5.1.3.3 Alternative 3 - More Aggressive

The more aggressive alternative for the LVZ is similar to the Reference Remedy involving pulsed SVE operation for 10 years with an enhanced LTM network, but also assumes that additional contamination is identified during monitoring well installation/monitoring and that one new SVE well would be installed in the LVZ during the second year of operation (Year 1). This alternative assumes pulsed SVE from two existing locations (i.e., VEL-3 and PER-14A) during the first year (Year 0), from three locations (two existing and one new) during the second year (Year 1), followed by MNA until Year 31. The assumed LTM network would include 6 clusters (4 new plus 2 existing) each with 4 individually nested wells under an annual frequency through Year 15, after which only the uppermost 6 well locations would be monitored biannually until Year 21, and once every 5 years thereafter. No further action is assumed after Year 31. Implementation details, durations, and assumptions for this alternative are reflected in Appendix J, Sheet J-5.3.

Uncertainties and Contingencies

Similar to Alternative 1, the primary uncertainties to this alternative include (1) encountering additional contamination; (2) requiring a longer treatment timeframe; and (3) observing vapor concentration increases as a result of an unknown source in the LVZ or rebound to unacceptable levels that continue to impact RA groundwater. Contingency responses include (1) installing a fourth additional SVE well; and (2) running the SVE system longer. The upper portion of the screened interval at PER-14A could also be sealed off to hinder diffusion of lower LVZ vapors to upper RA groundwater.

5.1.4 Regional Aquifer

This section discusses the three alternatives developed for the RA to address groundwater contamination potentially posing an unacceptable risk to receptors by groundwater consumption. Figures 5-4 and 5-5 illustrate proposed additional RA locations associated with Alternatives 1 and 3, respectively.

One common component to each of the three RA alternatives is to conduct additional characterization of the deeper RA as a pre-design effort. As discussed in Section 3.1.4, analytical results from incremental passive groundwater sampling across the well screen at PER-28 have indicated increasing concentrations with depth. Furthermore, there are few wells in the project area with deeper screened intervals similar to UAM-2B (approximately 330 to 410 feet bgs). PER-21 is screened from 339 to 389 feet bgs and detected a maximum PCE concentration of 52 ppb in July 2011; however, the plume is believed to have migrated downgradient from PER-21 and the next well with a deeper screened interval is UAM-2B, from which PCE or its degradation products have never been detected. The absence of PCE at UAM-2B may be due to an absence of deeper contamination, but it may also be that the distal portion of the deeper plume has not yet arrived at the sampled interval.

Therefore, additional characterization of the deeper RA interval will be completed prior to finalizing the remedy design. For the purposes of the FS, each RA alternative assumes that three deeper RA wells will be installed to 400 feet bgs each, with three discrete groundwater samples collected from approximately 330, 360, and 390 feet bgs. Their proposed locations are shown on Figures 5-4 and 5-5, and attempt to “twin” existing wells at two locations (PBR-10 and PER-28)

to form a cluster allowing measurement of vertical gradient. For the purposes of this FS, it is assumed that the wells would each be sampled once and that the additional characterization effort would demonstrate that the target interval remains from 200 to 330 feet bgs and that the alternatives described in the subsections below do not require modification. However, the implications of extending the targeted treatment zone an additional 70 feet to approximately 400 feet bgs are discussed for each of the RA alternatives in their respective uncertainties and contingencies subsections below.

Uncertainties and Contingencies

A significant uncertainty common to each alternative is the vertical extent of the RA groundwater plume and whether treatment depths may increase considerably. This would further complicate Alternative 1, making it even less feasible to implement. There would be no meaningful change to Alternative 2. An additional extraction well may be needed, and the extraction well's completion interval and pumping rates would certainly change under Alternative 3. However, as mentioned above, it is assumed that the results of the deeper RA characterization effort would not meaningfully alter the present understanding of Site conditions nor the alternative approaches as presently described.

Another significant uncertainty common to each alternative is whether the CoT, or another end user, would decide to install and operate a production well to extract water from the RA aquifer in the vicinity of the RA groundwater plume. The present understanding is that the CoT does not operate any nearby water supply wells nor does CoT, or another end user, have any current plans to withdraw groundwater from the project vicinity. However, the CoT does consider the RA in the Site area to be an integral part of the City's drinking water supply and may potentially seek to withdraw water from within the plume's footprint in the future, especially considering the long remedial timeframes (e.g., from 40 to 200 years) associated with each of the RA alternatives. In the event that impacted groundwater is withdrawn from the RA plume, ex situ treatment could be implemented at the wellhead (e.g., GAC).

Another related uncertainty is whether the UA production wells change their current pumping rates and durations from what is assumed in the modeling simulations. The assumed production rates in model predictions are likely not representative of future conditions in the distant future (e.g., over 30 years). Simulations generally assumed gradually increasing pumping rates according to long-term pumping projections obtained from the UA, as described in Appendices G and H-3. The pumping rate configuration is influential as much of the groundwater flow in the RA is induced by regional pumping and changes in production rates could alter the groundwater flow direction and rate. An uncertainty analysis was performed comparing simulation results using projected pumping rates to fixed rates based on historical averages, as described in Section 7.8 of Appendix G.

5.1.4.1 Alternative 1 - Reference

The reference alternative for the RA involves distributing PlumeStop™ in the RA via a series of injection and extraction wells to form a 775-foot long in situ treatment/containment barrier to the RA groundwater plume. The PlumeStop™ barrier would span the PCE plume across the targeted depth interval from 200 to 330 feet bgs and would be oriented east-west along the southern side of 8th Avenue (Figure 5-4). The RA groundwater plume would passively flow

through the barrier where it is "treated." Following barrier installation, LTM would be conducted until Year 40, when a NFAD is assumed to be given.

PlumeStop™ Information

PlumeStop™ is colloidal mixture manufactured by Regenesis containing micron-sized GAC, mixed with polymers to prevent clumping, and can be easily injected to the subsurface having a viscosity similar to water and being highly dispersible. The individual GAC particles coat the soil grains without influencing aquifer permeability and these GAC particles provide sorption sites, capturing and concentrating dissolved-phase contaminants within its structure, stopping their transport and making them available for biodegradation at an accelerated rate. PlumeStop™ effectively captures a wide variety of VOCs, including the Site COCs, and would effectively stop downgradient migration of the RA groundwater plume. Additional information regarding PlumeStop™ and its applications is included in Appendix I.

The PlumeStop™ barrier would effectively protect downgradient receptors (e.g., UA production wells) and would enhance attenuation from any naturally occurring biodegradation processes. However, as little to no natural biodegradation is assumed to be occurring in the RA groundwater plume, this approach essentially contains contamination by binding up aqueous-phase contamination in a stable sorbed phase by the same mechanisms as occur via ex situ treatment using conventional GAC. If natural biodegradation processes were occurring, the PlumeStop™ barrier would significantly enhance the degradation rate.

The sorptive effect of PlumeStop™ is expected to last indefinitely or until all sorption sites are occupied, with little to no impact on aquifer geochemical conditions. Sorption sites are continually being "freed up" or regenerated as the volatiles are consumed. Regardless of whether biodegradation would occur, the amount of PlumeStop™ required to achieve adequate distribution across the 130-foot thick by 775-foot long barrier significantly exceeds the estimated quantity needed to capture the contaminant mass resulting from the portion of the RA groundwater plume predicted to flow through the barrier, approximately by a factor of 20 (Appendix I).

Modeling and Barrier Installation

As summarized in Table 4-3D, there are implementability challenges to injecting across a 130-foot thick interval at the targeted depths in a densely developed area. Therefore, the proposed delivery approach uses a combination of injection and extraction between wells completed across multiple intervals to focus and improve distribution across the intervals. Actual well completion design and injection/extraction rates would be determined, at a later detailed design stage following geophysical efforts, to assess where primary flow intervals exist with an attempt to isolate the flow intervals. For the purposes of the FS, it was assumed that the wells would have seven 15-foot screen intervals separated by six 4-foot blank sections accounting for 129 feet of the 130-foot thick target interval.

Using extraction wells to pull groundwater via a cone of depression in conjunction with pressurized injection of amended groundwater will result in increased distribution distances and fewer well locations. Particle tracking model simulations injecting and extracting 100 gpm at well locations predicted varied travel path distances from 50 to 75 feet after one week's time. Iterations of particle tracking in the groundwater model determined locations for the injection and extraction wells, as presented in Figure 7-6 of Appendix G. The proposed locations shown

on Figure 5-4 were slightly modified/shifted from the modeled locations to reflect the differences between simulated and observed plume conditions and to account for practicability concerns, such as installing a parallel line of injection and extraction wells along the City's right-of-way (near the sidewalk) on the south side of 8th Avenue, as opposed to the modeled staggered approach within the roadway. Therefore, eight injection wells and nine extraction wells are proposed for installing the 850-foot long PlumeStop™ barrier, spaced approximately 50 feet from one another, as shown in Figure 5-4. Additional options for well spacing and injection/extraction durations were considered, as discussed later in this section, but the configuration depicted on Figure 5-4 was used for evaluation and costing purposes in this FS.

This alternative is essentially a groundwater recirculation approach and no source water would be needed, nor would extracted water need to be treated or discharged at the surface. Installing the barrier would involve withdrawing groundwater from eight extraction wells, blending the PlumeStop™ with the extracted water via in-line mixing/dosing, and immediately reinjecting the amended water via the seven injection wells. The modeled flow rate of 100 gpm per location assumes approximately 1 gpm per foot of screened interval, or 15 gpm per injection/extraction interval (resulting in 105 gpm per location). Packers would be placed within the upper and lower blank sections to isolate the subject injection/extraction screened intervals.

The GAC colloids within PlumeStop™ coat the soil particles as the product flows, resulting in a slight "product consumption" as the mixture flows. Therefore, the transport of the "PlumeStop™ front" is slightly retarded with respect to groundwater, conservatively estimated by a retardation factor of 1.25, meaning a 7-day travel time for groundwater per particle tracking is assumed to take up to 8.75 days. This alternative assumes a continuous circulation period of 9 days per screened interval, requiring 63 days per location. Assuming 3 crews, the injection-extraction component of this alternative would require approximately 150 days for implementation. The injection and extraction process would operate 24/7, but once setup and running, the pumping and in-line mixing/dosing could proceed with minimal oversight.

Additional Components

There are several other components to this alternative including:

- The installation of five additional monitoring wells to assist in evaluating the performance of the PlumeStop™ barrier, as shown in Figure 5-4. The additional wells would allow a comparison of pre- and post-barrier concentrations at two locations along the barrier, as well as monitoring concentrations potentially flowing around the barrier.
- Borehole contamination and flow vertical profiling to locate screen placement of the injection and extraction screen intervals. This would be conducted at monitoring wells in the vicinity of the barrier prior to installation to aid in screen placement, well spacing, and injection quantities.
- Pre- and post-installation geophysics to evaluate and delineate the PlumeStop™ distribution. One potential technology, called GeoTrax by Aestus, LLC, is a high-resolution electrical resistivity survey that would detect changes in aquifer conductivity from GAC coating the soil particles and illustrate the emplaced barrier if conducted before and after installation. Low levels of a benign salt (i.e., bromide or chloride) could also be used as a tracer to further differentiate the contrast between pre- and

post-injection (only a 20% difference in electrical signature is needed to delineate the injection). Pre-installation geophysics could also assist in locating different strata and used in conjunction with the borehole flow profiling to target the water bearing zones for PlumeStop™ delivery.

- Ongoing plume monitoring with an assumed network of 25 monitoring wells on an annual basis for the first 5 years, then reducing to biannually for the next 10 years, and once every 5 years thereafter until Year 40 when a NFAD is assumed to be given.

Additional implementation details, durations, and assumptions for this alternative are reflected in the cost estimate presented on Sheet J-6.1 of Appendix J.

Uncertainties and Contingencies

A significant uncertainty associated with this alternative is if the groundwater flow direction were to change beyond what has been simulated due to a significant change in UA pumping rates or if the CoT, or another end user, were to install and operate a nearby extraction well in the RA. If the groundwater flow direction changed considerably, RA groundwater contamination may flow past 8th Avenue without encountering the installed PlumeStop™ barrier. With the exception of the first year, this alternative is passive and once implemented cannot be altered without significant effort and cost. Therefore, ex situ treatment (e.g., GAC) may be required at the wellhead of production wells potentially intercepting the plume if it were to bypass the installed barrier.

A related uncertainty is if poor distribution of PlumeStop™ were obtained across the injected barrier. Modeling simulations indicate that approximately 80% of the contaminant mass needs to be treated/sorbed to not exceed the action threshold of 2.5 ppb for PCE at production wells (specifically at Aggie). Therefore, if PlumeStop™ is distributed across less than approximately 80% of the targeted interval due to implementation difficulties, ex situ treatment may still be required at downgradient production wells.

An alternate injection-extraction configuration was considered in an attempt to reduce costs and implementability difficulties involving approximately half of the wells (3 injection and 4 extraction wells), but with recirculating water for 3 weeks instead of one. However, the estimated cost savings was low (approximately 6% of the installation component and 4% of the alternative's total) as the increase in field time largely offset the savings in planning and well installation efforts. The benefit to a small reduction in estimated cost does not outweigh the increased uncertainty and decreased control in PlumeStop™ distribution from nearly doubling the travel distances.

In the event that the deeper RA characterization effort (installing three wells screened from 320 to 400 bgs) indicates that contamination needs to be treated as deep as 400 feet bgs, this would extend the needed barrier depth an additional 70 feet. Assuming 15-foot screens separated by 4-foot blanks, this would require an additional 4 injection intervals. This would increase drilling and material costs, but more significantly would increase the field time by approximately 36 days per location for a total estimated field time of approximately 312 field days. Given the necessary field time involving continuous groundwater recirculation, this alternative would become nearly impractical from an implementability standpoint.

5.1.4.2 Alternative 2 - Less Aggressive

The less aggressive alternative for the RA involves long-term MNA and ex situ treatment of extracted groundwater on an as-needed basis at the wellhead of UA production wells prior to distribution for consumption. Most of the details of this alternative (e.g., assumed monitoring and treatment durations and locations) are based on modeling simulations (see Appendix G) and have considerable cost implications (Appendix J). Overall, modeling simulations predicted that the RA groundwater plume would impact two UA production wells (e.g., exceeding a PCE concentration of 2.5 ppb), reaching the first production well (Aggie) by Year 30 and leaving by Year 75, and then reaching the second production well (S-Hospital) by Year 110 and being completely extracted by Year 195 (see Sheet J-6.4 of Appendix J).

Modeling Assumptions

This alternative assumes that natural attenuation occurs by diffusion and dispersion, as well as dilution when mixed with extracted groundwater across lengthy screened intervals represented by multiple layers in the model. However, based on a lack of historical evidence for biodegradation and in order to be consistent with assumptions used in the RI, it was conservatively assumed that no biodegradation is occurring in the RA for the purposes of the FS. It is likely that biodegradation processes are occurring at very slow rates in portions of the RA groundwater plume, such that there is no site-specific empirical evidence of degradation given the duration of monitoring data. Therefore, the conservative assumption of no biodegradation has been made in order to develop a remedy that can meet ROs with reasonable certainty. Potential implications, if biodegradation were to occur at very slow kinetics, are discussed later in this section.

Simulated pumping rates varied for the eight modeled UA production wells according to pumping projections provided by the UA, as specified in Appendix H-3 and tabulated in Table 7-1 of Appendix G. Pumping was simulated by assuming continuous pumping at an average rate throughout the year, averaging around 100 to 180 gpm across the 8 wells depending on the time period; however, the actual pumping occurs episodically at much higher rates (e.g., 300 to 450 gpm). The assumed pumping rates based on UA projections are important assumptions to this alternative as UA pumping is the primary influence on groundwater flow velocity and direction in the Site vicinity. A change in pumping rates and locations could considerably influence the migration of the RA plume.

Wellhead Monitoring and Treatment

Quarterly wellhead monitoring was assumed to occur upon detection and/or at least 10 years prior to reaching the action threshold level of 2.5 ppb for PCE. Wellhead treatment via GAC and wellhead monitoring are assumed to occur while extracted groundwater concentrations exceed 2.5 and 0.25 ppb for PCE, respectively. Modeling simulations predict that wellhead treatment is necessary at two production wells (Aggie and S-Hospital), each at different times and for varying durations. Durations of monitoring and treatment are presented along with yearly estimated PCE concentrations in extracted groundwater for the four production wells in Sheet J-6.4 of Appendix J. The estimated PCE concentrations are based off Figure 7-2 from Appendix G and were used in conjunction with simulated pumping rates from UA's projections to calculate carbon consumption rates presented in Sheet J-6.4 of Appendix J.

Although GAC consumption was estimated from average flow rates, the GAC vessels were sized using maximum anticipated flow rates. The maximum flow rates observed at these two wells from 2008 to 2013 ranged from 380 to 425 gpm (Table 2-2 of Appendix G); therefore, vessels capable of managing up to 500 gpm were selected (e.g., HP® 810SYS of Evoqua). Each treatment train would consist of two vessels in series, each containing 10,000 lbs of GAC, with a manifold that allows the flow direction to reverse (swapping lag and lead vessels) and with sampling ports installed within and between the vessels. GAC sorption capacities were estimated from vendor isotherms using site-specific data and included an inefficiency factor assuming other compounds (non-COCs) increased the GAC consumption by 20%. A change out was scheduled when approximately 10,000 lbs of GAC have been consumed, as shown in Sheets J-6.2 and J-6.4 of Appendix J.

For the purposes of the FS, it was assumed that treatment equipment would remain functional for the necessary duration at each wellhead given proper maintenance, but that it could not be reused at other locations or sold for a credit. As a result of the configuration of UA's water distribution system, there is not a centralized collection point and treatment would have to occur at the wellhead. Due to observed space limitations near UA's production wells, the treatment vessels would be housed in underground vaults. Additional information on UA's system is included in Appendix H-2. The Group would be responsible for utility services, routine maintenance, and changing out GAC. Based on UA's projected pumping plan (Appendix H-3), it is assumed that the UA would not install additional production wells in the plume vicinity necessitating additional treatment systems and monitoring efforts.

Plume Monitoring and Well Installation

The RA groundwater plume is not under stable conditions, likely because of pumping the UA wells, and contaminant migration is estimated at approximately 60 feet per year. Installing additional monitoring wells would be necessary to continue monitoring the downgradient portion of the plume as it moves beyond the extent of the existing monitoring well network. Therefore, this alternative assumes that 10 additional downgradient monitoring wells are installed and 10 existing upgradient monitoring wells are abandoned every 30 years, estimating that the plume migrates approximately 1,800 feet during this timeframe. Therefore, 60 wells are assumed to be installed and abandoned, with the remaining monitoring wells abandoned upon site closeout, over the assumed 200-year project duration. The total number of groundwater monitoring wells sampled during a given event does not change over time.

Plume monitoring is assumed to occur at 20 wells each event with a biannual frequency for the first 10 years after which the frequency would be reduced to once every 5 years until the RA groundwater plume is in the proximity of a production well upon which the frequency would return to biannual monitoring. Therefore, the frequency is assumed to be biannual for the first 10 years and from Year 30 to 200, for a total of 95 monitoring events over the 200-year duration.

Uncertainties and Contingencies

A significant uncertainty associated with this alternative is whether natural biodegradation processes do occur, even if at very slow rates. The modeling simulations assuming zero biodegradation (an infinite half-life) resulted in maximum predicted PCE concentrations of approximately 2.7 ppb at year 50 at Aggie and approximately 3.8 ppb at Year 140 at S-Hospital (Figure 7-2 of Appendix G). At these simulated concentrations and durations, half-lives of

approximately 390 and 230 years should be sufficient to naturally reduce concentrations below the action threshold of 2.5 ppb for PCE by the time the peak concentration would arrive at Aggie and S-Hospital, respectively. While there may be minimal biodegradation occurring in the RA, it is likely reasonable to assume that some degree of biodegradation is occurring at an average half-life less than (faster than) 230 years. Therefore, there is the possibility that wellhead treatment might never be needed under this alternative; however, there is also the possibility that incomplete biodegradation processes may occur and result in concentrations of the more toxic degradation product VC. Because VC does typically degrade more rapidly than PCE under aerobic conditions, PCE is anticipated to remain as the primary COC unless anaerobic conditions were encountered.

Overall, there is considerable uncertainty in the need for treatment at any of the UA production wells. If biodegradation processes were occurring at slow rates, or even in localized areas (e.g., as potentially observed at UAM-2), and future withdrawal rates were to change (influencing flow rate and direction), wellhead treatment may never be needed and this alternative would only include MNA. However, treatment was assumed to be necessary at both Aggie and S-Hospital to be conservative for the purposes of this FS.

In the event that the deeper RA characterization effort (installing three wells screened from 320 to 400 bgs) indicates that contamination needs to be treated as deep as 400 feet bgs, this alternative would remain essentially unchanged with the exception of slightly increased costs due to slightly increased GAC consumption.

5.1.4.3 Alternative 3 - More Aggressive

The more aggressive alternative for the RA involves groundwater extraction from a single withdrawal well with ex situ treatment via GAC near the wellhead. There are three viable water disposal or reuse options associated with this alternative, which include conveyance to the UA, discharge to High School Wash, or reinjection. These discharge options are discussed in detail in Section 5.1.4.4.

Groundwater modeling simulations (Appendix G) predict that the RA groundwater plume is adequately captured and completely withdrawn within approximately 30 years of pumping at 50 gpm from an extraction well positioned between PER-28 and UAM-2 (Figure 5-5). Groundwater would be treated via GAC at or near the wellhead prior to conveyance to the UA, discharge to High School Wash, or reinjection. LTM would be conducted until Year 40, when a NFAD is assumed to be given.

Modeling Simulations

Groundwater simulations were run iteratively to identify the optimal extraction well location and pumping rate for plume capture, as described in Section 7.4 of Appendix G. The proposed extraction well location shown on Figure 5-5 is shifted slightly to the southeast from the location determined in the model (Figure 7-3 of Appendix G) to reflect differences between simulated and observed plume conditions and to account for practicability concerns. The proposed location shown on Figure 5-5 is along the edge of a parking lot (approximately 85 feet by 95 feet) where it would be located out of the way of traffic and there would be adequate space to situate a rig to install the well and stage GAC vessels for above ground treatment. Reverse particle tracking was simulated to delineate the capture zone, illustrating that the width of the plume in Layer 1 (approximately 200 to 330 feet bgs) is captured if continuously pumped at 50 gpm (Figure 5-5).

Well Installation and Ex Situ Treatment

This alternative involves installing one 8-inch extraction well via air rotary between PER-28 and UAM-2 screened from 200 to 330 feet bgs. For the purposes of this FS, Schedule 10, stainless steel Type 304 blank casing and Type 304, wire-wrap stainless steel screen was assumed; however, the material specifications and screen sizing would be determined following borehole installation. It was also assumed that a 2-inch Schedule 80 PVC piezometer would be co-located within the 12-inch boring to allow gauging.

Following well installation, the well would be developed and an aquifer test conducted (or flow profiling). The deployment depth of the submersible pump would be determined during aquifer testing, but likely near the bottom of the well and would need to be capable of delivering 50 gpm with sufficient pressure at the surface. For the purposes of this FS, it was assumed that using a 4-inch, 10 hp submersible pump (e.g., American Turbine ATP 60-18) would deliver 50 gpm at sufficient pressure to overcome the 200 feet of hydraulic head, plus friction losses in the GAC vessels and piping conveying the water to either the UA, wash, or reinjection location without requiring an inline booster pump.

The wellhead would be housed within a 4-foot by 4-foot concrete well vault rated for heavy-vehicle traffic and conveyance piping would daylight at the GAC vessels and then return underground for conveyance to UA. In the event that adequate space does not exist to locate the GAC vessels at the surface, they could be located in underground vaults, which would incur greater expenses and maintenance requirements. The extraction well would be equipped with a programmable logic controller (PLC) and a high/low switch that turns the pump off if the pumping water level falls above or below the expected range. The PLC would be connected to a nearby transformer for an electricity source. In the event that it is not feasible to connect to an existing transformer, a new one would be installed. This FS assumed that a property parcel would be purchased to host the well and treatment accessories for the 40-year project duration, upon which it would be sold.

Simulated PCE concentrations withdrawn from the extraction well were predicted via groundwater modeling and used to estimate the treatment timeframe and GAC consumption rates, as shown in Sheets J-6.3 and J-6.4 of Appendix J. Groundwater extraction and treatment would occur until the plume is sufficiently remediated, which for the purposes of this FS was assumed to occur after approximately 30 years of system operation.

The proposed treatment train would include two vessels in series, each containing 2,000 lbs of GAC and capable of managing up to 100 gpm (e.g., HP2000 adsorbers by Evoqua). Similar to Alternative 2, a manifold would be installed to allow directing the flow to either vessel, enabling swapping of the lag and lead vessels, and sampling ports would be installed within and between the vessels. GAC sorption capacities were estimated from vendor isotherms including a 20% inefficiency factor, with change outs occurring when approximately 2,000 lbs of GAC have been consumed (Sheets J-6.2 and J-6.4 of Appendix J).

Plume Monitoring and Well Installation

This alternative includes the installation of four additional groundwater monitoring wells in the vicinity of the proposed extraction well (Figure 5-5) to improve potentiometric and chemical control in delineating the capture zone and be used in conjunction with existing wells in evaluating whether any portion of the plume is bypassing it. Biannual plume monitoring with an

assumed network of 24 monitoring wells lasts throughout the project duration until Year 40 when a NFAD is assumed to be given, for a total of 21 events.

Uncertainties and Contingencies

This alternative has a lower degree of uncertainty than Alternative 1 with respect to changes in groundwater flow direction and rate, as the pumping rate could be increased or decreased accordingly to change the capture zone. As a contingency measure, a second extraction well could be installed. Also, the concern to Alternative 1 with not achieving adequate distribution across zones is not as great of a concern in this alternative as a hydraulic gradient can be exerted across the entire screened interval irrespective of the permeability of the aquifer materials.

Potential uncertainties in this alternative include breaking components, a fouled well screen, and system down-time due to various reasons. Costs for standard maintenance were included, but catastrophic damages were not included. Another uncertainty is if access could not be obtained, or a property could not be purchased, to acquire a suitable location for the extraction well and associated treatment equipment. In this instance, the well would likely need to be located within the CoT right-of-way and untreated water piped to a nearby property housing the treatment vessels. The danger in piping untreated water is if a leak or rupture were to occur, releasing contamination to shallow soils.

In the event that the deeper RA characterization effort (installing three wells screened from 320 to 400 bgs) indicates that contamination needs to be treated as deep as 400 feet bgs, it would need to be evaluated whether a single extraction well screened from 200 to 400 feet bgs could effectively capture the plume and at what pumping rate. Depending on the pumping rate, the pump size may be too large to fit within an 8-inch well, necessitating a larger well or installing two extraction wells operating at lower pumping rates. The ex situ treatment costs would be increased due to increasing GAC consumption, power demands, and vessel/equipment sizing.

5.1.4.4 Alternative 3: Extracted Water Handling Options

The following four options were evaluated to handle water extracted from the RA under Alternative 3:

- Discharge untreated to the sanitary sewer (eliminated);
- Convey treated water to the UA (Alternative 3A);
- Discharge treated water to High School Wash (Alternative 3B); and
- Reinject treated water to the RA (Alternative 3C).

Of the above options, discharging to the sanitary sewer was eliminated from further consideration following discussions with Pima County, whereby it became apparent that this alternative would be cost prohibitive in fees associated with a sustained 50 gpm of remediated water (Class Code 6) for 30 years. The three remaining viable options are discussed in their respective sections below, shown on Figure 5-5, and costed in Sheets J-6.3A,B,C in Appendix J.

Alternative 3A: Convey to the UA

This option assumes that treated ground water would be conveyed at no cost to the UA, as costed in Sheet J-6.3A of Appendix J. Consideration was initially given to supplying treated water for consumption by directly tying into their water distribution system; however, following a Site visit

and discussions with UA, this was deemed difficult to implement and may be poorly perceived by the public (see Appendix H-2 for information on such constraints). Therefore, the preferred option entails conveying treated groundwater to UA by connecting directly to their cooling system at the Central Heating and Refrigeration Plant (CHRP) at Mountain Ave and Fourth Street.

Due to the numerous complications with surface trenching (e.g., vehicle traffic, buried utilities, potential for redevelopment), the preliminary design maximizes the use of directional drilling. The current plan includes installation of 4-inch SDR11 high density polyethylene (HDPE) conveyance piping using conventional surface trenching from the well head to the UA parking lot northeast of the intersection of Mountain Avenue and Eighth Streets where the treatment vessels will be housed assuming space limitations prohibit locating the compound adjacent to the wellhead. The route for this section of piping would be east from the wellhead to Mountain Avenue then north along the east side of Mountain to the parking lot (about 425 feet). This run of pipe will convey untreated groundwater, and although the concentrations of chlorinated solvents in the extracted water are expected to be very low, secondary containment of this section of piping will be used.

The preliminary design includes construction of the GAC treatment compound described above on the UA parking lot. Conveyance piping from the treatment compound to the UA north of 6th Street would be beneath Mountain Ave. installed at a depth of approximately 20 feet bgs via horizontal drilling (approximately 980 feet). A depth of 20 feet bgs was chosen to be clear of the deepest utility (e.g., sewer) and potential future developments. The piping would then continue north, northeast underneath the Highland Commons building north of 6th Street approximately 400 feet to the open field just southeast of the CHRP. Drilling beneath the City right-of-way and potentially adjacent properties would require coordination with the City and landowners, and potentially with the Pima County Regional Wastewater Reclamation Department (PCRWRD) during directional drilling operations concerning crossings of the public sanitary sewer.

The entry point for the horizontal boring requires a sizable clearing to stage the rig, drill pipe, mud pit, and store cuttings; therefore, the UA parking lot was selected for this activity. The boring exit requires a long and narrow corridor of approximately 40 feet by 200 feet to stage and connect the HDPE conveyance piping as it is pulled back through the boring. Therefore, the open field southeast of the CHRP described above was selected as the exit point, as shown in Figure 5-5. The angle at which the boring can move vertically is 1V:5H, therefore, the actually entry and exit points would be influenced by the presence of subsurface features (e.g., utilities and foundations) until the clearance depth is reached.

Upon reaching the exit point, the 4-inch HDPE pipe segments (typically 40 feet in length) would be connected via butt fusion or electrofusion welding. The installed piping would be pressure tested at greater than 1.5 times the operating pressure, prior to system startup. The field duration is estimated to require approximately 15 days to complete the drilling and 1 to 2 days to install the piping.

Considering the long-term nature of this alternative, it is uncertain whether the UA would be willing or able to continuously accept 50 gpm of water at the same location for their CHRP.

Alternative 3B: Treat and Discharge to High School Wash

This option assumes that the extracted water would be treated via above ground GAC vessels at or near the wellhead and that treated water would be piped approximately 60 feet directly south to High School Wash. In the event that adequate space does not exist to locate the GAC vessels

at the surface, they could be located in underground vaults, which would incur greater expense and maintenance requirements. The costs associated with the extraction and treatment of groundwater are identical to those of Alternative 3A; however, this option has lesser costs associated with conveyance, but greater costs associated with monitoring and permitting, as shown in Sheet J-6.3B of Appendix J.

There are number of ordinances and regulations that would apply to discharging treated/remediated groundwater to High School Wash, which is a drainage used for flood control south of the proposed extraction well location. The following regulations, permits, and procedures need to be considered for this option and were identified via a review of local, State, and federal regulations and coordination with various agencies:

- Alterations within a Floodplain: the proposed location for the extraction well and treatment compound is within the floodplain, but there is no floodway shown for the stretch of High School Wash. Rationale could be provided for why no impacts are anticipated given the size of the treatment compound, whose base could be elevated on stilts 1-foot above the base flood elevation and a no-rise analysis could be performed if necessary. Discharging 50 gpm (or 0.1 cubic feet per second [cfs]) is negligible during a storm event where the regulatory 100-yr flow is 2,098 cfs along this stretch.
- Sediment and Erosion Transport: the discharge point would involve a standard outfall design (e.g., concrete apron with armored channel banks) and gabions to reduce erosion and prevent scouring within the drainage. An analysis could be performed to optimize the outfall design based on sediment properties and flow conditions.
- Channel Alterations: any alteration of channel properties within a drainage classified as a water of the United States (WOTUS) would require approval from the US Army Corps of Engineers (USACE) per Section 404 of the Clean Water Act.
- Riparian Habitat: the proposed site is located outside and west of a riparian zone; therefore, no impacts are anticipated.
- Mosquito Abatement: will be addressed in the general permitting process in accordance with Tucson's mosquito control and abatement measures in their watercourse maintenance ordinance and mitigation documents.
- Discharge Permitting and Monitoring: regulated by ADEQ under the Arizona Pollutant Discharge Elimination System (AZPDES) likely as a minor Industrial Facility. This permit would require routine monitoring and reporting to demonstrate that surface water quality standards are being met.
- Beneficial Use Evaluation: Likely required by ADWR and an evaluation of whether discharging complies with the Water Management Plan for the Tucson Active Management Area.

Overall, none of the identified requirements are believed to be obstructive to implementing this option for handling extracted groundwater. The requirements and considerations are detailed further in Appendix K.

Alternative 3C: Treat and Reinject

This option includes reinjecting treated groundwater via two injection wells in a manner that does not negatively influence the extraction efficacy. The treatment vessels would be located above ground at or near the wellhead; however, if space restrictions do not permit the GAC vessels to be located at the surface, they could be placed in underground vaults, which would incur greater expenses and maintenance requirements.

The two injection wells would be screened across similar intervals to the extraction well (from 200 to 330 feet bgs) and located adjacent to one another. Two injection wells are recommended because a formation typically receives water via injection at approximately half the rate that it produces water under extraction, and also so that extraction could continue (perhaps at a reduced rate) while one injection well is undergoing rehabilitation and maintenance activities.

An orifice would be designed and installed within the drop tube to each of the injection wells that restricted the flow such that a continuous water column would be maintained within the well. This maintains a higher hydrostatic head to induce flow into the formation and prevents the water flow from free-falling or cascading within the well, causing aeriation that would lead to fouling. Several reinjection configurations were evaluated, as discussed in Appendix G, four of which were retained as viable options for evaluation. The four retained options, along with their pros and cons, include locating the two injection wells:

- Adjacent to the extraction well but screened in a deeper interval, approximately from 500 to 630 feet bgs (Alternative 3C-1)
    - Pros: eliminates the need to convey the water or coordinate additional property access; creates an upward gradient preventing downward plume migration.
    - Cons: requires deeper injection wells and increases the remedial timeframe by approximately 0.25 years (relative to without injection).
- Downgradient of the extraction well near 7th and N Santa Rita Ave (Alternative 3C-2)
    - Pros: slightly improves capture zone; is located on a straight line along the City right-of-way from the property where the extraction well will be installed with only one major street crossing, likely avoiding the need for directional drilling to install conveyance piping.
    - Cons: increases the remedial timeframe by approximately 2.0 years (relative to without injection).
- Crossgradient of the extraction well near 8th and N Tyndall Ave (Alternative 3C-3)
    - Pros: causes the least impact on the non-injection capture of the plume under the groundwater extraction alternative other than the upgradient injection scenario.
    - Cons: conveyance crosses several major intersections in the City right-of-way likely necessitating directional drilling to reach the injection location; slightly increases the remedial timeframe by approximately 0.75 years (relative to without injection).

- Upgradient of the plume along E Manlove St, between S Park Ave and S Fremont Ave (Alternative 3C-4)
    - Pros: decreases the remedial timeframe by approximately 1.5 years (relative to without injection).
    - Cons: furthest conveyance distance; considerable coordination and property access efforts needed. Directional drilling would be required.

Rather than completely cost out each of the above four options separately, a relative cost comparison is presented in Sheet J-6.3C1 of Appendix J that displays incremental costs unique to each option that would be beyond shared costs inherent to each alternative. Based on this analysis and the pros and cons stated above, Alternative 3C-2 (the downgradient option) was selected as the preferred reinjection option and is used as the basis for the costs of Alternative 3C presented in Sheet J-6.3C2. The downgradient injection option will be carried forward for remedy development, whereas the other three options will no longer be discussed but are reserved as contingency options.

5.2 SUMMARY OF REMEDIES

This section summarizes the reference and alternative remedies that were developed from the alternatives discussed in Section 5.1. As mentioned in Section 5.1, reference, less aggressive, and more aggressive alternatives were developed for each of the zones (UVZ, PA, LVZ, and RA) such that the four reference alternatives are assimilated into a single Reference Remedy, the four less aggressive alternatives are assimilated into a single Less Aggressive Remedy, and the four more aggressive alternatives are assimilated into a single More Aggressive Remedy.

5.2.1 Remedy 1 - Reference

The Reference Remedy (Remedy 1) includes:

- Pulsed SVE for 10 years followed by MNA until Year 30 in the UVZ;
- MNA for 200 years in the PA;
- Implementing pulsed SVE at two wells for 10 years in the LVZ, but with an expanded LTM network and monitoring until Year 30; and
- Installing a 775-foot long in situ PlumeStop™ barrier from 200 to 330 feet bgs along 8th Avenue in the RA, accompanied by LTM until Year 40.

Upon the completion of this remedy, it is assumed that vapor concentrations in the UVZ would be below levels presenting a vapor intrusion risk and soil concentrations would be below NR-SRLs beneath the Mission Plant area and residential SRLs elsewhere. Contamination would still likely exist above water quality standards in the PA, but would not be anticipated to impair RA water quality or shallow UVZ vapor concentrations. Soil contamination in the LVZ would have been remediated to levels below GPLs and would not impact RA groundwater above water quality standards. The RA groundwater plume would have been passively treated/sorbed by the barrier and would cease to exceed water quality standards, thus no longer posing a threat to receptors via downgradient production wells.

5.2.2 Remedy 2 - Less Aggressive

The Less Aggressive Remedy (Remedy 2) includes:

- MNA in the UVZ until Year 30;
- MNA for 30 years in the PA, with a contingency PlumeStop™ barrier at Year 25;
- Implementing pulsed SVE at two wells for 10 years in the LVZ with the current LTM network and monitoring until Year 30; and
- MNA with wellhead treatment at production wells in the RA until Year 200.

This remedy is considered to be less aggressive because it requires more remedial measures (wellhead treatment), a longer duration to achieve ROs (e.g., 200 yrs for the RA), and involves greater uncertainty. Similar to the Reference Remedy, it is assumed that upon completion of this remedy UVZ contamination would not present a vapor intrusion risk nor exceed SRLs. PA contamination would remain above water quality standards, but is assumed to not impair RA water quality or shallow UVZ vapor concentrations, particularly with the option to implement the PlumeStop™ barrier contingency remedy. LVZ contamination would be below GPLs and would not impact RA groundwater above water quality standards. The RA groundwater plume would have slowly attenuated and undergone ex situ treatment upon extraction at various production wells.

5.2.3 Remedy 3 - More Aggressive

The More Aggressive Remedy (Remedy 3) includes:

- In-well sparging with vapor capture by continuous SVE within the MPE wells for 5 years, followed by pulsed SVE until Year 10 and MNA in the UVZ and PA until Year 35;
- Implementing pulsed SVE at two wells for 1 year in the LVZ, followed by installing an additional SVE location and 10 years of pulsed SVE, and LTM with an expanded network until Year 31;
- Pump and treat with a single extraction well at 50 gpm and ex situ GAC treatment for 30 years followed by LTM until Year 40; and
- Disposal of treated groundwater either by conveying water to UA (3A), discharging to High School Wash (3B), or reinjecting to the RA at a downgradient location (3C-2).

This remedy is considered to be more aggressive because no remedial measures are anticipated, additional treatment of the UVZ, PA, and LVZ occurs, the RA plume is captured in a shorter period of time and with greater certainty/control. Similar to the other two remedies, it is assumed that upon completion of this remedy the UVZ contamination would not present a vapor intrusion risk nor exceed SRLs. PA contamination would be reduced but portions of the plume would still remain above water quality standards; however, it would not impair RA water quality or shallow UVZ vapor concentrations. The LVZ contamination would be below GPLs and not impair RA groundwater. The RA groundwater plume would be captured and treated over time, preventing unacceptable risk to receptors consuming groundwater from production wells downgradient of the plume.

This section individually evaluates the Reference Remedy and two alternative remedies against comparison criteria and then compares the remedies relative to one another.

6.1 COMPARISON CRITERIA

This section describes the comparison criteria specified in A.A.C. R18-16-407(H.3) used to evaluate the Reference Remedy and two alternative remedies, including practicability, risk, cost, and benefit.

Practicability

The evaluation of the practicability of the remedies includes the consideration of feasibility, short and long-term effectiveness and reliability, site-specific conditions, contamination characteristics, performance capabilities of available technologies, and institutional considerations (e.g., access issues, easements and right of ways, utilities, etc.).

Risk

The evaluation of risk must include consideration of the overall protectiveness of public health and the environment under reasonably foreseeable use scenarios and end uses of the water. Specifically, this includes an evaluation of:

- The contaminant's fate and transport, concentration, and toxicity over the remedial timeframe.
- Current and future land and water uses.
- Exposure pathways and durations, including the protection of human health and the environment during remedy implementation.
- Changes in risk over the remedial timeframe, including residual risk upon remedy conclusion.

Cost

The cost analyses (Appendix J) provide the estimated cost of each alternative, including direct and indirect capital/construction costs and long-term O&M costs. Costs estimated for the three remedies are pre-design, conceptual level estimates to support relative comparisons among alternatives, and are not to be used for establishing project budgets. At the FS stage, the remedy design is still conceptual, not detailed; however, detailed assumptions must be made in developing the costs. Such assumptions are subject to change and the expected level of accuracy of the cost estimates developed ranges from approximately -30% to +50%. Furthermore, costs projected in the distant future (e.g., greater than 30 years from the present) have increasing uncertainty. A more detailed design will be completed of the Proposed Remedy prior to implementation, which will refine and increase the level of accuracy of the cost estimate.

Direct capital costs include costs for equipment, materials, labor, subcontractors (e.g., drillers, vendors, etc.), laboratory, treatment, etc. Indirect capital costs include costs for engineering and design and project management. Long-term O&M costs include costs for continued operation, maintenance, and monitoring of the Site following implementation. The duration under which the long-term costs were applied varied by alternative and ranged from 30 to 200 years. Typically a FS does not consider costs exceeding a 30-year timeframe; however, costs are

presented for the entire duration necessary to achieve ROs, which in the case of Alternative 2 for the RA is estimated at 200 years.

A flat rate of 10% was applied to each task to account for anticipated project management efforts. A variable contingency factor was applied to each to task item in the cost estimates and ranged from 5 to 20% (Appendix J). Tasks with relative predictability and consistency, such as LTM, were assigned lower contingency factors, whereas tasks with less certainty in the scope and performance, such as installing the PlumeStop™ barrier, were assigned higher contingency factors.

Present worth analyses are included in the cost estimates to discount current dollar costs to net present value (NPV) costs. Given a long-term project life (e.g., over 30 years), this discounting effect can be very significant with NPV costs significantly lower than current costs. This is particularly true for alternatives that incur the majority of expenses later in their project life. The discount factor is calculated for each year over the project duration taking into account inflation and the expected return on investment. For costing purposes, the analysis assumes an annual inflation of 1.5%, based on average inflation rates in Tucson between 2009 and 2013 (Making Action Possible 2016), and a conservative return on investment rate of 3.5% based on the nominal interest rates forecast by the Office of Management and Budget (White House Administration 2015) for long-term (30 year) investments. At these rates, discount factors of 0.907, 0.557, 0.142, and 0.020 are applied at Years 5, 30, 100, and 200, respectively.

These rates are assumed for the purposes of this FS and can be altered upon remedy design, but overall result in conservatively low discount factors. According to a study by Forbes in 2014, average returns on investment for bonds from 2004 to 2013 was 4.6% (Forbes 2014), which would result in a higher discount rate. The EPA costing guidance recommends a discount rate of 7%, and occasionally higher discount rates are used (EPA and USACE 2000). Therefore, this FS cost analysis is conservative by using lower discount rates yielding higher discount factors and have less influence on the NPV calculation. Using a discount rate of 7%, which is common among FSs, would have resulted in extremely low discount factors of 0.713, 0.131, 0.001, and 0.000001 applied at Years 5, 30, 100, and 200, respectively.

Benefit

The benefit, or value, of each remedy is evaluated and considers:

- lowered risk to humans and the environment;
- reduced concentrations and volumes of contaminated water;
- decreased liability and anticipated degree of public acceptance;
- aesthetic aspects and the preservation or enhancement of land and water uses; and
- improvements to local economies.

6.2 INDIVIDUAL ANALYSIS

This section presents the individual analysis of the three remedies against the comparison criteria. The remedies are evaluated against the individual subcriteria of practicability in Tables 6-1, 6-2, and 6-3, for Remedies 1, 2, and 3, respectively. Various potential risks are listed

for each remedy in the subsections below. The first year costs and total remedy completion costs are summarized in the subsections below, but detailed costs are presented in Appendix J. Sheet J-1.0 summarizes costs for the three remedies, as well as a fourth remedy (the Proposed Remedy discussed in Section 7). Sheets J-2.1 to J-2.4 summarize alternative costs for each remedy. Sheets J-3.1 to J-6.4 correspond to individual alternatives for their respective zones. The remedy benefits are summarized in a "big-picture" sense considering the remedy as a whole.

6.2.1 Remedy 1 - Reference

This section evaluates the Reference Remedy against the comparison criteria in the following subsections.

6.2.1.1 Practicability

Table 6-1 presents the practicability analysis of the Reference Remedy for each alternative and its respective target zone.

6.2.1.2 Risk

The following are potential risks associated with the Reference Remedy:

- Rebound of soil vapor concentrations in the UVZ as a result of residual VOCs diffusing out of less permeable zones within the UVZ or diffusing upward from the PA. Further degradation of cDCE to VC in the PA potentially resulting in vapor intrusion of VC to indoor air. An evaluation of the potential for vapor intrusion to indoor air indicates that current vapor concentrations do not pose an unacceptable risk to human health under a residential exposure scenario (Appendix E). LTM of the PA and soil vapor within the UVZ will identify the occurrence and severity of the risk associated with rebounding soil vapor concentrations and accumulating vapor concentrations from PA diffusion thereby allowing for implementation of contingency actions (e.g., vapor mitigation systems), if necessary.
- Migration of VOCs within the PA laterally downgradient or vertically through the upper aquitard and into the LVZ. Based on LTM at the site and for reasons presented in Section 3.4.2, this risk is considered to be low.
- The 200-year timeframe associated with MNA of the PA is considered to be a risk given the uncertainties and unknowns associated with agency oversight, land use, and projected water use over this length of time.
- Installation of LVZ vapor monitoring wells penetrating the upper aquitard. The installation of wells penetrating the aquitard may result in a conduit for contaminants within the PA to be transported to the UVZ and the RA. This risk can be mitigated by completion of an outer casing within the upper portion of the aquitard prior to advancement of a boring through the aquitard and into the LVZ.
- Rebound of soil vapor concentrations in the LVZ resulting in potential impact to the RA. LTM of soil vapor within the LVZ and of groundwater in the RA will identify the occurrence and severity of this risk thereby allowing for implementation of contingency actions, if necessary.

- Well installation by an independent party penetrating the upper aquitard and releasing contaminants from the PA to the LVZ and RA. This risk may be addressed through the use of institutional controls whereby the ADWR reviews all drilling permits within the affected area and imposes special well construction requirements.
- Incomplete distribution of PlumeStop™ within the targeted zone. This risk may be partially addressed by conducting detailed design following geophysical efforts to assess where primary flow intervals exist. Post-installation geophysics would assist in understanding the achieved distribution and resulting associated risks. Monitoring downgradient of the barrier will provide data regarding the removal efficiency of the PlumeStop™ barrier.
- Variation in the long-term pumping rates of UA wells and/or installation and operation of additional production wells in the vicinity (e.g., by CoT) could alter the groundwater flow direction resulting in portions of the plume bypassing the PlumeStop™ barrier. This risk may be evaluated by performance monitoring (specifically gauging or using transducers) of wells in the barrier's vicinity. This is a significant risk and would require continuous monitoring of the bypassed plume until it is intercepted and COCs can be mitigated by wellhead treatment.

6.2.1.3 Cost

Estimated costs for the Reference Remedy are summarized in Sheet J-2.1 with detailed costs and assumptions reflected for the individual alternatives in Sheets J-3.1, -4.1, -5.1, and -6.1 for the UVZ, PA, LVZ, and RA, respectively (Appendix J). The total estimated cost for implementing the Reference Remedy in the first year (Year 0) is approximately $8,110,000, with an anticipated total remedy cost of $12,090,000 (current dollar) and $11,080,000 (NPV) by remedy completion.

6.2.1.4 Benefit

It is assumed that SRLs and AWQSs would be met in the UVZ, LVZ, and RA upon the completion of the Reference Remedy. Contamination would still likely exist above AWQSs in the PA, but would not be anticipated to impair RA water quality or shallow UVZ vapor concentrations. None of the alternatives offer aesthetic aspects or enhance land and water uses, beyond remediating contaminated groundwater in the RA that will likely be extracted for consumption in the future. The alternatives do not meaningfully improve local economies, with the exception providing work for field and consulting services, specifically during the implementation of the RA.

Implementing pulsed SVE in the UVZ and LVZ for 10 years under this remedy does result in reduced potential risk and future liability, but also produces spent GAC and PIZB needing to be disposed as hazardous waste. A benefit to the RA remedial alternative is that groundwater would be treated in situ and would not generate waste. LTM of the PA and RA would produce small quantities of investigation derived waste (IDW) requiring disposal for 200 years.

6.2.2 Remedy 2 - Less Aggressive

This section evaluates the Less Aggressive Remedy against the comparison criteria in the following subsections.

6.2.2.1 Practicability

Table 6-2 presents the practicability analysis of the Less Aggressive Remedy for each alternative and its respective target zone.

6.2.2.2 Risk

The following are potential risks associated with the Less Aggressive Remedy:

- Rebound of soil vapor concentrations in the UVZ as a result of residual VOCs diffusing out of less permeable zones within the UVZ or diffusing upward from the PA, as well as further degradation of cDCE to VC in the PA potentially resulting in vapor intrusion of VC to indoor air. LTM of the PA and soil vapor within the UVZ will identify the occurrence and severity of the risk associated with soil vapor concentrations thereby allowing for implementation of contingency actions, if necessary.
- Migration of VOCs within the PA laterally downgradient or vertically through the upper aquitard and into the LVZ. Based on LTM at the site and for reasons presented in Section 3.4.2, this risk is considered to be low and this remedy includes a contingency option to install a PlumeStop™ barrier in the PA to mitigate migration.
- Rebound of soil vapor concentrations in the LVZ following termination of SVE, thereby resulting in potential impact to the RA. LTM of soil vapor within the LVZ and of groundwater in the RA will identify the occurrence and severity of this risk thereby allowing for implementation of contingency actions, if necessary.
- Well installation by an independent party penetrating the upper aquitard and releasing contaminants from the PA to the LVZ and RA. This risk may be addressed through the use of institutional controls by ADWR.
- Variation in the long-term pumping rates of UA wells resulting in variation in flow direction and transport velocity of the untreated dissolved plume and uncertainty regarding time and duration of contaminant impact to the UA wells. This risk may be mitigated through LTM of the RA.
- Potential for CoT, or another end user, to install and operate a production well in the vicinity of the plume resulting in uncertainty in the flow direction and transport velocity of the untreated dissolved plume and uncertainty regarding time and duration of contaminant impact to UA wells and/or to possible CoT wells.
- Unknown long-term liabilities associated with the expected greater than 200-year life of the RA groundwater plume.

6.2.2.3 Cost

Estimated costs for the Less Aggressive Remedy are summarized in Sheet J-2.2 with detailed costs and assumptions reflected for the individual alternatives in Sheets J-3.2, -4.2, -5.2, and -6.2 for the UVZ, PA, LVZ, and RA, respectively (Appendix J). The total estimated cost for implementing the Less Aggressive Remedy in the first year (Year 0) is approximately $840,000, with an anticipated total remedy cost of $14,890,000 (current dollar) and $5,730,000 (NPV) by remedy completion. This cost includes a contingency remedial barrier installed in the PA at Year 25, as discussed in Section 5.1.2.2.

6.2.2.4 Benefit

It is assumed that SRLs and AWQSs would be met in the UVZ, LVZ, and RA upon the completion of the Less Aggressive Remedy. Contamination would still likely exist above AWQSs in the PA, but would not be anticipated to impair RA water quality or shallow UVZ vapor concentrations. None of the alternatives offer aesthetic aspects or enhance land and water uses, but may hinder land use in the vicinity of UA production wells by staging large GAC treatment vessels for a couple decades per well, even if located underground (Appendix H-2). The alternatives do not meaningfully improve local economies, with the exception providing work for field and consulting services, specifically for the routine installation and abandonment of RA monitoring wells and O&M of the wellhead treatment systems for the RA alternative.

Implementing MNA in the UVZ and PA instead of an active remedy does not result in as great a reduction in potential risk and future liability, but also does not produce as much waste streams requiring offsite disposal. LTM of the PA and RA would produce small quantities of IDW requiring disposal for 200 years.

6.2.3 Remedy 3 - More Aggressive

This section evaluates the More Aggressive Remedy against the comparison criteria in the following subsections.

6.2.3.1 Practicability

Table 6-3 presents the practicability analysis of the More Aggressive Remedy for each alternative and its respective target zone.

6.2.3.2 Risk

The following are potential risks associated with the More Aggressive Remedy:

- Rebound of soil vapor concentrations in the UVZ as a result of residual VOCs diffusing out of less permeable zones within the UVZ or diffusing upward from the PA, as well as further degradation of cDCE to VC in the PA potentially resulting in vapor intrusion of VC to indoor air. With air sparging of the PA, the risk of significant upward diffusion is reduced as vapors are captured by SVE in the lower portion of the UVZ. LTM of the PA and soil vapor within the UVZ will identify the occurrence and severity of the risk associated with soil vapor concentrations thereby allowing for implementation of contingency actions, if necessary.
- Migration of VOCs within the PA laterally downgradient or vertically through the upper aquitard and into the LVZ. Based on LTM at the site and for reasons presented in Section 3.4.2, this risk is considered to be low. This risk is further reduced with contaminant mass reduction from sparging of the PA in the source area.
- Installation of LVZ vapor monitoring wells and an LVZ vapor extraction well penetrating the upper aquitard, potentially resulting in a conduit for contaminants within the PA to be transported to the UVZ and the RA. This risk can be mitigated by completion of an outer casing within the upper portion of the aquitard prior to advancement of a boring through the aquitard and into the LVZ.

- Rebound of soil vapor concentrations in the LVZ resulting in potential impact to the RA. LTM of soil vapor within the LVZ and of groundwater in the RA will identify the occurrence and severity of this risk thereby allowing for implementation of contingency actions, if necessary. The addition of an additional extraction well and extension of SVE operational time lowers the risk for the More Aggressive Remedy.
- Well installation by an independent party penetrating the upper aquitard and releasing contaminants from the PA to the LVZ and RA. This risk may be addressed through the use of institutional controls by ADWR.
- Potential failure of a single groundwater extraction well to capture the dissolved plume. Following installation the extraction well should be tested and an evaluation be conducted regarding the suitability of the well to capture the plume and the design modified as necessary to meet ROs. Performance monitoring (specifically gauging or using transducers) of nearby monitoring wells will assist in evaluating capture.
- There may be uncertainty associated with long-term acceptance of extracted water by the UA (Alternative 3A) or in potential changes to flood control regulations that influence discharging to High School Wash (Alternative 3B). Furthermore, land use and development may change considerably over a 30-year period, necessitating realignments or alterations to conveyance piping and/or injection locations associated with reinjection (Alternative 3C).

6.2.3.3 Cost

Estimated costs for the More Aggressive Remedy are summarized in Sheet J-2.3 with detailed costs and assumptions reflected for the individual alternatives in Sheets J-3.3, -4.3, -5.3, and -6.3A,B,C for the UVZ, PA, LVZ, and RA, respectively (Appendix J). The total estimated cost for implementing the More Aggressive Remedy in the first year (Year 0) is approximately $3,650,000, $3,280,000, and $3,620,000 for Alternatives 3A, 3B, and 3C in the RA, respectively. The anticipated total cost for the More Aggressive Remedy is $10,540,000, $11,130,000, and $12,250,000 in current dollars for Alternatives 3A, 3B, and 3C in the RA, respectively; and $9,050,000, $9,420,000, and $10,340,000 in NPV for Alternatives 3A, 3B, and 3C in the RA, respectively, by remedy completion.

6.2.3.4 Benefit

It is assumed that SRLs and AWQSs would be met in the UVZ, LVZ, and RA upon the completion of the More Aggressive Remedy. Contamination would still likely exist above AWQSs in the PA, but would not be anticipated to impair RA water quality or shallow UVZ vapor concentrations. The UVZ, PA, and LVZ alternatives do not offer aesthetic aspects or enhance land and water uses; however, depending on the RA alternative selected, it would supplement UA's cooling water (Alternative 3A), slightly increase localized groundwater recharge (Alternative 3B), or return water to the RA (Alternative 3C). The alternatives do not meaningfully improve local economies, with the exception providing work for field and consulting services.

Implementing sparging in the PA with vapor capture by SVE in the UVZ for 5 years, along with pulsed SVE for 5 additional years, under this alternative, results in reduced potential risk and

future liability, but also produces considerable amounts of spent GAC and PIZB needing to be disposed as hazardous waste.

6.3 COMPARATIVE ANALYSIS

Table 6-4 provides a side-by-side comparison of the practicability, risk, cost, and benefits associated with the Reference Remedy, Less Aggressive Remedy, and More Aggressive Remedy for each of the four zones considered for treatment. The evaluation criteria given are based upon the information summarized in Section 6.2. Table 6-4 also presents numeric scores for each criterion, each remedy, and each zone.

As the More Aggressive Alternative was selected for the RA, the bullets below summarize which of the three water use/discharge options (e.g., 3A, 3B, or 3C-2) is most favorable:

- **Practicability**: discharging to High School Wash is the easiest and least disruptive alternative to implement and its logistics are mostly administrative in nature. Conveying treated water to the UA involves some difficult logistics associated with directional drilling and securing a long-term use agreement with the UA. Reinjecting treated water is relatively simple from an administrative standpoint, but involves the greatest level of maintenance and operational logistics.
- **Risk**: none of these options have differing risk from a contaminant exposure standpoint, as extracted groundwater is treated at the same proposed compound location. There is the greatest long term uncertainty associated with conveying water to the UA as operational changes may prevent continued receipt of treated water. Although unforeseen at this time, there is the potential for floodplain regulations to impede continual discharge to High School Wash. There is no perceived long-term uncertainty associated with reinjecting treated groundwater.
- **Cost**: conveyance to UA's cooling towers is the least expensive, followed by discharging to High School Wash (approximately 10% more expensive), and reinjection is the most expensive (approximately 30% more expensive).
- **Benefit**: none of these options offer great reductions in contamination or liability than one another; however, there is a slight benefit in using the water in UA's cooling towers or in reinjecting to the RA (aquifer recharge).

In summary, these three discharge or reuse options are comparable in risk and benefit to one another. Given the increased cost and complexity associated with reinjection relative to conveyance to the UA or discharging to High School Wash, reinjection is not selected for the Proposed Remedy. Although High School Wash is slightly more expensive than conveying to the UA, it is easier to implement and is a more certain long-term solution for handling water. Therefore, discharging to High School Wash is selected for inclusion in the Proposed Remedy.

This section presents the Proposed Remedy, explaining its selection, describing its components, and evaluating it against the comparison criteria. The Proposed Remedy is defined as "a combination of remedial strategies and remedial measures which, as a whole, is capable of achieving remedial objectives that is identified at the conclusion of a feasibility study and is incorporated in the proposed remedial action plan" (A.A.C. R18-16-401).

7.1 PROPOSED REMEDY SELECTION AND OVERVIEW

Based on the comparative analysis described in Section 6.3 and scoring shown in Table 6-4, the highest scoring alternatives for each zone were assimilated to form the Proposed Remedy, which utilizes a combination of alternatives from the reference, less aggressive, and more aggressive remedies. The Proposed Remedy includes:

- UVZ Alternative 1: Pulsed SVE for 10 years followed by MNA until Year 30;
- PA Alternative 2: MNA for 30 years in the PA, with a contingency PlumeStop™ barrier at Year 25;
- LVZ Alternative 1: Implementing pulsed SVE at two wells for 10 years with an expanded LTM network for monitoring until Year 30; and
- RA Alternative 3B: Pump and treat with a single extraction well at 50 gpm and ex situ GAC treatment prior to discharging water to High School Wash for 30 years, followed by LTM until Year 40.

The Proposed Remedy is anticipated to meet the requirements of ARS §49-282.06 (mentioned in Section 1.1), as it will:

I. Protect public health and welfare, as well as the environment by:
   a. Reducing and monitoring UVZ vapors to levels below those presenting a vapor intrusion risk and reducing UVZ soil concentrations below NR-SRLs beneath the Mission Plant Area and confirming they are below residential SRLs elsewhere via soil vapor monitoring;
   b. Monitoring PA contamination to confirm its stability and long-term attenuation, as well as applying institutional controls to future drilling efforts and potentially installing a PlumeStop™ barrier for additional protection;
   c. Remediating LVZ soils to concentrations below GPLs that are protective of RA groundwater; and
   d. Capturing and treating the RA groundwater plume.

II. To the extent practicable, provide for the control, management or cleanup of the hazardous substances in order to allow the maximum beneficial use of the waters of the state by:
   a. Remediating LVZ soils to concentrations below GPLs that are protective of RA groundwater; and
   b. Capturing and treating the RA groundwater plume.

III. Be reasonable, necessary, cost-effective, and technically feasible by:

a. Implementing only necessary actions, specifically with respect to conducting MNA in the PA with a potential contingency rather than an over-designed expensive remedy with limited technical benefit;

b. Utilizing existing remedial infrastructure for SVE in the UVZ and LVZ; and

c. Selecting the most proven and implementable RA alternative involving the least complications and disruptions to the City and nearby residents.

7.2 EX SITU TREATMENT TECHNOLOGY SELECTION

As mentioned in Section 4.4, commonly implemented ex situ technologies were assumed for the Reference Remedy and two alternative remedies with the intention of evaluating ex situ treatment technologies against effectiveness, implementability, and relative cost only for the Proposed Remedy. Under the Proposed Remedy there are essentially two waste streams: (1) combined extracted vapors from SVE in the UVZ and LVZ, and (2) groundwater withdrawn from the RA by the single extraction well that is proposed for treatment and beneficial reuse.

Table 7-1 presents the technology screening for ex situ vapor treatment for the Proposed Remedy and considers the following relevant factors:

- Vapors will be extracted beneath the Mission Plant Area, and portions of the plant's parking lot can be made available for staging equipment.
- Existing remedial infrastructure for GAC and PIZB already exist and are in use at the Site. Similarly, there is already an approved air permit in place.
- Contaminant vapor concentrations are expected to be initially high but are anticipated to quickly decrease over time.
- The SVE system may operate in a pulsed mode for some time and can be operated beyond the proposed timeframes if needed based on the existing infrastructure.
- cDCE and VC comprise a considerable portion of the contaminant stream.
- Short-term costs are more relevant than long-term costs as the UVZ and LVZ SVE operation are anticipated to be intermittent (four weeks per year).

Table 7-1 presents the technology screening for ex situ water treatment for the Proposed Remedy and considers the following relevant factors:

- Treatment must occur as close to the wellhead as practicable to avoid potentially releasing contamination to the environment by leaking untreated water from conveyance piping. Based on this, it is expected that private property will need to be leased or purchased to accommodate the treatment compound. Due to the nature of the location and property use (amongst residences), the treatment system must:
    - Be relatively quiet and/or use noise mitigation measures.
    - Require infrequent O&M as the system will be unmanned.

  - Not present physical or chemical hazards to potential trespassers, and ideally be "tamper-free."
  - Be fairly compact, occupying a small footprint, due to the space constraints in the vicinity of the wellhead and location adjacent to a floodplain.

- Groundwater is anticipated to be extracted at 50 gpm; however, the flow rate may vary (±30%) and will completely cease during maintenance and shutdown periods.
- PCE concentrations are fairly low and will vary from approximately 5 to 70 ppb (Sheet J-6.4) and must be reduced to below 2.5 ppb.
- The end use of the groundwater must meet AZPDES requirements, having water quality criteria beyond treating COCs (e.g., cannot directly supply effluent from an anaerobic bioreactor).
- Lower long-term costs are advantageous considering the 30 year duration.

Overall, GAC was selected as the most appropriate ex situ treatment technology for both extracted vapor and water contaminated with CVOCs. The vapor treatment options between GAC, catalytic oxidation, and thermal oxidation are fairly comparable; however, the estimated break-even cost between using existing GAC treatment system and implementing catalytic oxidation occurs slightly after 1.5 years of continuous operation, which would not occur until after Year 12 under pulsed SVE operation. Considering that this is longer than the predicted operation time (which is likely conservative) of the SVE system, GAC was chosen. For ex situ water treatment, GAC had the advantages of being installed in compact vessels that can be stored amongst residences, require little maintenance, and enable discharge of treated water to High School Wash without any additional treatment.

7.3 PERMITTING AND APPROVALS

Potentially applicable permits and approvals that are anticipated to be associated with implementing the Proposed Remedy include:

- Air Permit: a PDEQ Air Quality Permit for a Class III synthetic minor stationary source would be needed. The MPE system and LVZ SVE system are currently permitted (Permit No. 2144) to operate at 150 scfm in either of two modes of operation (MPE or SVE) with vapor abatement consisting of three 2,000-lb GAC vessels operating in series followed by flow through one 500-lb PIZB vessel prior to discharge to atmosphere. Any change or addition to equipment or flow rate or vapor treatment method would require a modification to the permit. The addition of a blower for operation of a UVZ SVE system would fall into this category. Because SVE is proposed for both the UVZ and the LVZ, the permitted flow rate may need to be increased.
- Waste Manifesting and Disposal: spent GAC resulting from vapor treatment from SVE in the UVZ and LVZ would be considered a listed hazardous waste due to recovery of the spent dry cleaning solvent and its degradation products and could potentially be characteristically hazardous depending upon analytical results. Tracking of hazardous waste manifests, reporting, and payment of generation fees will be required during operation of the SVE system. The treatment compound in which the GAC is housed

would need to be constructed in accordance with the International Building Code and International Fire Code.

- Development Services Permit: adding a blower for implementing SVE in the UVZ will require developing electrical plans, submitting them to CoT Development Services for review and approval, and inspecting the installation prior to final approval. The construction of an ex situ groundwater treatment system for the RA alternative will also require a CoT Development Services permit(s) including electrical, structural, and commercial review.
- Right-of-Way Permit and Fees: paying right-of-way permit and access fees will continue to be required for existing soil vapor monitoring points (UVZ and LVZ) and groundwater monitoring wells (PA and RA) installed within the CoT right-of-way, as well as new permits and fees for installing additional monitoring locations (as reflected in Appendix J).
- Access Agreements: installing new monitoring locations (UVZ, PA, LVZ, and RA) on private property will require negotiation of access agreements with private landowners and the City. Installing conveyance piping for the treated extracted groundwater would also require coordination with the City and landowners, and potentially with PCRWRD during trenching operations concerning crossings of the public sanitary sewer.
- Institutional Controls: coordination with ADWR to require special construction requirements for wells or soil borings that may penetrate the upper aquitard and allow cross-contamination of the PA to the RA.
- Poor Quality Groundwater Withdrawal Permit (PQGWP): extracting groundwater at a rate greater than 35 gpm requires a PQGWP application from ADWR.
- NOI to Drill a Well: in conjunction with the PQGWP, a completed Well Construction Supplement (DWR form 55-90) must be submitted for the new extraction well installed in the RA.
- Arizona Pollutant Discharge Elimination System (AZPDES): a NOI to discharge under the De Minimis General Permit (DMGP) under AZPDES provides for the discharge of groundwater generated by well/aquifer pump testing associated with remediation activities, provided the discharge (1) does not exceed 72 hours; (2) the water is treated to meet the surface water quality standards; and (3) a "Specific Approval" has been issued. Discharge to surface water (High School Wash) would also be regulated under AZPDES and the groundwater remediation system would likely be considered a minor Industrial Facility. This permit would require routine monitoring and reporting to demonstrate that surface water quality standards are being met.
- Access or Sales Agreements: installing an extraction well and treatment system will require a long-term lease agreement or purchase of land on which to install the extraction well and the treatment system compound. In addition, installing the underground conveyance pipe through the public right-of-way will require a right-of-way permit and payment of the associated fees.

Additional permitting and regulations for consideration under discharging treated water to High School Wash are detailed in Appendix K.

7.4 INDIVIDUAL ANALYSIS

This section presents the individual analysis of the Proposed Remedy against the comparison criteria of practicability, risk, cost, and benefit. This analysis is essentially a compilation of factors considered in Section 6.2 for the individual alternatives.

7.4.1 Practicability

Table 7-2 presents the practicability analysis of the Proposed Remedy for each alternative and its respective target zone. This information is identical to what is presented in Tables 6-1 to 6-3, but is "reorganized" for the respective alternatives comprising the Proposed Remedy.

7.4.2 Risk

- Rebound of soil vapor concentrations in the UVZ as a result of residual VOCs diffusing out of less permeable zones within the UVZ; however, implementing pulsed SVE for 10 years in the UVZ will assist in reducing residual contamination. Vapors diffusing upward from the PA, specifically from further degradation of cDCE to VC in the PA, may result in vapor intrusion concerns. LTM of the PA and soil vapor within the UVZ will identify the occurrence and severity of the risk associated with soil vapor concentrations thereby allowing for implementation of contingency actions, if necessary.
- Migration of VOCs within the PA laterally downgradient or vertically through the upper aquitard and into the LVZ. Based on LTM at the site and for reasons presented in Section 3.4.2, this risk is considered to be low, particularly with the option for implementing the contingency PlumeStop™ barrier in the PA.
- Installation of LVZ vapor monitoring wells penetrating the upper aquitard. The installation of wells penetrating the aquitard may result in a conduit for contaminants within the PA to be transported to the UVZ and the RA. This risk can be mitigated by completion of an outer casing within the upper portion of the aquitard prior to advancement of a boring through the aquitard and into the LVZ. Similarly, concerns of well installation by an independent party penetrating the upper aquitard could be addressed by institutional controls whereby the ADWR reviews all drilling permits within the affected area and imposes special well construction requirements.
- Rebound of soil vapor concentrations in the LVZ following termination of SVE, thereby resulting in potential impact to the RA. LTM of soil vapor within the LVZ and of groundwater in the RA will identify the occurrence and severity of this risk thereby allowing for implementation of contingency actions, if necessary.
- Potential failure of a single groundwater extraction well to capture the dissolved plume. Following installation the extraction well should be tested and an evaluation be conducted regarding the suitability of the well to capture the plume and the design modified as necessary to meet ROs. Performance monitoring (specifically gauging or using transducers) of nearby monitoring wells will assist in evaluating capture.

- If deeper RA contamination (e.g., as deep as 400 feet bgs) needs to be treated, the number of wells and pumping rate would need to be evaluated for effectively capturing the plume.
- Although unforeseen at this time, there may be potential changes to flood control regulations that influence discharging to High School Wash.

7.4.3 Cost

Estimated costs for the Proposed Remedy (identified as Remedy 4 in Appendix J) are summarized in Sheet J-2.4 with detailed costs and assumptions reflected for the individual alternatives in Sheets J-3.1, -4.2, -5.1, and -6.3 for the UVZ, PA, LVZ, and RA, respectively (Appendix J). The total estimated cost for implementing the Proposed Remedy in the first year (Year 0) is approximately $3,280,000, with an anticipated total remedy cost of $11,130,000 (current dollar) and $9,420,000 (NPV) by remedy completion.

7.4.4 Benefit

It is expected that SRLs and AWQSs will be met in the UVZ, LVZ, and RA upon the completion of the Proposed Remedy providing the significant benefits of contaminant mass reduction and achieving the Remedial Objectives for the RA. Contamination would still likely exist above AWQSs in the PA, but would not be anticipated to impair RA water quality or shallow UVZ vapor concentrations. The UVZ, PA, and LVZ alternatives do not offer aesthetic aspects or enhance land and water uses. The alternatives do not meaningfully improve local economies, with the exception providing work for field and consulting services.

Implementing MNA in the UVZ and PA, instead of more aggressive alternatives, does not result in as great a reduction in potential risk and future liability, but also does not produce the waste streams requiring offsite disposal included in the other alternatives. Considering that the HHRA and vapor intrusion assessment did not predict future unacceptable risks (Sections 3.2.2 and 3.2.3), the less aggressive MNA alternatives are considered acceptable. Implementing pulsed SVE in the LVZ for 10 years under this alternative does result in reduced potential risk and future liability, but also produces spent GAC and PIZB requiring disposal as hazardous waste. Long-term treatment of extracted RA also produces spent GAC (estimated at 58,300 lbs per Sheet J-6.4). LTM of the PA and RA would also generate small quantities of IDW requiring disposal for 30 to 40 years.

Arizona Department of Environmental Quality (ADEQ). 2008. Remedial Objectives Report, Park-Euclid Water Quality Assurance Revolving Fund Site, Tucson, Arizona. April 15.

ADEQ. 2011. Correspondence to Robert Boudra regarding the Work Plan for Multi-Phase Extraction System Early Response Action, Park-Euclid Water Quality Assurance Revolving Fund Site. January 21.

ADEQ. 2014. Correspondence to Joseph Drazek and James Sakrison regarding LVZ, Soil Vapor Extraction Early Response Action, Park-Euclid Water Quality Assurance Revolving Fund Site, Tucson, Arizona. July 7.

Carreón-Diazconti, C., J. Santamaría, J. Berkompas, J. A. Field, and M. L. Brusseau. 2009. Assessment of in Situ Reductive Dechlorination Using Compound-Specific Stable Isotopes, Functional Gene PCR, and Geochemical Data. Environmental Science & Technology, Volume 43, pp. 4301 – 4307.

Dames & Moore. 1999. Engineering Evaluation/Cost Analysis. Prepared for Mission Linen Supply. June.

Dames & Moore. 2000. Phase 4 Investigation Report, Park – Euclid WQARF Site. Mission Linen Supply, 301 South Park Avenue, Tucson, Arizona. February 17.

Earth Technology. 1991. Preliminary Site Characterization Report, Mission Linen and Uniform Service, 301 South Park Avenue, Tucson, Arizona. November.

EMCON. 1994. Remedial Investigation Status Report, Mission Industries, 301 South Park Avenue, Tucson, Arizona. Prepared for Streich Lang. December 1994.

EMCON. 1995. Phase 2 Remedial Investigation Shallow Aquifer Well (MLS-4, 5 & 6) Installation and Monitoring Report, Mission Industries, 301 South Park Avenue, Tucson, Arizona. Prepared for Mission Industries. August 16.

Environmental Protection Agency (EPA) and US Army Corps of Engineers (USACE). 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002; OSWER 9355.0-75. July.

GeoTrans, Inc. 2008. Groundwater Modeling Report, Park-Euclid WQARF Site, Tucson, Arizona, Prepared for Arizona Department of Environmental Quality. June 30.

Forbes. 2014. Why The Average Investor's Investment Return Is So Low by Sean Hanlon. http://www.forbes.com/sites/advisor/2014/04/24/why-the-average-investors-investment-return-is-so-low/. April 24.

Interstate Technology & Regulatory Council (ITRC). 2003. Technical and Regulatory Guidance for Design, Installation, and Monitoring of Alternative Final Landfill Covers. December.

Making Action Possible (MAP) for Southern Arizona. 2016. Cost of Living. http://mapazdashboard.arizona.edu/health-social-well-being/cost-living. Accessed March 26.

Hydro Geo Chem (HGC). 2003. Correspondence, Results of Soil Gas Sampling from the Lower Unsaturated Zone, Park-Euclid WQARF Site, ADEQ ASRAC Contract #99-0017. June 20.

Miller Brooks Environmental (MBE). 2004. Final Draft Park – Euclid Remedial Investigation Report. Prepared for Park – Euclid Water Quality Assurance Revolving Fund Site, Tucson, Arizona. June 29.

Tetra Tech GEO (TTG). 2011. Final Remedial Investigation Report, Park-Euclid WQARF Site, Tucson, Arizona. November 15.

URS Corporation (URS). 2003a. Vadose Zone Confirmation Study, Park-Euclid Water Quality Assurance Revolving Fund Site, Tucson, Arizona. August 7.

URS. 2003b. Multi-Phase Extraction Pilot Test Report, Park-Euclid WQARF Site, Tucson, Arizona. November 26.

URS. 2009. Multi-Phase Extraction System Operation Summary, Park-Euclid WQARF Site, Tucson, Arizona. November 9.

URS. 2011. Multi-Phase Extraction System Early Response Action Work Plan, Park-Euclid WQARF Site, Tucson, Arizona. January 3.

URS. 2013. Work Plan, Feasibility Study and Associated Activities, Park-Euclid WQARF Site, Tucson, Arizona. June 21.

URS. 2014a. Lower Vadose Zone SVE Pilot Test Technical Memorandum, Park – Euclid WQARF Site, Tucson, Arizona. From URS to ADEQ on June 2.

URS. 2014b. Work Plan, Lower Vadose Zone Soil Vapor Extraction Early Response Action, Park Euclid WQARF Site, Tucson, Arizona. June 4, 2014.

URS. 2014c. Human Health Risk Assessment for Feasibility Study and Associated Activities Technical Memorandum, Park-Euclid WQARF Site, Tucson, Arizona. November 17.

URS. 2014d. Groundwater Modeling Status Technical Memorandum, Park-Euclid WQARF Site, Tucson, Arizona. March 21.

URS. 2015. 2015 Annual Report for Long-Term Monitoring, Park-Euclid WQARF Site, Tucson, Arizona. October 6.

White House Administration – Office of Management and Budget. 2015. Circular A-94 Appendix C: Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses. https://www.whitehouse.gov/omb/circulars_a094/a94_appx-c. Revised November 2015 and Accessed March 26, 2016.

Table 4-1
Screening of Remedial Measures and Strategies
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Types	Technology Type Potentially Applicable?				
		UVZ	PA	LVZ	RA	Comment
Remedial Measures[1]	Water Supply Solutions	-	-	-	Yes	The PA does not contain any water supply wells and nor is it of sufficient aquifer thickness and transmissivity to be an economical water supply source. Process options will be screened for the RA.
No Action	None	Yes	Yes	Yes	No	The RAOs may still be achievable even if no action is implemented in the UVZ, PA, and LVZ; however, no action is not an appropriate strategy to address existing impacts to groundwater in the RA.
Monitoring	Monitoring	Yes	Yes	Yes	Yes	Process options will be screened for each zone.
Source Control	Physical - Surface Capping	No	-	-	-	Implementing a cap attempts to prevent additional migration of residual contamination in the vadose zone; however, underlying groundwater has already been significantly impacted. Furthermore, much of the Site is already paved and developed.
	Soil Removal	No	-	-	-	Impractical and unsafe to implement due to the vertical and lateral extent of impacted area. Removal is better suited to remove sorbed and residual free-phase contamination, as opposed to vapor phase.
	Ex Situ Soil Treatment	No	-	-	-	Ex situ soil treatment is not needed as soil removal is not applicable.
	Solidification	No	-	No	-	Purposed to trap sorbed and residual free-phase contamination, as opposed to vapor phase.
	Stabilization	No	No	No	No	Purposed to immobilize sorbed and residual free-phase contamination, as opposed to vapor phase. Not applicable as technology relies on ionically charged contaminants.
	Destructive Thermal Treatment	No	-	No	-	Although this technology would address COC vapors in the vadose zone, it is most effective in addressing significant quantities of residual free-phase and sorbed phase contamination. As contamination in the UVZ is largely present in the vapor phase, this technology would be overdesigned.
	Free Product Extraction	-	Yes	-	No	Process options will be screened for the PA, where free product containing COCs is present.
	Recovery Enhanced Thermal Treatment	No	No	No	-	These technologies are generally used to enhance recovery of residual product, which is not needed.
	Biological Treatment	Yes	-	Yes	-	Process options will be screened for the UVZ and LVZ.
	Physical and/or Chemical Treatment	Yes	-	Yes	-	Process options will be screened for the UVZ and LVZ.
Controlled Migration	Groundwater Extraction	-	No	-	No	There are no receptors in the PA. For the RA, controlled migration could be used to divert the groundwater plume around the UoA, but it would not address that the entire project vicinity is subject to potential CoT water use.

Table 4-1
Screening of Remedial Measures and Strategies

Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Types	Technology Type Potentially Applicable?				
		UVZ	PA	LVZ	RA	Comment
Physical Containment	Barriers	-	No	-	No	This would be impractical considering the depth to groundwater, width of the plumes, and the densely developed land.
	Groundwater Extraction	-	No	-	Yes	Groundwater in the PA is not used for drinking water and the PA has a limited extent. Groundwater extraction in the PA will be evaluated to the degree that it is a component of source control extraction technologies; however, groundwater extraction applying solely to the PA groundwater plume (particularly beyond the footprint of the diesel layer) was not retained as it does not pose an unacceptable risk to receptors, making its extraction an overdesigned and impractical technology. Process options will be screened for the RA.
Plume Remediation (in situ)	Biological Treatment	-	Yes	-	Yes	Process options will be screened for the PA and RA.
	Physical and/or Chemical Treatment	-	Yes	-	Yes	Process options will be screened for the PA and RA.
Plume Remediation (ex situ)	Disposal or Reuse	-	Yes	-	Yes	Process options will be screened for the PA and RA.
	Biological Treatment	-	Yes	-	Yes	Process options will be screened for the PA and RA.
	Physical and/or Chemical Treatment	-	Yes	-	Yes	Process options will be screened for the PA and RA.

Notes & Acronyms

[1]The identification and implementation of remedial measures involves consultation with water providers and well owners, including the quantity and quality of water, water rights, other legal constraints, reliability of water suppliers, and any operational implication.

COC = chemical of concern
CoT = City of Tucson
LVZ = lower vadose zone
PA = perched aquifer
RA = regional aquifer
RAOs = remedial action objectives
UoA = University of Arizona
UVZ = upper vadose zone

Table 4-2
Screening of Potentially Applicable Remedial Technology Process Options
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Types	Technology Process Options	Brief Description	Potentially Applicable to COCs?	Potentially Applicable to Site Characteristics?				Screening Comments
					UVZ	PA	LVZ	RA	
Remedial Measures	Water Supply Solutions	Well Replacement	Involves replacing contaminated water with uncontaminated water by drilling a new well (or using an existing unused well) located outside of the contaminated area.	-	-	-	-	No	Not applicable with respect to CoT, as they do not presently have any production wells in the project vicinity. Replacing a UoA production well doesn't address the concern that CoT considers the RA in the Site area to be an integral part of the City's drinking water supply and may seek to withdraw water from within the plume's footprint in the future.
		Well Modification	Modifying existing water supply wells that are impacted or threatened by selectively extracting water from uncontaminated intervals by deepening wells and/or sealing off contaminated intervals. Another option is to seal off uncontaminated zones and use the well for contaminant extraction at higher concentrations.	-	-	-	-	Yes	Retained for the RA with particular focus on the active UoA production wells. CoT does not actively operate any production wells in the project vicinity, but still considers the RA in the Site area to be an integral part of the City's drinking water supply.
		Wellhead Treatment	Extracted waters are either actively treated by destroying or removing contaminants or they are passively treated by dilution from mixing contaminated water with treated water, or untreated water with lower contaminant concentrations.	Yes	-	-	-	Yes	
		Provision of Replacement Water Supplies	Extraction ceases from impacted locations and water demands are met with clean water from another source such as municipal water, another well owner, and/or bottled water.	-	-	-	-	Yes	
		Engineering Controls	Implemented to reduce or eliminate exposure to contaminants by restricting the use of or exposure to contaminated water, such as measures preventing point-source discharges of concentrated contaminants or access and use restrictions for impacted surface waters.	-	-	-	-	No	Rejected as it reduces water supply and would not improve water quality nor meet current or future water supply demands.
No Action	None	No Action	No further actions or responses would be implemented. Current remedial operations and monitoring would cease. Contamination would remain in place with no plans for future monitoring, control, treatment, removal, or evaluation.	-	Yes	Yes	Yes	No	The remedial objectives may still be achievable even if no action is implemented in the UVZ, PA, and LVZ; however, no action is not an appropriate strategy to address existing impacts to groundwater in the RA.
Monitoring	Monitoring	Monitored Natural Attenuation	Routine groundwater and/or vapor monitoring would be conducted to evaluate changes in contaminant concentrations and natural attention parameters over time. Natural processes (dilution, dispersion, adsorption, volatilization, biodegradation, and chemical processes) gradually reduce contaminant concentrations.	Yes	Yes	Yes	Yes	Yes	Retained for further consideration for each target interval.
Source Control	Free Product Extraction	Groundwater Extraction via Pumping Wells	A well or series of wells are pumped to withdraw NAPL mixed with groundwater. Free product would be separated from groundwater and potentially treated, recycled, and/or disposed. Groundwater would require treatment as well.	Yes	-	No	-	-	Rejected, as MPE or other strategies would prove more effective for the purpose of product removal.
		Bioslurping	Purposed to remove LNAPL while gently aerating the unsaturated zone (similar to bioventing) to enhance aerobic biodegradation. A "slurp" tube extends into the LNAPL layer and draws LNAPL, groundwater, and air in the same process stream. LNAPL is separated from water and air.	Yes	Yes	Yes	-	-	Retained for further consideration to address UVZ and PA contamination. This bioventing element of this technology is most applicable to fuels that degrade aerobically; however, the COCs preferentially degrade under anaerobic conditions. Product removal with minimal water extraction is preferred.
		Multi-Phase Extraction (MPE)	A high-vacuum system removes contaminated groundwater, LNAPL, and soil vapors from an extraction well screened across the water table. Extraction depresses the water table, inducing liquid flow to the well and exposing residual LNAPL and contaminated soils (capillary fringe) that are stripped by vapor extraction. Extracted vapors and liquids are separated and treated above ground.	Yes	Yes	Yes	-	-	Retained for further consideration to address UVZ and PA contamination.
		Skimmer Pumps	Utilizes a skimmer pump with a hydrophobic filter, collection tank, solar panel, and control box to intermittently recover only product without water at the rate matching the formation recovery rate. Does not produce water or air waste streams. Only effective in recovering mobile NAPL. Capable of recovering low to high viscosity LNAPLs and DNAPLs.	Yes	-	Yes	-	-	Retained for further consideration in the PA.
		Passive Collection (canisters or adsorptive socks)	A canister with a slotted screen and hydrophobic filter slowly receives LNAPL or DNAPL from the well without collecting water. Collection is passive and NAPL can be containerized at time of manual collection/retrieval. Adsorptive socks gradually fill with NAPL and are disposed upon retrieval.	Yes	-	No	-	-	Rejected as this technology is best used for thin product layers in lower permeability settings for long-term recovery.

Table 4-2
Screening of Potentially Applicable Remedial Technology Process Options
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Types	Technology Process Options	Brief Description	Potentially Applicable to COCs?	Potentially Applicable to Site Characteristics?				Screening Comments
					UVZ	PA	LVZ	RA	
Source Control	Biological Treatment	Anaerobic Bioventing	Can be achieved through injection of nitrogen amended with gaseous electron donor, or by soil vapor extraction, with amendment and reinjection of the extracted vapors. The nitrogen or anaerobic vapors flush oxygen from the soil gas. Solvents are degraded through reductive processes under anaerobic conditions in the presence of electron donor. Typical donors that are sufficiently volatile to be supplied as gases include hydrogen, carbon dioxide, and alkanes (e.g., propane, methane, hexane).	Yes	Yes	-	Yes	-	Retained for further consideration.
		Aerobic Bioventing	Air or oxygen is injected (sometimes amended) to the vadose zone to create conditions conducive to aerobic biodegradation. Flow rates are significantly lower than those used for soil vapor extraction, because bioventing seeks only to induce enough air flow to provide sufficient oxygen to sustain microbial activity.	No	-				Rejected. The COCs preferentially degrade under anaerobic conditions, therefore, if biostimulation were implemented, anaerobic would be preferred.
		Phytoremediation	A biological process that uses various plants to remove, transfer, stabilize, and destroy constituents in soil or shallow groundwater. Contaminants are reduced via enhanced rhizosphere biodegradation, phyto-degradation, and phyto-volatilization.	Yes	No	-	-	-	Rejected. The land is highly developed in vicinity of shallow vadose zone contamination and groundwater is too deep for phytoremediation.
	Physical and/or Chemical Treatment	Soil Vapor Extraction (SVE)	A vacuum is applied to the vadose zone creating a pressure gradient that induces volatilization and mobilizes contaminants toward extraction wells. SVE can also be accomplished using a MPE system with limited deployment.	Yes	Yes	Yes	Yes	-	Retained for further consideration to remove soil contamination in the UVZ and LVZ, and to strip solvents from the diesel product in the PA.
		Air Sparging	Air is injected or bubbled through the affected saturated zone. Volatile contaminants partition into the air bubbles; thereby transferring from the aqueous phase to the gaseous phase. Vapors migrate into the unsaturated zone where they are captured, extracted, and treated. The introduced air also promotes aerobic biodegradation, though that is a secondary means of treatment.	Yes	-	Yes	-	-	Retained for further consideration to strip solvents from the diesel product and groundwater in the PA.
		Surfactant or Cosolvent Flushing (Soil Flushing)	A water extraction/reinjection system that consists of injecting a solvent or surfactant solution to enhance constituent solubility, physically displace contamination, and leads to contaminant desorption. Mobilized contaminants are extracted with groundwater and the flushing solution. Adequate hydraulic control must be provided to prevent further migration of contamination.	No	-				Rejected as unnecessary because COCs are not present in a free-phase (NAPL) form and the availability of sorbed phase mass for treatment is not believed to be limited by desorption.
		In Situ Chemical Oxidation (ISCO) via Injections	A strong oxidizing compound is delivered (e.g., hydrogen peroxide, permanganate, ozone, persulfate, etc.) to chemically react with organics. The reaction requires direct contact between the reagent and contaminant, which destroys the organic compound by breaking bonds. Sufficient contact results in complete mineralization yielding carbon dioxide and water as byproducts.	Yes	No	No	No	-	Better suited to address aqueous phase contamination, as opposed to sorbed and residual free-phase. The diesel layer would compete heavily for oxidant consumption.
		In Situ Chemical Reduction (ISCR)	The mirror process of ISCO, involving the transfer of electrons from one compound to another. One compound is oxidized (loses electrons) and the target COC is reduced (gains electrons). ISCR is a combination of abiotic chemical reduction, using zero valent iron (ZVI), for example, coupled with anaerobic bioremediation for the effective treatment of chlorinated solvents, pesticides, and energetics. One product commonly used to address solvents in the vadose zone is Daramend.	Yes	No	No	No	-	Better suited to address aqueous phase contamination, as opposed to sorbed and residual free-phase. The diesel layer would compete heavily for oxidant consumption.
		Electrochemical Remediation	Also referred to as ElectroGeoChemical-Oxidation (EGCO). Proprietary AC/DC converters produce a low-voltage, low-amperage electrical field that polarizes the soil, causing soil particles to charge and discharge electricity. This causes redox reactions that occur at all interfaces within the system, which mineralizes organics and mobilizes metals. Metals and ions migrate to and collect at charged electrodes. Also can be modified for use in a specific technology referred to as Lasagna.	Yes	No	No	No	-	Primarily used to remove metals and radionuclides in low permeability soils, but can be used to address volatile organics. Better suited to address sorbed and residual free-phase contamination, as opposed to vapor phase. Less effective in applications deeper than 40 feet bgs.
		Electrokinetic Separation	Process to remove ions from soil by inducing a direct current electric field that causes water and contaminants to flow between electrodes. Flow can be induced through treatment or extraction zones. Anions move toward the cathode, where they can be extracted.	No	-				Electrokinetics is primarily used to remove metals and radionuclides in low permeability soils. Has limited effectiveness with organics.
	Distribution and Delivery	Infiltration Gallery	Uses a permeable trench or bed extending into and across the targeted zone as a method of passively allowing gravity-driven delivery of liquids.	-	No	-	No	-	Rejected as none of the retained technologies for the UVZ involve injecting liquids. The LVZ is too deep and is isolated by the PA aquitard.
		Trenching	Digging and excavation of soils using heavy machinery (i.e., backhoe). May require shoring or sheet piling for stability depending on depth, soil type, and moisture.	-	No	-	No	-	Rejected due to depth of contamination.

Table 4-2
Screening of Potentially Applicable Remedial Technology Process Options
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Types	Technology Process Options	Brief Description	Potentially Applicable to COCs?	Potentially Applicable to Site Characteristics?				Screening Comments
					UVZ	PA	LVZ	RA	
Source Control	Distribution and Delivery	Vertical Wells	Vertical wells installed with perforated casing across targeted zone.	-	Yes	-	Yes	-	Commonly used - retained for alternative development.
		Directional Wells	Directionally drilled wells are positioned horizontally or at an angle and can be double-or single-ended. A navigation tool is located close to the drill bit allowing steering. Slow drill head rotation cuts and compacts the soil into the borehole wall (sometimes cuttings are removed). Useful for increased extraction or injection distribution. May be limited by depth and cobbles.	-	Yes	-	No	-	Rejected for deep depths, but retained for further consideration in UVZ.
		Soil Mechanical Mixing	Mixing chemical amendments into affected soil via augering or caissons to achieve distribution and contact for chemical processes that decrease contaminant concentrations and/or mobility.	-	No	-	No	-	Did not retain any technologies that would involve mixing an amendment in the UVZ. The LVZ is too deep for soil mixing.
Physical Containment	Groundwater Extraction	Interceptor Trench	A trench is installed across the groundwater flow path and backfilled with granular material and a perforated pipe (drain) to collect groundwater. Groundwater extraction serves as a hydraulic control to limit further migration of affected water and removes contaminated liquids for subsequent treatment and/or disposal.	Yes	-	No	-	No	Rejected. Impractical as depth to groundwater is too great to install a trench to groundwater.
		Groundwater Extraction via Pumping Wells	A well or series of wells are pumped to create a capture zone for the groundwater. Aids in preventing further migration and in capturing dissolved phase contamination. Extracted liquids would require treatment and/or disposal or reinjection.	Yes	-	No	-	Yes	Rejected for the PA there are no receptors and lateral migration is not a concern. Retained for further consideration in the RA.
Plume Remediation (in situ)	Biological Treatment	Anaerobic Bioremediation via Amendments	Involves the addition of microorganisms (e.g., fungi, bacteria, or microbes) and/or substrate (e.g. carbon or hydrogen source) to the subsurface to accelerate anaerobic biodegradation processes. Amendments are delivered via injection wells or infiltration galleries. The addition and consumption of carbon will cultivate and maintain an anaerobic (oxygen limited) environment.	Yes	-	No	-	Yes	Rejected for the PA as the diesel layer is believed to inhibit biological activity of the dehalococcoides based on laboratory bench-scale testing using site-specific groundwater-diesel mixtures in microcosms. Retained for further consideration to biologically degrade groundwater contamination in the RA.
		Anaerobic Biosparging	Injection of a gaseous substrate (i.e., hydrogen gas) into the saturated zone. Considered an innovative or experimental technology.	Yes	-	No	-	No	Rejected for the PA as the diesel layer provides sufficient substrate for biological activity, which it may also inhibit. Rejected for the RA as the entire 130-foot contaminated interval cannot be effectively sparged.
		PlumeStop Colloidal Biomatrix (PlumeStop™)	PlumeStop is a new technology developed by Regenesis in 2014 designed to address the challenges of excessive time and end-point uncertainty in groundwater bioremediation. PlumeStop is a colloidal mixture of micron-sized GAC mixed with polymers to prevent clumping and can be easily injected to the subsurface having a viscosity similar to water and being highly dispersible. The individual GAC particles coat the soil grains without influencing aquifer permeability and capture and concentrates dissolved-phase contaminants within its structure, making them available for biodegradation at an accelerated rate. PlumeStop is effective on most organic groundwater contaminants including hydrocarbons, halogenated compounds, and a wide variety of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). PlumeStop inhibits spreading plumes and can protect sensitive receptors or prevent contaminant migration across property boundaries. Once in place, PlumeStop is expected to last for decades with minimal impact on aquifer oxidation-reduction potential or geochemistry.	Yes	-	Yes	-	Yes	Retained for further consideration in the PA and RA to immobilize groundwater contamination and potentially enhance biodegradation.
		Aerobic Bioremediation via Amendments	Involves the addition of microorganisms (e.g., fungi, bacteria, or microbes) and/or amendments (e.g. oxygen) to the subsurface to accelerate the aerobic biodegradation process. Addition of oxygen will cultivate and maintain an aerobic (oxygen-rich) environment through oxygen release compounds or sparging air into system.	No	-				Rejected. The COCs preferentially degrade under anaerobic conditions, therefore, if biostimulation were implemented, anaerobic would be preferred.

Table 4-2
Screening of Potentially Applicable Remedial Technology Process Options
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Types	Technology Process Options	Brief Description	Potentially Applicable to COCs?	Potentially Applicable to Site Characteristics?				Screening Comments
					UVZ	PA	LVZ	RA	
Plume Remediation (in situ)	Biological Treatment	Aerobic Biosparging	Air or oxygen (sometimes amended) is injected to the saturated zone to create conditions conducive to aerobic biodegradation. The air injection rate is lower than conventional sparging, which removes contaminants primarily through volatilization, as the purpose of biosparging is to increase dissolved oxygen levels without mobilizing volatiles into the vadose zone.	No	-				Rejected. The COCs preferentially degrade under anaerobic conditions, therefore, if biostimulation were implemented, anaerobic would be preferred.
		Biobarrier (trenched)	A treatment wall/barrier is filled with highly porous, slowly degradable, carbon-based material that serves as an energy source and supports the growth of indigenous microbial populations capable of destroying biodegradable compounds. Commonly used materials include mulch, pecan shells, cottonseed, chitin, vegetable oils, and mushroom compost.	Yes	-	No	-	No	Rejected as impractical because the depth to groundwater is too great to install a trench to groundwater.
	Physical and/or Chemical Treatment	Air Sparging	Air is injected or bubbled through the affected saturated zone. Volatile contaminants partition into the air bubbles; thereby transferring from the aqueous phase to the gaseous phase. Vapors migrate into the unsaturated zone where they are captured, extracted, and treated. The introduced air also promotes aerobic biodegradation, though that is a secondary means of treatment.	Yes	-	Yes	-	No	Retained for further consideration to strip solvents from the diesel product and groundwater in the PA. Rejected for the RA as the entire 130-foot contaminated interval cannot be effectively sparged and air sparging is better used in higher concentration applications.
		In-Well Air Stripping	Somewhat of a combination of SVE and air sparging within a single well location. Air is injected into a vertical well screened at two depths that are sealed off from each other with a form-fitting disc. The lower screen is in groundwater and the upper screen is in the unsaturated zone. Pressurized air is injected in groundwater and bubbles out the lower screen and up into the vadose zone where the vapors are extracted through the upper screen and are treated.	Yes	-	Yes	-	No	Retained for further consideration to remove vapors from the base of the UVZ and strip solvents from the diesel product and uppermost groundwater in the PA. Rejected for the RA as the entire 130-foot contaminated interval could not be effectively sparged and air sparging is better used in higher concentration applications. Although vapor contamination would be removed by this technology in the UVZ if implemented in the PA, this technology would not be implemented primarily to address the UVZ.
		In Situ Chemical Oxidation (ISCO) via Injections	Delivery of a strong oxidizing compound (e.g., hydrogen peroxide, permanganate, ozone, persulfate, etc.) to chemically react with organics. Reaction requires contact between reagent and contaminant, which destroys the organic compound by breaking bonds. Sufficient contact results in complete mineralization to carbon dioxide and water.	Yes	-	Yes	-	Yes	Retained for further consideration to destroy groundwater contamination in the PA and RA.
		Surfactant-enhanced In Situ Chemical Oxidation (SISCO)	Uses a surfactant to increase the physical displacement, desorption, and solubility of contamination. Aqueous contamination is then available for ISCO processes that destroy the contamination in place. This technology essentially increases the amount of contamination available for treatment by ISCO.	Yes	-	No	-	No	Rejected. Though applicable, there is no reason to suspect that contaminant mass is not readily accessible to ISCO without the use of surfactants. Furthermore, some oxidants already have surfactant-like effects on sorbed contaminants.
		In Situ Chemical Reduction (ISCR)	The mirror process of ISCO, involving the transfer of electrons from one compound to another. One compound is oxidized (loses electrons) and the target COC is reduced (gains electrons). ISCR is a combination of abiotic chemical reduction, using zero valent iron (ZVI), for example, coupled with anaerobic bioremediation for the effective treatment of chlorinated solvents, pesticides, and energetics. One product commonly used to reduce solvents is EHC®.	Yes	-	Yes	-	Yes	Retained for further consideration to destroy groundwater contamination in the PA and RA.
		Permeable Reactive Barriers (PRBs)	Impacted groundwater is remediated through in situ chemical reactions with chemically active materials (e.g., ZVI) contained in a subsurface wall installed downgradient of a contaminant plume. Contaminants passively react (no pumping) with the media to either break the compound down into harmless products or immobilize contaminants by precipitation or sorption. Funnel-gate method employs slurry walls at the edges of the wall to prevent contaminated groundwater from flowing around the barrier.	Yes	-	No	-	No	Rejected as impractical because the depth to groundwater is too great to install a trench into.

Table 4-2
Screening of Potentially Applicable Remedial Technology Process Options
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Types	Technology Process Options	Brief Description	Potentially Applicable to COCs?	Potentially Applicable to Site Characteristics?				Screening Comments
					UVZ	PA	LVZ	RA	
Plume Remediation (in situ)	Distribution and Delivery	Infiltration Gallery	Uses a permeable trench or bed extending into and across the targeted zone as a method of passively allowing gravity-driven delivery of liquids.	-	-	No	-	No	Rejected as depth to groundwater in the PA is too deep to install a trench to. The RA is even deeper and isolated by the PA aquitard.
		Trenching	Digging and excavation of soils using heavy machinery (i.e., a backhoe) and may require shoring or sheet piling for stability depending on depth, soil type, and moisture.	-	-	No	-	No	Rejected due to depth to groundwater.
		Vertical Wells	Vertical wells installed with perforated casing across targeted zone.	-	-	Yes	-	Yes	Retained for further consideration.
		Directional Wells	Directionally drilled wells are positioned horizontally or at an angle and can be double-or single-ended. A navigation tool is located close to the drill bit allowing steering. Slow drill head rotation cuts and compacts the soil into the borehole wall (sometimes cuttings are removed). Useful for increased extraction or injection distribution. May be limited by depth and cobbles.	-	-	No	-	No	Groundwater is too deep for directional wells to be practical.
		Recirculation Wells	A network of vertical wells is used to extract and inject amended water to improve distribution of amendment.	-	-	Yes	-	Yes	Retained for further consideration.
		Hydraulic Fracturing - Solid Amendment Emplacement	The solid form of chemical oxidants (e.g., permanganate solids) or biological amendments (e.g., HRC or EHC®) can be delivered to the subsurface via fracturing if mixed with the carrier fluid (e.g., guar). The delivered solid or undiluted amendment can provide a longer-term source of treatment that gradually dissolves over time. Amendments can be injected in a pattern or "fence" to create a treatment zone similar to an injected treatment wall.	-	-	Yes	-	Yes	Retained for further consideration.
Plume Remediation (ex situ)	Disposal or Reuse	Offsite Disposal or Recycling Facility	Extracted liquids are temporarily stored onsite until they are transported to an offsite facility for treatment (e.g., incineration).	Yes	-	Yes	-	No	Rejected for extracted water, as quantities would be immense. However, retained for potentially extracted product from Perched Aquifer.
		Discharge Treated Water to Surface Water	Treated water is discharged to the surface, potentially in a drainage, pond, or at a creek. Would require permitting, conveyance piping, and meeting discharge concentrations requirements.	Yes	-	No	-	Yes	Retained for futher consideration in the RA. Liquids extracted from the PA may have poor aesthetics (e.g., odor) following treatment.
		Onsite Treatment Facility Associated with Plant	Extracted waters are treated for COCs (e.g., GAC, stripping, etc.) and are then discharged to the Plant's wastewater treatment system equalization tank. Ultimately the Plant's wastewater treatment system discharges to the sanitary sewer.	Yes	-	Yes	-	No	Retained for the PA. The onsite facility plant can only handle limited volumes and would not be able to receive the anticipated extraction quantities from the RA.
		Give to UoA or CoT for Reuse	Treated water is conveyed to the UoA or CoT water distribution system for their consumption/utilization.	Yes	-	No	-	Yes	Retained for evaluation for the RA as considerable volumes of water may be extracted. Will need UoA's and CoT's input. Rejected for the PA due to lower volumes, longer conveyance distances, and potentially poor aesthetics.
		Discharge to Sanitary Sewer	Treated or untreated water is discharged directly to the sanitary sewer system to be conveyed to CoT's treatment plant.	Yes	-	Yes	-	Yes	Retained for further consideration for extracted groundwater from the PA and RA. Some level of pre-treatment would be certainly needed for PA groundwater and potentially for RA groundwater.
		Irrigation as Treatment	A relatively simple technology used to volatilize VOCs and distribute extracted groundwater.	Yes	-	No	-	No	Typically used in rural areas. Cannot implement in densely populated neighborhood due to limited application areas and contaminant exposure concerns, as well as public perception.
		Reinjection of Treated Water to the Subsurface	Treated water is returned to the subsurface through a series of injection wells and/or infiltration galleries. Treated water can often further enhance in situ natural attenuation processes by the addition of clean water (e.g., dilution), especially if supplemented with nutrients and heat to promote biodegradation.	Yes	-	No	-	Yes	Retained for the RA as reinjection would serve as a beneficial use. However, rejected for the PA due to the presence of product and the potential to increase contaminant and product migration.

Table 4-2
Screening of Potentially Applicable Remedial Technology Process Options
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Types	Technology Process Options	Brief Description	Potentially Applicable to COCs?	Potentially Applicable to Site Characteristics?				Screening Comments
					UVZ	PA	LVZ	RA	
Plume Remediation (ex situ)	Biological Treatment	Bioreactor	An above ground system that biologically degrades dissolved contaminants with the addition of nutrients, heat, and microorganisms. A typical system uses fixed-film bioreactors that contain plastic media to support films of biological growth.	Yes	No	Yes	No	Yes	Rejected for treating vapors from the UVZ and LVZ as implementing an anaerobic bioreactor for air is very difficult to implement and not as efficient as other air treatment technologies. Retained for further consideration for extracted groundwater from the PA and RA.
		Constructed/Engineered Wetlands or Terrestrial Phytoremediation	A wetland is constructed to use natural geochemical and biological processes to treat dissolved contaminants in groundwater through filtration, biodegradation, phytoremediation, volatilization, and photochemical oxidation. Constructed with a base impermeable layer (e.g., clay), a gravel layer to provide nutrients and support for roots, and a vegetation zone. The gravel layer and root zone is where water flows and bioremediation and denitrification take place. Both aerobic and anaerobic systems exist within the wetland, which can be divided into separate cells.	Yes	-	No	-	No	Used primarily for explosives and nitrates. Degradation of organic compounds via plants is slow and often incomplete.
	Physical and/or Chemical Treatment	Chemical Oxidation	Strong oxidizing compounds are mixed with contaminated water. The reaction requires direct contact between the reagent and contaminant, which destroys the organic compound by breaking bonds. Sufficient contact results in complete mineralization producing carbon dioxide and water.	Yes	-	Yes	-	Yes	Retained for further consideration for extracted groundwater from the PA and RA.
		Chemical Reduction	Strong reducing compounds are mixed with contaminated water. The reaction requires direct contact between the reagent and contaminant, which destroys the organic compound by breaking bonds. Sufficient contact results in complete mineralization producing carbon dioxide and water.	Yes	-	Yes	-	Yes	Retained for further consideration for extracted groundwater from the PA and RA.
		Capacitive Deionization	Separates ions from solution using an electric field applied between electrodes, where cations and anions are electrosorbed onto the cathode and anode, respectively, while treated water passes through. The positively charged electrode attracts anions.	No	-				Rejected as the COCs do not have an ionic charge and would not be targeted by this process.
		Electrodialysis	A direct current (DC) voltage potential field is applied across semipermeable and permeable ion-exchange membranes to induce ion separation in the water flowing through the channels. Cations and anions move through the transfer membranes and they migrate toward the anode and cathode, respectively.	No	-				Rejected as the COCs do not have an ionic charge and would not be targeted by this process.
		Ultraviolet Oxidation	Organic constituents in groundwater or air are oxidized by strong oxidizers and irradiation with ultraviolet light. Oxidation is achieved by high intensity UV light with the addition of ozone and/or hydrogen peroxide to break their chemical bonds. Highly reactive hydroxyl radicals destroy most organic compounds leaving carbon dioxide, water, and salts. Ozone would be generated onsite. Could be used to treat water or vapor from an extraction system.	Yes	Yes	Yes	Yes	Yes	Retained because easily oxidized organic compounds, such as PCE and its degradation products, are rapidly destroyed in UV/oxidation processes.
		Catalytic Oxidation	Vapor treatment for an extraction system (i.e., SVE, MPE, or an air stripper unit) using a metal catalyst (commonly platinum or palladium) to oxidize contaminants at lower temperatures. The catalyst accelerates the rate of oxidation beyond thermal oxidation by sorbing oxygen and the contaminant onto the catalyst surface where they react forming carbon dioxide, water, and hydrochloric gas.	Yes	Yes	-	Yes	-	Retained for further consideration as a treatment for potentially extracted vapors from the UVZ and LVZ.
		Thermal Oxidation	Vapor treatment for an extraction system (i.e., SVE, MPE, or an air stripper unit) by heating the vapor stream to a temperature that oxidizes the organic contaminants. These units typically have a single chamber and are equipped with a propane or natural gas burner and stack.	Yes	Yes	-	Yes	-	Retained for further consideration as a treatment for potentially extracted vapors from the UVZ and LVZ.

Table 4-2
Screening of Potentially Applicable Remedial Technology Process Options
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Types	Technology Process Options	Brief Description	Potentially Applicable to COCs?	Potentially Applicable to Site Characteristics?				Screening Comments
					UVZ	PA	LVZ	RA	
Plume Remediation (ex situ)	Physical and/or Chemical Treatment	Air Sparging or Aeration	Air is injected or bubbled through contaminated water and volatile contaminants partition into the air bubbles; thereby, transferring from the aqueous phase to the gaseous phase where the vapors are extracted and treated. The introduced air also promotes aerobic biodegradation, though that is a secondary means of treatment.	Yes	-	No	-	No	Although this technology could potentially treat extracted liquids from the PA and RA, air stripping is more effective and efficient (particularly with respect to surface area footprint). Considering that aerobic biodegradation is not a means of destroying COCs, simple aeration is not beneficial.
		Air Stripping	Typically takes place in a packed tower where water is injected/sprayed at the top of the column and percolates downward through baffles or packed media while an upward air flow is induced throughout the tower. Volatile contaminants partition out of groundwater (aqueous phase) into the air flow (gaseous phase) where the vapors are collected and treated.	Yes	-	Yes	-	Yes	Retained for further consideration as a treatment for potentially extracted liquids from the PA and RA.
		Granular Activated Carbon Adsorption	Removes organics by adsorption onto the carbon's microporous surface. Typically applied to remove contaminants that are not readily biodegraded or to polish low level concentrations beyond those attained by biological treatment. Feed water must be free of suspended solids to avoid bed fouling.	Yes	Yes	Yes	Yes	Yes	Retained for further consideration as a treatment for potentially extracted vapors from the UVZ and LVZ, and potentially extracted liquids from the PA and RA.
		Membrane Filtration/Reverse Osmosis	The membrane separation process removes suspended particles and select dissolved species based on size, shape, or charge. Ultrafiltration/ microfiltration occurs when particles are separated by forcing fluid through a semipermeable membrane. Only the particles whose sizes are smaller than the pores of the membrane are able to flow through. Reverse osmosis passed water through a semi-permeable membrane at high pressure. Both processes leave a concentrated waste stream requiring disposal or further treatment.	No	-				Rejected because reverse osmosis has limited effectiveness with solvents and VOCs. There are methods that can successfully remove PCE and its degradation products; however, this technology primarily removes inorganics. Any removal of PCE and its degradation products would be a secondary benefit. Therefore, it is not practical to use this technology as the primary treatment for solvent contamination.
		Ion Exchange/Resin Adsorption	Groundwater or air is passed through a resin bed where ions are removed by the exchange of electrical charges between resin and water. The resins can be disposed or regenerated for reuse. Regeneration of resins results in a concentrated brine.	Yes	Yes	Yes	Yes	Yes	Retained for further consideration as a treatment for potentially extracted vapors from the UVZ and LVZ, and potentially extracted liquids from the PA and RA.

Notes & Acronyms

Technology process options were screened against site conditions (e.g., contaminant characteristics and geology) to determine whether the technology is potentially applicable and should be carried forward for further evaluation.

-	Denotes that technology process option is not applicable for this particular media (e.g., for water or soil).
No	Denotes that technology process option would not be effective or practical and will not be carried forward for further evaluation.
Yes	Denotes that technology process option is potentially applicable for addressing contamination in one or more of the target intervals and will be carried forward for further evaluation.

AC/DC = alternating current/direct current
COC = chemical of concern
CoT = City of Tucson
EGCO = ElectroGeoChemical Oxidation
GAC = granular activated carbon
HRC = hydrogen release compound
ISCO = in-situ chemical oxidation
ISCR = in-situ chemical reduction
LNAPL = light non-aqueous phase liquid
LVZ = lower vadose zone
MPE = multi-phase extraction
NAPL = non-aqueous phase liquid
PCE = tetrachloroethene
PRB = permeable reactive barriers
PA = perched aquifer
RA = regional aquifer
RAOs = remedial action objectives
SISCO = surfactant-enhanced in-situ chemical oxidation
SVE = soil vapor extraction
SVOCs = semi-volatile organic compounds
UoA = University of Arizona
UVZ = upper vadose zone
VOCs = volatile organic compounds
ZVI = zero valent iron

Table 4-3A
Technology Evaluation for the UVZ
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
No Action	No Action	Low: soil concentrations do not presently exceed soil standards and no unacceptable risk is posed to potential receptors due to vapor intrusion. The implementation of SVE as an ERA, in addition to operating the MPE in the PA as an ERA, for several years cumulatively has removed considerable amounts of contamination from the UVZ. Therefore, SVE and MPE as ERAs have reduced risk by reducing contaminant mass. However, vapor intrusion risks are possible if shallow vapor concentrations rebound to hazardous levels. Although the most recent analytical results indicated acceptable levels, concentrations may have been abnormally low due to prior operation of the MPE system as considerable rebound has been historically observed following remedial system shutdown periods. The level of anticipated rebound in vapor concentrations is believed to be less than historically observed, however, vapor concentrations should be monitored until the trend is well understood.	High: easily implemented as no further action would be required. Current monitoring would cease.	None: no costs would be incurred as no further action would be required.	Rejected due to low effectiveness, despite its high implementability and no cost.
Monitoring	Monitored Natural Attenuation	Moderate to High: soil concentrations do not presently exceed soil standards and no unacceptable risk is posed to potential receptors due to vapor intrusion. Ongoing monitoring will assess the potential for rebound and allow for contingency measures to be implemented in the event that concentrations rebound to levels posing an unacceptable vapor intrusion risk.	High: relatively easily implemented by conducting routine sampling events using the existing monitoring network. Additional shallow vapor monitoring points could be installed with relative ease, however, the present network is believed to be adequate and no additional locations are anticipated.	Low: no additional capital costs are anticipated under this technology. Additional shallow vapor monitoring locations could be installed at low capital costs. Relatively low O&M costs would be would be associated with long-term monitoring.	Retained for incorporation into remedy development due to relatively high effectiveness, high implementability, and low cost.
Source Control	Bioslurping	Low to Moderate: soil concentrations do not presently merit an active remedy. In the event of rebounded concentrations, this technology may assist in removing vapors volatizing from the diesel product layer (or as a vapor capture for a PA sparging remedy), but will not influence upper portions of the UVZ. Vapor generation from the product layer is also reduced with product removal under this technology. Because the COCs preferentially degrade under anaerobic conditions, the secondary effect of aerobic bioventing is not desirable.	Moderate: the existing MPE system could be altered to operate as a bioslurping system by adjusting the stinger heights to sit at the product-air interface. Additional wells may be recommended based on the desired treatment area, but the extraction and central collection network may be difficult to install as the land in the project vicinity is densely developed. System O&M can be time intensive. Extracted product would need to be collected for disposal or recycling. Extracted air would require treatment. Little to no groundwater would be extracted.	Moderate to High: minor capital costs would be incurred in modifying existing MPE wells. Installing new wells to the product layer is expensive. System O&M and treatment is relatively expensive.	Rejected because it has relatively low effectiveness, is moderately difficult to implement, and is relatively expensive. SVE is a better option for removing contaminated vapors.
	Multi-Phase Extraction (MPE)	Moderate: soil concentrations do not presently merit an active remedy. In the event of rebounded concentrations, this technology would assist in removing vapors volatizing from the diesel product layer (or as a vapor capture for a PA sparging remedy). Historical operation of the MPE system as an ERA has successfully reduced concentrations in both the lower and upper portions of the UVZ. Vapor generation from the product layer is also reduced with product removal under this technology.	Low to Moderate: the existing MPE system would continue to operate as installed. If the stingers are lowered into the saturated zone, it would extract water, product, and air. However, the stinger heights could be set above the product-air interface to operate as a SVE system. Additional wells may be recommended based on the desired treatment area, but the extraction and central collection network may be difficult to install as properties in the project vicinity are densely developed. System operation involves significant O&M efforts. Extracted liquid would require treatment and/or disposal or reuse. Extracted product would be collected for disposal or recycling. Extracted air would require treatment.	High: no capital costs would be incurred in using the existing MPE wells and system, however, capital costs would be associated with implementing a different ex situ treatment technology from what the system is presently set up for (see Table 7-1 for ex situ treatment screening). Moderate capital costs would be involved in installing new wells to the product layer, if desired. System O&M and treatment of extracted vapor and liquids is expensive.	Rejected as a sole technology to use for the UVZ as it is over-designed and costly for the level of effort needed to control vapors in the UVZ. However, if it is employed to address the PA, it would have benefits in reducing contamination in the UVZ. SVE is better suited to remove rebounded vapor contamination.

Table 4-3A
Technology Evaluation for the UVZ
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria: Effectiveness	Screening Criteria: Implementability	Screening Criteria: Relative Cost	Screening Comments
Source Control	Anaerobic Bioventing	Low to Moderate: soil concentrations do not presently merit an active remedy. It is uncertain whether indigenous microorganisms could completely degrade PCE and its daughter products. Adequate distribution may be difficult to achieve given the thickness of the UVZ. This technology would not provide vapor capture in the event that vapors are generated from a PA remedy.	Low to Moderate: existing SVE and MPE wells could be modified to inject gaseous substrates across the vadose zone. Additional wells may be recommended based on the desired treatment area, but it may be difficult to install the injection/substrate delivery network as the land in the project vicinity is densely developed. If electron donor is not consumed, or is oversupplied, potentially hazardous conditions could develop if explosive/ignitable gasses are used. System O&M can be time intensive and require frequent deliveries or recharges of the substrate supply. It may be difficult to attain and sustain anaerobic conditions across such a thick vadose zone.	Moderate to High: moderate capital costs would be incurred in modifying existing SVE and MPE wells as injection wells and installing substrate delivery infrastructure. New injection wells can be costly depending on depth. System O&M and substrate supply is moderately expensive in the long term.	Rejected because it has relatively low effectiveness and is moderately difficult to implement and is relatively expensive. SVE is a better option for removing contaminated vapors. Bioventing may have been more attractive if ongoing vapor generation due to residual or sorbed contamination was anticipated to pose an unacceptable risk.
	Soil Vapor Extraction (SVE)	High: soil concentrations do not presently merit an active remedy; however, if vapor concentrations rebounded to hazardous levels, SVE would be ideal in removing contaminated vapors and reducing residual sorbed contamination throughout the UVZ. SVE would also assist in removing vapors volatizing from the diesel product layer, serving as a vapor capture technology for a PA sparging remedy, and/or stripping solvents from the product layer. Historical operation of the SVE system as an ERA successfully removed significant quantities of contamination in the UVZ.	Moderate to High: there are four existing SVE wells that could be utilized along with the existing MPE wells if the stinger heights were adjusted sufficiently above the product-air interface to operate as a SVE system. Additional wells may be recommended based on the desired treatment area, but the extraction and central collection network may be difficult to install as the land in the project vicinity is densely developed. System O&M can be time intensive. Extracted air would require treatment; limited liquids would be generated from condensation.	Moderate to High: minor capital costs would be incurred in modifying the MPE system and connecting to the SVE wells. If installing new SVE wells was desired, shallow directional wells would be relatively inexpensive and could be drilled beneath the Plant building without impacting their operations. System O&M and vapor treatment is expensive.	Although it may not be necessary based on current soil and vapor concentrations, SVE is retained for incorporation into the more aggressive remedy as it is the most practical vapor remedy in the UVZ.
	Vertical Wells	Because only SVE was retained as an active remedy for the UVZ, the four existing SVE wells will be used. However, in the event that shallow vapor concentrations rise to levels posing a vapor intrusion risks, the need for installing additional wells would be evaluated. Shallow horizontal wells would be more effective in extracting vapors in shallow soils, could be installed beneath buildings and roads without disrupting site activities, and are generally less expensive than deep vertical wells. Additional vertical wells would not be recommended as soil contamination has already been remediated to acceptable levels and SVE would be implemented solely as a protective measure against vapor intrusion.			
	Directional Wells				
Ex Situ Treatment	To Be Determined (see Table 7-1)	The suitability of technologies (effectiveness, implementability, and relative cost) for ex situ treatment of air and/or water will vary based on the chosen remedial strategy. Factors to consider include the average values and variations (anticipated ranges) in contaminant concentrations and flow rates. Furthermore, technologies employed across various intervals (e.g., UVZ, PA, LVZ, and RA) may benefit from sharing a common ex situ treatment, whereas evaluated individually different option(s) may have been selected. For example, if SVE were implemented at only one location in the LVZ, it may not extract enough contamination or have a sufficient flow rate to economically select a catalytic oxidizer and GAC may be more suitable; however, if extracted flow from the LVZ were joined with extracted flows from SVE in the UVZ, GAC may become uneconomical. Therefore, the ex situ treatment technologies will be evaluated only for the proposed remedy.			

Notes & Acronyms

ERA = early response action
COCs = chemicals of concern
GAC = granular activated carbon
LVZ = lower vadose zone
MPE = multi-phase extraction
O&M = operations and maintenance
PCE = tetrachloroethene
PA = perched aquifer
RA = regional aquifer
SVE = soil vapor extraction
UVZ = upper vadose zone

Table 4-3B
Technology Evaluation for the PA
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
No Action	No Action	Low to Moderate: because PA groundwater is not used for potable water and does not have the economic potential for use in the future, contamination in groundwater and product does not pose an unacceptable risk due to consumption. The implementation of MPE as an ERA for a few years has removed considerable amounts of contamination from the diesel layer and some from the PA groundwater. Furthermore, operating the MPE system has assisted in degrading much of the contaminant mass from PCE to its less toxic daughter product, cDCE. Therefore, MPE as an ERA has reduced risk by reducing contaminant mass and its toxicity. No further action would be effective as long as (1) vapors volatizing from the PA do not migrate and accumulate in shallow soils at hazardous concentrations posing a vapor intrusion risk; and (2) the PA aquitard continues to prevent or significantly retard downward migration into the LVZ and ultimately the RA. It is believed that the PA aquitard effectively protects the RA for reasons discussed in Section 3.4.2. Overall, no action in the PA could likely achieve the remedial objectives; however, without monitoring it would not be possible to assess contaminant migration toward the northern extent of the PA aquitard. Therefore, some degree of infrequent routine monitoring is likely merited.	High: easily implemented as no further action would be required. Current monitoring would cease.	None: no costs would be incurred as no further action would be required.	Rejected due to relatively low effectiveness despite its high implementability and no cost.
Monitoring	Monitored Natural Attenuation	Moderate: for the reasons stated above (in No Action), the PA contamination is not believed to present an unacceptable risk via vapor intrusion or RA water supply wells. Ongoing monitoring will allow for continued evaluation of risk to human health and the environment, enabling contingency measures to be implemented in a timely manner to be protective of receptors in the event that an unacceptable risk is posed. It is recommended that monitoring efforts focus on the migration of the distal portion of the plume and its location with respect to the estimated extent of the PA aquitard. Another effective means of monitoring potential vertical migration of contamination from the PA through the aquitard would be monitoring changes in vapor concentrations in the LVZ.	High: relatively easily implemented by conducting routine sampling events using the existing monitoring network. Additional monitoring wells could be installed without much difficulty; however, the current network is believed to be adequate and no additional locations are anticipated in the near future. In the event that the PA groundwater plume continues to migrate further downgradient, additional PA groundwater monitoring wells may be appropriate to assess the plume's proximity to the estimated edge of the PA aquitard. Also, installing additional vapor monitoring points in the LVZ would assist in evaluating the potential for vertical migration through the PA aquitard.	Low: no additional capital costs are anticipated under this technology. Additional PA monitoring locations could be installed at fairly low capital costs. Installing additional LVZ vapor monitoring points would involve higher capital costs. Relatively low O&M costs would be would be associated with long-term monitoring.	Retained for incorporation into remedy development due to moderate effectiveness, high implementability, and low cost.

Table 4-3B
Technology Evaluation for the PA
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
Source Control	Bioslurping	Moderate to High: this technology would effectively remove product within the immediate vicinity of the extraction wells; however, the product layer is fairly extensive and covers a much larger area than the present MPE wells could influence. However, for the reasons presented under "No Action," the current condition of the PA is not believed to pose a threat to receptors. Therefore, implementing bioslurping in a limited portion of the diesel layer beneath the Plant area still achieves some additional protectiveness. Additional extraction wells could be installed if a greater treatment footprint were desired.	Moderate: the existing MPE system could be altered to operate as a bioslurping system by adjusting the stinger heights to sit at the product-air interface. Additional wells may be recommended based on the desired treatment area, but the extraction and central collection network may be difficult to install as the land in the project vicinity is densely developed. System O&M can be time intensive. Extracted product would need to be collected for disposal or recycling. Extracted air would require treatment. Little to no groundwater would be extracted.	Moderate to High: minor capital costs would be incurred in modifying existing MPE wells. Installing new wells to the product layer and their above ground extraction network is relatively expensive. System O&M and treatment is relatively expensive.	Retained for incorporation into remedy development due to its moderately high effectiveness and moderate implementability, despite its moderately high cost. This option would be more advantageous than MPE if only product were desired to be recovered.
	Multi-Phase Extraction (MPE)	High: this technology would effectively remove groundwater and product within the immediate vicinity of the extraction wells; however, contamination in groundwater and product layer covers a much larger area than the present MPE wells could influence. However, for the reasons presented under "No Action," the current condition of the PA is not believed to pose a threat to receptors. Therefore, implementing MPE in a limited portion of the PA beneath the Plant area still achieves additional protectiveness. Additional extraction wells could be installed if a greater treatment footprint were desired. Historical operation of the MPE system as an ERA has successfully reduced concentrations in both the lower and upper portions of the UVZ.	Low to Moderate: the existing MPE system would continue to operate as installed. If the stingers are lowered into the saturated zone, it would extract water, product, and air. Additional wells may be recommended based on the desired treatment area, but the extraction and central collection network may be difficult to install as properties in the project vicinity are densely developed. System operation involves significant O&M efforts. Extracted liquid would require treatment and/or disposal or reuse. Extracted product would be collected for disposal or recycling. Extracted air would require treatment.	High: no capital costs would be incurred in using the existing MPE wells and system, however, capital costs would be associated with implementing a different ex situ treatment technology from what the system is presently set up for (see Table 7-1 for ex situ treatment screening). Moderate capital costs would be involved in installing new wells to the product layer, if desired. System O&M and treatment of extracted vapor and liquids is expensive.	Bioslurping would be more advantageous than MPE if only product were desired to be recovered. However, MPE is retained as a contingency option in the event that groundwater extraction is desired or if residual product trapped below the water table needs to be accessed via dewatering.
	Skimmer Pumps	Low: relatively low volumes of product would be continuously recovered over long periods of time. Based on pilot testing of this technology conducted for several weeks in the fall of 2001, this technology was deemed unsuccessful. Problems encountered included recovering large volumes of water and low recovery of free product.	Low: pumps would be deployed in each well with a connection to pressurized gas (e.g., nitrogen) and would discharge product through tubing to storage containers at the surface. Permanently deployed systems would likely interfere with Plant operations, though a centralized gathering system would aid in reducing the surface footprint. Numerous challenges were encountered during its pilot testing.	Low: relatively low capital costs and low O&M costs are associated with this technology.	Rejected due to its low effectiveness and low implementability based on prior pilot testing of this technology at the Site.
	Soil Vapor Extraction (SVE)	Low: if SVE were implemented in the lower portion of the UVZ immediately above the diesel product layer, some COC mass would be extracted from the diesel layer by creating a stronger diffusion gradient out of the product and into the soil vapor. However, the contaminant mass removal process would be relatively inefficient as only the uppermost portion of the diesel layer would be subject to an increased diffusion rate. It would require significant periods of time before meaningful amounts of contaminant mass are removed from the entire diesel layer.	Moderate to High: there are four existing SVE wells that could be utilized along with the existing MPE wells if the stinger heights were adjusted sufficiently above the product-air interface to operate as a SVE system. System O&M can be time intensive. Extracted air would require treatment; limited liquids would be generated from condensation.	Moderate to High: minor capital costs would be incurred in modifying the MPE system and connecting to the SVE wells. System O&M and vapor treatment is expensive.	Rejected as a primary technology to address the PA, as bioslurping or MPE are more effective physical means of removing contaminant mass in the saturated zone. SVE is retained as secondary as a UVZ treatment technology or as vapor capture for a PA technology (e.g., air sparging).

Table 4-3B
Technology Evaluation for the PA
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
Plume Remediation (in situ)	PlumeStop with MNA	High: this technology would be used as a contingency in the event that the PA plume appears to be migrating with elevated concentrations toward the estimated extent of the PA and poses a threat for vertical migration to the RA. PlumeStop would transfer contamination from the aqueous phase to the sorbed phase, as well as enhancing natural biodegradation processes. When contaminants come in contact with the micron-sized GAC, they sorb to the surface of the GAC where they remain indefinitely or until consumed via biodegradation processes. Overall this technology would immobilize and subsequently reduce contaminant mass, effectively eliminating the potential risk of migration beyond the PA aquitard and ultimately to the RA. Regardless of the level of natural biodegradation occurring, the plume would essentially "stop" at the treatment barrier; therefore, this technology is as effective as its distribution is complete. Similar to processes involved with ex situ GAC treatment, once the GAC becomes fully saturated (or reaches its sorption capacity), contamination will "break through" and continue migrating downgradient fairly uninhibited. However, PlumeStop could be delivered at quantities capable of sorbing the entire plume without breakthrough occurring (even without ongoing degradation) and biodegradation will continue to "regenerate" the carbon making more sorption sites available.	Moderate: PlumeStop would be injected in a series of injection wells or temporary points to create a continuous barrier spanning the width of the PA plume. To reduce the number of injection points and material used, the treatment barrier could selectively focus on the elevated portion of the plume (e.g., concentrations above 1,000 ppb). Assuming a plume width of 500 feet (running east-west), approximately 16 injection wells would be needed assuming an injection radius of 15 feet. The treatment depth would extend from the water table to the top of the aquitard - the saturated thickness (treatment zone) is a few thick. PlumeStop easily injects and does not reduce the formation's permeability. It has a viscosity similar to water and the GAC particles are generally 1-micron in size (significantly smaller than most pore throat diameters) allowing it to freely flow in the aquifer without clogging or reducing permeability. The GAC particles are negatively charged and do not adhere together, but will continuously coat the surfaces of the soil grains as it flows through the aquifer. Essentially, the PlumeStop distribution is limited only by the volume injected and the injection method's ability to distribute water. In general, PlumeStop will migrate with water for a period of a couple months prior to losing its polarity and settling out. Therefore, the distribution achieved is controlled mostly by the injection hydraulics and quantities of PlumeStop injected.	Moderate: this option involves high capital costs associated with well installation/drilling, labor, and material costs; however, there are no O&M costs associated with this technology beyond groundwater sampling as part of performance monitoring.	Retained as a contingency measure in the event that the PA plume appears to be migrating with elevated concentrations toward the estimated extent of the PA and poses a threat for vertical migration to the RA.
	PlumeStop with ERD	High: this technology is identical to the PlumeStop technology described above, except it is paired with biostimulation and potentially bioaugmentation to enhance reductive dechlorination processes within the treatment zone. The plume would still be stopped irrespective of biodegradation processes, as aqueous phase contamination is transferred to the sorbed phase; however, the contamination would be biologically consumed instead of being immobilized indefinitely. Therefore, the net contaminant mass in the PA would be reduced under this technology. There are multiple benefits to pairing PlumeStop and ERD, which include (1) downgradient migration of the plume is "stopped" and risk posed to drinking water receptors is eliminated without concern about whether complete or successful biodegradation was achieved; (2) the PlumeStop GAC creates biologically active "sites" where microorganisms can readily access the contaminant to respire; and (3) biological processes are accelerated within the treatment zone because the contaminants are more accessible and the microorganism colonies are not as stressed (or starved). Overall, contaminant mass can be destroyed within a much narrower treatment zone because the biological processes are considerably more active and the contaminant is immobilized until it is consumed.	Low to Moderate: the PlumeStop implementation portion of this technology would be implemented in an identical manner to the technology described above, except the injection solution would be a mixture of water, PlumeStop, and an amendment for ERD (e.g., EVO) instead of just PlumeStop and water. The EVO would yield anaerobic conditions over a period of a few months that would be conducive to ERD. Distributing the EVO may be more difficult than the PlumeStop and it may not spread out as far as the PlumeStop; therefore, non-biologically active pockets may reside within the injected barrier. Repeat injections of EVO may be required depending on how self-sufficient the biological treatment zone becomes with the natural organic content in the aquifer concentrated on the GAC particles. The reason why PlumeStop with ERD would be more desirable and implementable than the ERD only option is that the PlumeStop would significantly increase the contaminant's retention/retardation within the biologically active treatment zone, necessitating only one treatment zone/row, as opposed to multiple treatment zones. Depending on the species of indigenous microorganisms present, bioaugmentation (the addition of select microorganisms) may be needed to promote ERD. Prior to injecting microbial culture, the system would need to have well established anaerobic conditions and would require a separate injection event multiple months later. Anaerobic chase water would need to be used to push the microbes further into the formation, possibly using the recirculation wells to further distribute the microbes. Although the distribution achieved would be more limited than that achieved by the PlumeStop, the microorganisms tend to slowly spread or bloom out over time.	Moderate to High: this option involves high capital costs associated with well installation/drilling, labor, and material costs; however, there are no O&M costs associated with this technology beyond groundwater sampling as part of performance monitoring.	Rejected as the first contingency measure, as PlumeStop with MNA is likely to achieve the same level of protection. Considering that there is evidence of natural biodegradation in the PA, adding amendment may be redundant. However, if enhanced biodegradation is desired, this technology could be implemented.

Table 4-3B
Technology Evaluation for the PA
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
Plume Remediation (in situ	Air Sparging	High: air sparging removes volatile contaminants relatively quickly as long as adequate distribution is achieved. This technology would involve sparging air at the base of the PA (or top of the aquitard) and the air would bubble through the saturated zone and the diesel product layer until reaching the UVZ where it would be captured by SVE, or a similar vapor control technology. Placing the sparging diffuser immediately above the top of the aquitard would assist in increasing the sparging radius of influence as pressurized air would be forced laterally outward by the impermeable layer prior to moving upward.	Moderate: some degree of sparging could be achieved if the stingers in the MPE wells were lowered to the base of the wells and retrofitted for air injection (instead of extraction). Sealing discs or gaskets would need to be placed immediately above the bottom of the stinger to force air into the filter pack and prevent air moving up the well casing. Even this configuration is less than ideal as air would likely move up the well's filter packs. If it were desired to treat the plume within the 1,000 ppb cDCE contour via sparging, a row of injection wells could be installed at the downgradient edge of the 1,000 ppb contour, spanning approximately 400 feet. Approximately 13 injection wells would be needed for such a configuration if installed on 30-foot spacing. However, air sparging should be conducted at additional locations beneath the plant if the objective is to remove contaminant mass from the product layer. Injection wells would have 1 to 2-foot screened intervals above the base of the PA aquitard.	Moderate to High: this technology would involve considerable capital costs associated with the numerous injection points and the above ground infrastructure to pressurize the wells. High O&M costs would be associated with continually supplying pressurized air and performance monitoring. SVE, or another vapor capture technology, would also be required.	Retained due to high effectiveness and moderate implementability, despite the relatively high cost.
	In-Well Air Stripping	High: this technology is somewhat of a combination of SVE and air sparging, and therefore, shares their respective effectiveness.	Moderate: this technology would be implemented in essentially the same manner as described in the air sparging technology above. The advantage to in-well stripping is that a single boring can be advanced to house both the sparging and SVE capabilities, saving on costs and requiring fewer locations. The disadvantage is that typically SVE can achieve a considerably greater radius of influence than sparging and a larger borehole would need to be advanced to house both components. Therefore, an optimal scenario may be to have every other well be an in-well air stripping setup and the remaining wells as strictly air sparging. The separation disc would need to form a good seal to prevent short-circuiting.	Moderate to High: this technology would involve considerable capital costs associated with the numerous injection points and the above ground infrastructure to supply pressurized air and extract vapors from the wells. High O&M costs would be associated with continually supplying pressurized air, extracting vapors, and conducting performance monitoring.	Retained due to high effectiveness and moderate implementability, despite the relatively high cost.
	In Situ Chemical Oxidation (ISCO) via Injections	Low: this technology oxidizes aqueous-phase contamination that it comes into contact with, but does not address contamination in the sorbed phase or NAPL phase. Most oxidants have a brief longevity ranging from less than a month (e.g., Fenton's) to a few years (e.g., permanganate). Contaminant mass in the sorbed phase or in the diesel product would be secondarily treated by increasing the diffusion gradient from the product to the groundwater. Considering that the significant majority of contaminant mass is present within the diesel layer, this technology would not be very effective.	Low: oxidant would be delivered to the PA via injection wells, or temporary injection wells throughout the desired treatment area. Assuming a treatment area within the 1,000 ppb cDCE contour, approximately 130 or 90 injection locations would be required assuming a radius of influence of 20 or 25 feet, which is fairly large. Considering the densely developed project vicinity, injecting at this many locations is not feasible. Furthermore, repeat injections would be needed as contaminant mass would continue to diffuse from the diesel into groundwater following oxidant consumption. Organic content from the diesel layer would strongly compete for oxidant demand. Solid oxidant (e.g., potassium permanganate solids) could be emplaced with hydraulic fracturing; however, great care would need to be taken to not compromise the PA aquitard during the fracturing process.	High: this technology would involve significant capital costs associated with the numerous injection points and considerable quantities of oxidant required. O&M costs would also be high due to repeat injections and performance monitoring.	Rejected due to low effectiveness, difficult implementability, and high cost.
	In Situ Chemical Reduction (ISCR)	Low: this technology would not be effective for similar limitations shared with ISCO.	Low: this technology shares similar implementation difficulties with ISCR.	High: same reasons as ISCO.	Rejected due to low effectiveness, difficult implementability, and high cost.
	Vertical Wells	Because the PA is too deep for directional wells and there is no additional benefit in using recirculation wells, standard vertical wells would be utilized for remedy implementation.			
	Recirculation Wells	Because none of the retained active remedies involve injecting material, the advantage gained by recirculation wells in increased distribution is not needed.			
	Hydraulic Fracturing - Solid Amendment Emplacement	Because none of the retained active remedies involve injecting material, the advantage gained by emplacing solid amendments (e.g., $KMnO_4$ solids) is not needed.			

Table 4-3B
Technology Evaluation for the PA
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
Ex Situ Treatment	To Be Determined (see Table 7-1)	The suitability of technologies (effectiveness, implementability, and relative cost) for ex situ treatment of air and/or water will vary based on the chosen remedial strategy. Factors to consider include the average values and variations (anticipated ranges) in contaminant concentrations and flow rates. Furthermore, technologies employed across various intervals (e.g., UVZ, PA, LVZ, and RA) may benefit from sharing a common ex situ treatment, whereas evaluated individually different option(s) may have been selected. For example, if SVE were implemented at only one location in the LVZ, it may not extract enough contamination or have a sufficient flow rate to economically select a catalytic oxidizer and GAC may be more suitable; however, if extracted flow from the LVZ were joined with extracted flows from SVE in the UVZ, GAC may become uneconomical. Therefore, the ex situ treatment technologies will be evaluated only for the proposed remedy.			

Notes & Acronyms

cDCE = cis-1,2-Dichloroethene
ERA = early response action
ERD = enhanced reductive dechlorination
EVO = emulsified vegetable oil
GAC = granular activated carbon
ISCO = in situ chemical oxidation
ISCR = in situ chemical reduction
$KMnO_4$ = potassium permanganate
LVZ = lower vadose zone
MNA = monitored natural attenuation
MPE = multi-phase extraction
NAPL = non-aqueous phase liquid
O&M = operations and maintenance
PA = perched aquifer
PCE = tetrachloroethene
ppb = parts per billion
RA = regional aquifer
SVE = soil vapor extraction
UVZ = upper vadose zone

Table 4-3C
Technology Evaluation for the LVZ
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
No Action	No Action	Low: there is known contamination in the LVZ that is believed to contribute to elevated groundwater concentrations in the RA, particularly in the vicinity of PER-14A. Under no action, this contamination is anticipated to continue impacting groundwater via volatilization and infiltration, likely serving as a long-term source. Some degree of natural attenuation is likely to occur over time; however, no monitoring would be conducted to evaluate vapor concentrations and the progress of attenuation. If the recent increasing groundwater elevation trend continues in the RA, groundwater may come into contact with additional residual contamination in the LVZ, further impacting groundwater. Therefore, no action in the LVZ may delay or inhibit achieving the remedial objectives.	High: easily implemented as no further action would be required. Current monitoring would cease.	None: no costs would be incurred as no further action would be required.	Rejected, as no action would not address the LVZ as a source to the RA and may inhibit achieving remedial objectives. RA groundwater would remain impacted directly beneath and downgradient of the Plant area. The condition of the LVZ could not be monitored.
Monitoring	Monitored Natural Attenuation	Low to Moderate: for the reasons stated above, the LVZ is believed serves as a continuing source for groundwater contamination in the RA in the vicinity of PER-14A and may increasingly impact the RA if groundwater elevations continue to increase. Monitoring the LVZ would assist in evaluating risks posed by vapor concentrations in the LVZ and the potential for natural attenuation, but residual contamination is likely to serve as a source to RA groundwater for the long term. Extracted groundwater from UoA production wells is anticipated to remain below MCLs due to attenuation and dilution with MNA in the LVZ; however, a considerable portion of the present plume footprint would have degraded water quality negatively impacting CoT, should CoT decide to extract from the area in the future.	Moderate: implemented relatively easily by conducting routine sampling of a monitoring network. The existing network would benefit from installing a few additional nested monitoring points, which would involve considerable effort to install. An improved monitoring network would also assist in evaluating the potential for vertical migration of contamination through the PA aquitard into the LVZ.	Low to Moderate: moderate capital costs would be incurred in installing additional monitoring points. Relatively low O&M costs would be would be associated with long-term monitoring.	Rejected, as MNA would not address the LVZ as a source to the RA and may inhibit achieving remedial objectives. RA groundwater would remain impacted directly beneath and downgradient of the Plant area.
Source Control	Anaerobic Bioventing	Low: it is uncertain whether the indigenous microorganisms could completely degrade PCE and its daughter products. If able to do so, the process would likely be slow and the LVZ would continue to serve as a source to RA groundwater in the interim. Furthermore, anaerobic bioventing could increase risks by achieving only partial degradation resulting in elevated concentrations of the more toxic compound, vinyl chloride, in groundwater.	Low: the existing VEL-03 well could be modified to inject gaseous substrates across the vadose zone; however, additional injection wells would be needed to obtain and sustain anaerobic conditions across the vadose zone. Installing wells into the LVZ beneath the plant must be done with care to avoid carrying contamination from the PA into the LVZ or creating a conduit for contaminant migration through the PA aquitard. System O&M can be time intensive and require frequent deliveries or recharges of the substrate supply.	High: relatively high capital costs would be incurred in modifying VEL-03 and installing new injection well locations, as well as installing substrate delivery infrastructure. System O&M and substrate supply is moderately expensive in the long term.	Rejected, as it has low effectiveness, is relatively difficult to implement and is relatively expensive. SVE is a better option for remediating contaminated vapors.
	Soil Vapor Extraction (SVE)	High: a pilot test of SVE in the LVZ was conducted in January 2014 and was found to be a successful technology in removing COCs and significantly reducing vapor concentrations in the LVZ. An early response action of SVE in the LVZ was implemented in early 2015 and deemed effective. Additional SVE operation may be required going forward based on future monitoring results.	Moderate to High: based on pilot testing, it is anticipated that adequate treatment could be achieved using VEL-03. In this instance, SVE could be readily implemented with relative ease. In the event that a larger treatment area is desired, additional SVE wells could be installed and incorporated to the central collection network. Installing wells into the LVZ beneath the plant must be done with care to avoid carrying contamination from the PA into the LVZ or creating a conduit for contaminant migration through the PA aquitard. System O&M can be time intensive. Extracted air would require treatment; limited liquids would be generated from condensation.	Moderate: small capital costs would be incurred in modifying the MPE system and connecting to the VEL-03. Relatively high capital costs would be incurred if new SVE wells were installed. System O&M and vapor treatment can become expensive in the long-term.	SVE is retained for incorporation into remedy development as it is the most practical technology to address contamination in the LVZ.
	Vertical Wells	As the LVZ is too deep for directional wells, standard vertical wells would be utilized for remedy implementation.			
Ex Situ Treatment	To Be Determined (see Table 7-1)	The suitability of technologies (effectiveness, implementability, and relative cost) for ex situ treatment of air and/or water will vary based on the chosen remedial strategy. Factors to consider include the average values and variations (anticipated ranges) in contaminant concentrations and flow rates. Furthermore, technologies employed across various intervals (e.g., UVZ, PA, LVZ, and RA) may benefit from sharing a common ex situ treatment, whereas evaluated individually different option(s) may have been selected. For example, if SVE were implemented at only one location in the LVZ, it may not extract enough contamination or have a sufficient flow rate to economically select a catalytic oxidizer, so GAC may be more suitable. However, if extracted flow from the LVZ were joined with extracted flows from SVE in the UVZ, GAC may become uneconomical. Therefore, the ex situ treatment technologies will be evaluated only for the proposed remedy.			

Notes & Acronyms

COCs = chemicals of concern
CoT = City of Tucson
GAC = granular activated carbon
LVZ = lower vadose zone
MCLs = maximum contaminant levels
MNA = monitored natural attenuation
MPE = multi-phase extraction
O&M = operations and maintenance
PA = perched aquifer
PCE = tetrachloroethene
RA = regional aquifer
SVE = soil vapor extraction
UoA = University of Arizona
UVZ = upper vadose zone

Table 4-3D
Technology Evaluation for the RA
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
Remedial Measures	Well Modification	Low: sealing off the upper interval (from approximately 200 to 330 feet bgs) of the UoA production wells would result in decreased groundwater production, affecting UoA water supplies. Because the natural groundwater surface has a mild gradient, groundwater flow is considerably influenced by groundwater extraction. Therefore, withdrawing greater quantities from a deeper depth would result in a negative vertical gradient inducing downward migration of the plume. Extracted groundwater concentrations would remain above acceptable levels (requiring wellhead treatment) and the plume would be spread across an even greater vertical extent. Furthermore, it is anticipated that groundwater contamination will exist in the deeper intervals (though to a lesser extent than in the upper interval) due to diffusion and dispersion by the time the plume has migrated to the UoA production wells based on preliminary model simulations.	High: the upper layer (approximately 200 to 330 feet bgs) of the UoA production wells would be sealed off using a liner bounded by well packers. For example, a "GRIFFITTS Double-locking well seal" could be deployed with the upper packer set above the water table and the PVC liner extending to the lower packer set below 330 feet bgs. The packers would have an outer diameter matching the inner diameter of the well casing and have multiple flexible flanges that create an effective seal. The PVC liner would have a large enough diameter to allow the water conveyance tubing from the well's submersible or turbine pumps to pass through. The well packers and liner would be assembled at the wellhead during deployment and would require a standard work-over rig.	Very Low: the capital costs involved in implementing this technology would be the materials for the packer-liner assembly, which is inexpensive, and the labor involved in its installation. There are no O&M costs associated with this technology.	Rejected due to its low effectiveness, despite its high implementability and low cost.
	Wellhead Treatment	High: numerous treatment technologies can be effectively implemented at the wellhead to treat or remove contamination from extracted groundwater, preventing unacceptable risks from receptors exposure to contamination. Individual treatment technology types are evaluated in Table 7-1.	Moderate to High: the degree of ease with which wellhead treatment is implemented depends on the chosen technology considering the O&M involved (frequency of maintenance, operational demands, administrative coordination, etc.) and the surface area (footprint) required to implement the treatment process. Many of the technologies are well-understood and commonly used.	High: this technology involves relatively low to moderate capital costs depending on the process implemented; however, long-term O&M costs are high and involve labor costs, performance monitoring, power supply, and materials used.	Retained due to its high effectiveness and relatively high implementability, despite the high costs. This technology would be implemented as a contingency factor, if plume remediation alone is not protective.
	Provision of Replacement Water Supplies	Low to High: if CoT were willing and able to connect UoA to city water, they could provide clean water to the UoA users and the existing UoA production wells would be taken offline, thereby eliminating potential risks to receptors from exposure to groundwater contamination. This option, however, is not effective from the standpoint of CoT in the event that they seek to install and operate production wells within the footprint of the groundwater plume. In this instance, wellhead treatment would need to be implemented. If CoT was not able to provide treated water to UoA, another option would be providing bottled water services to UoA for drinking water consumption. This option has limited effectiveness though as the UoA campus is very large and water is used for many uses beyond drinking (e.g., hand washing, showering, irrigation, sanitary, cooking uses, etc.) for which exposure to contamination could not be controlled. Furthermore, the UoA already has established infrastructure for drinking water supplies (e.g., drinking fountains, soda fountains, etc.) that would need to be discontinued.	Low to Moderate: if CoT were willing and able to connect UoA to city water, city water would replace the groundwater production wells and the existing infrastructure could be readily used. However, it is anticipated that CoT could not meet all of UoA's water demands without negatively affecting their water supply capabilities. Furthermore, should CoT seek to withdraw water supplies from the RA within the footprint of the groundwater plume, this option does not apply and cannot be implemented. As mentioned in the "effectiveness" discussion, providing bottled water to UoA is not a feasible option as it cannot achieve adequate protection.	Moderate to High: there would be moderately low capital costs involved in connecting City water to the UoA, however, the long-term utility costs of using City water are relatively high.	Rejected as this technology cannot be implemented or effective to protect CoT's water supply. Furthermore, its implementability is doubtful and expensive for the UoA.

Table 4-3D
Technology Evaluation for the RA
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
Monitoring	Monitored Natural Attenuation	Low: because little to no biodegradation is believed to naturally occur in the RA, contaminant mass is not reduced, but rather redistributed via diffusion, dispersion, volatilization, and sorption. As the UoA extraction wells span deep intervals, vertical dispersion and diffusion does not assist in reduced extracted concentrations as the net mass extracted is unchanged. Sorption and desorption helps lengthen the plume with decreased aqueous concentrations; however, modeled simulations predicted a peak extraction concentration of approximately 9.1 ppb of PCE at the Agriculture well under MNA conditions, with concentrations greater than 2.5 ppb of PCE for approximately 43 years. Wellhead treatment could be implemented for the period during which concentrations exceed the action threshold level (i.e., 2.5 ppb) to protect groundwater users.	High: implemented relatively easily by conducting routine sampling events using the existing monitoring network. Installing additional monitoring wells would require considerable effort. The current network is believed to be adequate until elevated concentrations are detected at the UAM sentinel wells. Therefore, no additional locations are anticipated in the near future, but several more monitoring wells may need to be installed once the plume has migrated beyond the most downgradient wells.	Low: no additional capital costs are anticipated under this technology. Additional monitoring locations could be installed at fairly low capital costs. Relatively low O&M costs would be would be associated with long-term monitoring.	Rejected without remedial measures, but retained for incorporation into remedy development with wellhead treatment due to high implementability and low cost.
Physical Containment	Groundwater Extraction via Pumping Wells	High: contaminated groundwater can be effectively captured and prevented from downgradient migration to the UoA production wells. This technology captures the plume, protecting downgradient water users but does not address upgradient contamination. Modeling identified a configuration that completely captures groundwater contamination in the RA and does not result in concentrations greater than 2.5 ppb of PCE at the UoA production wells. In the event that CoT wanted to extract groundwater within the RA plume upgradient of the extraction well, wellhead treatment would need to be implemented.	Moderate: this technology has been frequently employed and is well-understood. Contaminated groundwater is withdrawn from an extraction well screened across the impacted portion of the RA and is then treated at the surface prior to discharge, reuse, or reinjection. Preliminary optimization modeling simulations identified the ideal extraction scenario (fewest locations with minimum extraction rate to achieve adequate plume capture) to include one extraction well located approximately 200 feet north of PER-28, screened from 200 to 330 feet bgs, and pumping at 50 gpm for approximately 30 years. Ex situ water treatment would need to be implemented at the surface prior to reinjection, reuse, or discharge (see Table 7-1 for screening ex situ treatment technologies).	Moderate to High: there would be moderate capital costs associated with installing an extraction well to 330 feet bgs and for configuring the ex situ treatment and reuse/reinjection conveyance system. The long-term O&M costs of operating the pump, treating the water, and discharging/reinjecting the treated water are relatively high.	Retained due to high effectiveness and moderate implementability, despite the relatively high long-term costs.

Table 4-3D
Technology Evaluation for the RA
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
Plume Remediation (in situ)	Anaerobic Bioremediation via Amendments	Moderate: this technology is partially effective, as it reduces contamination in RA groundwater but wellhead treatment would still likely be required to protect groundwater users based on preliminary modeling that was conducted to evaluate the effectiveness of enhanced reductive dechlorination (ERD). Modeling results show a decrease from a peak extraction concentration of approximately 9.1 ppb of PCE at the Agriculture well under MNA conditions to approximately 4.0 ppb of PCE using one row of wells to implement ERD. If three rows of injection wells are used to implement ERD, a peak extraction concentration of approximately 1.8 ppb of PCE is predicted at the Agriculture well. Another concern is that if complete degradation is not achieved in RA groundwater prior to being extracted for consumption, the daughter products produced by partial degradation (i.e., vinyl chloride) could be considerably more hazardous than if no degradation were achieved. Considering that complete degradation is not anticipated to occur using one or three rows of ERD treatment zones, the potential for increased risk is a real possibility. Overall, some mass reduction is achieved under this technology, but it could actually increase risk to receptors and cannot be implemented as a sole technology while being conservatively protective.	Very Low: given the nature of the Site, this technology would be very difficult and costly to implement. Assuming that the targeted treatment area is within the 10 ppb contour for the PCE plume, the treatment barrier (or line of injection wells) would need to span a distance of approximately 600 feet laterally (running east-west). The treatment depth would extend to 330 feet bgs with a 130-foot thickness. Assuming a radius of influence (ROI) of 15 feet, approximately 20 injection locations would be required for a single row and 60 wells for three rows. In order to inject across such a thick interval, one option would be using nested injection wells screened at differing depths to control the injection distribution. Injection could occur simultaneously at multiple wells per location. Assuming injection intervals occur across screens between 10 to 12 feet in length, approximately 11 to 13 individual wells would be nested at each injection location. Assuming a maximum of four nested wells could be co-located within a single boring, four borings would need to be advanced for every injection location. This would result in approximately 80 borings for a single row and 240 borings for three rows. Another option would be to use a single well per location with individually screened segments to control the injection distribution. For example, the well could include approximately 10 discrete 10-foot screened intervals separated by brief 3-foot blank sections. The well construction would be complex and bentonite seals would need to be precisely placed to avoid communication through filter packs. Individual screens could be isolated by inflating packers in the blank casing portions above and below the targeted screen interval. Only one screen interval could be injected at a time, which would significantly increase field time as each well would involve 10 separate injection intervals before moving on to the next injection location. The treatment area would need to be located between PER-28 and UAM-2 in order to capture the targeted treatment zone of the plume (10 ppb). Given the densely populated land use and the difficulty in carefully installing a RA well through the PA aquitard, installing this many locations is not feasible. Significant administration coordination would be required in obtaining land access and clearing utilities. Furthermore, the ERD treatment zone would need to remain effective for at least 35 years based on the simulated duration it would take the plume to flow through the treatment zone. Because most substrates for ERD have a longevity of approximately 3 to 5 years, this technology would require between 7 and 12 injection events. This would require an immense volume of amendment. Another difficulty is that separate injection events would be needed - first for the substrate to drive the system anaerobic, and second to deliver the proper microbial culture (e.g., dehalococcoides) It is likely that a portion of the injection wells would be damaged or fouled over the 35 year period with minimal use, likely requiring the reinstallation of a portion of wells throughout the project life. Overall, this technology cannot be feasibly implemented to address RA contamination.	High: this technology involves very high capital costs associated with the installation of numerous injection wells, the field time spent injecting large volumes of amendment, and the material costs for such large quantities. O&M costs would include repeat injections, as well as long-term performance monitoring. Considerable long-term costs would also be associated with ongoing wellhead treatment at RA production wells.	Rejected due to very low implementability, high costs, and the continued need for wellhead treatment.

Table 4-3D
Technology Evaluation for the RA
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
Plume Remediation (in situ)	PlumeStop™ and MNA	Moderate to High: PlumeStop™ paired with MNA essentially transfers contamination from the aqueous phase to the sorbed phase. When contaminants come in contact with the micron-sized GAC, they sorb to the surface of the GAC where they remain indefinitely or until consumed via biodegradation processes. Given that minimal to no biodegradation is assumed to naturally occur in RA groundwater, it is anticipated that the plume would be removed from the aqueous phase and transferred to the sorbed phase within the PlumeStop injection/treatment zone, while the total contaminant mass would remain essentially unchanged. Although this technology would not result in a meaningful reduction of contaminant mass (minor long-term degradation may occur), it would be effective in reducing or eliminating potential risk from exposure to drinking water receptors. The plume would essentially "stop" at the treatment barrier; therefore, this technology is as effective as its distribution is complete. Drinking water supply wells could be installed downgradient of the treatment zone (where the plume has been removed); however, production wells should not be installed within the treatment barrier to avoid potential disturbance and remobilization of sorbed contaminant mass. Similar to processes involved with ex situ GAC treatment, once the GAC becomes fully saturated (or reaches its sorption capacity), contamination will "break through" and continue migrating downgradient fairly uninhibited. However, the observed Site plume concentrations (generally between 10 and 100 ppb of PCE) are relatively dilute for what PlumeStop™ is capable of and it could be delivered in quantities great enough to sorb the entire plume without breakthrough occurring (even without ongoing degradation). If incomplete distribution or breakthrough was a concern, monitoring wells could be installed within the treatment zone to evaluate groundwater concentrations moving through the zone. Overall, the disadvantage to this technology is that given the aerobic conditions of the RA, little to no biodegradation is anticipated and contaminant mass is essentially transferred from one phase to another without a meaningful net reduction. The advantage is that the plume is essentially removed (or immobilized) indefinitely and this technology effectively protects groundwater uses without the need for wellhead treatment. However, in the event that CoT wanted to extract groundwater within the RA plume upgradient of the treatment zone, wellhead treatment would need to be implemented.	Moderate: this technology is ideal for sites with large and dilute plumes, which the RA plume resembles. Using PlumeStop™ enables long-term treatment across a single treatment barrier using a single injection event, as opposed to complete coverage of the plume or numerous injections and numerous rows. Therefore, this technology is relatively more implementable than most other injection-based technologies for the RA. However, given the nature of the Site, it still has implementability challenges. Assuming that the targeted treatment area spans the 5 ppb contour simulated to flow past 8th Avenue for the PCE plume, the treatment barrier would need to span a distance of approximately 775 feet in length (running east-west). The treatment depth would extend to 330 feet bgs with a 130-foot thickness. PlumeStop™ was designed specifically for easy injection without reducing the permeability of the formation. It has a viscosity similar to water and the GAC particles are generally 1-micron in size (significantly smaller than most pore throat diameters) allowing it to freely flow in the aquifer without clogging or reducing permeability. The GAC particles are negatively charged and do not adhere together, but will continuously coat the surfaces of the soil grains as it flows through the aquifer. Essentially, the PlumeStop™ distribution is limited only by the volume injected and the injection method's ability to distribute water. In general, PlumeStop™ will migrate with water for a period of a couple months prior to losing its polarity and settling out. Therefore, the distribution achieved is controlled mostly by the injection hydraulics and quantities of PlumeStop injected (see Appendix H). In order to minimize injection locations, PlumeStop™ could be delivered using recirculation wells where a series of injection and extraction wells are installed and PlumeStop™ solution is injected into the injection wells and pulled across the formation to the nearby extraction wells where it is extracted, dosed again with PlumeStop™ and reinjected. After some time, the process can then be reversed where the solution is injected into the former extraction wells and the former injection wells are used for extraction. This "push-pull" method allows for increased distribution with fewer well locations. Particle tracking modeling suggests that injection and extraction wells could be spaced approximately 60 feet apart with continuous injection/extraction rates of 100 gpm per injection location across the 130-foot interval for a one-week period in order to achieve adequate distribution across the 775-foot treatment barrier. Therefore, a total of approximately seven injection wells and eight extraction wells would be installed under this alternative. Given the densely populated land use, significant administrative coordination would be required in obtaining land access and clearing utilities. In order to inject across such a thick interval (130 feet), injection/extraction wells would be installed with individually screened segments to control the injection distribution. For example, the well could include approximately 7 discrete 15-foot screened intervals separated by 4-foot blank sections. Under this example, approximately 15 gpm would be injected/extracted at each 15-foot screened interval. Bentonite seals would need to be precisely placed to avoid communication through filter packs. Individual screens could be isolated by inflating packers in the blank casing portions above and below the targeted screen interval. Only one screen interval could be injected at a time, which would increase field time as each well would involve five separate injection intervals before moving on to the next injection location. Because this delivery method requires extraction using a submersible pump (or similar), the extraction wells need to have a large enough diameter to lower a pump; therefore, smaller nested wells could likely not be implemented making a single well with multiple screened intervals the preferred approach. Overall, this technology does have some implementation challenges but is easier to implement relative to other injection-based remedial technologies in addressing RA contamination.	Moderate: this technology involves high capital costs associated with the installation of a series of injection/extraction wells, the field time spent injecting and extracting large volumes of PlumeStop™, and the material costs for such large quantities needed. However, this technology would not include repeat injections, does not require wellhead treatment, and includes fewer injection well installations than other injection-based technologies. O&M costs would include long-term performance monitoring.	Retained due to its relatively high effectiveness, moderate implementability, and moderate costs.

Table 4-3D
Technology Evaluation for the RA
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
Plume Remediation (in situ)	PlumeStop™ and ERD	High: this technology is identical to the PlumeStop™ technology described above, except it is paired with biostimulation and potentially bioaugmentation to enhance reductive dechlorination processes within the treatment zone. The plume would still be stopped irrespective of biodegradation processes, as aqueous phase contamination is transferred to the sorbed phase; however, the contamination would be biologically consumed instead of being immobilized indefinitely. Therefore, the net contaminant mass in the RA would be reduced under this technology. There are multiple benefits to pairing PlumeStop™ and ERD, which include (1) downgradient migration of the plume is "stopped" and risk posed to drinking water receptors is eliminated without concern about whether complete or successful biodegradation was achieved; (2) the GAC in PlumeStop™ creates biologically active "sites" where microorganisms can readily access the contaminant to respire; and (3) biological processes are accelerated within the treatment zone because the contaminants are more accessible and the microorganism colonies are not as stressed (or starved). Overall, contaminant mass can be destroyed within a much narrower treatment zone because the biological processes are considerably more active and the contaminant is immobilized until it is consumed.	Low to Moderate: the PlumeStop™ implementation portion of this technology would be implemented in an identical manner to the technology described above, except the injection solution would be a mixture of water, PlumeStop™, and an amendment for ERD (e.g., EVO) instead of just PlumeStop™ and water. The EVO would yield anaerobic conditions over a period of a few months that would be conducive to ERD. Distributing the EVO would be more difficult than the PlumeStop™ and would not spread out nearly as far as the PlumeStop™ (i.e., less than 30 feet); therefore, non-biologically active pockets would reside within the injected barrier. However, PlumeStop™ alone (without ERD) would still be effective in protecting groundwater users, where any reduction in contaminant mass is an added benefit, but not essential in meeting remedial objectives. Repeat injections of EVO may be required depending on how self-sufficient the biological treatment zone becomes with the natural organic content in the aquifer concentrated on the GAC particles. The reason why PlumeStop™ with ERD would be more desirable and implementable than the ERD only option is that the PlumeStop™ would significantly increase the contaminant's retention/retardation within the biologically active treatment zone, necessitating only one treatment zone/row, as opposed to the three under ERD alone (which may potentially still result in incomplete degradation). Depending on the species of indigenous microorganisms present, bioaugmentation (the addition of select microorganisms) may be needed to promote ERD. Prior to injecting microbial culture, the system would need to have well established anaerobic conditions and would require a separate injection event multiple months later. Anaerobic chase water would need to be used to push the microbes further into the formation, possibly using the recirculation wells to further distribute the microbes. Although the distribution achieved would be more limited than that achieved by the PlumeStop™, the microorganisms tend to slowly spread or bloom out over time. The EVO distribution and degree of microbial activity could be evaluated using an electro-resistivity survey such as GeoTrax.	Moderately High: this technology involves high capital costs associated with the installation of a series of injection/extraction wells, the field time spent injecting and extracting large volumes of PlumeStop™ and EVO, and the material costs for such large quantities needed. Additional costs would be associated with bioaugmentation (if needed). However, this technology would not require wellhead treatment and includes fewer injection well installations than other injection-based technologies. There may be the need for repeat injections of EVO. O&M costs would include long-term performance monitoring.	Retained due to its high effectiveness despite its moderately low implementability and moderately high costs. If Site closure can be granted with immobilized sorbed contamination remaining in the RA, then PlumeStop™ with MNA would be just as effective, but easier to implement and less costly than this technology.
	In Situ Chemical Oxidation (ISCO) via Injections	Moderate: this technology is partially effective, as it reduces contamination in RA groundwater but wellhead treatment would still likely be required to protect groundwater users based on preliminary modeling that was conducted to evaluate the effectiveness of ISCO. Modeling results show a decrease from a peak extraction concentration of approximately 9.1 ppb of PCE at the Agriculture well under MNA conditions to approximately 2.0 ppb of PCE assuming that the entire plume area within the 10 ppb contour is treated with post-treatment concentrations of 10 ppb (to account for imperfect contact). Overall, some mass reduction is achieved under this technology, but it could not be implemented as a sole technology while being conservatively protective.	Very Low: given the nature of the Site, this technology would be very difficult and costly to implement. Assuming a targeted treatment zone within the 10 ppb contour for the PCE plume, the amendment would need to cover an area of approximately 500 feet laterally by 1600 feet longitudinally and a depth of approximately 130 feet. Injecting oxidant would not have persistence great enough to treat in rows or fences, therefore, much of the treatment would need to be "covered" with injection ROIs. Even assuming an optimistic ROI of 30 feet, the treatment area would require approximately 250 injection locations, many of which access could not be obtained for given the densely populated nature of the area. Even if staggered rows were used and only half of the injection locations were utilized, 125 locations is still an impractical number of locations to install to a depth of 330 feet bgs and through the PA aquitard. Significant administration coordination would be required in obtaining land access and clearing utilities. An alternative approach would be to install one or two rows of injection wells and do repeated injections as the plume migrates downgradient. However, this would involve between 25 and 50 injection events over a 35-year time period which is impractical and it is highly unlikely that the injection wells could be used for so many injection events. Similar to the concerns for ERD, delivery the oxidant across such a thick interval is problematic and would necessitate numerous nested wells or complex well construction and the use of packers while injecting. It would also require an immense volume of oxidant. Furthermore, ISCO processes rely on direct contact, which does not address sorbed phase mass or contamination in secondary-permeability strata. This often results in rebound and necessitates repeat injections. Overall, this technology cannot be feasibly implemented to address RA contamination.	Very High: this technology involves extremely high capital costs associated with the installation of numerous injection wells, the field time spent injecting large volumes of oxidant, and the material costs for such large oxidant quantities. O&M costs would include potential repeat injections, as well as long-term performance monitoring. Considerable long-term costs would also be associated with ongoing wellhead treatment at RA production wells.	Rejected due to very low implementability, high costs, and the potential need for wellhead treatment.

Table 4-3D
Technology Evaluation for the RA
Park Euclid Feasibility Study, Tucson, AZ

Remedial Strategies	Technology Process Options	Screening Criteria			Screening Comments
		Effectiveness	Implementability	Relative Cost	
Plume Remediation (in situ)	In Situ Chemical Reduction (ISCR)	The treatment process for this technology is essentially the mirrored image of ISCO and utilizes the same delivery mechanisms. ISCR would share very similar implementability challenges and likely obtain similar effectiveness. Therefore, this technology is rejected due to very low implementability, high costs, and the continued need for wellhead treatment.			Rejected based on similarity to ISCO.
	Vertical Wells	Vertical wells would be used in each of the retained remedial technologies, with recirculation methods employed in better distributing the PlumeStop and potentially EVO for ERD.			Both are retained for use.
	Recirculation Wells				
	Hydraulic Fracturing - Solid Amendment Emplacement	Hydraulic fracturing was retained for use in delivery solid or viscous amendments or oxidants to the subsurface. However, the only retained technology that includes injections involves low-viscosity liquid, making hydraulic fracturing unnecessary.			Rejected as this delivery method is not needed for retained technologies.
Ex Situ Treatment	To Be Determined (see Table 7-1)	The suitability of technologies (effectiveness, implementability, and relative cost) for ex situ treatment of air and/or water will vary based on the chosen remedial strategy. Factors to consider include the average values and variations (anticipated ranges) in contaminant concentrations and flow rates. Furthermore, technologies employed across various intervals (e.g., UVZ, PA, LVZ, and RA) may benefit from sharing a common ex situ treatment, whereas evaluated individually different option(s) may have been selected. For example, if SVE were implemented at only one location in the LVZ, it may not extract enough contamination or have a sufficient flow rate to economically select a catalytic oxidizer and GAC may be more suitable; however, if extracted flow from the LVZ were joined with extracted flows from SVE in the UVZ, GAC may become uneconomical. Therefore, the ex situ treatment technologies will be evaluated only for the proposed remedy.			

Notes & Acronyms

COCs = chemicals of concern
CoT = City of Tucson
ERD = enhanced reductive dechlorination
EVO = emulsified vegetable oil
GAC = granular activated carbon
gpm = gallons per minute
ISCO = in-situ chemical oxidation
ISCR = in-situ chemical reduction
LVZ = lower vadose zone
MNA = monitored natural attenuation
MPE = multi-phase extraction
O&M = operations and maintenance
PA = perched aquifer
PCE = tetrachloroethene
ppb = parts per billion
RA = regional aquifer
ROI = radius of influence
SVE = soil vapor extraction
UoA = University of Arizona
UVZ = upper vadose zone

Table 5-1
Alternatives and Remedy Development and Descriptions
Park Euclid Feasibility Study, Tucson, AZ

Interval	Retained Technologies	Alternatives and Remedies		
		1. Reference	2. Less Aggressive	3. More Aggressive
Upper Vadose Zone	MNA SVE Directional Wells	**Pulsed SVE, then MNA**	**MNA for 30 years**	**SVE as Vapor Control, then MNA**
		Pulsed SVE for 10 years, then MNA of UVZ vapor wells until Year 30, then Site Closure	MNA of UVZ vapor wells for 30 years, then no action	Continuous SVE in MPE wells as vapor control for sparging in PA for 5 years followed by pulsed SVE for 5 more years
		Install 4 additional shallow locations and monitor 36 individual wells initially		
		Refine to 25 individual wells and reduce sampling frequency		
		No further action after Year 30		No further action after Year 35
Perched Aquifer	MNA Bioslurping MPE PlumeStop with MNA Air Sparging In-Well Air Stripping Vertical Wells	**MNA for 200 years**	**MNA for 30 years**	**Sparging with SVE as Vapor Control**
		MNA of PA wells for 200 years	MNA of PA wells for 30 years PlumeStop barrier at Year 25	Sparge and SVE for 5 years in modified MPE wells
		Install 7 additional locations and monitor initially 30 individual wells		
		Refine network to 20 wells and reduce sampling frequency		
		No further action after Year 200	No further action after Year 30	No further action after Year 35
Lower Vadose Zone	SVE Vertical Wells	**SVE & Expanded LTM**	**SVE & Current LTM**	**Enhanced SVE & Expanded LTM**
		Pulsed SVE for 10 years in two wells		Pulsed SVE in 2 wells first year, install a 3rd SVE well and operate to Year 11
		Install 4 additional monitoring clusters	Use current LTM network	Install 4 additional monitoring clusters
		Annual initial monitoring of LVZ vapor wells to assess post SVE rebound		
		Infrequent LTM to assess vertical migration of PA contamination through aquitard		
		No further action after Year 30		No further action after Year 31
Regional Aquifer	Wellhead Treatment MNA Groundwater Extraction via Pumping Wells PlumeStop with MNA PlumeStop with ERD Vertical Wells Recirculation Wells	**In-Situ PlumeStop Barrier**	**MNA with Wellhead Treatment**	**Groundwater Pump & Treat**
		Install a 850-foot long PlumeStop barrier from 200 to 330 feet bgs along 8th Ave using 8 injection and 9 extraction wells with multiple screened intervals	MNA at approximately 25 RA groundwater wells for 200 years	Install an extraction well screened from 200 to 330 feet bgs between PER-28 and UAM-2 and operate at 50 gpm for 30 years
			Quarterly monitoring at UoA production wells when plume is near capture zone	
		In Situ passive treatment	Ex Situ treatment when extracted PCE concentration exceeds 2.5 ppb	
		Install 5 additional wells for performance monitoring of the barrier	Install & abandon 10 wells every 30 years as plume moves	Install 4 additional wells (for chemical and potentiometric control)
		LTM at 25 wells at with reducing frequency	Varied LTM program depending on plume location	LTM at 25 wells at with reducing frequency
		No further action after Year 40	No further action after Year 200	No further action after Year 40

Notes & Acronyms

ERA = early response action
ERD = enhanced reductive dechlorination
LTM = long term monitoring
LVZ = lower vadose zone
MNA = monitored natural attenuation
PA = perched aquifer
RA = regional aquifer
SVE = soil vapor extraction
UVZ = upper vadose zone

Table 6-1
Practicability Evaluation of the Reference Remedy
Park Euclid Feasibility Study, Tucson, AZ

Criteria	UVZ Pulsed SVE, then MNA	PA MNA for 200 years	LVZ SVE & Expanded LTM	RA In-Situ PlumeStop ™ Barrier
Feasibility	Implementing SVE in the UVZ beneath the Plant is feasible. The necessary well network already exists in four usable SVE wells and six MPE wells. The SVE and MPE piping networks also exist and are usable. Regarding MNA, the addition of four shallow monitoring points is feasible. Continued long-term soil vapor monitoring within the UVZ is feasible as such monitoring is already occurring.	Implementing MNA is feasible for the PA and installing six additional PA monitoring wells to enhance plume delineation and analysis is also feasible.	Implementing SVE in the LVZ at wells VEL-03 and PER-14A is very feasible. An existing SVE system began operation on February 2, 2015 as an ERA and incorporates elements of the existing MPE system. The system could be operated for additional years with existing infrastructure. Implementing MNA in the LVZ is feasible. Installing four additional nested vapor monitoring wells in the LVZ is feasible, but carries risk due to the penetration of the aquitard beneath the PA (see Section 6.2.1.2).	As discussed in Section 5.1.4.1, this remedy has inherent implementability challenges associated with injecting across a 130-foot thick interval at such depths in a densely developed area. The implementation assumes that a barrier will be installed to "trap" the VOC plume as it migrates downgradient. The most efficient barrier would be a line of wells perpendicular to the flow direction; however, due to surface development, the most feasible layout for injections wells is in the public right-of-way, along a street, which is not perpendicular to flow direction. Thus, the line of barrier wells must be lengthened to treat the plume width. Implementing MNA in the RA is feasible and has been conducted routinely for over a decade. This remedy includes the installation of five additional wells for performance monitoring of the barrier.
Short-Term Effectiveness	As has been demonstrated during former ERA implementations, short-term operation of the SVE system and/or of the MPE system is very effective in reducing soil vapor concentrations within the UVZ. The existing well network is sufficient to address soil vapor across the source area. MNA is considered to be a long-term effort. The former SVE ERA has already addressed much of the contamination in the UVZ source area.	In the short-term, MNA is not expected to result in reduced PA concentrations; however, MNA is considered to be effective in that VOCs within the PA are not expected to pose a threat to human health, to significantly migrate laterally, and to migrate vertically. The PA is not used for potable or non-potable purposes. The observed degradation to cDCE means that, in the short-term, the VOCs within the PA are less toxic than the released constituent PCE.	Based on pilot testing in 2014, SVE is projected to be effective within a one-year timeframe. Additional operation may be required contingent on future monitoring results. MNA is considered to be a long-term rather than a short-term remedy.	Assuming that the injectability issues can be overcome, PlumeStop™ is expected to immediately decrease VOC concentrations within the area of injection. Upgradient contamination would not be treated until it flows into contact with the barrier.
Long-Term Effectiveness	Pulsed SVE will result in additional VOC mass reduction within the source area, which reduces the long-term risks associated with VOCs within the UVZ. MNA provides the means for continued attenuation of VOCs within the UVZ and a long-term means to monitor and address potential risks associated with such VOCs. Should increasing VOC concentrations be identified, the risk can be addressed by contingency measures.	MNA is expected to continue to result in decreased PCE and TCE concentrations due to biodegradation and accumulation of cDCE. VC concentrations are also expected to increase in the future due to ongoing degradation of cDCE. Although VC is more toxic than cDCE, it is expected to continue to breakdown to ethene in the long term. Soil vapor monitoring within the UVZ will provide a means to evaluate whether VC in the PA poses a risk to human health as a result of vapor intrusion to indoor air.	Based on pilot testing, SVE is projected to effectively remove mass within a one-year timeframe. Rebound of soil vapor concentrations within the LVZ is possible due to mass retained within low-permeability intervals. The existing SVE operational plan includes monitoring for rebound of VOCs in the LVZ. Following mass removal in the source area using SVE, natural attenuation of VOCs is expected to be effective over the long-term. Monitoring will provide sufficient data to demonstrate the effectiveness of the remedy.	As the VOC plume migrates downgradient and encounters the PlumeStop barrier, VOCs will be adsorbed and eventually biodegraded. However, VOCs will migrate through portions of the barrier where PlumeStop™ was not effectively distributed. Assuming 83 percent distribution/contact efficiency, the highest concentration of PCE that is predicted to be observed at the UoA Agricultural Well in the future is 2.2 µg/L.

Table 6-1
Practicability Evaluation of the Reference Remedy
Park Euclid Feasibility Study, Tucson, AZ

Criteria	UVZ Pulsed SVE, then MNA	PA MNA for 200 years	LVZ SVE & Expanded LTM	RA In-Situ PlumeStop ™ Barrier
Performance Capabilities	SVE is a proven technology that has been shown to be effective at the Site. The existing vapor treatment equipment has, however, been shown to be less effective at capturing PCE degradation products cDCE and VC, resulting in higher operating costs. Because SVE operation is proposed to be pulsed operation, the high consumption of vapor-phase GAC is expected to be manageable. Under MNA, natural attenuation is expected to continue to occur at the Site as a result of physical and biological processes. Long-term soil vapor monitoring is a proven method of observing and evaluating such attenuation.	The existing PA monitoring well network expanded by six wells is expected to provide the coverage required to demonstrate the performance of MNA.	SVE is a proven technology and has been shown to be effective at the Site during pilot testing. The existing vapor treatment equipment has, however, been shown to be less effective at capturing the degradation products cDCE and VC, resulting in higher operating costs when extracting vapor from the UVZ. If the ratio of PCE to cDCE in extracted vapor from the LVZ decreased over time, the performance of the vapor treatment equipment (i.e., vapor-phase GAC) may decrease resulting in higher operational costs. Natural attenuation is expected to continue to occur at the Site as a result of physical and biological processes. Long-term soil vapor monitoring is a proven method of observing and evaluating such attenuation.	The evaluation of the technology estimates 83 percent efficiency in VOC removal by the PlumeStop™ barrier. Performance will be measured at downgradient monitoring wells. Assuming 83 percent distribution/contact efficiency, the highest concentration of PCE that is predicted to be observed at the UoA Agricultural Well in the future is 2.2 µg/L.
Institutional considerations	Operating a SVE system beneath the Plant is not expected to interfere with existing laundry operations. Treatment of extracted vapor to meet ambient air guidelines (based on air permit emission limits) is expected to be accepted by PDEQ and nearby residents. Noise abatement may be required to meet CoT code. MNA of the UVZ is anticipated to be acceptable to project stakeholders due to the previous SVE ERA activities at the Site. LTM over a period of 30 years will confirm that the UVZ meets remedial objectives for the Site.	Institutional controls will be required to regulate that future wells installed within the area are constructed properly to prevent cross-contamination from the PA to the RA.	Operating a SVE system at the Plant is not expected to interfere with existing laundry operations. Treatment of extracted vapor to meet ambient air guidelines (based on air permit emission limits) is expected to be accepted by the PDEQ and nearby residents. Noise abatement may be required to meet CoT code. MNA of the LVZ is anticipated to be acceptable to project stakeholders following SVE ERA activities at the Site. LTM over a period of an additional 29 years will provide confirm that the LVZ meets remedial objectives for the Site.	This technology requires the installation of 17 wells across an 850-foot stretch within the CoT public right-of-way, followed by several weeks of groundwater recirculation by injection and extraction. Temporary lane closures of portions of the City street would be required. In addition, noise abatement is of concern during well installation activities.

Acronyms:

cDCE = cis-1,2-dichloroethene
CoT = City of Tucson
ERA = early response action
GAC = granular activated carbon
LTM = long-term monitoring
LVZ = lower vadose zone
MNA = monitored natural attenuation
MPE = multi-phase extraction
µg/L = micrograms per liter
O&M = operations and maintenance
PA = perched aquifer
PCE = tetrachloroethene
PDEQ = Pima County Department of Environmental Quality
RA = regional aquifer
SVE = soil vapor extraction
UoA = University of Arizona
UVZ = upper vadose zone
VC = vinyl chloride
VOCs = volatile organic compounds

Table 6-2
Practicability Evaluation of the Less Aggressive Remedy

Park Euclid Feasibility Study, Tucson, AZ

Criteria	UVZ MNA for 30 years	PA MNA for 30 years	LVZ SVE & Current LTM	RA MNA with Wellhead Treatment
Feasibility	Installing four shallow monitoring points is feasible. Continued long-term soil vapor monitoring within the UVZ is feasible and already occurring.	Implementing MNA is feasible for the PA and installing six additional PA monitoring wells to enhance plume delineation and analysis is also feasible.	Implementing SVE in the LVZ at wells VEL-03 and PER-14A is very feasible. An existing SVE system began operation on February 2, 2015 as an ERA and incorporates elements of the existing MPE system. Implementing MNA in the LVZ using the existing network is feasible and already occurring. The system could be operated for additional years with existing infrastructure.	Implementing MNA in the RA is feasible using the existing monitoring well network with additional wells to be installed as the dissolved plume continues to move downgradient toward the UoA production wells. Implementing wellhead treatment at impacted UoA wells is also feasible.
Short-Term Effectiveness	MNA is considered to be a long-term effort. The former SVE ERA has already addressed much of the contaminant mass in the UVZ source area.	In the short-term, MNA is not expected to result in reduced PA concentrations; however, MNA is considered to be effective in that VOCs within the PA are not expected to pose a threat to human health, to significantly migrate laterally, and to migrate vertically. The PA is not used for potable or non-potable purposes. The observed degradation to cDCE means that, in the short-term, the VOCs within the PA are less toxic than the released constituent PCE.	Based on pilot testing in 2014, SVE is projected to be effective within a one-year timeframe. Additional operation may be required contingent on future monitoring results. MNA is considered to be a long-term rather than a short-term remedy.	In the short-term, the dissolved plume will continue to migrate downgradient untreated, but is not expected to impact the UoA production wells within the next 30 years.
Long-Term Effectiveness	MNA provides the means for continued attenuation of VOCs within the UVZ and a long-term means to monitor and address potential risks associated with such VOCs. If VOC concentrations increase, the risk can be addressed by contingency measures.	MNA is expected to continue to result in decreased PCE and TCE concentrations due to biodegradation and accumulation of cDCE. VC concentrations are also expected to increase in the future due to ongoing degradation of cDCE. Although VC is more toxic than cDCE, it is expected to continue to breakdown to ethene in the long term. Soil vapor monitoring within the UVZ will provide a means to evaluate whether VC in the PA poses a risk to human health as a result of vapor intrusion to indoor air.	Based on pilot testing, SVE is projected to effectively remove mass within a one-year timeframe. Rebound of soil vapor concentrations within the LVZ is possible due to mass retained within low-permeability intervals. The existing SVE operational plan includes monitoring for rebound of VOCs in the LVZ. Following mass removal in the source area using SVE, natural attenuation of VOCs is expected to be effective over the long-term. Monitoring will provide sufficient data to demonstrate the effectiveness of the remedy.	As the VOC plume migrates downgradient and as monitoring wells are impacted upgradient of the UoA production wells, wellhead treatment will be designed and implemented at affected UoA production wells. This remedial measure is considered to be effective in the long-term.
Performance Capabilities	Natural attenuation is expected to continue to occur at the Site as a result of physical and biological processes. Long-term soil vapor monitoring is a proven method of observing and evaluating such attenuation.	The existing PA monitoring well network expanded by six wells is expected to provide the coverage required to demonstrate the performance of MNA.	SVE is a proven technology and has been shown to be effective at the Site during pilot testing. The existing vapor treatment equipment has, however, been shown to be less effective at capturing the degradation products cDCE and VC, resulting in higher operating costs when extracting vapor from the UVZ. If the ratio of PCE to cDCE in extracted vapor from the LVZ decreased over time, the performance of the vapor treatment equipment (i.e., vapor-phase GAC) may decrease resulting in higher operation costs and more downtime of the SVE system. Natural attenuation is expected to continue to occur at the Site as a result of physical and biological processes. Long-term soil vapor monitoring is a proven method of observing and evaluating such attenuation.	Wellhead treatment using GAC is a proven and frequently implemented technology.

Table 6-2
Practicability Evaluation of the Less Aggressive Remedy

Park Euclid Feasibility Study, Tucson, AZ

Criteria	UVZ MNA for 30 years	PA MNA for 30 years	LVZ SVE & Current LTM	RA MNA with Wellhead Treatment
Institutional considerations	MNA of the UVZ is anticipated to be acceptable to project stakeholders as ongoing LTM are presently being implemented at the Site. LTM over a period of 30 years will confirm that the UVZ meets remedial objectives for the Site.	Institutional controls will be required to regulate that future wells installed within the area are constructed properly to prevent cross-contamination from the PA to the RA.	Operating a SVE system at the Plant is not expected to interfere with existing laundry operations. Treatment of extracted vapor to meet ambient air guidelines (based on air permit emission limits) is expected to be accepted by the PDEQ and nearby residents. Noise abatement may be required to meet CoT code. MNA of the LVZ is anticipated to be acceptable to project stakeholders following SVE ERA activities at the Site. LTM over a period of an additional 29 years will provide confirm that the LVZ meets remedial objectives for the Site.	This remedy requires the UoA to agree to wellhead treatment on their property and to accept the use of treated water in their supply system. In addition, this remedy assumes that CoT will not develop the water supply within the Park-Euclid area over the long term (i.e., greater than 30 years).

Acronyms:

cDCE = cis-1,2-dichloroethene
CoT = City of Tucson
ERA = early response action
GAC = granular activated carbon
LTM = long-term monitoring
LVZ = lower vadose zone
MNA = monitored natural attenuation
MPE = multi-phase extraction
µg/L = micrograms per liter
O&M = operations and maintenance
PA = perched aquifer
PCE = tetrachloroethene
PDEQ = Pima County Department of Environmental Quality
RA = regional aquifer
SVE = soil vapor extraction
UoA = University of Arizona
UVZ = upper vadose zone
VC = vinyl chloride
VOCs = volatile organic compounds

Table 6-3
Practicability Evaluation of the More Aggressive Remedy

Park Euclid Feasibility Study, Tucson, AZ

Criteria	UVZ SVE as Vapor Control, then MNA	PA Sparging with SVE as Vapor Control	LVZ Expanded SVE & Expanded LTM	RA Groundwater Pump & Treat
Feasibility	Implementing SVE in the UVZ beneath the Plant is feasible, as the necessary well network already exists in four usable SVE wells with associated SVE piping networks. The existing vapor treatment system may also be used, where vapor-phase GAC is a feasible treatment technology. A SVE blower can be readily procured and installed. The addition of four shallow monitoring points is feasible. Continued long-term soil vapor monitoring within the UVZ is feasible and already occurring.	The existing MPE wells may be adapted to allow in-well sparging within the PA. Existing MPE piping may be adapted to transport pressurized air to the MPE wells and connected to an air sparge blower at the well manifold. Implementing MNA in the PA is feasible and installing six additional PA monitoring wells to enhance plume delineation and analysis is also feasible.	Implementing SVE in the LVZ at wells VEL-03 and PER-14A and one new LVZ extraction well is very feasible. An existing SVE system began operation on February 2, 2015 as an ERA and incorporates elements of the existing MPE system. Operation in conjunction with the UVZ SVE will require a control strategy and modification of the air permit, both of which are feasible. The system could be operated for additional years with existing infrastructure. Implementing MNA in the LVZ is feasible and installing four additional nested vapor monitoring wells in the LVZ and one additional extraction well is feasible, but carries risk (see Section 6.2.1.2) due to the penetration of the aquitard beneath the PA.	Extracting and treating groundwater is feasible at the Site. Groundwater modeling has predicted that the plume is extracted within 30 years and that the downgradient UoA production wells are protected. Implementability issues for this remedy include acquiring or leasing property to stage the extraction well and groundwater treatment equipment, as well as for routing a treated water pipeline through the public right-of-way to the UA (Alt 3A) or a reinjection location (Alt 3C). There are also several permitting steps involved in discharging to High School Wash (Alt 3B).
Short-Term Effectiveness	As has been demonstrated during ERA implementation, short-term operation of the SVE system and/or of the MPE system is very effective in reducing soil vapor concentrations within the UVZ. The existing extraction well network is sufficient to address soil vapor across the source area. MNA is considered to be a long-term effort. The former SVE ERA has already addressed much of the contaminant mass in the UVZ source area, addressing the short-term concern.	Air sparging is expected to be effective in removing contaminants in the PA and in LNAPL floating on the PA in the vicinity of the sparge wells. Following initial startup of the air sparge system, dissolved concentrations are expected to increase temporarily due to increased mixing. In the short-term, MNA is not expected to result in reduced PA concentrations; however, MNA is considered to be effective in monitoring the distribution and stability of VOCs within the PA to evaluate risks to human health. The PA VOC plume is not expected to significantly migrate laterally and is not expected to migrate vertically. The PA is not used for potable or non-potable purposes. The observed degradation to cDCE has, in the short-term, resulted in VOCs within the PA that are less toxic than the released constituent PCE.	Based on pilot testing in 2014, SVE is projected to be effective within a 1-year timeframe. However, with an additional well, the SVE system will require operation for an additional year. Additional operation may be required contingent on future monitoring results. MNA is considered to be a long-term rather than a short-term remedy.	Groundwater extraction is expected to be effective in containing the dissolved plume to prevent further downgradient contaminant migration.
Long-Term Effectiveness	SVE will result in additional VOC mass reduction within the source area, which will reduce the long-term risks associated with VOCs within the UVZ. MNA provides the means for continued attenuation of VOCs within the UVZ and a long-term means to monitor and address potential risks associated with such VOCs. If VOC concentrations increase, the risk can be addressed by contingency measures.	Air sparging will result in additional VOC mass reduction within the source area which reduces the long-term risks associated with VOCs within the PA. Rebound of contaminant concentrations may be observed following cessation of air sparging. MNA is expected to observe decreasing PCE and TCE concentrations in the long-term due to biodegradation and accumulation of cDCE. VC concentrations are also expected to increase in the future due to degradation of cDCE. Although VC is more toxic than cDCE, it is expected to continue to breakdown to ethene over the long term. LTM of soil vapor within the UVZ will provide a means to evaluate whether VC in the PA poses a risk to human health as a result of vapor intrusion to indoor air.	SVE is expected to effectively remove mass within a 1- to 2-year timeframe. Rebound of soil vapor concentrations within the LVZ is possible due to mass retained within low-permeability intervals. The existing SVE operational plan includes monitoring for rebound of VOCs in the LVZ. Following mass removal in the source area using SVE, natural attenuation of VOCs is expected to be effective over the long-term. Monitoring will provide sufficient data to demonstrate the effectiveness of the remedy.	Groundwater extraction is expected to be effective in the long-term with cleanup of the dissolved plume projected within 30 years based on groundwater modeling.

Table 6-3
Practicability Evaluation of the More Aggressive Remedy
Park Euclid Feasibility Study, Tucson, AZ

Criteria	UVZ SVE as Vapor Control, then MNA	PA Sparging with SVE as Vapor Control	LVZ Expanded SVE & Expanded LTM	RA Groundwater Pump & Treat
Performance Capabilities	SVE is a proven technology and has been shown to be effective at this site. The existing vapor treatment equipment has, however, been shown to be less effective at capturing PCE degradation products cDCE and VC resulting in higher operating costs. Natural attenuation is expected to continue to occur at the site as a result of physical and biological processes. Long-term soil vapor monitoring is a proven method of observing and evaluating such attenuation.	Air sparging is a proven technology that, used in conjunction with SVE in the UVZ, can result in source mass reduction. The existing vapor treatment equipment has, however, been less efficient in capturing PCE degradation products cDCE and VC, resulting in higher operating costs when extracting vapor from the UVZ. Based on observed high concentrations of cDCE in the PA, the adsorption performance of the vapor treatment equipment (i.e., vapor-phase GAC) is likely to be low, resulting in higher operation costs and more downtime of the SVE system. A catalytic oxidizer and scrubber system could be a more efficient vapor treatment option depending on the project timeframe. The existing PA monitoring well network expanded by six wells is expected to provide the coverage required to demonstrate the performance of MNA.	SVE is a proven technology and has been shown to be effective at this Site during pilot testing. The addition of another extraction well in a nearby area will increase the SVE system's zone of influence. The existing vapor treatment equipment has been shown to be less efficient at capturing PCE degradation products cDCE and VC, resulting in higher operating costs. If the ratio of PCE to cDCE in extracted vapor from the LVZ decreases over time, the performance of the vapor treatment equipment (i.e., vapor-phase GAC) may decrease resulting in higher operation costs and more downtime of the SVE system. Natural attenuation is expected to continue to occur as a result of physical and biological processes. Long-term soil vapor monitoring is a proven method of observing and evaluating such attenuation.	Groundwater extraction is an accepted technology for containment and cleanup of large, diffuse VOC plumes. When there is a continuing source present and/or if residual contaminants adhere to soil, groundwater extraction systems may require very long operational times to achieve cleanup goals. In this case, the dissolved plume had detached from the source area and appears to be moving downgradient indicating removal of the contaminant source and no apparent residual mass adhering to soil.
Institutional considerations	Operating a SVE system at the Plant is not expected to interfere with existing laundry operations. Treatment of extracted vapor to meet ambient air guidelines (based on air permit emission limits) is expected to be accepted by the PDEQ and nearby residents. Noise abatement may be required to meet CoT code. MNA of the UVZ is expected to be acceptable to project stakeholders as SVE will have addressed much of the contaminant mass. LTM over a period of 30 years will confirm that the UVZ meets remedial objectives for the Site.	Operating an air sparge system at the Plant is not expected to interfere with existing laundry operations. Treatment of extracted vapor to meet ambient air guidelines (based on air permit emission limits) is expected to be accepted by the PDEQ and nearby residents. Noise abatement may be required to meet CoT code. Institutional controls will be required to regulate that future wells installed within the area are constructed properly to prevent cross-contamination from the PA to the RA.	Operating a SVE system at the Plant is not expected to interfere with existing laundry operations. Treatment of extracted vapor to meet ambient air guidelines (based on air permit emission limits) is expected to be accepted by the PDEQ and nearby residents. Noise abatement may be required to meet CoT code. MNA of the LVZ is expected to be acceptable to project stakeholders following SVE ERA activities at the Site. LTM over a period of an additional 29 years will confirm that the LVZ meets remedial objectives for the Site.	This remedy requires the UA to accept the long-term conveyance of treated water to their cooling towers under Alternative 3A. There are several permitting steps and regulations that need to be met for discharging to High School Wash under Alternative 3B. Reinjecting under Alternative 3C has few controls as reinjection of restored water is exempt from needing an aquifer protection permit. The remedy relies on CoT acceptance of a water transport pipeline within the public right-of-way. Also, a property must be available to place the treatment system and groundwater extraction well that is correctly positioned within the plume.

Acronyms:

cDCE = cis-1,2-dichloroethene
CoT = City of Tucson
ERA = early response action
GAC = granular activated carbon
LTM = long-term monitoring
LVZ = lower vadose zone
MNA = monitored natural attenuation
MPE = multi-phase extraction
µg/L = micrograms per liter
O&M = operations and maintenance
PA = perched aquifer
PCE = tetrachloroethene
PDEQ = Pima County Department of Environmental Quality
RA = regional aquifer
SVE = soil vapor extraction
UoA = University of Arizona
UVZ = upper vadose zone
VC = vinyl chloride
VOCs = volatile organic compounds

Table 6-4
Comparative Analysis and Scoring of Remedies
Park Euclid Feasibility Study, Tucson, AZ

Criteria	Upper Vadose Zone			Perched Aquifer		
	Reference Remedy	**Less Aggressive Remedy**	**More Aggressive Remedy**	**Reference Remedy**	**Less Aggressive Remedy**	**More Aggressive Remedy**
	Pulsed SVE, then MNA	MNA for 30 years	SVE as Vapor Control, then MNA	MNA for 200 years	MNA for 30 years	Sparging with SVE as Vapor Control
Practicability	The remedy is feasible, effective in the short term and long term, a proven technology that has been demonstrated at the Site. The system can be operated without interfering with land use at the Site. Additional wells may be added to expand the MNA monitoring network.	The remedy is feasible, is less effective in the short term, but is expected to be effective in the long term. Natural attenuation including biodegradation has been observed at the site. Long term soil vapor monitoring is a proven method of evaluating such attenuation.	The remedy is feasible, effective in the short term and long term, a proven technology that has been demonstrated at the Site. The system can be operated without interfering with land use at the Site. Additional wells may be added to expand the MNA monitoring network.	Installing additional wells and implementing MNA for the PA is feasible. MNA is not expected to be effective in the short term, but attenuation is expected in the long term. An expanded monitoring network will provide the coverage required to evaluation potential future risks. The 200-year timeframe for monitoring is considered to be less practicable than the other options.	Installing additional wells and implementing MNA of the PA is feasible. MNA is not expected to be effective in the short term, but attenuation is expected in the long term. An expanded monitoring network will provide the coverage required to evaluation potential future risks. Installing the PlumeStop™ contingency barrier would pose implementability challenges.	Air sparging is feasible and effective in the short term, with long term impact on MNA due to the removal of mass from the PA. Air sparging is a proven technology. The efficiency of the existing GAC vapor treatment is lower due to lower adsorption capacity for cDCE and VC.
Risk	There is potential for rebound of soil vapor concentrations from less permeable soil intervals and for degradation product VC to pose a risk to indoor air. This risk can be monitored and addressed.	There is potential for rebound of soil vapor concentrations from less permeable soil intervals and for degradation product VC to pose a risk to indoor air. This risk can be monitored.	There is potential for rebound of soil vapor concentrations from less permeable soil intervals is reduced due to longer term operation of the SVE system with associated reduced risk for degradation product VC to pose a risk to indoor air. This potential risk can be monitored.	VC in soil vapor originating from the degradation of PCE, TCE, and cDCE in the PA is a possibility and may pose a risk to indoor air. This potential risk can be monitored. The potential for lateral and vertical downward migration of contaminants is considered to be minimal. The risk of cross-contamination between the perched and regional aquifers can be mitigated using institutional controls.	VC in soil vapor originating from the degradation of PCE, TCE, and cDCE in the PA is a possibility and may pose a risk to indoor air. This potential risk can be monitored. The potential for lateral and vertical downward migration of contaminants is considered to be minimal. The risk of cross-contamination between the perched and regional aquifers can be mitigated using institutional controls and installing the PlumeStop™ contingency barrier.	There is potential for rebound in soil vapor concentrations originating from the PA is reduced due to operation of the SVE system and reduction in mass within the PA reducing potential for degradation product VC to pose a risk to indoor air. This potential risk can be monitored. The potential for lateral and vertical downward migration of contaminants is considered to be minimal. The risk of cross-contamination between the perched and regional aquifers can be mitigated using institutional controls.
Cost to Completion (current dollar)	$1,190,000	$330,000	$2,390,000	$1,010,000	$1,440,000 *$560,000 without the contingency barrier*	$990,000
Benefit	Reduced potential risk and future environmental liability.	Less hazardous waste generation from GAC usage.	Reduced potential risk and future environmental liability.	No hazardous waste generation	Reduced potential risk and future environmental liability. Minor amounts of IDW from drilling.	Reduced potential risk and future environmental liability.
Scoring						
Practicability • Practicable = 2 • Less Practicable = 1 • Not Practicable = 0	2	1	1	1	1	1
Risks • Low = 3 • Medium = 2 • High = 1	3	2	3	2	3 with the contingency	3
Costs • Least Expensive = 3 • Mid-range Cost = 2 • Most Expensive = 1	2	3	1	2	1 with the contingency	2
Benefits • Beneficial = 1 • Not Beneficial = 0	0	1	0	1	1	0
Total Numeric Score	**7** *has the potential to be higher if pulsed SVE operation were shorter*	7	5	6	**6** *has the potential to be higher if the contingency barrier were not implemented*	6

Acronyms

cDCE – *cis*-1,2-dichloroethene
GAC – granular activated carbon
IDW – investigation derived waste
MNA – monitored natural attenuation
PA – Perched Aquifer
PCE – tetrachloroethene
SVE – soil vapor extraction
TCE - trichloroethene
VC – vinyl chloride

The highlighted zone alternatives had the highest comparative analysis scores and were combined into the Proposed Remedy (see Section 7.1).

Table 6-4
Comparative Analysis and Scoring of Remedies
Park Euclid Feasibility Study, Tucson, AZ

Criteria	Lower Vadose Zone			Regional Aquifer		
	Reference Remedy	**Less Aggressive Remedy**	**More Aggressive Remedy**	**Reference Remedy**	**Less Aggressive Remedy**	**More Aggressive Remedy**
	SVE ERA & Expanded LTM	SVE ERA & Current LTM	Expanded SVE ERA & Expanded LTM	In-Situ PlumeStop™ Barrier	MNA with Wellhead Treatment	Groundwater Pump & Treat
Practicability	SVE is a proven technology and has been tested in the LVZ at this site. Installation of additional wells in the LVZ is considered feasible, but carries risk. Based on pilot testing SVE is effective in the short term and MNA is considered to effective in the long term. The existing vapor-phase GAC treatment is less effective in treating degradation products cDCE and VC.	SVE is a proven technology and has been tested in the LVZ at this site. Based on pilot testing SVE is effective in the short term and MNA is considered to effective in the long term. The existing vapor-phase GAC treatment is less effective in treating degradation products cDCE and VC.	SVE is a proven technology and has been tested in the LVZ at this site. Installation of additional wells in the LVZ is considered feasible, but carries risk. Based on pilot testing SVE is effective in the short term and MNA is considered to effective in the long term. The existing vapor-phase GAC treatment is less effective in treating degradation products cDCE and VC.	The technology has challenges associated with implementation across a wide barrier length and across a 130-foot depth. The base technology (activated carbon) is a proven technology for the adsorption of VOCs. Although cDCE and VC are not as easily adsorbed to carbon, the primary contaminants in the RA are PCE and TCE. Surface development limits the locations at which injection wells may be installed.	Implementation of MNA with additional monitoring wells and UA wellhead treatment is considered to be feasible, will be effective in the short-term, and effective in the long-term. GAC treatment is a proven technology. Wellhead treatment may require underground systems due to space restrictions. This alternative assumes that CoT will not develop the water supply in the area within the foreseeable future.	Extraction and potential treatment of groundwater is feasible, expected to result in the short-term containment of the dissolved RA plume, and expected to be effective in remediating the dissolved plume in the long term. Implementation of the remedy requires long-term lease or purchase of property for a treatment system and groundwater extraction well.
Risk	Installing wells in the LVZ that penetrate the aquitard may result in a conduit for contamination of the RA. This risk may be mitigated using proper well construction procedures. Rebound in soil vapor concentrations from low permeability zones may pose a risk to the RA. This risk may be monitored using MNA.	Rebound in soil vapor concentrations from low permeability zones may pose a risk to the RA. This risk may be monitored using MNA. Having a limited monitoring network may not allow adequate LTM for potential migration through the upper aquitard.	Installation of wells in the LVZ that penetrate the aquitard may result in a conduit for contamination of the RA. This risk may be mitigated using proper well construction procedures. Rebound in soil vapor concentrations from low permeability zones may pose a risk to the RA. This risk may be monitored using MNA.	Incomplete distribution of PlumeStop™ within the targeted zone or a change in groundwater flow direction may allow transport of contaminants past the treatment zone with potential impact to the UA wells. Variations in permeability are expected to result in uneven distribution of PlumeStop™. To account for this, an 83% efficiency in VOC removal is assumed.	Variation in UA long-term pumping rates or installation of a CoT production well in the vicinity of the Site may result in a variation in flow direction and transport velocity of the untreated dissolved plume thereby resulting in uncertainty regarding time and duration of wellhead treatment. This risk may be mitigated through long-term monitoring of the RA. There are unknown long-term liabilities associated with the expected persistence of the dissolved plume (over 200-years).	Potential failure of a single extraction well to capture the dissolved plume thereby allowing contaminants to migrate to the UoA production wells. The time required to remediate the plume may extend beyond the proposed 30 years.
Cost to Completion (current dollar)	$1,920,000	$1,390,000	$2,350,000	$7,890,000	$14,890,000	*$5,990,000 (3A)* **$6,590,000 (3B)** *$7,710,000 (3C)*
Benefit	None.	None.	Reduced potential risk and future environmental liability, but consumes more GAC for disposal.	Groundwater is treated in situ with no production of waste streams or consumption of product. Minor amounts of IDW from drilling.	None, as generates considerable amounts of spent GAC.	None, as generates considerable amounts of spent GAC.
Scoring						
Practicability • Practicable = 2 • Less Practicable = 1 • Not Practicable = 0	1	1	1	1	2	2
Risks • Low = 3 • Medium = 2 • High = 1	3	2	2	1	2	3
Costs • Least Expensive = 3 • Mid-range Cost = 2 • Most Expensive = 1	2	3	1	2	1	3
Benefits • Beneficial = 1 • Not Beneficial = 0	0	0	0	1	0	0
Total Numeric Score	**6**	6	4	5	5	**8**

Acronyms

cDCE – *cis*-1,2-dichloroethene
CoT – City of Tucson
GAC – granular activated carbon
IDW – investigation derived waste
LTM – long term monitoring
LVZ – lower vadose zone
MNA – monitored natural attenuation
PCE – tetrachloroethene
RA – Regional Aquifer
SVE – soil vapor extraction
TCE - trichloroethene
UA – University of Arizona
VOCs – volatile organic compounds
VC – vinyl chloride

The highlighted zone alternatives had the highest comparative analysis scores and were combined into the Proposed Remedy (see Section 7.1).

Table 7-1
Ex Situ Treatment Technology Evaluation for the Proposed Remedy

Park Euclid Feasibility Study, Tucson, AZ

Technology Process Options	Screening Criteria and Scoring																	
	SVE Vapor Treatment								RA Water Treatment									
	Effectiveness			Implementability			Cost		Effectiveness			Implementability				Cost		
	Pulsed Operation	**Decreasing Vapor Concentrations**	**cDCE & VC**	**Staging at Plant**	**Level of O&M Involved**	**Existing Infrastructure**	**Brief Operation Duration**	**Scoring**	**Varied Flow Rate**	**PCE Concentrations**	**General Water Quality**	**Noise Concerns**	**Level of O&M Involved**	**Hazards to Trespassers**	**Size/Footprint**	**Capital**	**O&M**	**Scoring**
Catalytic Oxidation	2	1	2	2	2	1	1	11	*Not Applicable*									
Thermal Oxidation	2	1	2	2	2	1	1	11										
Granular Activated Carbon	2	2	1	2	2	2	2	**13**	2	2	2	2	2	2	2	2	2	**18**
Bioreactor	*Not Applicable*								1	1	1	2	1	1	1	1	1	10
Chemical Oxidation									1	1	1	2	1	1	1	1	1	10
Chemical Reduction									1	1	1	2	1	1	1	1	1	10
Ultraviolet Oxidation													0		0			
Air Stripping (with vapor treatment)									2	2	2	1	1	1	1	1	1	12
Ion Exchange									2	1	2	2	2	2	2	2	1	16

Scoring and Acronyms

0 = technology cannot meet criterion/requirement and must be rejected

1 = technology can meet criterion/requirement but is not ideal

2 = technology is well-suited for the requirement

cDCE = cis-1,2-dichloroethene

O&M = operations and maintenance

PCE = tetrachloroethene

SVE = soil vapor extraction

VC = vinyl chloride

Table 7-2
Practicability Evaluation of the Proposed Remedy

Park Euclid Feasibility Study, Tucson, AZ

Criteria	UVZ Pulsed SVE, then MNA	PA MNA for 30 years	LVZ SVE & Expanded LTM	RA Groundwater Pump & Treat
Feasibility	Implementing SVE in the UVZ beneath the Plant is feasible. The necessary well network already exists in four usable SVE wells and six MPE wells. The SVE and MPE piping networks also exist and are usable. Regarding MNA, the addition of four shallow monitoring points is feasible. Continued long-term soil vapor monitoring within the UVZ is feasible as such monitoring is already occurring.	Implementing MNA is feasible for the PA and installing six additional PA monitoring wells to enhance plume delineation and analysis is also feasible.	Implementing SVE in the LVZ at wells VEL-03 and PER-14A is very feasible. An existing SVE system began operation on February 2, 2015 as an ERA and incorporates elements of the existing MPE system. The system could be operated for additional years with existing infrastructure. Implementing MNA in the LVZ is feasible. Installing four additional nested vapor monitoring wells in the LVZ is feasible, but carries risk due to the penetration of the aquitard beneath the PA (see Section 6.2.1.2).	Extracting and treating groundwater is feasible at the Site. Groundwater modeling has predicted that the plume is extracted within 30 years and that the downgradient UoA production wells are protected. Implementability issues for this remedy include acquiring or leasing property to stage the extraction well and groundwater treatment equipment, as well complying with the permitting steps and regulations involved with discharging to High School Wash.
Short-Term Effectiveness	As has been demonstrated during former ERA implementations, short-term operation of the SVE system and/or of the MPE system is very effective in reducing soil vapor concentrations within the UVZ. The existing well network is sufficient to address soil vapor across the source area. MNA is considered to be a long-term effort. The former SVE ERA has already addressed much of the contamination in the UVZ source area.	In the short-term, MNA is not expected to result in reduced PA concentrations; however, MNA is considered to be effective in that VOCs within the PA are not expected to pose a threat to human health, to significantly migrate laterally, and to migrate vertically. The PA is not used for potable or non-potable purposes. The observed degradation to cDCE means that, in the short-term, the VOCs within the PA are less toxic than the released constituent PCE.	Based on pilot testing in 2014, SVE is projected to be effective within a one-year timeframe. Additional operation may be required contingent on future monitoring results. MNA is considered to be a long-term rather than a short-term remedy.	Groundwater extraction is expected to be effective in containing the dissolved plume to prevent further downgradient contaminant migration.
Long-Term Effectiveness	Pulsed SVE will result in additional VOC mass reduction within the source area, which reduces the long-term risks associated with VOCs within the UVZ. MNA provides the means for continued attenuation of VOCs within the UVZ and a long-term means to monitor and address potential risks associated with such VOCs. Should increasing VOC concentrations be identified, the risk can be addressed by contingency measures.	MNA is expected to continue to result in decreased PCE and TCE concentrations due to biodegradation and accumulation of cDCE. VC concentrations are also expected to increase in the future due to ongoing degradation of cDCE. Although VC is more toxic than cDCE, it is expected to continue to breakdown to ethene in the long term. Soil vapor monitoring within the UVZ will provide a means to evaluate whether VC in the PA poses a risk to human health as a result of vapor intrusion to indoor air.	Based on pilot testing, SVE is projected to effectively remove mass within a one-year timeframe. Rebound of soil vapor concentrations within the LVZ is possible due to mass retained within low-permeability intervals. The existing SVE operational plan includes monitoring for rebound of VOCs in the LVZ. Following mass removal in the source area using SVE, natural attenuation of VOCs is expected to be effective over the long-term. Monitoring will provide sufficient data to demonstrate the effectiveness of the remedy.	Groundwater extraction is expected to be effective in the long-term with cleanup of the dissolved plume projected within 30 years based on groundwater modeling.
Performance Capabilities	SVE is a proven technology that has been shown to be effective at the Site. The existing vapor treatment equipment has, however, been shown to be less effective at capturing PCE degradation products cDCE and VC, resulting in higher operating costs. Because SVE operation is proposed to be pulsed operation, the high consumption of vapor-phase GAC is expected to be manageable. Under MNA, natural attenuation is expected to continue to occur at the Site as a result of physical and biological processes. Long-term soil vapor monitoring is a proven method of observing and evaluating such attenuation.	The existing PA monitoring well network expanded by six wells is expected to provide the coverage required to demonstrate the performance of MNA.	SVE is a proven technology and has been shown to be effective at the Site during pilot testing. The existing vapor treatment equipment has, however, been shown to be less effective at capturing the degradation products cDCE and VC, resulting in higher operating costs when extracting vapor from the UVZ. If the ratio of PCE to cDCE in extracted vapor from the LVZ decreased over time, the performance of the vapor treatment equipment (i.e., vapor-phase GAC) may decrease resulting in higher operational costs. Natural attenuation is expected to continue to occur at the Site as a result of physical and biological processes. Long-term soil vapor monitoring is a proven method of observing and evaluating such attenuation.	Groundwater extraction is an accepted technology for containment and cleanup of large, diffuse VOC plumes. When there is a continuing source present and/or if residual contaminants adhere to soil, groundwater extraction systems may require very long operational times to achieve cleanup goals. In this case, the dissolved plume had detached from the source area and appears to be moving downgradient indicating removal of the contaminant source and no apparent residual mass adhering to soil.

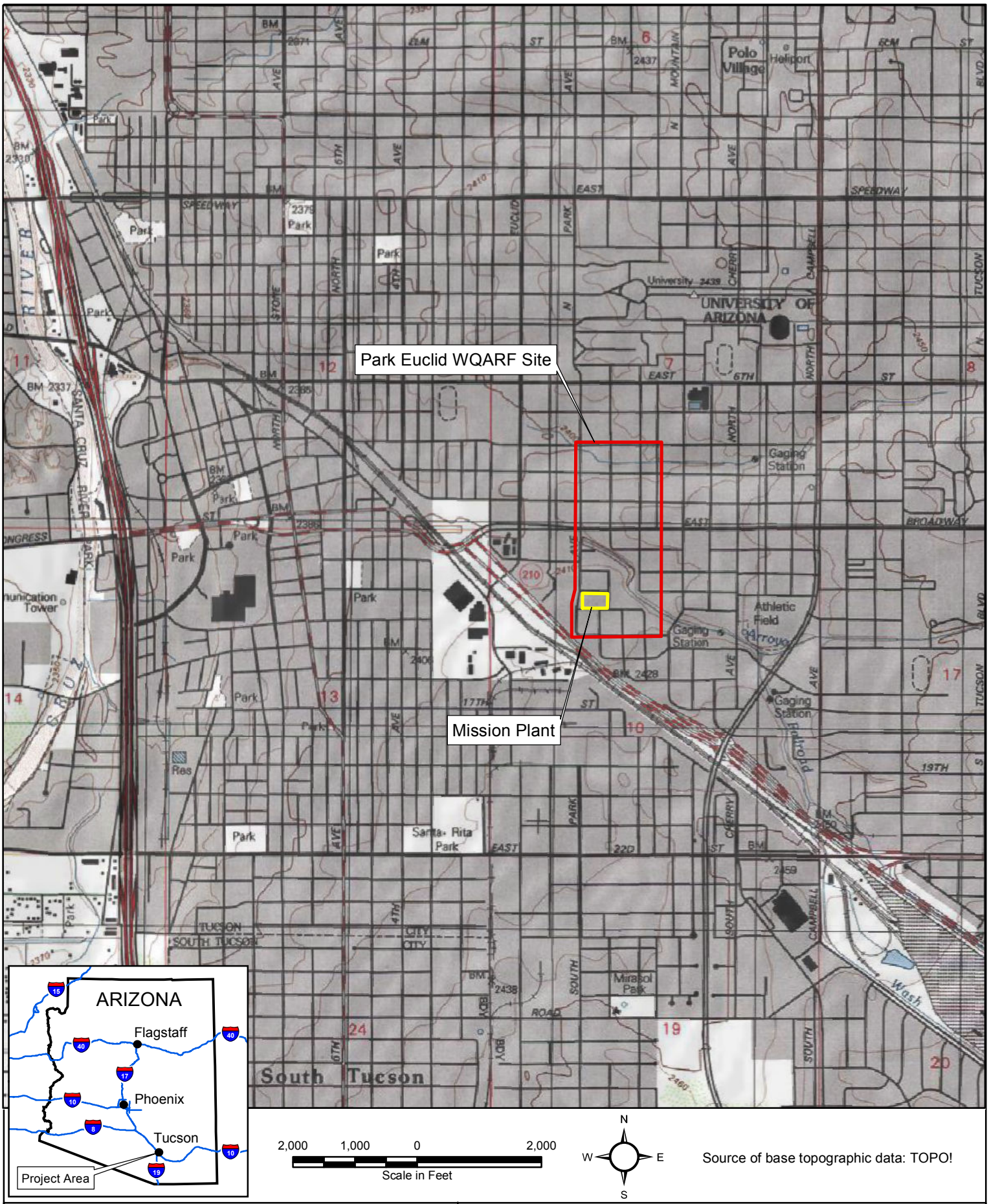
Table 7-2
Practicability Evaluation of the Proposed Remedy

Park Euclid Feasibility Study, Tucson, AZ

Criteria	UVZ Pulsed SVE, then MNA	PA MNA for 30 years	LVZ SVE & Expanded LTM	RA Groundwater Pump & Treat
Institutional considerations	Operating a SVE system beneath the Plant is not expected to interfere with existing laundry operations. Treatment of extracted vapor to meet ambient air guidelines (based on air permit emission limits) is expected to be accepted by PDEQ and nearby residents. Noise abatement may be required to meet CoT code. MNA of the UVZ is anticipated to be acceptable to project stakeholders due to the previous SVE ERA activities at the Site. LTM over a period of 30 years will confirm that the UVZ meets remedial objectives for the Site.	Institutional controls will be required to regulate that future wells installed within the area are constructed properly to prevent cross-contamination from the PA to the RA.	Operating a SVE system at the Plant is not expected to interfere with existing laundry operations. Treatment of extracted vapor to meet ambient air guidelines (based on air permit emission limits) is expected to be accepted by the PDEQ and nearby residents. Noise abatement may be required to meet CoT code. MNA of the LVZ is anticipated to be acceptable to project stakeholders following SVE ERA activities at the Site. LTM over a period of an additional 29 years will provide confirm that the LVZ meets remedial objectives for the Site.	There are several permitting steps and regulations that need to be met for discharging to High School Wash under Alternative 3B. The remedy relies on CoT acceptance of a water transport pipeline within the public right-of-way. Also, a property must be available to place the treatment system and groundwater extraction well that is correctly positioned within the plume.

Acronyms:

cDCE = cis-1,2-dichloroethene
CoT = City of Tucson
ERA = early response action
GAC = granular activated carbon
LVZ = lower vadose zone
MNA = monitored natural attenuation
MPE = multi-phase extraction
µg/L = micrograms per liter
O&M = operations and maintenance
PA = perched aquifer
PCE = tetrachloroethene
PDEQ = Pima County Department of Environmental Quality
RA = regional aquifer
SVE = soil vapor extraction
UoA = University of Arizona
UVZ = upper vadose zone
VC = vinyl chloride
VOCs = volatile organic compounds



Source of base topographic data: TOPO!

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

Date: April 2016

SITE LOCATION MAP
PARK-EUCLID WQARF SITE
301 SOUTH PARK AVENUE
TUCSON, ARIZONA

Mission/Park_Euclid_p/Projects15/FeasStudy/mxds/Fig1-1_SiteLocation.mxd

Figure 1-1

Notes:

Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

Date: April 2016

WELL LOCATIONS AND EXISTING SAMPLING PROGRAM
PARK-EUCLID WQARF SITE
301 SOUTH PARK AVENUE
TUCSON, ARIZONA

Park_Euclid_p/Projects15/Feas_Study/mxds/Fig2-1_Wells.mxd

Figure 2-1

Notes:

Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

URS

Project Name: Park-Euclid WQARF Site

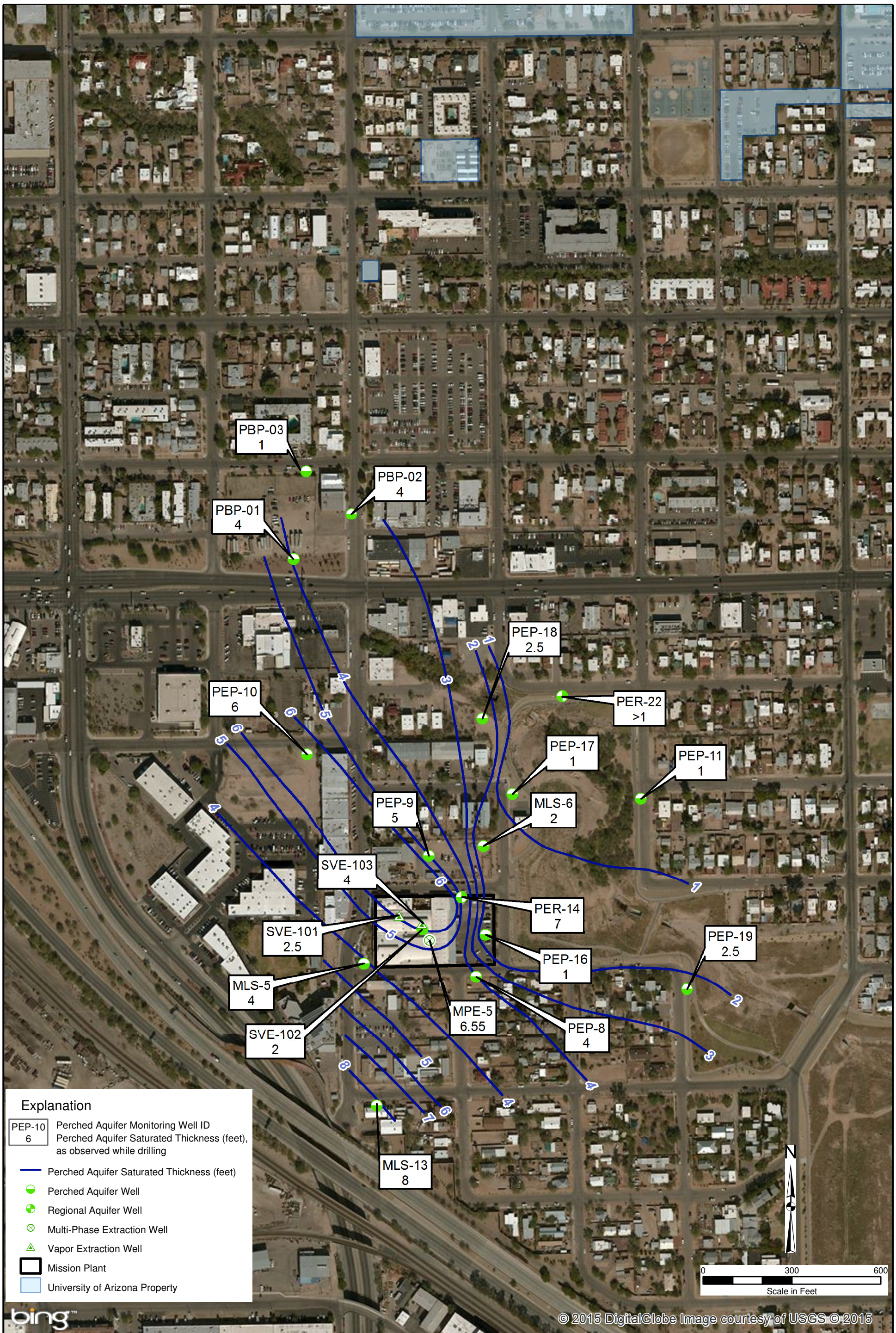
Job No: 22241866

Date: April 2016

PLANT AREA WELL LOCATIONS
AND EXISTING SAMPLING PROGRAM
PARK-EUCLID WQARF SITE
301 SOUTH PARK AVENUE
TUCSON, ARIZONA

Park_Euclid/Projects15/Feas_Study/mxds/Fig2-2_Plant_Wells.mxd

Figure 2-2



Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866 | Date: April 2016

ESTIMATED SATURATED THICKNESS MAP OF THE PERCHED AQUIFER
PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

Mission.../P-E_p/Proj15/Feas_Study/mxds/Fig2-3_PA_Sat_Thick.mxd

Figure 2-3

Notes:

Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866 | Date: April 2016

STRUCTURE CONTOUR ELEVATION MAP - TOP OF UPPER AQUITARD
PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

ML/P-E/Proj15/Feas_Study/mxds/Fig2-4_Upper_Aquitard_Structure.mxd **Figure 2-4**

NE = Not Encountered

NOTE: Only RA wells penetrated the PA aquitard, but PA well locations are posted for reference purposes.

Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

URS

Project Name: Park-Euclid WQARF Site

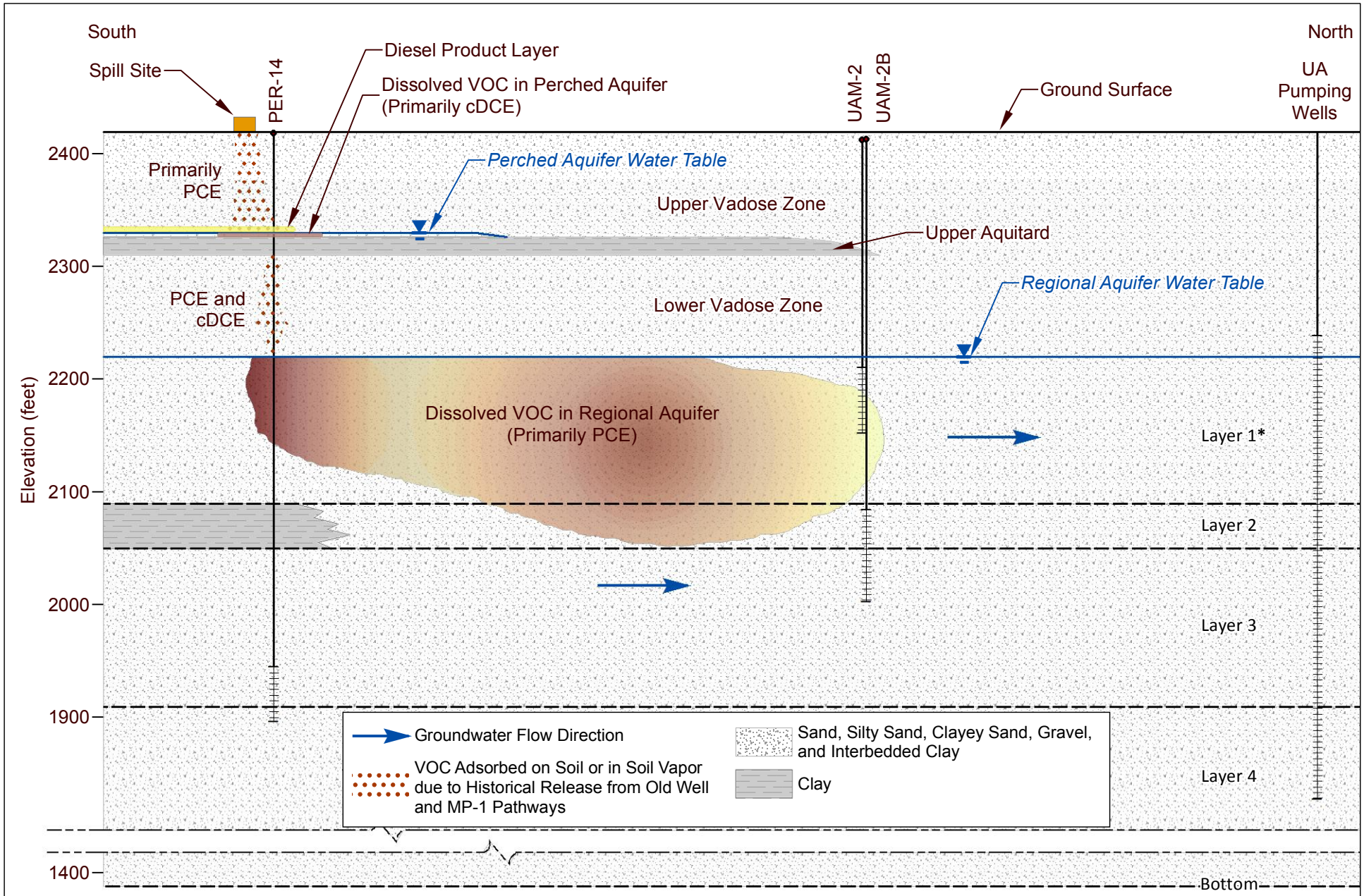
Job No: 22241866

Date: April 2016

UPPER AQUITARD THICKNESS MAP
PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

Mission.../P-E/Proj15/Feas_Study/mxds/Fig2-5_Aquitard_thick.mxd

Figure 2-5



0 600 1,200

Horizontal Scale in Feet

*Layers presented are from Groundwater Model in Appendix G

URS	Contamination Migration Conceptual Site Model
Project Name: Park-Euclid WQARF Site	
Job No: 22241866 / Date: April 2016	*Feasibility Study* *Park-Euclid WQARF Site, Tucson, Arizona* **Figure 2-6**

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig2-06 Conceptual Model.mxd

Figure 2-7
MPE System VOC Mass Removal Rates as a Function of Time

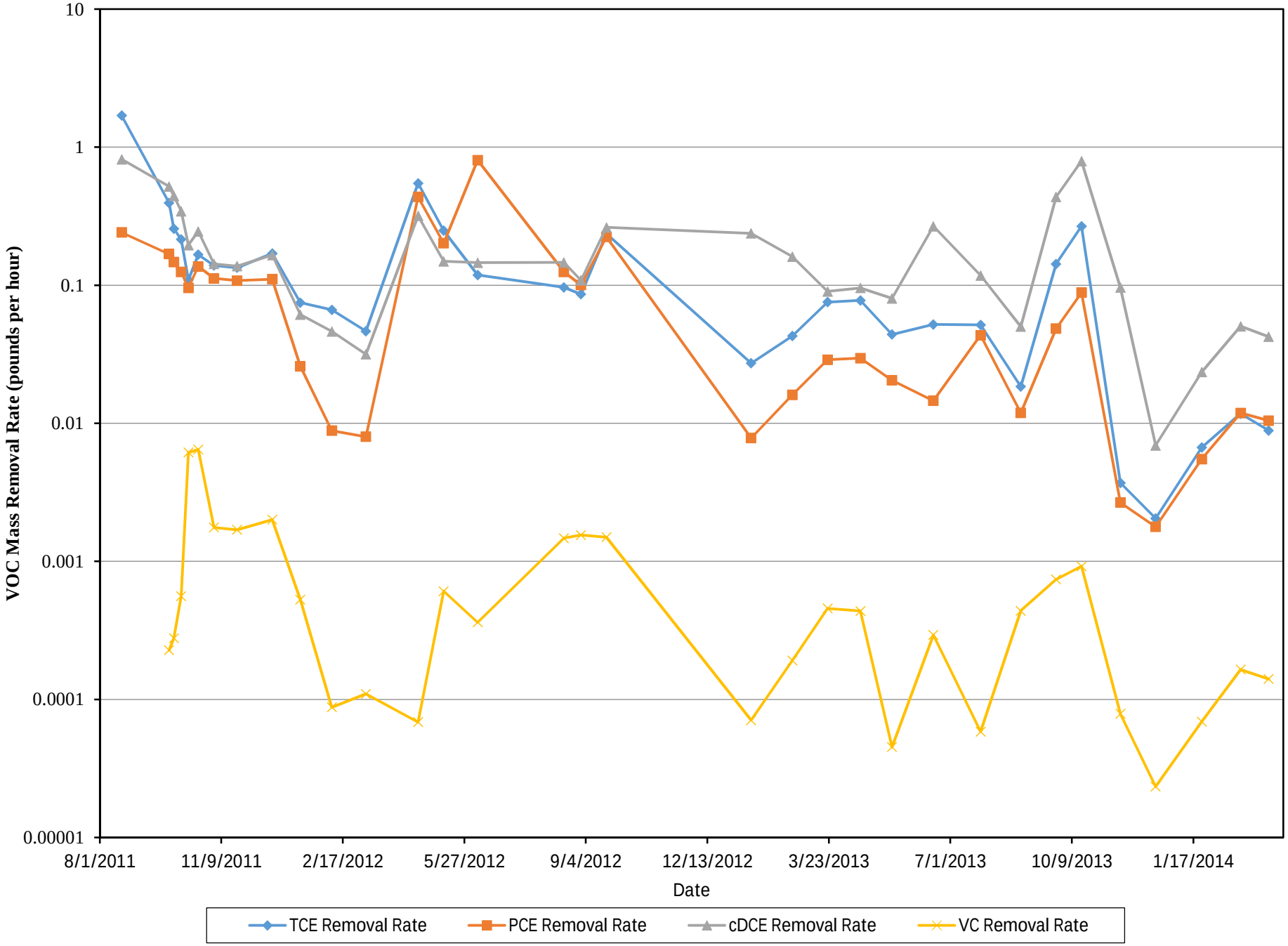
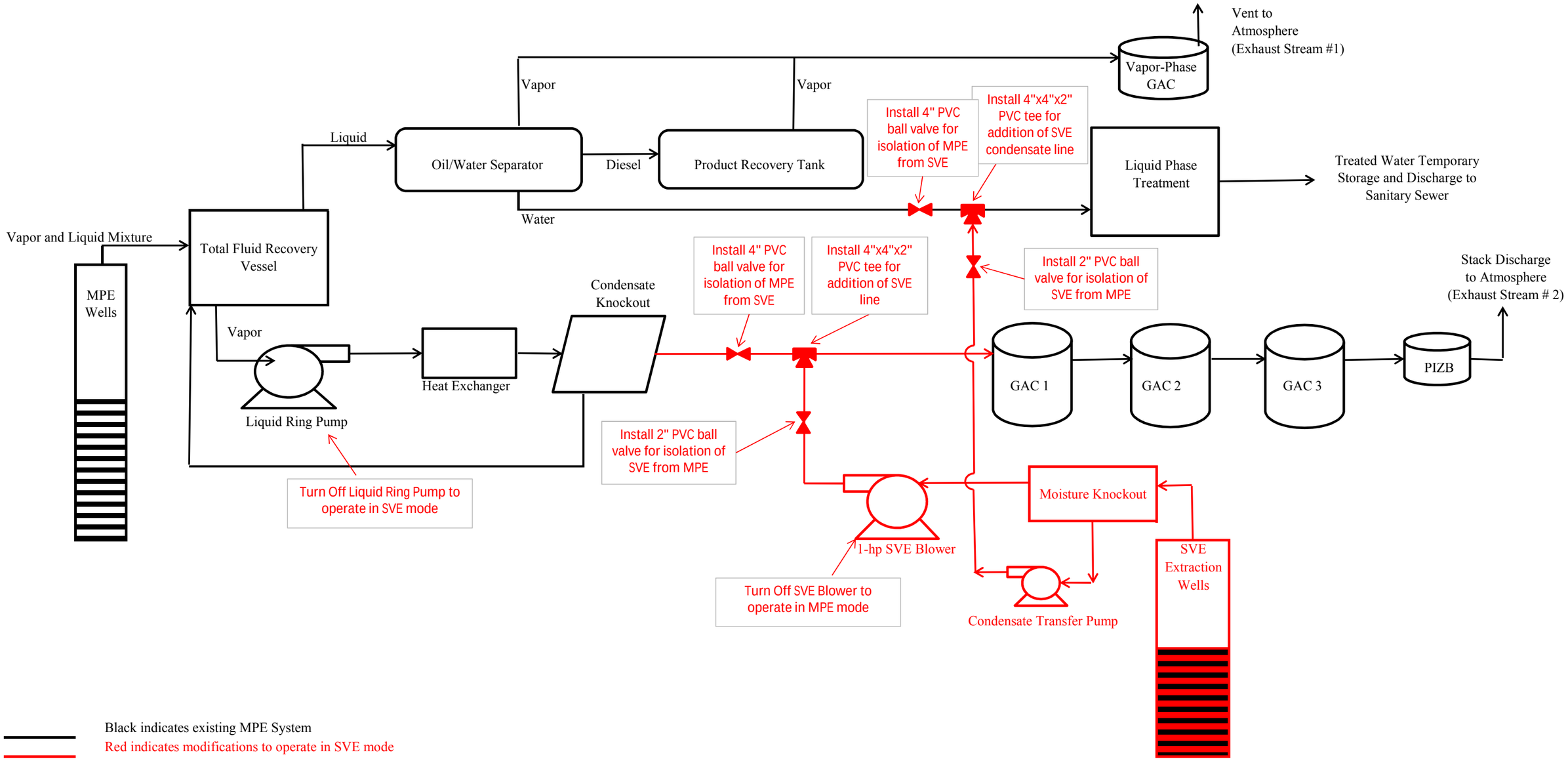


Figure 2-8
SVE and/or MPE System Process Flow Diagram



Note:
If no number is posted then free product was not present at that location.

Aerial Imagery Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

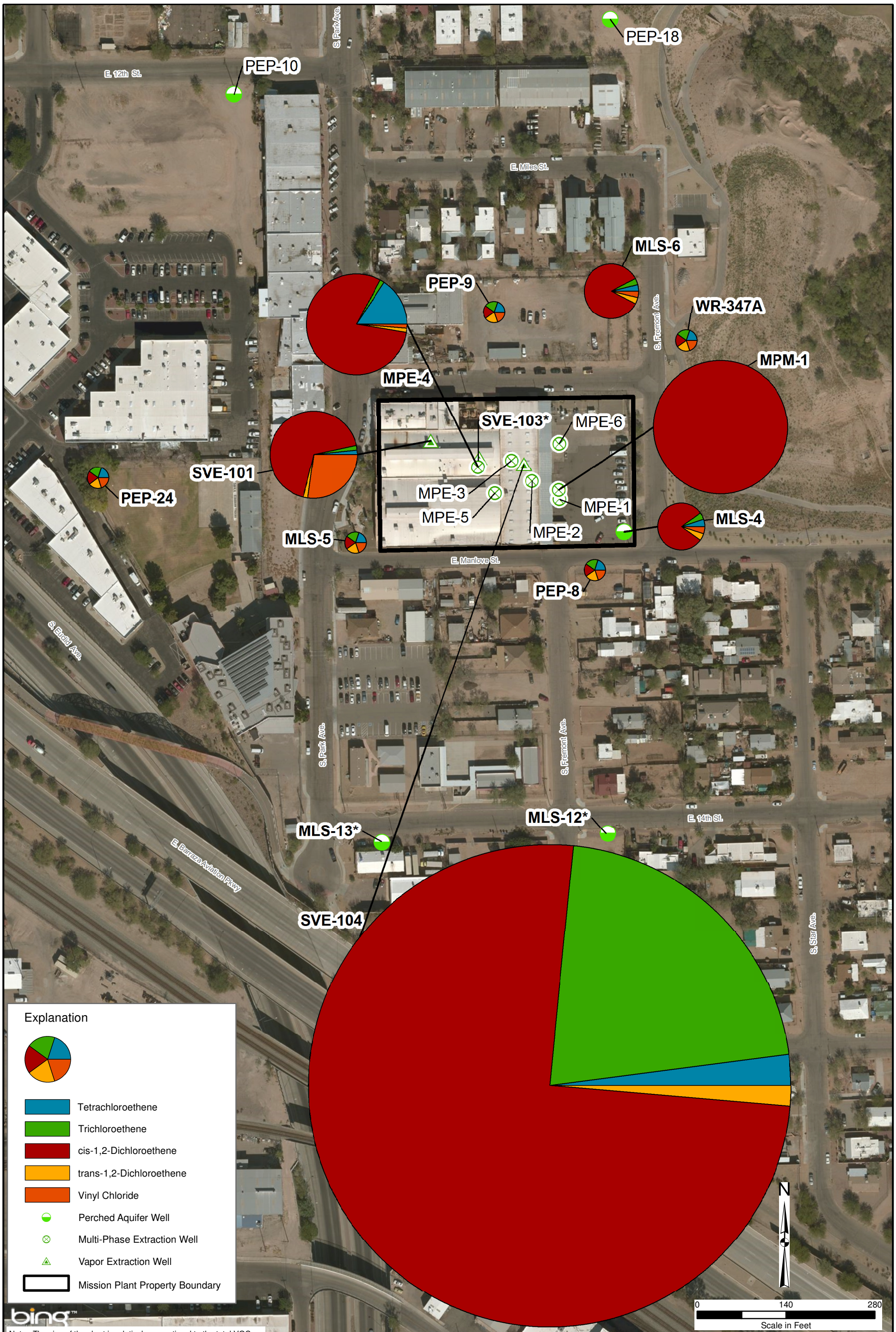
URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866 | Date: April 2016

PRODUCT THICKNESS AND DISTRIBUTION
FEBRUARY 2015
PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

Projects15/Feas_Study/mxds/Fig3-1_PD_thickness_PA_Feb2015.mxd **Figure 3-1**



Note: The size of the chart is relatively proportional to the total VOC concentrations. Small equal values were assigned for non-detects, rather than utilizing reporting limits, which varied and falsely portrayed various compositions.
* Insufficient product volume was present at SVE-103 to collect a sample. Product samples are no longer collected from wells MLS-12 and MLS-13.
Aerial Imagery Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

URS

Project Name: Park-Euclid WQARF Site

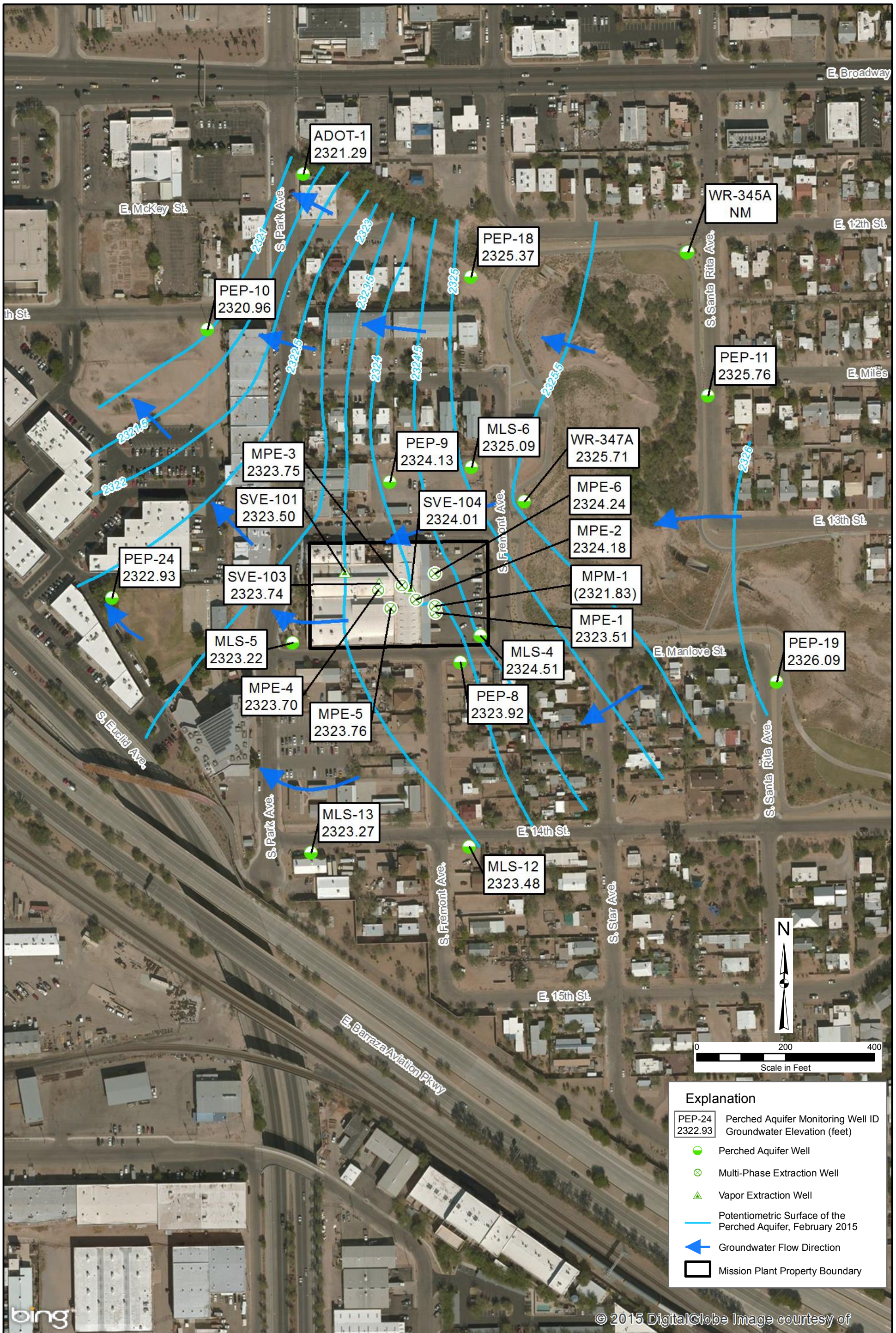
Job No: 22241866

Date: April 2016

PCE AND DEGRADATION COMPONENTS IN PRODUCT
FEBRUARY 2015
PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

Projects15/Feas_Study/mxds/Fig3-2_PD_PA_pie_charts_Feb2015.mxd

Figure 3-2



Notes:
Groundwater elevations at wells containing product reflect corrected elevations accounting for LNAPL thickness at a specific gravity of 0.87.
( ) Data point omitted in developing the potentiometric surface as it is anomalous with nearby wells.
NM There was an obstruction in well WR-345A at the time of measurement.
Aerial Imagery Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866 | Date: April 2016

PERCHED AQUIFER POTENTIOMETRIC MAP
FEBRUARY 2015
PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

Projects15/Feas_Study/mxds/Fig3-3_PA_potentiometric_Feb2015.mxd **Figure 3-3**

Note:
The AWQS for VC is 2 µg/L.
In regions with non-detections at elevated reporting limits, historical concentration data were used to assist in contouring.

Aerial Imagery Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

URS

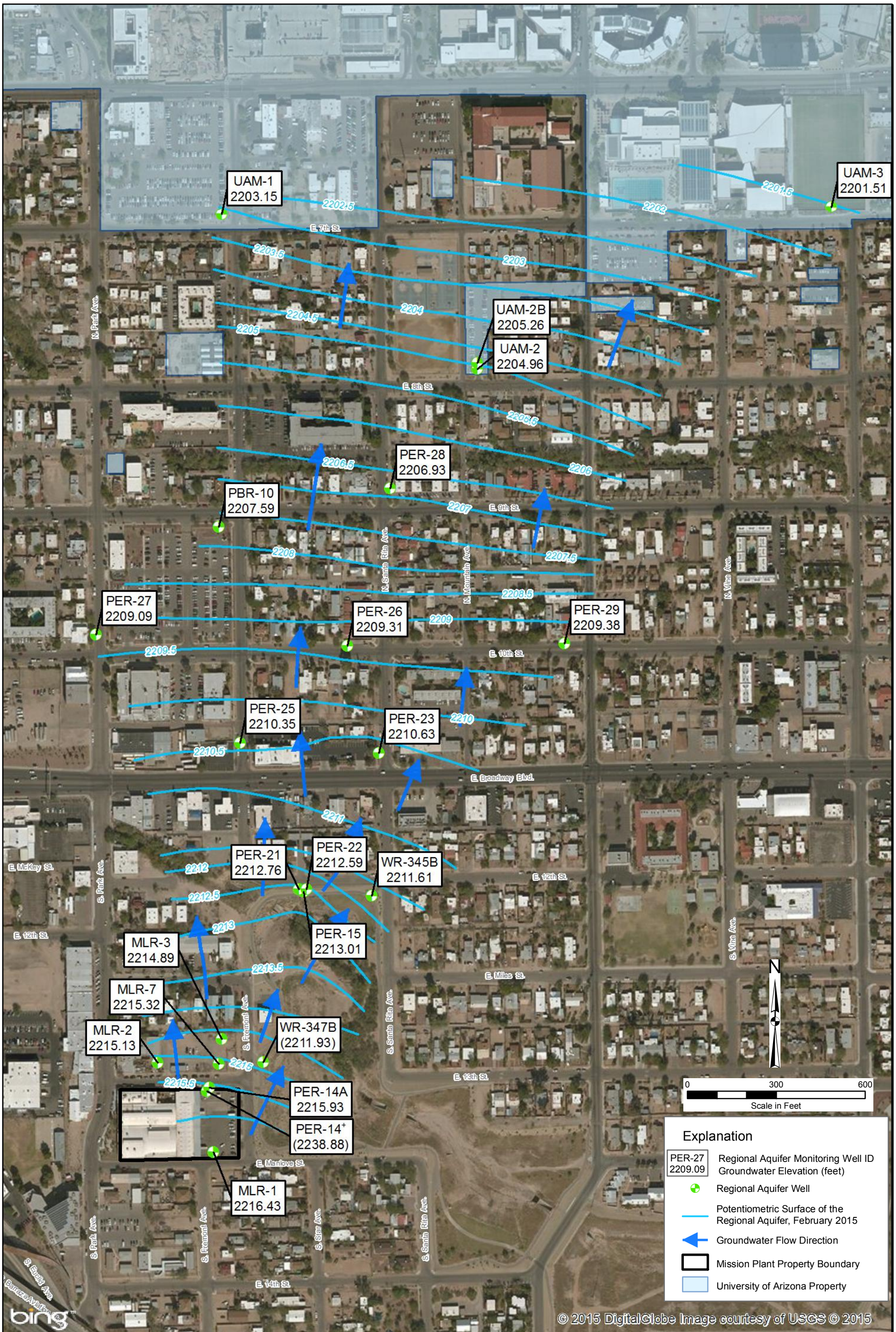
Project Name: Park-Euclid WQARF Site

Job No: 22241866 | Date: April 2016

VC DISTRIBUTION IN PERCHED GROUNDWATER, FEBRUARY 2015
PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

Projects15/Feas_Study/mxds/Fig3-4_PA_VC_Feb2015.mxd

Figure 3-4



Note:
( ) Data point omitted in developing the potentiometric surface as it is anomalous with nearby wells.
+ PER-14 is screened in a deeper zone than surrounding wells.

Aerial Imagery Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866 | Date: April 2016

REGIONAL AQUIFER POTENTIOMETRIC MAP
FEBRUARY 2015
PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

Projects15/Feas_Study/mxds/Fig3-5_RA_potentiometric_Feb2015.mxd **Figure 3-5**

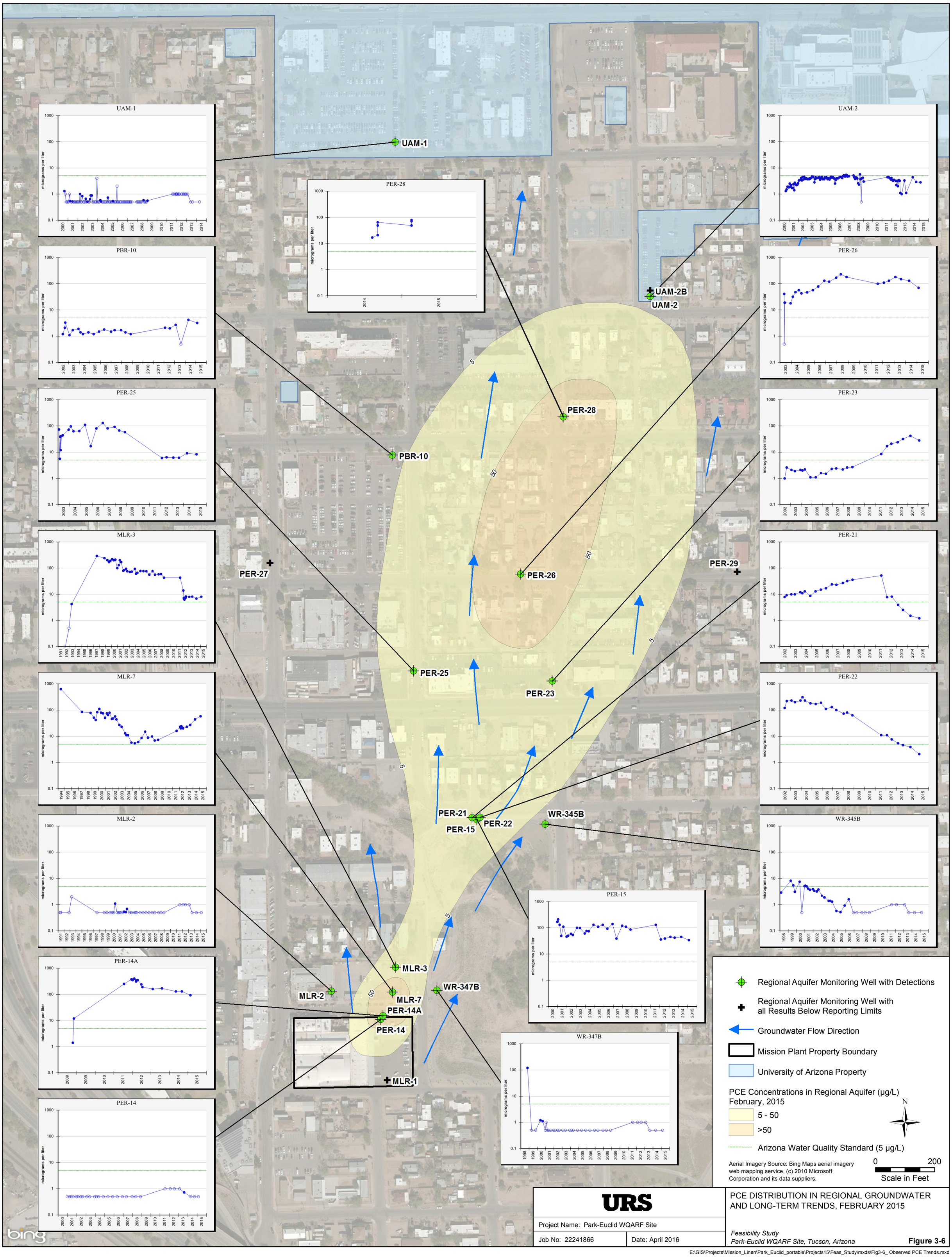
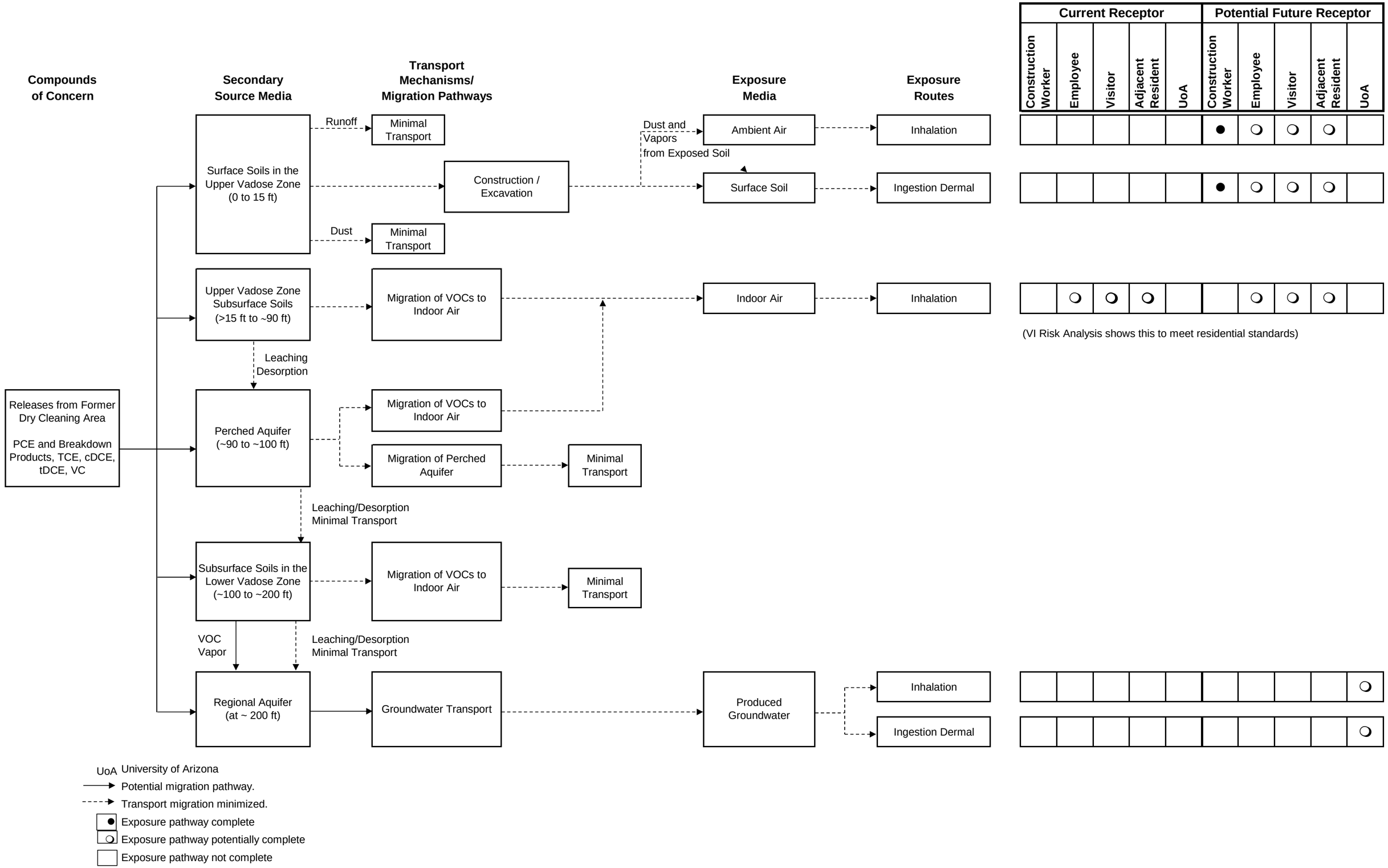
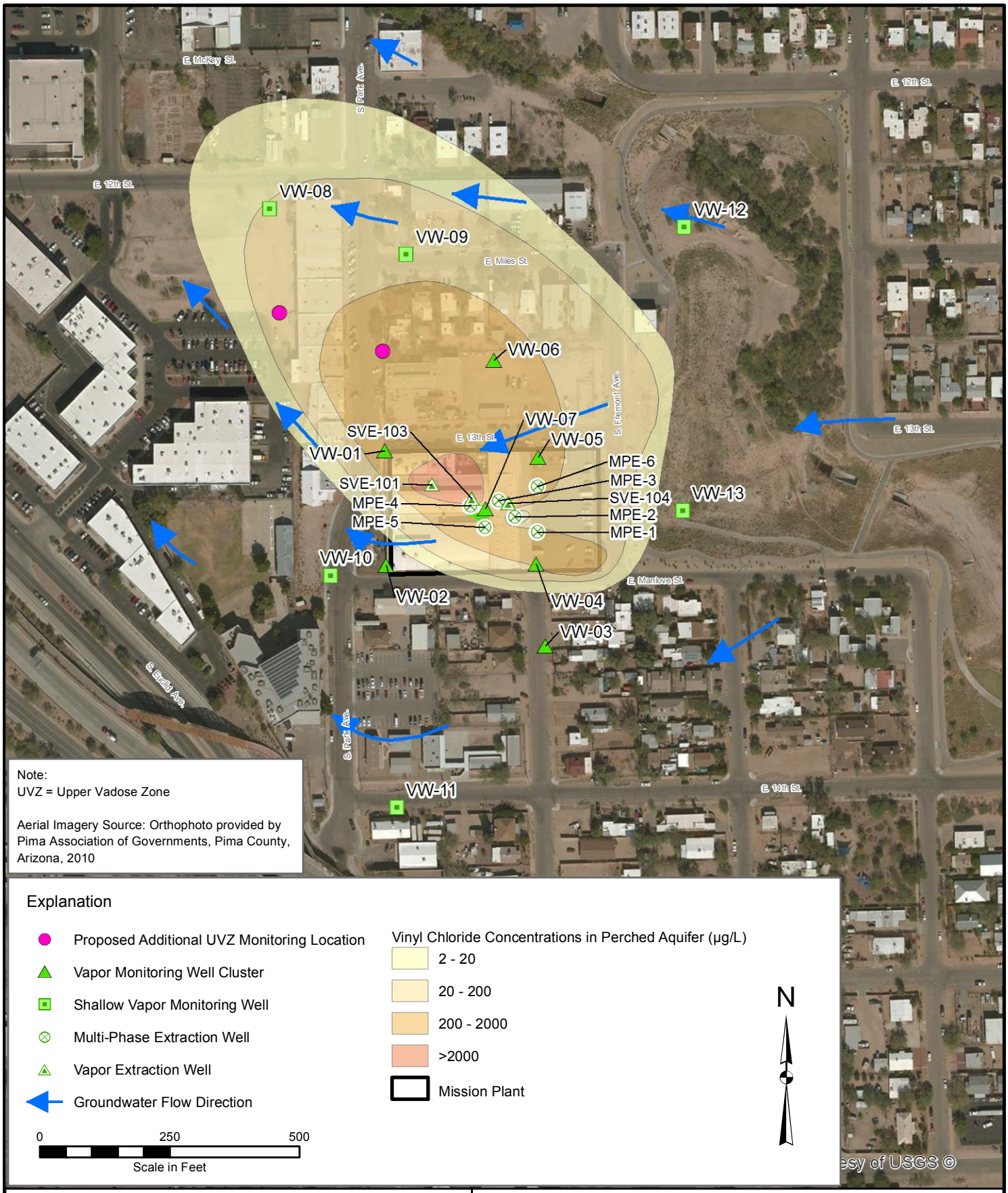

UAM-1
PER-28
UAM-2
PBR-10
PER-26
PER-25
PER-23
MLR-3
PER-21
MLR-7
PER-22
MLR-2
WR-345B
PER-15
PER-14A
PER-14
WR-347B
UAM-2B
PER-27
PER-29
MLR-1
5
50
Regional Aquifer Monitoring Well with Detections
Regional Aquifer Monitoring Well with all Results Below Reporting Limits
Groundwater Flow Direction
Mission Plant Property Boundary
University of Arizona Property
PCE Concentrations in Regional Aquifer (µg/L) February, 2015
5 - 50
>50
Arizona Water Quality Standard (5 µg/L)
N
Aerial Imagery Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.
0
200
Scale in Feet
URS
Project Name: Park-Euclid WQARF Site
Job No: 22241866
Date: April 2016
PCE DISTRIBUTION IN REGIONAL GROUNDWATER AND LONG-TERM TRENDS, FEBRUARY 2015
Feasibility Study
Park-Euclid WQARF Site, Tucson, Arizona
Figure 3-6
E:\GIS\Projects\Mission_Linen\Park_Euclid_portable\Projects15\Feas_Study\mxds\Fig3-6_ Observed PCE Trends.mxd

Figure 3-7
Diagram of Park-Euclid Exposure Scenarios





URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

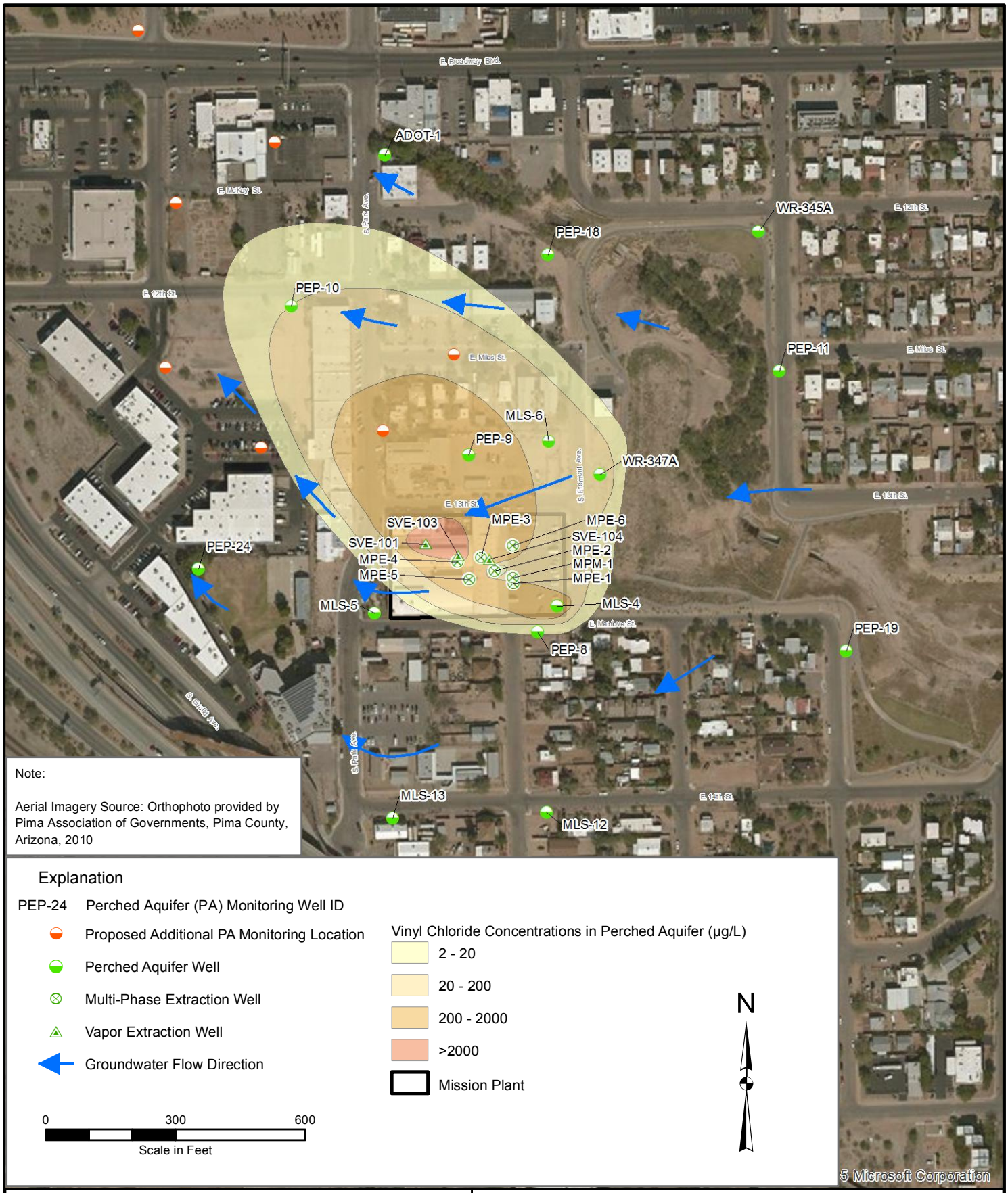
Date: April 2016

UVZ LOCATIONS FOR REMEDIAL ALTERNATIVES

PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

P-E/Projects15/Feas_Study/mxds/Fig5-1_UVZ_Locations.mxd

Figure 5-1



URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

Date: April 2016

PA LOCATIONS FOR REMEDIAL ALTERNATIVES

PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

P-E/Proj15/Feas_Study/mxds/Fig5-2_PA_Locations.mxd

Figure 5-2

URS

Project Name: Park-Euclid WQARF Site

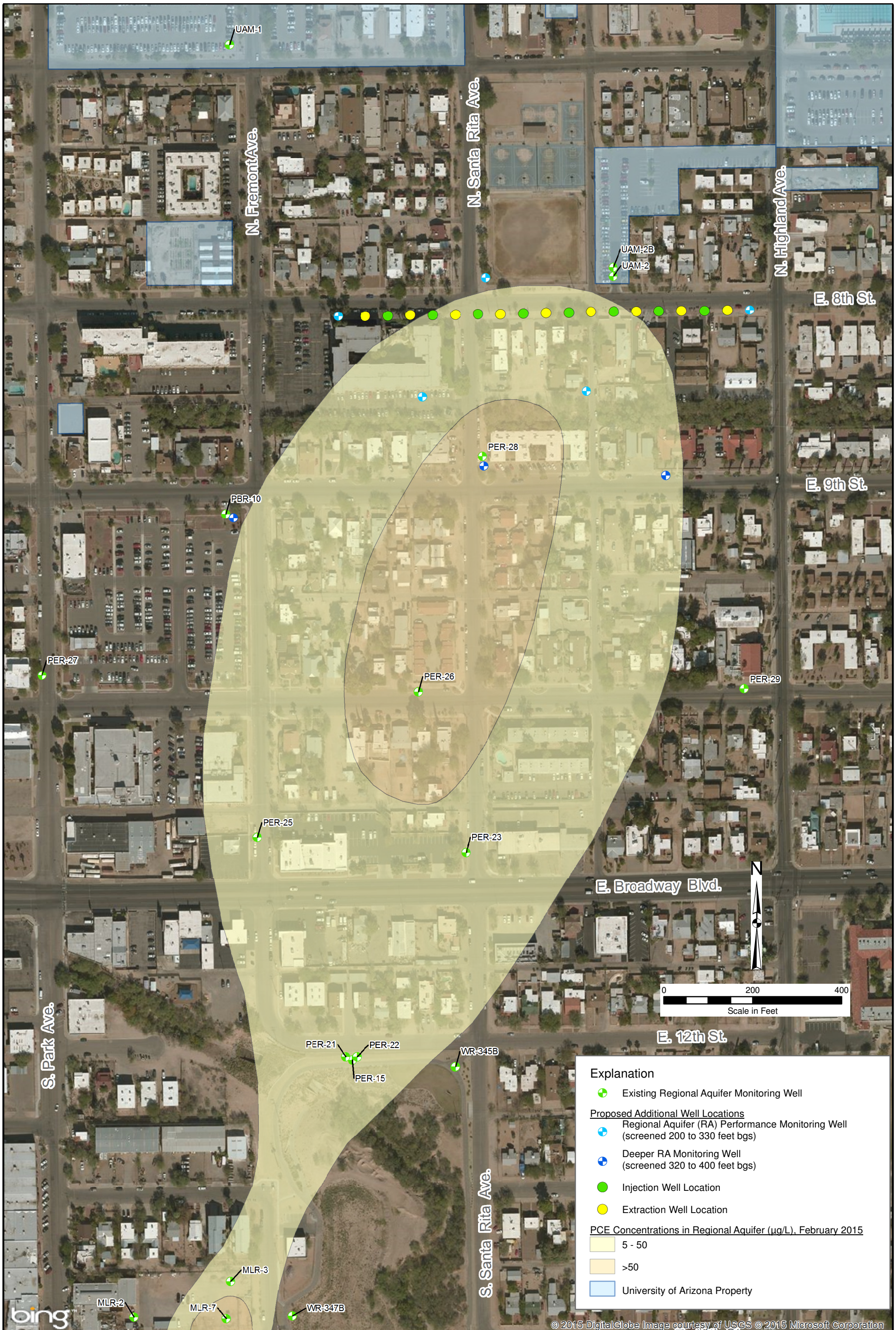
Job No: 22241866

Date: April 2016

LVZ LOCATIONS FOR REMEDIAL ALTERNATIVES
PARK-EUCLID WQARF SITE
301 SOUTH PARK AVENUE
TUCSON, ARIZONA

Park_Euclid/Projects15/Feas_Study/mxds/Fig5-3_LVZ_Locations.mxd

Figure 5-3



Note:

Aerial Imagery Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

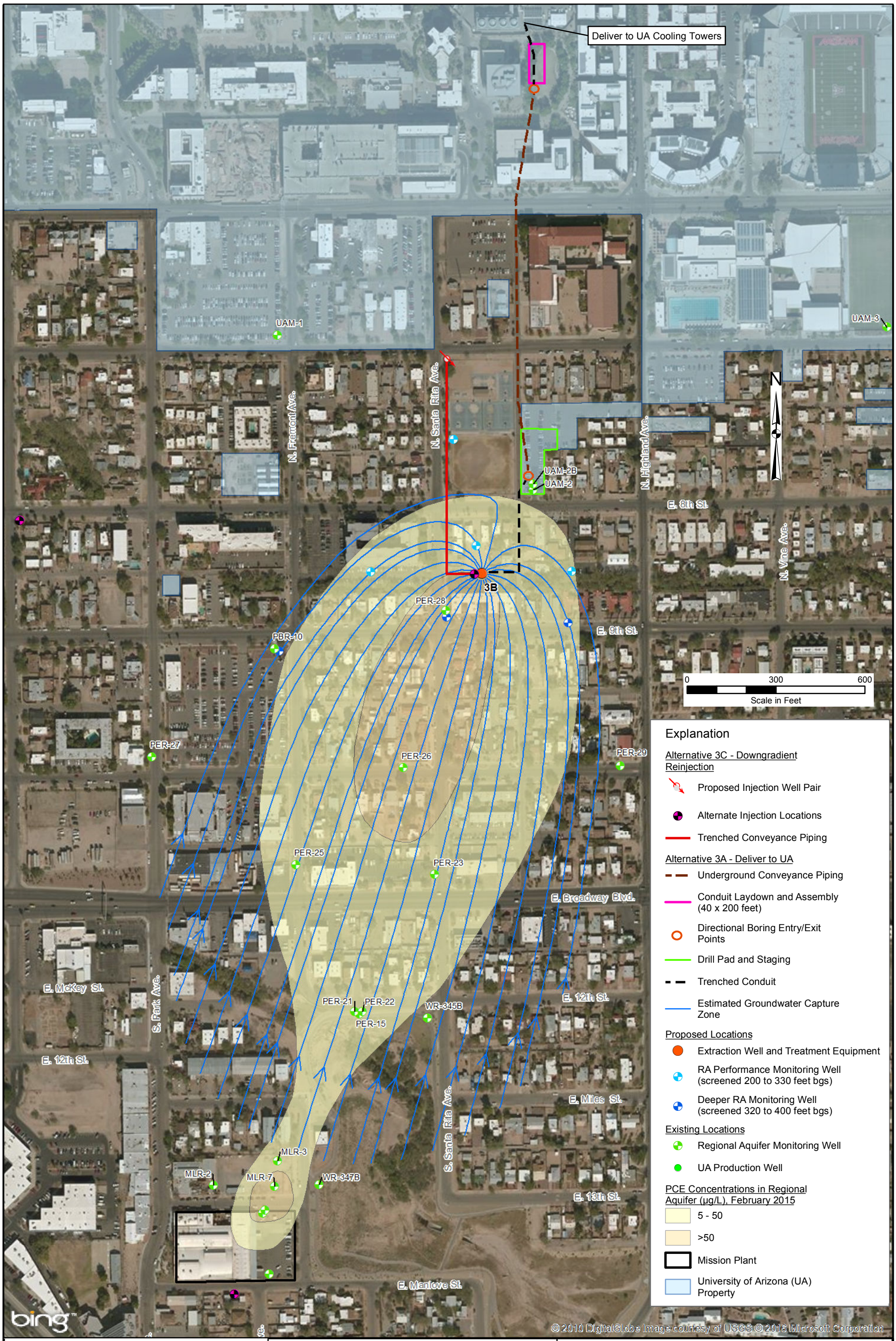
Date: April 2016

RA LOCATIONS FOR THE REFERENCE ALTERNATIVE

PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

P-E/Proj_2015/Feas_Study/mxds/Fig5-4_RA_/Alt1_PCE.mxd

Figure 5-4



Note:
*3B denotes location of discharge to High School Wash.

Aerial Imagery Source: Bing Maps aerial imagery web mapping service, (c) 2010 Microsoft Corporation and its data suppliers.

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866 | Date: April 2016

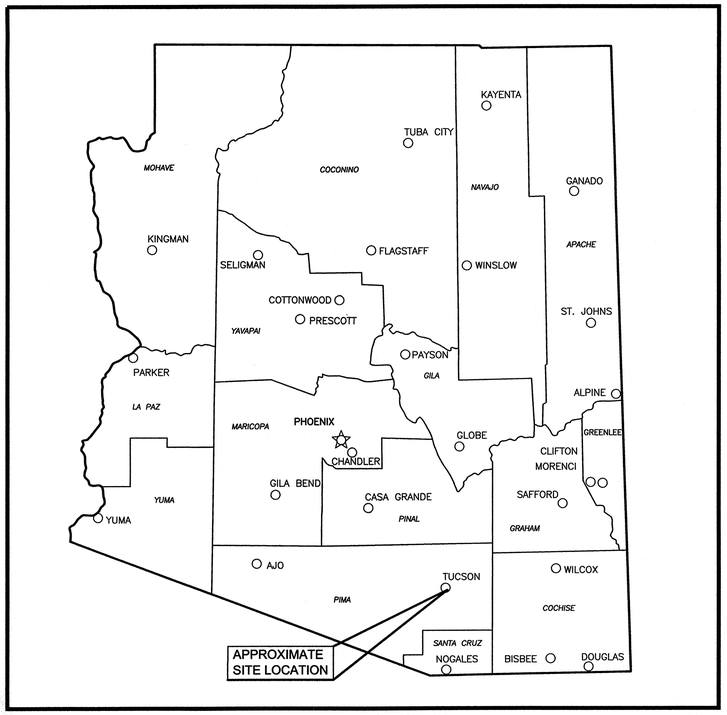
RA LOCATIONS FOR THE MORE AGGRESSIVE ALTERNATIVES
PARK-EUCLID WQARF SITE
TUCSON, ARIZONA

P-E/Proj_2015/Feas_Study/mxds/Fig5-5_RA_Alts3_PCE_2016.mxd

Figure 5-5

Appendix A

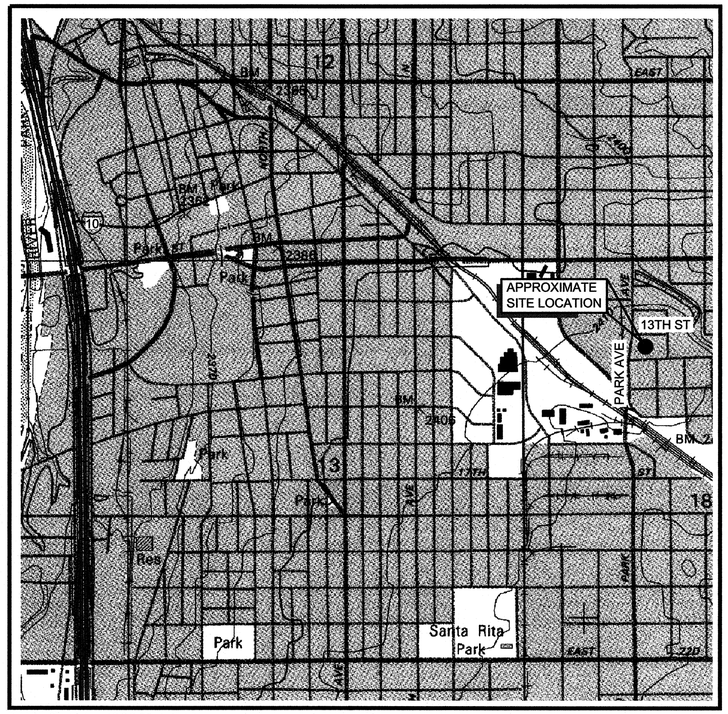
MPE System As-Built Drawings



LOCATION MAP

0 50 100

SCALE IN MILES



REFERENCE: Map from U.S.G.S. 7.5 minute sieries (topographic), Tucson Arizona 1992

VICINITY MAP

0 1000 2000

SCALE IN FEET

APPROVED BY:

APPROVED _____

CITY OF TUCSON DEVELOPMENT SERVICES DEPARTMENT

NOTICE 1:
BUILDING OCCUPANCY CLASSIFICATION -
FACTORY GROUP: LAUNDRIES, FACTORY INDUSTRIAL
F-1 MODERATE HAZARD OCCUPANCY, IBC 2003 -
SECTION 306.

NOTICE 2:
THIS DESIGN WAS PREPARED SOLELY FOR CONSTRUCTION OF A REMEDIATION SYSTEM INTENDED TO REMEDIATE CHLORINATED SOLVENT AND PETROLEUM HYDROCARBON CONTAMINATION IN SUBSURFACE SOIL AND GROUNDWATER BENEATH THE SUBJECT FACILITY.

NOTICE 3:
THE SYSTEM IS NOT PART OF THE CURRENT FACILITY'S OPERATIONS AND THE SYSTEM DESIGN DOES NOT CLAIM OR VERIFY THAT THE OVERALL FACILITY IS COMPLIANT WITH CURRENT CODE REQUIREMENTS RECOGNIZED BY THE LOCAL PERMITTING AUTHORITIES.

AS BUILT DRAWINGS FOR:

MULTI-PHASE EXTRACTION REMEDIATION SYSTEM MISSION LINEN SUPPLY

Mission Linen Supply
MISSION LINEN & UNIFORM SERVICE

301 SOUTH PARK AVENUE
TUCSON, ARIZONA 85719

Registered Professional Engineer (Civil)
CERTIFICATE NO. 46861
WILLIAM J. NEESE
Date Signed 2-26-08
ARIZONA U.S.A.
EXPIRES 06-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig, CALL FOR THE BLUE STAKES
1-800-STAKE-IT
1-800-782-5348
(OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	2-06	RE-ISSUED FOR PERMIT
AB	WN	8-08	AS-BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE: AS NOTED	DATE
DESIGNED BY: MAB/JWB	2-06
DRAWN BY: RJW	2-06
CHECKED BY: PJS, JMW	2-06
APPROVED BY: MAB	2-06
CLIENT APPROVAL BY:	

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

COVER SHEET

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188

DRAWING NO. G-1

REV. AB

P:\mission linen\CADD\DESIGN_MPE_SYSTEM\REV-1\G-1-R1.dwg 02-20-06

DRAWING INDEX

SHEET NO.	REVISION	TITLE
G-1	AB	COVER SHEET
G-2	AB	DRAWING INDEX, LEGEND AND ABBREVIATIONS
G-3	2	GENERAL NOTES
G-4	2	GENERAL NOTES/CONTROL AREA TABLE
P-1	AB	MPE SYSTEM SCHEDULES
P-2	AB	PROCESS FLOW DIAGRAM
C-1	AB	SITE PLAN
C-2	AB	MPE EQUIPMENT LAYOUT
C-3	AB	FOUNDATIONS AND VAULTS
C-4	AB	TRENCHING SECTIONS AND DETAILS
C-5	AB	SECTIONS AND DETAILS
M-1	AB	MPE WELLS
M-2	AB	PIPING PLAN, DETAILS, AND SECTION AND EXHAUST FAN DETAIL
M-3	1	MPE BLOWER AND PIPING SKID
M-4	AB	OIL/WATER SEPARATOR DETAILS
M-5	AB	PRODUCT RECOVERY TANK
M-6	AB	WATER RECOVERY TANK
M-7	AB	VAPOR PHASE TREATMENT (STAGE 1)
M-8	AB	LIQUID PHASE CARBON TREATMENT SYSTEM
S-1	3	CONCRETE PADS - STRUCTURAL DETAILS
S-2	0	TREATED WATER STORAGE TANK FOUNDATION PLAN AND DETAIL, AND DISCHARGE STACK DETAILS
E-1	AB	SINGLE LINE DIAGRAM & LEGEND
E-2	AB	ELECTRICAL SITE PLAN
E-3	AB	CONTROL LINE DIAGRAM
E-4	AB	ELECTRICAL SPECIFICATION AND DETAILS

LEGEND:

- CONCRETE
- EXISTING GROUND SURFACE
- COMPACTED NATIVE SOIL
- COMPACTED FILL
- ASPHALT
- GRAVEL
- PEA GRAVEL (AB)
- AB MATERIAL
- BEDDING MATERIAL
- STATIC WATER TABLE
- MPE-1 — MULTI PHASE EXTRACTION WELL
- ABOVE GROUND MPE PIPE
- UNDER GROUND MPE PIPE
- DCP — DOUBLE CONTAINMENT PIPE (ABOVE GROUND)
- DCP — DOUBLE CONTAINMENT PIPE (UNDER GROUND)
- F — FUTURE PIPE (ABOVE GROUND)
- F — FUTURE PIPE (BELOW GROUND)
- EXISTING MANHOLE
- EXISTING UTILITY VALVE BOX
- EXISTING UTILITY POLE
- SVE-101 — EXISTING SOIL VAPOR EXTRACTION WELL
- EXISTING UNDERGROUND PIPE
- s — EXISTING SANITARY SEWER
- W — EXISTING POTABLE WATER
- EXISTING PROPERTY LINE
- X — EXISTING CHAINLINK FENCE
- SIAMEESE CONNECTION
- FIRE HYDRANT

SECTION LETTER OR DETAIL NUMBER IDENTIFICATION — LETTER DESIGNATION DEFINES A SECTION NUMBER DESIGNATION DEFINES A DETAIL

SHEET NUMBER FROM WHICH SECTION OR DETAIL IS TAKEN "–" INDICATES REFERENCED IN MULTIPLE LOCATIONS OR IS TYPICAL — SHEET NUMBER ON WHICH SECTION OR DETAIL IS DRAWN

ABBREVIATIONS:

AB – ANCHOR BOLT
ABV – ABOVE
ACC – ACCESS
ACI – AMERICAN CONCRETE INSTITUTE
A/C – AIR CONDITIONING
ACFM – ACTUAL CUBIC FEET PER MINUTE
ADWR – ARIZONA DEPARTMENT OF WATER RESOURCES
AGS – ABOVE GRADE SURFACE
AFF – ABOVE FINISHED FLOOR
AP – ACCESS PANEL
ADD – ADDENDUM
ADH – ADHESIVE
AGG – AGGREGATE
APX – APPROXIMATE
ADEQ – ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
ASTM – AMERICAN STANDARD OF TESTING AND MATERIALS
ASPH – ASPHALT
ASSE – AMERICAN SOCIETY SANITARY ENGINEERS
AST – ABOVEGROUND STORAGE TANK
ADA – AMERICAN DISABILITY ACT
APWA – AMERICAN PUBLIC WORKS ASSOCIATION

BPL – BEARING PLATE
BEL – BELOW
BGS – BELOW GRADE SURFACE
BM – BENCH MARK
BIT – BITUMINOUS
BS – BOTH SIDES
BRZ – BRONZE
BLDG – BUILDING
BFV – BUTTERFLY VALVE

CEM – CEMENT
CS – CARBON STEEL
CF – CUBIC FOOT
CFM – CUBIC FEET PER MINUTE
CFR – CODE OF FEDERAL REGULATIONS
CHAM – CHAMFER
CIPC – CAST IN PLACE CONCRETE
CI – CAST IRON
CIMJ – CAST IRON MECHANICAL JOINT
CK – CAULKING
CL – CENTERLINE
CLR – CLEARANCE
CLSM – CONTROLLED LOW STRENGTH MATERIAL
CMU – CONCRETE MASONRY UNIT
COL – COLUMN
CONC – CONCRETE
CONT – CONTINUOUS
COT – CITY OF TUCSON
CS – CARBON STEEL
CSMT – CASEMENT
CV – CHECK VALVE
CY – CUBIC YARD

DCP – DOUBLE CONTAINMENT PIPE
DIA – DIAMETER
DIM – DIMENSION
DOT – DEPARTMENT OF TRANSPORTATION
DPI – DIFFERENTIAL PRESSURE INDICATOR
DTL – DETAIL
DR – DOOR
DWG – DRAWING

E – EAST
ELEC – ELECTRIC
ELEV – ELEVATION
EMB – EMBEDMENT
EX – EXISTING
EXP – EXPOSED
EB – EXPANSION BOLT
EXT – EXTERIOR

FF – FINISHED FLOOR
FLX – FLEXIBLE
FD – FLOOR DRAIN
FH – FIRE HYDRANT
FM – FLOW METER
FMP – FLOW MONITORING PORT
FND – FOUNDATION
FBO – FURNISHED BY OTHERS
FT – FEET
FUT – FUTURE

GAC – GRANULATED ACTIVATED CARBON
GALS – GALLONS
GALV – GALVANIZED
GP – GALVANIZED PIPE
GR – GRADE
GS – GALVANIZED STEEL
GV – GLOBE VALVE
GD – GRADING
GVL – GRAVEL
GT – GROUT

HASP – HEALTH AND SAFETY PLAN
HTG – HEATING
HVAC – HEATING/VENTILATION /AIR CONDITIONING
HD – HEAVY DUTY
HK – HOOK(S)
HOR – HORIZONTAL
HP – HORSE POWER
HB – HOSE BIB
HWST – HOT WATER STORAGE TANKS
HYD – HYDRAULIC

IBC – INTERNATIONAL BUILDING CODE
IZ – IMPREGNATED ZEOLITE
INCL – INCLUDE
ID – INSIDE DIAMETER
INT – INTERIOR
INV – INVERT
IE – INVERT ELEVATION
IPS – IRON PIPE SIZE

JT – JOINT
JTF – JOINT FILLER

KSI – KIPS PER SQUARE INCH
KO – KNOCKOUT

LBL –LABEL
LB – LAG BOLT
LRP – LIQUID RING PUMP
LW – LIGHT WEIGHT
LWC – LIGHT WEIGHT CONCRETE
LPC – LIQUID PHASE CARBON
LVR –LOUVRE

MAG – MARICOPA ASSOCIATION OF GOVERNMENT
MPE – MULTI PHASE EXTRACTION
MTL(S) – MATERIALS
MECH – MECHANICAL
MH – MANHOLE
MFR – MANUFACTURER
MAX – MAXIMUM
MIN – MINIMUM
MISC – MISCELLANEOUS

NOM – NOMINAL
NMT – NON METALLIC
NRV – NON RETURN VALVE
NTS – NOT TO SCALE
NPT – NATIONAL PIPE THREAD
NFPA – NATIONAL FIRE PROTECTION ASSOCIATION
NOAA – NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

OSHA – OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OC – ON CENTER
OCEW – ON CENTER EACH WAY
OPP – OPPOSITE
OD – OUTSIDE DIAMETER
OH –OVERHEAD
OHE – OVERHEAD ELECTRIC
OWS – OIL–WATER SEPARATOR

PCE – PERCHLOROETHYLENE
PCF – PONDS PER CUBIC FOOT
PNT – PAINT
PV – PAVING
PVMT – PAVEMENT
PED – PEDESTAL
PER – PARK EUCLID REGIONAL
PKG – PARKING
PDEQ – PIMA COUNTY DEPARTMENT OF ENVIRONMENTAL QUALITY
PI – PRESSURE INDICATOR
PL – PROPERTY LINE
PVC – POLYVINYL CHLORIDE
PSI – POUNDS PER SQUARE INCH

Q – FLOW RATE

RAD – RADIUS
RED – REDUCING
REF – REFERENCE
RH – RELATIVE HUMIDITY
RE – REINFORCE (D), (ING)
REV – REVISION (S), REVISED
RMA – RUBBER MANUFACTURERS ASSOCIATION
RO – ROUGH OPENING
R/R – RESTROOM

SCH – SCHEDULE
SCFM – STANDARD CUBIC FEET PER MINUTE
SNT – SEALANT
SEC – SECTION
SHT – SHEET
SIM – SIMILAR
SL – SLEEVE
S – SOUTH
SP – SAMPLE PORT
SPC – SPACER
SPEC – SPECIFICATION
SPL – SPECIAL
SRP – SALT RIVER PROJECT
SS – STAINLESS STEEL
STL – STEEL
STR – STRUCTURAL
STA – STATION
STD – STANDARD
SVE – SOIL VAPOR EXTRACTION
SYS – SYSTEM
SXS – SOCKET BY SOCKET
SXT – SOCKET BY THREADED

TDH – TOTAL DYNAMIC HEAD
THK – THICK
TI – TEMPERATURE INDICATOR
TOB – TOP OF BERM
TOW – TOP OF WALL
TS – TUBULAR STEEL
TYP – TYPICAL
TBM – TEMPORARY BENCH MARK

UPC – UNIFORM PLUMBING CODE
UG – UNDERGROUND

VERT – VERTICAL
VMP – VACUUM MONITORING PORT

WQARF – WATER QUALITY ASSURANCE REVOLVING FUND
WS – WATER STOP
WWET – WASTEWATER EQUALIZATION TANK
WWF – WELDED WIRE FABRIC
W – WELDED
WO – WITHOUT
WI – WROUGHT IRON

XLPE – CROSS LINKED POLYOLEFIN

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 4-14-08 ARIZONA U.S.A. EXPIRES 06-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	9-05	RE-ISSUED FOR CONSTRUCTION
2	MB	2-06	RE-ISSUED FOR PERMIT
AB	WN	8-08	AS-BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE: AS NOTED		DATE
DESIGNED BY:	MAB/JWB	2-06
DRAWN BY:	KLP	2-06
CHECKED BY:	PJS, JMW	2-06
APPROVED BY:	MAB	2-06
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

DRAWING INDEX, LEGEND AND ABBREVIATIONS

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. G-2
REV. AB

P:\mission linen\CADD\DESIGN\MPE SYSTEM\REV-2\G-2-R2.dwg 03-03-06

GENERAL PROJECT NOTES

1. CONTRACTOR IS ADVISED THAT SOIL AND GROUNDWATER BENEATH THE SITE IS IMPACTED WITH KNOWN CONTAMINANTS OF DIESEL FUEL, TETRACHLOROETHENE (PCE) AND ASSOCIATED DAUGHTER PRODUCTS TRICHLOROETHENE, (TCE), CIS-1, 2 DICHLOROETHENE (CIS-1,2-DCE), AND VINYL CHLORIDE. THESE CONTAMINANTS MAY BE ENCOUNTERED DURING CONSTRUCTION AND INSTALLATION OF SUBGRADE INFRASTRUCTURE. ALL PERSONNEL WORKING FOR THE CONTRACTOR MUST POSSESS ON HIS OR HER PERSON AT ALL TIMES, A VALID CERTIFICATION IN CONFORMANCE WITH OSHA REQUIREMENTS UNDER 29 CFR 1910.120.

2. THE CONTRACTOR IS RESPONSIBLE FOR CONDUCTING A SITE VISIT AND FOR VERIFYING ALL EXISTING INFORMATION SHOWN OR SPECIFIED ON THE DRAWINGS. THE CONTRACTOR SHALL NOT SCALE WORKING DIMENSIONS FROM PLANS, SECTIONS OR DETAILS SHOWN ON THE DRAWINGS.

3. ALL NOTES SHALL APPLY TO ALL CONSTRUCTION DISCIPLINES INVOLVED IN THIS PROJECT. ALL WORK SHALL BE COMPLETED BY LICENSED CONTRACTORS REGISTERED, INSURED AND BONDED WITH THE STATE OF ARIZONA REGISTRAR OF CONTRACTORS. CONSTRUCTION SHALL CONFORM TO CURRENT CODE REQUIREMENTS AND STANDARDS RECOGNIZED BY THE LOCAL PERMITTING AUTHORITY.

4. THE WORD OWNER OR PLANT SHALL BE REFERRED TO INTERCHANGEABLY WITHIN THE DRAWINGS, NOTES AND PROJECT SPECIFICATIONS. EACH WORD IN TEXT SHALL REFER TO THE MISSION LINEN & SUPPLY COMPANY.

5. THE WORD CITY, AND ABBREVIATED TEXT COT IS USED INTERCHANGEABLY WITHIN TEXT ON THE DRAWINGS TO REFER TO THE CITY OF TUCSON.

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ARRANGING AND COORDINATING CONSTRUCTION OF ALL APPLICABLE WORK TO BE DONE "BY OTHERS."

7. CONTRACTOR EQUIPMENT STAGING AND STORAGE AREAS, SANITATION FACILITIES, AND TEMPORARY OFFICE TRAILERS LOCATIONS SHALL BE APPROVED BY THE OWNER OR ENGINEER PRIOR TO COMMENCEMENT OF WORK.

8. THE CONTRACTOR IS RESPONSIBLE FOR PROTECTING THE WELFARE OF THE GENERAL PUBLIC FOR THE DURATION OF THE PROJECT (24-HOURS PER DAY FOR EACH CALENDAR DAY OF THE PROJECT DURATION) AND THE CONTRACTOR SHALL PROVIDE PROTECTION (INCLUDES INSTALLING FENCING, TRAFFIC BARRICADES, LIGHTING, SECURITY PERSONNEL, ETC.) OF ALL WORK AREAS AT NO ADDITIONAL COST TO THE OWNER OR ENGINEER.

8. THE CONTRACTOR SHALL PROVIDE THE ENGINEER WITH A GANT CHART SCHEDULE OUTLINING PROJECT MILESTONES AND COMPLETION DATES.

10. ALL WORK AND MATERIALS MUST CONFORM TO THE PROJECT SPECIFICATIONS SHOWN ON THE DRAWINGS, APPLICABLE CODES, RELATED DOCUMENTS (REQUEST FOR QUOTATION FOR MPE SYSTEM, AND CONSTRUCTION OF MPE SYSTEM), AND CITY AMENDMENTS.

11. THE CONTRACTOR SHALL MAINTAIN ON-SITE A COPY OF THE APPROVED PLANS, A COPY OF ALL APPROVED SHOP DRAWINGS, SUBMITTALS, SCHEDULES, PERMITS AND PLANS. ALL SUCH RECORDS SHALL BE MADE READILY AVAILABLE ON REQUEST, AS REQUESTED BY THE OWNER, ENGINEER, AND COT AS REQUIRED BY PERMIT.

12. COMPACTION BY WATER JETTING OR WATER SETTLING IS NOT ALLOWED FOR SUBGRADE PIPING TRENCH BACKFILL. ONLY EQUIPMENT SPECIFICALLY DESIGNED FOR MECHANICAL COMPACTION ARE ALLOWED.

13. DAMAGED ASPHALT AND/OR DISPLACED CONCRETE CURB, GUTTER, SIDEWALK, OR DRIVEWAY SLABS SHALL BE REPLACED OR REPAIRED AS DIRECTED BY THE OWNER BEFORE FINAL ACCEPTANCE OF THE WORK.

14. THE CONTRACTOR'S CONSTRUCTION SUPERINTENDENT SHALL BE ON-SITE AT ALL TIMES THAT CONSTRUCTION ACTIVITIES ARE IN OPERATION. THE SUPERINTENDENT SHALL HAVE A MOBILE PHONE ON HIS OR HER PERSON SUCH THAT COMMUNICATION IS READILY AVAILABLE BETWEEN THE OWNER, ENGINEER AND CONTRACTOR.

15. THE CONTRACTOR IS RESPONSIBLE TO FOLLOW ALL APPLICABLE GUIDELINES, STANDARDS AND RECOMMENDATIONS SET FORTH BY OSHA. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING A HEALTH AND SAFETY PLAN TO THE ENGINEER FOR APPROVAL PRIOR TO COMMENCEMENT OF ANY WORK ACTIVITIES. THE PLAN SHALL BE PREPARED IN CONFORMANCE WITH OSHA STANDARDS.

16. WITH THE EXCEPTION OF THE HAUL PLAN, THE ENGINEER WILL OBTAIN ALL CONSTRUCTION AND BUILDING PERMITS AND COORDINATE ALL APPLICABLE INSPECTIONS. THE CONTRACTOR AND ALL RELATED TRADE DISCIPLINES SHALL BE RESPONSIBLE FOR BEING READILY AVAILABLE TO SUPPORT THE ENGINEER AT THE SITE FOR ALL ON-SITE INSPECTIONS WHERE REQUIRED.

17. CONTRACTOR IS ADVISED THAT THE PERIMETER OF THE BUILDING IS LOCATED ON, AND/OR ENCROACHES ON OR OVER THE OWNERS PROPERTY LINE AT THE NORTH, EAST AND SOUTH BOUNDARIES. DRAWING C-1 SHOWS THE BOUNDARY AS REFERENCED BY SURVEY. SURVEY DATA SHOWN IN THE CONTEXT OF THE DRAWINGS IS REPRESENTATIVE OF A SITE SURVEY COMPLETED BY A REGISTERED LAND SURVEYOR AS REFERENCED ON DRAWING C-1.

18. CONTRACTOR SHALL PROVIDE THE ENGINEER WITH A LIST OF COMPANIES THAT CAN BE RELIED UPON TO BE READILY AVAILABLE 24-HOURS PER DAY/7 DAYS PER WEEK TO PROVIDE EMERGENCY REPAIR SERVICES FOR COMMERCIAL AND INDUSTRIAL TRADE WORK RELATED TO: 1) PLUMBING SYSTEMS, 2) MECHANICAL - HVAC SYSTEMS, 3) ELECTRICAL SYSTEMS, AND 4) CONCRETE AND MASONRY.

19. CONTRACTOR IS ADVISED THAT THE SITE WORK FOR THIS PROJECT WILL BE CONDUCTED AT AN ACTIVE LAUNDRY FACILITY. THE FACILITY IS AN INDUSTRIAL PLANT THAT PROVIDES SERVICES TO: 1) PICK-UP, 2) PROCESS, 3) CLEAN, AND 4) DELIVER COMMERCIAL AND INDUSTRIAL TYPE LAUNDRY. UNLESS SPECIFIED OTHERWISE THE PROJECT'S WORK HOURS SHALL BE BETWEEN THE HOURS OF 4:00 PM AND 4:00 AM, MONDAY THROUGH FRIDAY, EXCEPT HOLIDAYS. WEEKEND WORK MAY BE CONDUCTED BETWEEN FRIDAY 4:00 PM AND MONDAY 4:00 AM.

20. THE CONTRACTOR SHALL PROVIDE TEMPORARY PROTECTION AS NECESSARY SUCH THAT FACILITY OPERATIONS ARE NOT HINDERED OR IMPEDED IN ANY WAY. PRIOR TO INSTALLATION, THE ENGINEER MUST APPROVE ALL TEMPORARY PROTECTION.

21. CONTRACTOR SHALL MAINTAIN ALL WORK AREAS SUCH THAT THE FACILITY REMAINS CLEAN AT ALL TIMES.

22. CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER WHEN CONFLICTS BETWEEN THE DRAWINGS AND ACTUAL CONDITIONS ENCOUNTERED ON SITE ARE DISCOVERED.

PRESSURE TESTING

1. CONTRACTOR SHALL CONDUCT A PRESSURE TEST USING WATER FOR EACH SECTION OF INSTALLED PIPE. PRESSURE TESTING FOR PVC PIPE SHALL BE CONDUCTED UNDER MODERATE PRESSURE (25 PSI) FOR A PERIOD OF 1 HOUR. ANY PRESSURE LOSS DURING ONE HOUR IS CONSIDERED A FAILURE. CONTRACTOR SHALL FURNISH AND INSTALL ALL TESTING EQUIPMENT; INCLUDING BUT NOT LIMITED TO BLIND FLANGES, CAPS, AIR RELEASE VALVE AND PRESSURE GAUGES THAT MAY BE NEEDED TO TEST PIPING SECTIONS.

2. TESTING SHALL BE CONDUCTED AFTER BACKFILLING PIPING AND BEFORE PLACEMENT OF PERMANENT SURFACE COMPLETIONS.

3. THE CONTRACTOR MAY PERFORM SIMULTANEOUS OR SEPARATE PRESSURE TESTS ON PIPING SECTIONS AS APPROVED BY THE ENGINEER. PIPING SHALL NOT LEAK. THE CONTRACTOR AT NO ADDITIONAL COST TO THE ENGINEER OR OWNER SHALL IMMEDIATELY REPLACE LEAKING OR FAILED PIPING.

UNDERGROUND FACILITIES

1. THE CONTRACTOR IS NOTIFIED THAT UNDERGROUND FACILITIES (REFERED TO HEREIN AS SUBGRADE UTILITIES, CONDUITS, DRAINAGE DEVICES, PIPING, VALVES, ETC.) ARE LOCATED BENEATH SEVERAL WORK AREAS AS IDENTIFIED IN THE DRAWINGS. THE DRAWINGS MAY NOT SHOW ALL UTILITIES LOCATED BENEATH THE SITE AND UTILITIES SHOWN ARE BASED ON UTILITY MARKOUT LOCATIONS THAT MAY NOT DEPICT THE EXACT LOCATION OF THE UTILITIES. PRIOR TO COMMENCING CONSTRUCTION THE CONTRACTOR SHALL CONTACT THE ARIZONA BLUE STAKE CALL CENTER (1-800-782-5348) FOR UTILITY LOCATION MARKOUTS. THE CONTRACTOR SHALL NOT PROCEED WITH ANY SITE WORK UNTIL THE CONTRACTOR HAS RECEIVED CONFIRMATION FROM ALL RELATED UNDERGROUND FACILITY COMPANIES.

CONTRACTOR SHALL MAINTAIN VALID BLUE STAKE CASE NUMBERS FOR THE DURATION OF THE PROJECT WORK. CASE NUMBER RECORDS MUST BE MAINTAINED ON-SITE AT ALL TIMES.

2. UNDERGROUND FACILITIES ENCOUNTERED BY THE CONTRACTOR NOT SHOWN ON THE DRAWINGS SHALL BE REPORTED TO THE ENGINEER. THE CONTRACTOR SHALL MARK THE LOCATION OF THE FACILITY ON THE DRAWINGS FOR REFERENCE AND SHALL PROVIDE THE DEPTH AND SIZE OF THE UNDERGROUND FACILITY. THE CONTRACTOR SHALL ALSO REPORT TO THE ENGINEER ANY DISCREPANCIES RELATIVE TO UNDERGROUND FACILITIES SHOWN ON THE DRAWINGS.

3. THE CONTRACTOR SHALL NOT DISTURB, SHUT DOWN, COMPROMISE OR INTERRUPT ANY EXISTING FACILITY WITHOUT AUTHORIZATION FROM THE SPECIFIC UTILITY OR ORDER BY THE ENGINEER. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY PROTECTION OR SHORING OF UTILITIES, IF NECESSARY AT NO ADDITIONAL COST TO THE OWNER OR ENGINEER.

VALVES & SPECIALTY FITTINGS

1. UNLESS SPECIFIED OR SHOWN OTHERWISE ON THE DRAWINGS:

A. BALL VALVES - SHALL BE SOCKET TYPE, SCH 80 PVC - TYPE 1, GRADE 1 CONFORMING TO ASTM D-1784, TRUE UNION BALL VALVES EQUIPPED WITH VITON SEALS

B. CHECK VALVES - SHALL BE SOCKET TYPE, SCH 80 PVC - TYPE 1, GRADE 1 CONFORMING TO ASTM D-1784, TRUE UNION BALL CHECK VALVES EQUIPPED WITH VITON-O-RINGS.

C. LOCAL INDICATOR ISOLATION VALVES - SHALL BE SOCKET TYPE, SCH 80 PVC

D. GAUGE GUARDS - SHALL BE SCH 80 PVC - TYPE 1, GRADE 1 CONFORMING TO ASTM D-1784 AND EQUIPPED WITH A VITON MEMBRANE.

E. GAUGES - VACUUM AND PRESSURE GAUGES SHALL BE LIQUID FILLED, STAINLESS STEEL CASE GAUGES AND EQUIPPED WITH A PROTECTIVE DIAPHRAGM. DIAL SIZES, SCALES AND RANGES SHALL BE PROVIDED AS SHOWN ON THE DRAWINGS.

SITE GRADING, EXCAVATION, GRADING AND BACKFILL ACTIVITIES

1. SITE GRADING SHALL BE PERFORMED IN ACCORDANCE WITH THE PROVISIONS OF CHAPTER 18 OF THE INTERNATIONAL BUILDING CODE (CITY OF TUCSON APPROVED EDITION) AND CONTRACT DOCUMENTS.

2. RELATIVE COMPACTION OF 95% SHALL MEAN SOIL COMPACTED TO A DRY DENSITY EXCEEDING 95% OF THE MAXIMUM DRY DENSITY IN ACCORDANCE WITH A STANDARD PROCTOR IN ACCORDANCE WITH ASTM D-698.

3. CONTRACTOR IS ADVISED THAT ROCK OR UNACCEPTABLE FILL MATERIAL MAY BE ENCOUNTERED DURING GENERAL EXCAVATION AND TRENCHING ACTIVITIES. WHERE SUCH MATERIAL IS ENCOUNTERED CONTRACTOR SHALL (AT NO ADDITIONAL COST TO THE OWNER) EXCAVATE SAID ROCK OR UNACCEPTABLE FILL MATERIAL AND REMOVE IT OFFSITE TO A LOCATION APPROVED BY THE ENGINEER AND OWNER.

4. CONTRACTOR SHALL FURNISH AND INSTALL SELECTED FILL MATERIAL IN ACCORDANCE WITH THE REQUIREMENTS SHOWN ON THE DRAWINGS.

5. ALL SURFACES AND EXCAVATIONS TO RECEIVE FILL SHALL BE GRADED AND SCARIFIED TO A DEPTH OF AT LEAST 8-INCHES. THE SURFACE TO BE FILLED SHALL ALSO BE WORKED UNTIL IT IS FREE FROM ROOTS, ORGANIC MATTER AND OTHER MATERIALS THAT MAY CAUSE AN UNEVEN SURFACE OR UNWARRANTED SOIL ARCHING OR BRIDGING THAT MAY CAUSE UNEVEN COMPACTION.

6. ALL CONCRETE SHOWN ON THE DRAWINGS UNLESS OTHERWISE NOTED SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.

7. AS APPROVED BY THE ENGINEER, SUITABLE, APPROVED NATIVE MATERIAL MAY BE USED FOR THE REMAINING TRENCH BACKFILL OPERATION BEING THAT THE COMPACTION REQUIREMENTS ARE MET.

8. CONTRACTOR SHALL NOT SAW-CUT, REMOVE AND/OR EXCAVATE ANY CONCRETE OR SOIL THAT CANNOT BE FOLLOWED BY THE IMMEDIATE INSTALLATION OF SUBGRADE PIPING, FITTINGS, VAULTS AND CONCRETE SURFACE PAVEMENT.

9. CONTRACTOR SHALL SECURE A CERTIFIED INDEPENDENT GEOTECHNICAL TESTING FIRM TO VERIFY CIOMPACTION REQUIREMENTS FOR ALL ORIGINAL GRADES/SUBGRADES, LIFTS AND FINISHED GRADE SURFACES WHERE APPLICABLE.

10. CONTRACTOR SHALL PROVIDE ALL SHORING, TRENCH BOXES, AND EQUIPMENT TO INSTALL SUBGRADE INFRASTRUCTURE. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH OSHA 29 CFR 1926 SUBPART P.

FENCING

1. FENCING SHALL BE CONSTRUCTED AT THE LOCATIONS SHOWN ON THE DRAWINGS. ALL FENCE POSTS AND GATE FRAMES SHALL BE HOT DIPPED GALVANIZED INSIDE AND OUT.

2. UNLESS SPECIFIED OTHERWISE FENCING SHALL BE INSTALLED TO A HEIGHT OF 72-INCHES.

3. FABRIC SHALL CONFORM TO ASTM A315 AND BE CONSTRUCTED OF NO. 11 GAUGE WIRE WOVEN IN A 2-INCH MESH. FABRIC SHALL HAVE A HOT-DIPPED GALVANIZED COATING NOT LESS THAN 1.2 OUNCES OF ZINC PER SQUARE FOOT.

4. LINE POSTS, CORNER POSTS AND TOP RAILS SHALL BE STANDARD WEIGHT SCHEDULE 40 AND CONFORM TO ASTM A120.
   LINE POSTS SHALL BE 1.5 INCH NOMINAL DIAMETER (1.9-INCH O.D)
   CORNER POSTS SHALL BE 2-INCH NOMINAL DIAMETER (2.375-INCH O.D.)
   TOP RAILS SHALL BE 1.25-INCHES NOMINAL DIAMETER (1.66-INCH O.D.)

5. ALL JOINTS FOR LINE POSTS, CORNER POSTS, TOP RAILS AND GATES SHALL BE WELDED AND BRACED WHERE NECESSARY.

6. FRAMES FOR GATES SHALL BE 1.5-INCH NOMINAL DIAMETER. GATES SHALL BE COVERED WITH FABRIC TO MATCH FENCING.

7. ALL POSTS SHALL BE EMBEDDED IN CONCRETE FOOTINGS INSTALLED TO A DEPTH OF 36-INCHES BELOW EXISTING GROUND SURFACE. FOOTINGS SHALL BE COMPLETED TO GROUND SURFACE AND ROUNDED TO DRAIN WATER.

SITE CONTROL

1. CONTRACTOR IS RESPONSIBLE FOR PROVIDING SECURITY FOR ITS PERSONNEL, SUBCONTRACTORS AND ALL RELATED EQUIPMENT (RENTED, LEASED OR OWNED) AND PROJECT MATERIALS (RENTED, LEASED OR PURCHASED).

2. A HAUL PLAN MAY BE REQUIRED FOR MATERIAL IMPORTED OR EXPORTED TO AND FROM THE SITE. PIMA COUNTY AND/OR ADEQ PERMITS MAY BE REQUIRED. CONTRACTOR IS RESPONSIBLE TO OBTAIN AND PAY ALL COSTS ASSOCIATED WITH OBTAINING APPLICABLE PERMITS AND IS RESPONSIBLE FOR ADHERING TO THE REQUIREMENTS STATED IN THE PERMIT(S).

3. THE FACILITY LOADING DOCK MUST REMAIN UNDISTURBED FOR THE DURATION OF THE PROJECT. THE CONTRACTOR WILL BE RESPONSIBLE FOR ANY DISTURBANCE THAT CAUSES FINANCIAL IMPACT OR LOSS TO THE OWNER AT NO ADDITIONAL COST TO THE ENGINEER OR OWNER.

4. UNLESS SPECIFIED OTHERWISE, CONTRACTOR IS RESPONSIBLE FOR MAINTAINING PROPER AND ADEQUATE ACCESS TO AND FROM THE FACILITY (INCLUDING LOADING DOCK AREA) AT ALL TIMES. FACILITY PERSONNEL MUST HAVE UNIMPEDED ACCESS TO VEHICLES AND EQUIPMENT

5. THE CONTRACTOR SHALL PROVIDE DUST CONTROL MITIGATION AND SOUND ABATEMENT WHERE NECESSARY AT NO ADDITIONAL COST TO THE OWNER OR ENGINEER.

6. CONTRACTOR AGREES TO PROTECT ALL ADJACENT PROPERTIES AND EXISTING IMPROVEMENTS, INCLUDING POSITIVE CONTROL OF EARTH SPILLAGE, CONSTRUCTION WATER AND STORM WATER RUNOFF. THIS INCLUDES BUT IS NOT LIMITED TO TRAFFIC CONTROL SIGNS, BARRIERS, TEMPORARY LIGHTING, TEMPORARY FENCING AND ROAD PLATES. CONTRACTOR AGREES TO PROVIDE SOUND ATTENUATION BARRIERS AS NEEDED TO DAMPEN SOUND DURING EVENING HOURS.

7. UNLESS SPECIFIED OTHERWISE, CONTRACTOR IS ADVISED THAT INTERNAL COMBUSTION EQUIPMENT IS STRICTLY PROHIBITED FROM OPERATING INSIDE THE BUILDING.

8. CONTRACTOR IS ADVISED THAT THE BUILDING CURRENTLY ENCROACHES ON, AT ORE BEYOND THE OWNERS PROPERTY LINE AT THE BUILDING.

PIPING AND FITTINGS

1. PIPING MATERIALS AND FITTINGS SHALL BE SUBJECT TO THE TEST PRESSURES SHOWN ON THE DRAWINGS, INCLUDING VACUUM PRESSURES.

2. PROVIDE DOUBLE CONTAINMENT PIPING WHERE SHOWN ON THE DRAWINGS.

3. UNLESS OTHERWISE NOTED, PIPING MATERIALS SHALL BE SCHEDULE 80 PVC WITH SOLVENT WELDED SOCKET FITTINGS.

4. OPEN ENDS AND OPEN PENETRATIONS OF ALL PIPING AND FITTINGS SHALL BE TEMPORARILY CAPPED TO PREVENT DEBRIS OR UNWARRANTED MATTER FROM ENTERING THE PIPING. CAPPING SHALL INCLUDE BUT NOT BE LIMITED TO INSTALLATION OF BLIND FLANGES, THREADED CAPS, OR THREADED PLUGS. USE OF DUCT TAPE, TOWELS OR RAGS IS PROHIBITED.

5. PIPING RUNS SHALL BE LABELED AND IDENTIFIED AS SHOWN ON THE DRAWINGS. LABELING SHALL BE INSTALLED ON BOTH BELOW GROUND AND ABOVE GROUND INSTALLATIONS FOR THE DURATION OF CONSTRUCTION ACTIVITIES SUCH THAT PIPING IS READILY IDENTIFIED AT ALL TIMES.

6. PVC PIPING WHERE SHOWN ON THE DRAWINGS, SHALL BE SOLVENT WELDED IN ACCORDANCE WITH THE REQUIREMENTS OF ASTM F656-93 FOR PRIMER AND ASTM D2564 FOR SOLVENT CEMENT. SOLVENT SHALL BE APPLIED DELIBERATELY AND WITHOUT DELAY.

7. FLANGED CONNECTIONS WHERE SHOWN ON THE DRAWINGS SHALL BE COMPLETED IN ACCORDANCE WITH THE MANUFACTURE'S RECOMMENDATIONS.

8. NO THREADED OR FLANGED CONNECTIONS SHALL BE MADE BELOW GROUND SURFACE.

9. PIPE SHALL BE SUPPORTED WITH HANGERS, STANCHIONS, ANCHORED SUPPORTS OR SUPPORT MANIFOLDS AS SHOWN ON THE DRAWINGS.

10. ALL PIPE AND FITTINGS SHALL BE PROTECTED FROM DIRECT EXPOSURE TO SUNLIGHT AND AMBIENT CONDITIONS.

11. IF AN OBSTRUCTION THAT IS NOT SHOWN ON THE DRAWINGS IS ENCOUNTERED AND INTERFERES WITH THE INSTALLATION OF WORK, THE CONTRACTOR SHALL NOTIFY THE ENGINEER BEFORE PROCEEDING WITH THE INSTALLATION OF SAID WORK. THE ENGINEER SHALL APPROVE ALTERATIONS, RELOCATION AND REALIGNMENT OF PIPING DUE TO THE OBSTRUCTION.

12. CUTS SHALL BE SMOOTH AND SQUARE. ALL ENDS SHALL BE BEVELED WITH A HAND-FILE AND DEBURRED. PIPE SHAVINGS, CHIPS AND OTHER DEBRIS RESULTING FROM CUTTING MUST BE REMOVED FROM PIPING TO PREVENT UNWARRANTED MATTER FROM ACCUMULATING IN THE SYSTEM.

13. THREADED CONNECTIONS SHALL MEET THE FOLLOWING REQUIREMENTS:

A. INSTALLED WITH AN APPROVED PIPE SEALANT: 1) TEFLON TAPE WITH A THICKNESS NOT TO EXCEED 3.5 MILS, OR A MANUFACTURER APPROVED 2) PIPE DOPE WITH TEFLON.

B. MALE METAL THREADS SHALL NOT BE INSTALLED INTO PLASTIC FEMALE THREADED FITTINGS.

C. CLOSE NIPPLES ARE PROHIBITED.

D. PLASTIC TO PLASTIC CONNECTIONS SHALL BE INSTALLED AS SHOWN ON THE DRAWINGS OR AS APPROVED BY THE ENGINEER.

E. PLASTIC TO METAL CONNECTIONS SHALL MEET THE FOLLOWING CONDITIONS:

1. A MALE PLASTIC THREAD CAN BE INSERTED INTO A FEMALE METAL THREADED JOINT IF HEAT IS NOT INVOLVED AND BOTH LINES BEARING THE DISSIMILAR MATERIALS ARE IMMEDIATELY ANCHORED AND SECURED.

2. METAL FLANGE TO PLASTIC FLANGE FITTINGS MAY BE USED WITH A COMPRESSIBLE GASKET.

Two working days before you dig, CALL FOR THE BLUE STAKES
1-800-STAKE-IT
1-800-782-5348
(OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE

REVISIONS

NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	9-05	RE-ISSUED FOR CONSTRUCTION
2	MB	2-06	RE-ISSUED FOR PERMIT

REVISIONS

NO.	BY	DATE	DESCRIPTION

Registered Professional Engineer (Environmental) CERTIFICATE NO. 41997 MICHAEL A. BARONE Expires 3-8-08 ARIZONA, U.S.A.

		DATE
SCALE:	AS NOTED	
DESIGNED BY:	MAB/JWB	2-06
DRAWN BY:	KLP	2-06
CHECKED BY:	PJS, JMW	2-06
APPROVED BY:	MAB	2-06
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

GENERAL NOTES

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. G-3
REV. 2

P:\mission linen\CADD\DESIGN_MPE_SYSTEM\REV-2\G-3-R2.dwg 02-20-06

CONCRETE FOR PIPE TRENCHES INSIDE BUILDING

1. ALL CONCRETE FURNISHED AND INSTALLED FOR PIPE TRENCHES SHALL BE ASTM TYPE III, HIGH EARLY STRENGTH, WITH 28 DAY COMPRESSIVE STRENGTH OF 6,000-PSI.

2. CONCRETE COVERING PIPE TRENCHES SHALL BE LEVEL AND SMOOTH FINISHED TO MATCH ADJACENT FINISHED FLOOR.

3. MINIMUM THICKNESS OF NEW CONCRETE FLOOR SHALL BE 6 INCHES.

4. ALL CONCRETE DELIVERED TO THE JOB SITE MUST INCLUDE A WEIGHMASTER TICKET IN ACCORDANCE WITH MAG SPECIFICATIONS.

5. NO HAND MIXING WILL BE PERMITTED.

6. COMPACTED BASE MATERIAL MUST BE APPROVED BY ENGINEER PRIOR TO PLACING CONCRETE.

7. CONTRACTOR SHALL PULL AND TEST ONE CORE FOR EACH OF THE WELL PIPE RUNS.

8. CONCRETE REINFORCING SHALL CONFORM TO ASTM A615, GRADE 60

ASPHALT REPLACEMENT FOR PIPE TRENCHES OUTSIDE BUILDING

1. ALL PIPE TRENCHES ON ASPHALT SURFACES SHALL BE SAW-CUT.

2. PIPE TRENCHES MUST BE COVERED WITH 3/4" THICK STEEL PLATES AND BARRICADED WHEN LEFT OPEN OVERNIGHT.

3. BACKFILL AND PAVEMENT REPLACEMENT SHALL BE PER MAG SECTION 601 AND STANDARD DETAIL 200.

CONTAINED PIPING SYSTEMS

1. SECONDARY CONTAINMENT PIPING SYSTEMS SHALL BE PROVIDED AT THE LOCATIONS SHOWN ON THE DRAWINGS.

2. SECONDARY CONTAINMENT PIPING SHALL BE TERMINATED INSIDE THE SYSTEM ENCLOSURE OR AS DIRECTED BY THE ENGINEER.

3. PRIMARY CONTAINMENT PIPING SHALL BE SUPPORTED WITHIN THE SECONDARY CONTAINMENT PIPING WITH POLYPROPYLENE CENTRA-GUIDE SUPPORTS SIMILAR OR PRE-APPROVED EQUAL TO PEP PRODUCTS.

PRIMARY CONVEYANCE PIPING

1. UNLESS OTHERWISE SPECIFIED, ALL PRIMARY PIPING AND FITTINGS WHERE SHOWN ON THE DRAWINGS SHALL BE CARBON STEEL ""BLACK PIPE"" IN CONFORMANCE WITH ASTM A-53 GRADE A.

2. PRIMARY PIPING SHALL CONFORM TO ASTM A-53 GRADE A AND FITTINGS SHALL CONFORM TO ASTM A105.

3. THREAD SEALANTS SHALL BE PRE-APPROVED FOR USE BY THE ENGINEER.

4. ALL THREADS SHALL CONFORM TO NPT STANDARDS.

SECONDARY CONTAINMENT PIPING

1. SIZES, DIMENSIONS AND MATERIAL GRADES OF CONTAINMENT PIPING SHALL BE PROVIDED FOR THE FLOW STREAMS SHOWN ON THE DRAWINGS AND AS LISTED IN THE CONVEYANCE PIPE SCHEDULE.

2. EACH SYSTEM SHALL BE PROVIDED WITH SUITABLE DRAINS AND VENTS TO PROVIDE COMPLETE DRAINAGE OF THE SECONDARY CONTAINMENT PIPING SYSTEM.
DRAIN AND VENT FITTINGS SHALL BE PLACED AS DIRECTED BY THE ENGINEER.

3. ALL TERMINATION FITTINGS BETWEEN PRIMARY CONVEYANCE PIPING AND SECONDARY CONTAINMENT PIPING SHALL BE PRE-APPROVED BY THE ENGINEER.

4. ALL UNLISTED COMPONENTS THAT ARE INTENDED FOR USE IN THE SECONDARY CONTAINMENT SYSTEM SHALL BE SUITABLE FOR THE MATERIAL BEING
CONTAINED AND RATED FOR THE PRESSURES SHOWN IN THE CONVEYANCE PIPE SCHEDULE.

5. SECONDARY CONTAINMENT JOINTS SHALL BE SOLVENT-CEMENTED USING A HEAVY-BOND SLOW SET PVC CEMENT (ASTM D-2564).

6. CONTAINMENT PIPING INSTALLED OUTDOORS SHALL BE CONTINUOUSLY SUPPORTED WITH UNISTRUT SUPPORT SYSTEMS OR APPROVED EQUAL.

Reference Documents

Document No.	General Description	Date	Prepared by:	Prepared for/Submitted To:
1	Bench-Scale Analysis of Diesel-PCE Mixture	6/25/2002	Mark L. Bresseau & Kenneth C. Carroll	ADWR
	Behavior for the Park-Euclid WQARF Site:		University of Arizona, in collaboration with	
	Final Report for the Task I and Task II.		Golder Associates, Inc.	
2	Mission Linen Pilot Test Report	11/26/2003	URS Corporation	Mr. Patrick Thurman, Mission Linen Supply
3	Hazardous Area Classification Letter Document	8/9/2005	URS Corporation	Ms. Linda Pazinsky, City of Tucson Development Services Department
4	Remediation System Intent Letter Document	8/25/2005	URS Corporation	Mr. Walter Tellez, City of Tucson Development Services Department
5	Air Permit (In Progress)	In Progress	URS Corporation	Pima County Department of Environmental Quality
6	Poor Quality Groundwater Withdrawal Permit (In Progress)	In Progress	URS Corporation	ADWR
7	Industrial Wastewater Discharge Permit - Permit No. 51 10708,	6/15/2005	Mission Linen	Pima County Wastewater Management Department
	Reapplication No. 01237			
8	Flood Insurance Rate Map, Panel 2229 of 4700 - Map No. 04019C2229K	2/8/1999	National Flood Insurance Rate Map	NA

INTENT OF SYSTEM OPERATION

1. FOR REMEDIATION OF IMPACTED GROUNWATER AND SUBSURFACE SOIL. CONTAMINANTS WILL BE RECOVERED IN LIQUID AND VAPOR PHASES AND INCLUDE RECOVERY OF WEATHERED DIESEL FUEL AND CHLORINATED VOC's, CINSISTING PRIMARILY OF TETRACHLOROETHENE (PCE) AND ASSOCIATED DAUGHTER PRODUCTS OF TRICHLOROETHENE (TCE), cis-1,2-DICHLORETHENE (cis-1,2-DCE) AND VINYL CHLORIDE. RECOVERED FLUID HAS BEEN CATEGORIZED AS A COMBUSTIBLE LIQUID. CLASS II.

2. ANTICIPATED SYSTEM OPERATING PERIOD IS FOR 3 TO 5 YEARS, 24 HOURS PER DAY / 7 DAYS PER WEEK AFTER WHICH ALL EQUIPMENT SHALL BE REMOVED BY MISSION LINEN AND SUPPLY.

3. SYSTEM INSTALLATION AND OPERATION IS DUE IN PART OF AN EARLY RESPONSE ACTION ON BEHALF OF MISSION LINEN SUPPLY TO REMOVE SUBSURFACE CONTAMINANTS BENEATH THE SITE.

SITE CONTAMINANT BACKGROUND

1. SITE IS LOCATED WITHIN THE ADEQ PARK-EUCLID WQARF AREA.

2. KNOWN CONTAMINANTS BENEATH THE SITE ARE ASSOCIATED WITH HISTORICAL DRY CLEANING ACTIVITIES.

3. REFER TO NOTE 1 - INTENT OF SYSTEM OPERATION.

SITE HYDROLOGY / FLOOD ZONE CLASSIFICATION

1. THE SITE IS LOCATED IN AN AREA OUTSIDE OF THE 500 YEAR FLOOD ZONE (DESIGNATION - UNSHADED X) AS SHOWN ON THE MOST RECENT FLOOD INSURANCE RATE MAP (COMMUNITY MAP NO. 04019C2229K), 2/8/99 PREPARED BY THE NATIONAL FLOOD INSURANCE PROGRAM.

2. DESIGN PRECIPITATION FOR CONTAINMENT FOR THE PRODUCT RECOVERY TANK AND OIL-WATER SEPARATOR IS BASED ON A 25 YEAR/24 HOUR STORM EVENT.

OCCUPANCY CLASSIFICATION - FACTORY GROUP: LAUNDRIES; SECTION 306_IFC 2003

FACTORY INDUSTRIAL F-1 MODERATE HAZARD OCCUPANCY

CONTROL AREA LOAD SUMMARY[c]

AREA	CONTROL LOCATION	LOCATION DESRIPTION	AREA (ft^2)	TOTAL VOLUME[a] Solids (ft^3)	TOTAL VOLUME[a] Liquid (gals)
1	Inside Building	Former Storage Area	1,620.00	NA	95
2	Outside Building	Loading Dock Area	2,360.00	NA	2030[d]

[a]Hi-vacuum extraction blower total recovery vessel contains a maximum volume of 95 gallons of total recovered product that consists of a Class II Combustible liquid. All other containers in Control Area 1 are considered to contain a mixture of groundwater with dissolved phase VOCs.

[b]Maximum allowable quantity per control area is not exceeded; Table 2703.1.1(1) - Allowable 120 gallons x 100% (240 gallons) for facilty's automatic wet-pipe sprinkler system. Materials generated as result of remediation efforts are process orientated and are not considered long-term storage or use.

[c]Load summary based on combustible liquid only, Chapter 27 - IFC 2003.

[d] (1)Convault Storage Tank at 2,000 gallons, nom. capacity, (2) OWS Unit - Product Reservoir 30 gallons.

CONTROL AREA LOAD DESCRIPTION

AREA	UNIT	MATERIAL WT (Pounds)	VOLUME Solids (ft^3)	VOLUME Liquid (gals)
AREA 1	Liquid Phase Carbon-1	200.00	6.70	40.00
	Liquid Phase Carbon-2	200.00	6.70	40.00
	Liquid Phase Carbon-3	200.00	6.70	40.00
	Liquid Phase Carbon-4	200.00	6.70	40.00
	Particle Filter-1	NA	NA	12.00
	Particle Filter-2	NA	NA	12.00
	Organophillic-1	300.00	6.90	55.00
	Organophillic-2	300.00	6.90	55.00
	Total Fluid Recovery Vessel	NA	NA	95.00
TOTAL INDOOR AGGREGATE →		**1,400.00**	**40.60**	**389.00**
AREA 2	Vapor Phase Carbon-1	2,000.00	67.00	NA
	Vapor Phase Carbon-2	2,000.00	67.00	NA
	Vapor Phase Carbon-3	2,000.00	67.00	NA
	Impreganated Zeolite	500.00	17.00	NA
	OWS Vent Scrub	200.00	6.70	NA
	Product Tank Vent Scrub	200.00	6.70	NA
	Product Tank	NA	NA	2,000.00
	OWS	NA	NA	920.00
TOTAL OUTDOOR AGGREGATE →		**6,900.00**	**231.40**	**2,920.00**

Non Combustable

Table Notes

1) Cubic feet of carbon based on reference density of 30 pcf; Ref: Carbtrol Corporation.

2) Values shown are approximate and may vary depending upon manufacturers' equipment and materials.

3) Liquid volume contained within liquid phase carbon drums less than vessel capacity due to volume of carbon. - Information provided by US Filter Westates.

Two working days before you dig. CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE

REVISIONS

NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	9-05	RE-ISSUED FOR CONSTRUCTION
2	MB	2-06	RE-ISSUED FOR PERMIT

REVISIONS

NO.	BY	DATE	DESCRIPTION

Registered Professional Engineer (Civil) CERTIFICATE NO. 41997 MICHAEL A. BARONE Expires 3/31/06 ARIZONA U.S.A.

		DATE
SCALE:	AS NOTED	
DESIGNED BY:	JWB/MAB	2-06
DRAWN BY:	KLP	2-06
CHECKED BY:	PJS, JMW	2-06
APPROVED BY:	MAB	2-06
CLIENT APPROVAL BY:		

URS

7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

GENERAL NOTES/CONTROL AREA TABLE

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. G-4
REV. 2

P:\mission linen\CADD\DESIGN_MPE_SYSTEM\REV-2\G-4-R2.dwg 03-03-06

CONVEYANCE PIPE SCHEDULE						
Flow Stream	Piping System	System Type	Diameter (inches)	Material	Grade	Containment Pipe
1	Vacuum Piping Lateral	Vacuum	2	PVC	Schedule 80	None
2	Vacuum Piping Lateral	Vacuum	2	PVC	Schedule 80	None
3	Vacuum Piping Lateral	Vacuum	2	PVC	Schedule 80	None
4	Vacuum Piping Lateral	Vacuum	2	PVC	Schedule 80	None
5	Vacuum Piping Lateral	Vacuum	2	PVC	Schedule 80	None
6	Vacuum Piping Lateral	Vacuum	2	PVC	Schedule 80	None
7	Future Vacuum Piping Lateral	Vacuum	2	PVC	Schedule 80	None
8	Future Vacuum Piping Lateral	Vacuum	2	PVC	Schedule 80	None
9	Future Vacuum Piping Lateral	Vacuum	2	PVC	Schedule 80	None
10	Future Vacuum Piping Lateral	Vacuum	2	PVC	Schedule 80	None
11	Future Vacuum Piping Lateral	Vacuum	2	PVC	Schedule 80	None
12	Future Vacuum Piping Lateral	Vacuum	3	PVC	Schedule 80	None
13	Future Vacuum Piping Lateral	Vacuum	3	PVC	Schedule 80	None
14	Future Expansion Bypass	Vacuum	3	PVC	Schedule 80	None
15	Blower Recovery Vessel Discharge	Pressure	1.25	CS (Black Pipe)	ASTM A-53 GR. A	4-inch Dia. Sch. 80 PVC
16	Future Blower Recovery Vessel Discharge	Pressure	1.25	CS (Black Pipe)	ASTM A-53 GR. A	4-inch Dia. Sch. 80 PVC
17	Not Used					
18	OWS Product Discharge	Pressure	1.00	CS (Black Pipe)	ASTM A-53 GR. A	3-inch Dia. Sch. 80 PVC
19	Not Used					
20	OWS Water Discharge	Pressure	1.25	CS (Black Pipe)	ASTM A-53 GR. A	4-inch Dia. Sch. 80 PVC
21	OWS Vent	ATM	1.00	PVC	Schedule 80	None
22	Biomin Vessel Inflow	Pressure	2.00	Rubberized Hose	Green XLPE	None
23	Biomin Vessel Inflow	Pressure	2.00	Rubberized Hose	Green XLPE	None
24	Vapor Phase Carbon Influent	Pressure	3.00	PVC	Schedule 80	None
25	Future Vapor Phase Carbon Influent	Pressure	3.00	PVC	Schedule 80	None
26	Treated Discharge to WWET	Pressure	1.00	PVC	Schedule 80	None
27	Treated Discharge to HWST	Pressure	1.00	PVC	Schedule 80	None

FLUID MEDIA

MIXTURE OF THE FOLLOWING CONSTITUENTS:
GROUNDWATER CONTAINING A MIXTURE OF PCE (10% BY WEIGHT), DIESEL FUEL, AND VINYL CHLORIDE

CONVEYANCE PIPE TABLE NOTES

1. HOSE SHALL BE PROVIDED SIMILAR OR PRE-APPROVED EQUAL TO GREEN XLPE CONFORMING TO RMA STANDARDS.
2. GASKETS FOR ALL HOSE ADAPTORS/FITTINGS SHALL BE VITON OR ALTERNATE EQUAL.
3. ABOVE GROUND NONMETALIC PIPING INSTALLED OUTDOORS SHALL BE CONTINUOUSLY SUPPORTED.
4. PIPING SHALL BE PRESSURE TESTED AS SHOWN ON THE DRAWINGS.
5. ALL THREADED JOINTS SHALL BE MADE WITH A PRE-APPROVED THREAD SEALANT.

PROCESS FLOW IDENTIFICATION									
Flow Stream ID	Media	Line Vacuum		Line Pressure	Total Line Flow		Product Recovery	Water Recovery	Discharge Flow
		(in.Hg)	(in. WC)	(psi)	(acfm)	(scfm)	(gpm)	(gpm)	(gpm)
1	TF	23	313	NA	182	27	0.081	0.322	NA
2	TF	23	313	NA	182	27	0.081	0.322	NA
3	TF	23	313	NA	182	27	0.081	0.322	NA
4	TF	23	313	NA	182	27	0.081	0.322	NA
5	TF	23	313	NA	182	27	0.081	0.322	NA
6	TF	23	313	NA	182	27	0.081	0.322	NA
7[B]	TF	23	313	NA	182	27	0.081	0.322	NA
8[B]	TF	23	313	NA	182	27	0.081	0.322	NA
9[B]	TF	23	313	NA	182	27	0.081	0.322	NA
10[B]	TF	23	313	NA	182	27	0.081	0.322	NA
11[B]	TF	23	313	NA	182	27	0.081	0.322	NA
12	TF	23-24	326	NA	980	~150	0.486	1.93	NA
13[B]	TF	23-24	326	NA	980	~150	0.41	1.61	NA
14	TF	25	326	NA	[A]980,980	[A]~150, ~150	[A]0.486, 0.41	[A]1.93, 1.61	NA
15	TF	NA	NA	8	NA	NA	NA	NA	3-5
16[B]	TF	NA	NA	8	NA	NA	NA	NA	3-5
17	DELETED								
18	NAPL	NA	NA	5	NA	NA	NA	NA	10.0
19	W	NA	NA	10	NA	NA	NA	NA	10
20	W	NA	NA	10	NA	NA	NA	NA	10
21	V	NA	NA	> ATM	NA	~4	NA	NA	NA
22	W	NA	NA	10	NA	NA	NA	NA	5
23	W	NA	NA	10	NA	NA	NA	NA	5
24	V	NA	NA	35 inH2O	NA	150	NA	NA	NA
25[B]	W	NA	NA	10 inH2O	NA	NA	NA	NA	10
26	TW	NA	NA	10	NA	NA	NA	NA	10
27	TW	NA	NA	5-10	NA	NA	NA	NA	2-5

[A]FLOW AND/OR LIQUID RECOVERY RATES WILL VARY BASED UPON EXTRACTION STAGE USED.

[B]FUTURE
TF: TOTAL FLUIDS
in.Hg: INCHES OF MERCURY
gpm: GALLONS PER MINUTE
acfm: ACTUAL CUBIC FEET PER MINUTE
NA: NOT APPLICABLE

NAPL: NON-AQUEOUS PHASE LIQUID
W: RECOVERED WATER
psi: POUNDS PER SQUARE INCH
V: VAPOR
scfm: STANDARD CUBIC FEET PER MINUTE
NA: PARAMETER NOT APPLICABLE
TW: TREATED WATER

Registered Professional Engineer (Civil)
CERTIFICATE NO. 46861
WILLIAM J. NEESE
Date Signed 4-6-09
ARIZONA, U.S.A.
EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

VALVES AND ACTUATORS

NORMALLY OPEN	VALVE TYPE	NORMALLY CLOSED
	GATE VALVE	
	BUTTERFLY VALVE	
	BALL VALVE	
	CHECK VALVE	N/A
	FLEX HOSE	N/A
	VACUUM RELIEF VALVE	N/A
	PRESSURE RELIEF VALVE	N/A
AB	THREE WAY VALVE	N/A
	CONTROL VALVE	
LPS	LOW PRESSURE SWITCH	N/A
FS	FLOW SWITCH	N/A

PIPE SPECIALTIES

SYMBOL	TYPE
FM-1	FLOW METER
	FLOW DIRECTION
5	FLOW STREAM INDICATOR
	REDUCER
PI	PRESSURE INDICATOR
PS	PRESSURE SWITCH
DPI	DIFFERENTIAL PRESSURE INDICATOR
VI	VACUUM INDICATOR
FI	FLOW INDICATOR
	CENTRIFUGAL PUMP
	LIQUID RING PUMP
SP	SAMPLE PORT
	BLIND FLANGE
	CARTRIDGE FILTER (DUAL ASSEMBLY)
	EXHAUST FILTER AB
P	PRESSURE GAUGE
V	VACUUM GAUGE

NOTE:
SEE ELECTRICAL DRAWINGS FOR SWITCHES OR OTHER ELECTRICAL SYMBOLS SHOWN ON PROCESS FLOW DRAWINGS

PROCESS FLOW DIAGRAM LEGEND

- MAJOR PROCESS
- INSTRUMENT SUPPLY OR CONNECTION TO PROCESS
- FUTURE PROCESS EQUIPMENT/PIPE/VALVES
- CONTROL INTERFACE

PROCESS FLOW DIAGRAM ABBREVIATIONS

ACFM	ACTUAL CUBIC FEET PER MINUTE
AFF	AUTOMATIC FLUSH FILTER
AGS	ABOVE GROUND SURFACE
ATM	ATMOSPHERIC
AVV	AIR VENT/VACUUM RELIEF VALVE
BA	BALL VALVE
BF	BAG FILTER
BGS	BELOW GROUND SURFACE
BV	BUTTERFLY VALVE
CONC	CONCENTRIC REDUCER
CRV	COMBINATION PRESSURE/RELIEF VALVE
CS	CARBON STEEL
DPI	DIFFERENTIAL PRESSURE INDICATOR
ECC	ECCENTRIC REDUCER
FCV	FLOW CONTROL VALVE
FI	FLOW INDICATOR
FM	FLOW METER
FS	FLOW SWITCH
FT	FEET
GAC	GRANULATED ACTIVATED CARBON
GAL	GALLON
GBV	GLOBE VALVE AB
GPM	GALLONS PER MINUTE
GR	GRADE
GV	GATE VALVE
HP	HORSE POWER
HS	HIGH LEVEL SWITCH
HWT	HOT WATER
IZ	IMPREGNATED ZEOLITE
INHG	INCHES OF MERCURY
IWC	INCHES OF WATER COLUMN
LB	POUND
LPC	LIQUID PHASE CARBON
LSP	LIQUID SAMPLE PORT
NA	NOT APPLICABLE
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
P	RECOVERED PRODUCT
PCV	PNEUMATIC CONTROL VALVE
PI	PRESSURE INDICATOR
PLC	PROGRAMMED LOGIC CONTROLLER
PS	PRESSURE SWITCH
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
Q	FLOW RATE
SP	SAMPLE PORT
SCFM	STANDARD CUBIC FEET PER MINUTE
SCH	SCHEDULE
SS	STAINLESS STEEL
TBD	TO BE DETERMINED
TDH	TOTAL DYNAMIC HEAD
TEMP	TEMPERATURE
TF	TOTAL FLUIDS
TH	TANK HIGH-LEVEL SENSOR
THH	TANK HIGH-HIGH LEVEL SENSOR
TI	TEMPERATURE INDICATOR
TL	TANK LOW-LEVEL SENSOR
TP	TRANSFER PUMP
TW	TREATED WATER
TYP	TYPICAL
VG	VAPOR GAS
VFD	VARIABLE FREQUENCY DRIVE
VI	VACUUM INDICATOR
VSP	VAPOR SAMPLE PORT
W	RECOVERED WATER
WEQ	WATER EQUALIZATION

GENERAL PUMP SCHEDULE				
PUMP IDENTIFICATION	PUMP FUNCTION/PERFORMANCE	PUMP TYPE	PUMP (HP)	PERFORMANCE DATA
LRP1	MULTI PHASE EXTRACTION	LIQUID RING	60	24 inHg @ ~1000 ACFM
LRP2 (FUTURE)	MULTI PHASE EXTRACTION (FUTURE)	LIQUID RING	60	24 inHg @ ~1000 ACFM
P1 (FUTURE)	CONVEY TF TO OWS	CENTRIFUGAL	1	
P2	CONVEY TF TO OWS	CENTRIFUGAL	1	5 GPM @ 39 psi [A]
P3	DELETED			
P4	DELETED			
P5	CONVEY PRODUCT FROM OWS	CENTRIFUGAL	1	10 GPM @ 35 psi [A]
P6	CONVEY IMPACTED WATER FROM OWS	CENTRIFUGAL	1	10 GPM @ 35 psi [A]
P7	DELETED			
P8	DELETED			
P9	DELETED			
P10	DELETED			
P11	TRANSFER TW FOR REUSE	CENTRIFUGAL	1	10 GPM @ 35 psi [A]
P12	DELETED - REMOVED FROM DESIGN			

[A] PERFORMANCE DATA BASED ON PUMP PERFORMANCE CURVE SHOWING FLOW RATE IN US GPM IN CORRELATION TO TOTAL OPERATING HEAD IN FEET OF WATER

FLOW METER SCHEDULE				
METER IDENTIFICATION	TYPE	SIZE (IN)	FLOW RANGE (GPM)	TOTALIZER[B]
FM-1[A]	MULTI-WING TURBINE	3/4	0.22 - 11	US GALLONS
FM-2	FUTURE USE			
FM-3[A]	MULTI-WING TURBINE	1	0.5 - 26.4	US GALLONS
FM-4	MULTI-WING TURBINE	1	0.22 - 20	US GALLONS
FM-5	MULTI-WING TURBINE	1	0.22 - 20	US GALLONS

[A] SUPPLIED BY EQUIPMENT VENDOR
[B] TOTALIZERS SHALL RECORD IN US GALLONS AND BE NONRESETTABLE

FLOW INDICATOR SCHEDULE		
INDICATOR IDENTIFICATION	TYPE *	FLOW RANGE (SCFM)
FI-1	PITOT TUBE W/ MAGNEHELIC GAUGE	0-150
FI-2	PITOT TUBE W/ MAGNEHELIC GAUGE	0-150
FI-3 (FUTURE)		0-150

*STATIC TIP SENSOR PITOT TUBE COMBINED WITH A DIFFERENTIAL PRESSURE GAUGE.
- PITOT TUBES SHALL BE SS SIMILAR OR PREAPPROVED EQUAL TO DWYER SERIES 160.
- MAGNEHELIC GAUGE SHALL BE CAPABLE OF READING 0 - 1.0 IWC. SIMILAR OR PREAPPROVED EQUAL TO DWYER MAGNEHELIC SERIES 2000.

Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE
HEBARA SS CENTRIFUGAL PUMP CURVE DATA	
HISTEC FLOW MEASUREMENT & CONTROL DATA	
MANUFACTURER INFORMATION	
PROVIDED BY: ENVIROSUPPLY, INC.	

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	9-05	RE-ISSUED FOR CONSTRUCTION
AB	WN	8-08	AS-BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE: AS NOTED		DATE
DESIGNED BY:	MAB/JWB	6-05
DRAWN BY:	KLP	6-05
CHECKED BY:	PJS, JMW	6-05
APPROVED BY:	MAB	6-05
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

MPE SYSTEM SCHEDULES

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. P-1
REV. AB

P:\mission linen\CADD\DESIGN\REV-1\P-1-R1.dwg 09-07-05

NOTES:

1. ALL SUBGRADE LATERALS SHALL BE 2-INCH DIA. SCH 80 PVC. REFER TO SHEET C-1 FOR SUBGRADE LATERAL PIPING PLAN.

2. MANIFOLD PIPING INSTALLED ABOVE GROUND SURFACE SHALL BE 3-INCH DIA SCH 80 PVC.

3. OWS-UNIT, PRODUCT AND RECOVERY TANKS SHALL BE DOUBLE WALLED.

4. THE MANIFOLD PIPING IS SHOWN ON THIS DRAWING FOR CLARIFICATION OF PROCESS FLOW ONLY AND DOES NOT REPRESENT THE TRUE LOCATION OF THE PIPING. THE VACUUM SIDE PIPING MANIFOLDS SHALL BE LOCATED INSIDE THE FACILITY BUILDING AS SHOWN ON DRAWINGS C-2 AND M-2.

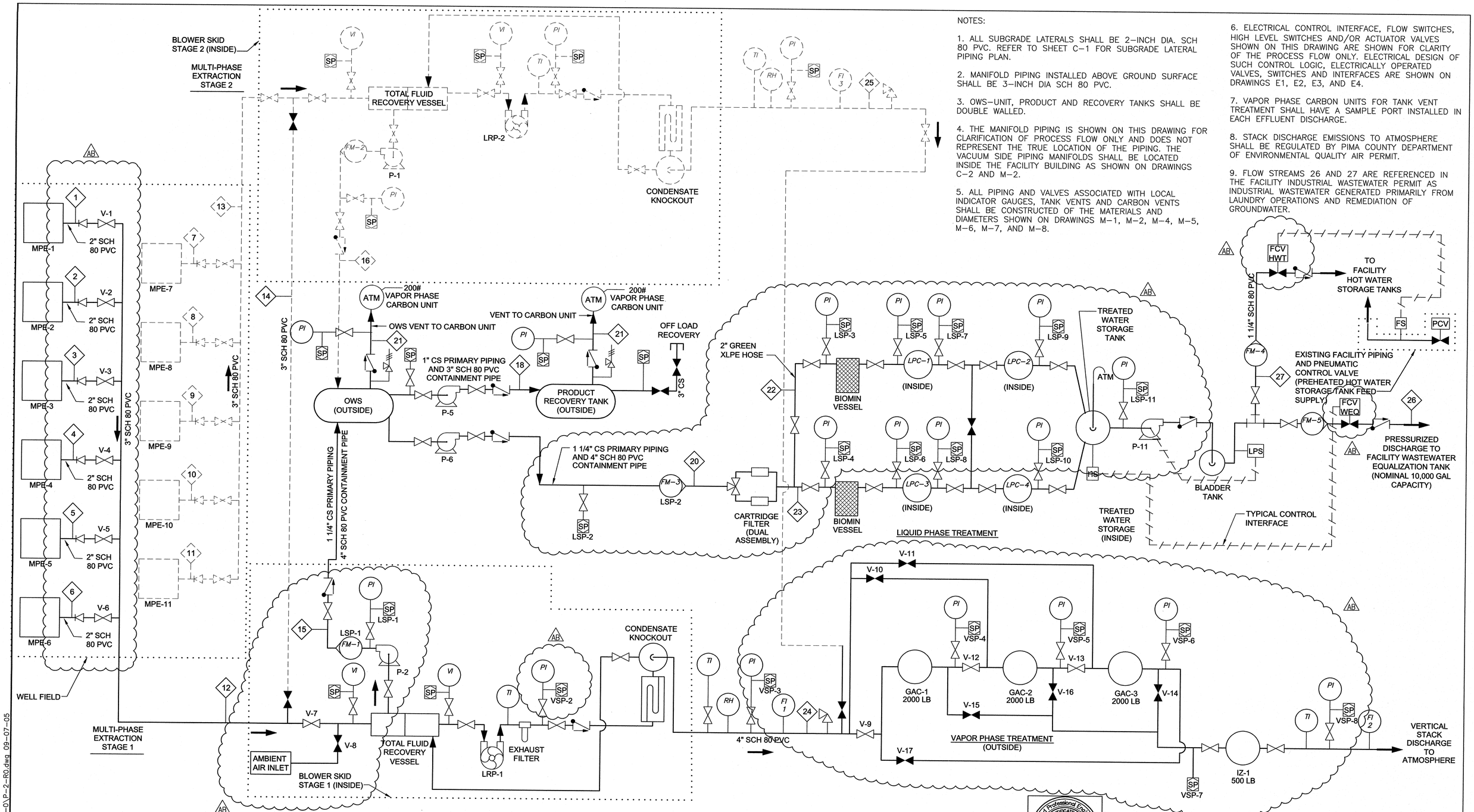
5. ALL PIPING AND VALVES ASSOCIATED WITH LOCAL INDICATOR GAUGES, TANK VENTS AND CARBON VENTS SHALL BE CONSTRUCTED OF THE MATERIALS AND DIAMETERS SHOWN ON DRAWINGS M-1, M-2, M-4, M-5, M-6, M-7, AND M-8.

6. ELECTRICAL CONTROL INTERFACE, FLOW SWITCHES, HIGH LEVEL SWITCHES AND/OR ACTUATOR VALVES SHOWN ON THIS DRAWING ARE SHOWN FOR CLARITY OF THE PROCESS FLOW ONLY. ELECTRICAL DESIGN OF SUCH CONTROL LOGIC, ELECTRICALLY OPERATED VALVES, SWITCHES AND INTERFACES ARE SHOWN ON DRAWINGS E1, E2, E3, AND E4.

7. VAPOR PHASE CARBON UNITS FOR TANK VENT TREATMENT SHALL HAVE A SAMPLE PORT INSTALLED IN EACH EFFLUENT DISCHARGE.

8. STACK DISCHARGE EMISSIONS TO ATMOSPHERE SHALL BE REGULATED BY PIMA COUNTY DEPARTMENT OF ENVIRONMENTAL QUALITY AIR PERMIT.

9. FLOW STREAMS 26 AND 27 ARE REFERENCED IN THE FACILITY INDUSTRIAL WASTEWATER PERMIT AS INDUSTRIAL WASTEWATER GENERATED PRIMARILY FROM LAUNDRY OPERATIONS AND REMEDIATION OF GROUNDWATER.



Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 9-30-09 ARIZONA U.S.A. EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE

REVISIONS

NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	9-05	RE-ISSUED FOR CONSTRUCTION
AB	WN	8-08	AS-BUILTS

REVISIONS

NO.	BY	DATE	DESCRIPTION

SCALE:	AS NOTED	DATE
DESIGNED BY:	MAB/JWB	9-05
DRAWN BY:	KLP	9-05
CHECKED BY:	PJS, JMW	9-05
APPROVED BY:	MAB	9-05
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

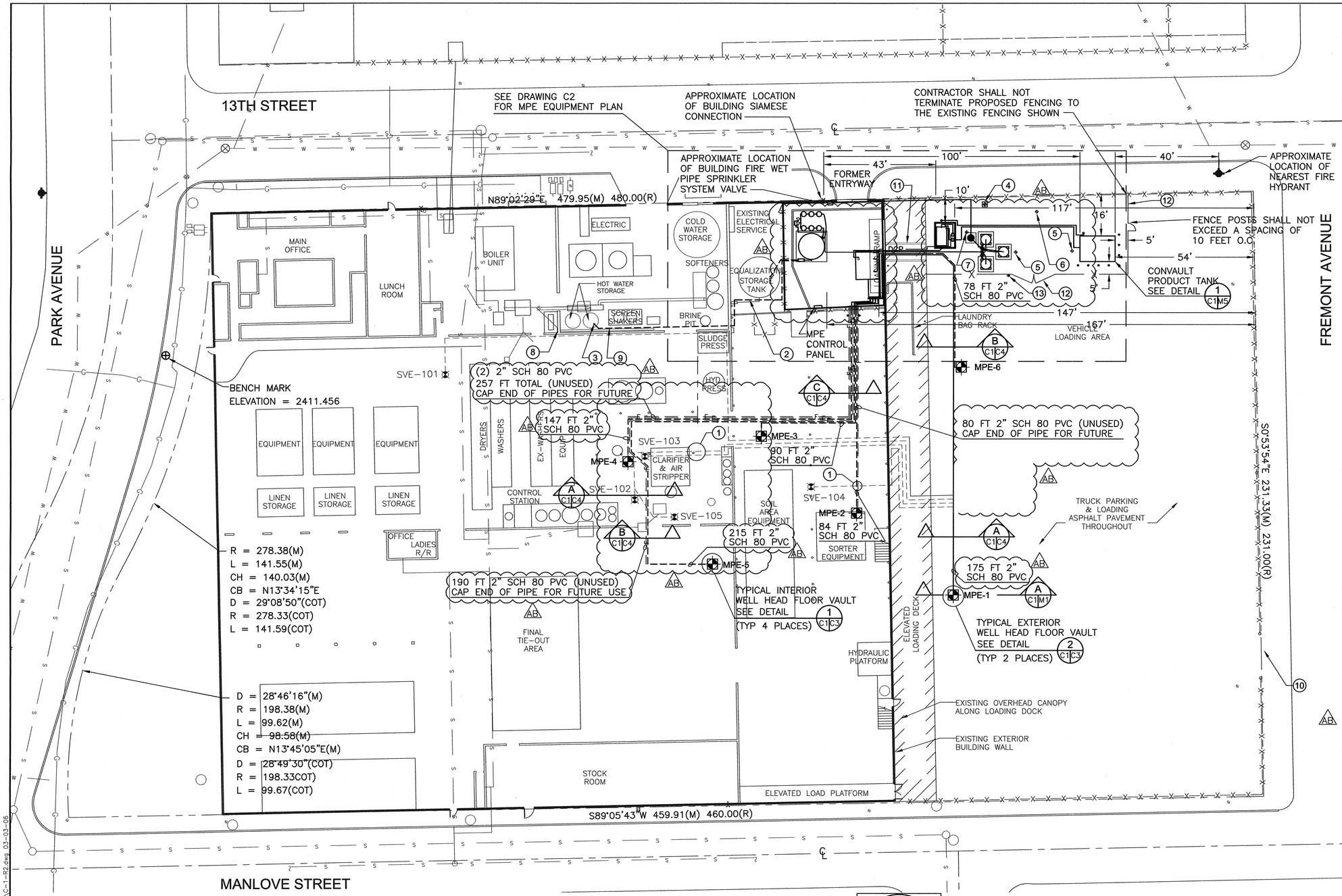
MISSION LINEN SUPPLY

PROCESS FLOW DIAGRAM

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. P-2
REV. AB

P:\mission linen\CADD\DESIGN\REV-0\P-2-R0.dwg 09-07-05



LEGEND:

PROPERTY LINE

KEY NOTES:

1. ~~FIELD PIPING CONFLICT – POTHOLE THIS LOCATION PRIOR TO INSTALLING PIPE RUN TO DETERMINE EXISTING PIPE INVERT AND ADJUST NEW PIPE DEPTH AS REQUIRED TO MAINTAIN POSITIVE SLOPE AND AT LEAST 4-INCH CLEARANCE.~~
2. 1–1/4" OVERHEAD SCH 80 OR SCH 40 STEEL PIPE RUN FROM RECLAIMED WATER TANK TO FACILITY HOT WATER STORAGE. OVERHEAD PIPE SUPPORTS TO BE COORDINATED WITH FACILITY SUPERVISOR.
3. RECLAIMED WATER MAKEUP LINE SHALL BE TERMINATED INTO THE TOP OF THE TANK AS SHOWN. CONTRACTOR SHALL INSTALL ONE CARBON STEEL WELD–O–LET BY 1–INCH NPT PENETRATION INTO THE TOP OF THE TANK. PRIOR TO INSTALLATION, THE ENGINEER SHALL APPROVE THE PENETRATION LOCATION, MATERIALS AND INSTALLATION METHODS.
4. EXIST PER–14 REGIONAL AQUIFER MONITORING WELL ON 4'x4' CONCRETE PAD AND 4–BOLLARDS.
5. EXIST MONITORING WELL. FLUSH WITH PAVEMENT.
6. EXIST ABANDONED MP–1 SUPPLY WELL. 4" DIA IRON PIPE STICK UP WITH CAP.
7. EXIST VW–05 MULTI–DEPTH SOIL GAS MONITORING POINT. FLUSH WITH PAVEMENT.
8. LOCATION OF HOT WATER STORAGE TANK LEVEL CONTROL PANEL.
9. CONTRACTOR SHALL INSTALL SPECIFIED FLOW SWITCH INTO EXISTING PIPING INFRASTRUCTURE IN THE LOCATION SHOWN IN DRAWING P–2. PRIOR TO INSTALLATION, THIS LOCATION SHALL BE FIELD VERIFIED BY THE ENGINEER.
10. CONTRACTOR ACCESS TO SITE.
11. RAMP TO BRIDGE PIPING PROVIDED BY OTHERS.
12. CONTRACTOR SHALL INSTALL 6' HIGH GALVANIZED CHAIN–LINK FENCING AROUND THE OUTDOOR PERIMETER OF THE EQUIPMENT COMPOUND. FENCING SHALL INCLUDE ONE 3'–0" WIDE ENTRY GATE AND (2) 8'–0" WIDE DOUBLE ENTRY GATE AS SHOWN.
13. 10# FIRE EXTINGUISHER SIMILAR OR PREAPPROVED EQUAL TO PROPLUS DRY CHEMICAL GRAINGER MODEL 4XP89 UL RATING 4A:80B:C EXTINGUISHER SHALL BE MOUNTED WITH HEAVY DUTY BRACKET GRAINGER MODEL 5T909.
14. INTERIOR EQUIPMENT ENCLOSURE: OWNERS EXISTING CHAIN–LINK FENCING. CONTRACTOR SHALL RETROFIT EXISTING CHAN–LINK FENCING AT THE WEST AND EAST PERIMETER LOCATIONS OF THE EQUIPMENT COMPOUND. REFER TO DRAWING C–2, KEY NOTES 20 AND 21 FOR MODIFICATION INSTRUCTIONS.

ENGINEERS NOTES:

1. FOR CLARITY OF PROPERTY LINE LOCATION–SURVEY COMPLETED BY S&S SURVEYS SHOWS BUILDING ENVELOPE TO BE LOCATED ON, AT OR IN SOME LOCATIONS ENCROACHING OVER THE PROPERTY LINE AT THE SUBJECT LOCATIONS NORTH, EAST, AND SOUTH BOUNDARIES.
2. BEARINGS ARE SHOWN TO CLARIFY PROPERTY LINE LOCATION.

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 4-16-08 ARIZONA U.S.A. EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE	REFERENCES TITLE
1. BASE MAP EXISTING FEATURES AND DIMENSIONS ARE BASED ON URS FIELD OBSERVATIONS AND MEASUREMENTS, 2004	2. UNIVERSITY HEIGHTS AREA AUGMENTATION & REPLACEMENT 13TH ST PIMA COUNTY WASTEWATER MANAGEMENT SHEET 7 OF 11, JAN 1989	3. BOUNDARY SURVEY – S&S SURVEY FEBRUARY, 2006

REVISIONS

NO.	BY	DATE	DESCRIPTION
0	JW	6–05	ISSUED FOR CONSTRUCTION
1	MB	9–05	RE–ISSUED FOR CONSTRUCTION
2	JB	2–06	RE–ISSUED FOR PERMIT
AB	WN	8–08	AS–BUILTS

SCALE: AS NOTED		DATE
DESIGNED BY:	MAB/JWB	2–06
DRAWN BY:	KLP	2–06
CHECKED BY:	PJS, JMW	2–06
APPROVED BY:	MAB	2–06
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

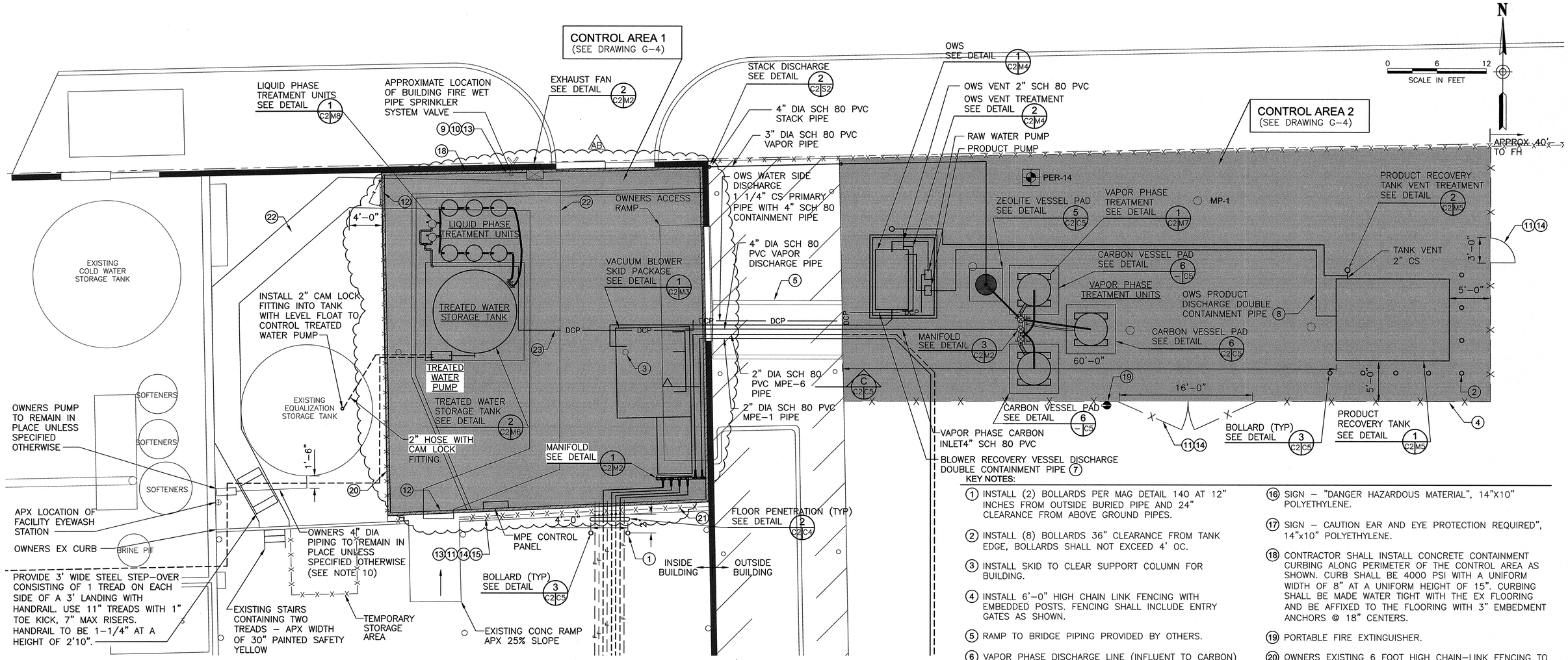
MISSION LINEN SUPPLY

SITE PLAN

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. C-1
REV. AB

P:\mission linen\CADD\DESIGN_MPE_SYSTEM\REV-2\C-1-R2.dwg 03-03-06



KEY NOTES:

1. INSTALL (2) BOLLARDS PER MAG DETAIL 140 AT 12" INCHES FROM OUTSIDE BURIED PIPE AND 24" CLEARANCE FROM ABOVE GROUND PIPES.
2. INSTALL (8) BOLLARDS 36" CLEARANCE FROM TANK EDGE, BOLLARDS SHALL NOT EXCEED 4' OC.
3. INSTALL SKID TO CLEAR SUPPORT COLUMN FOR BUILDING.
4. INSTALL 6'-0" HIGH CHAIN LINK FENCING WITH EMBEDDED POSTS. FENCING SHALL INCLUDE ENTRY GATES AS SHOWN.
5. RAMP TO BRIDGE PIPING PROVIDED BY OTHERS.
6. VAPOR PHASE DISCHARGE LINE (INFLUENT TO CARBON)
7. PRIMARY PIPE SHALL BE 1 ¼" CS AND SECONDARY CONTAINMENT PIPE SHALL BE 4" SCH 80 PVC
8. PRIMARY PIPE SHALL BE 1" CS AND SECONDARY CONTAINMENT PIPE SHALL BE 3" SCH 80 PVC
9. SIGN – FIRE SPRINKLER VALVE W DIRECTIONAL ARROW, 10"x14" POLYETHYLENE
10. SIGN – FIRE EXTINGUISHER W/ARROW (TWO SIDED), 4"x24" 20 GA STEEL
11. SIGN – "NOTICE AUTHORIZED PERSONNEL ONLY", 14"x10" POLYETHYLENE
12. SIGN – "EXIT", 14"x10" POLYETHYLENE
13. SIGN – "NOTICE/FIRE SPRINKLER VALVE INSIDE", 14"x10" POLYETHYLENE
14. SIGN – "NO SMOKING"
15. SIGN – "IN CASE OF EMERGENCY CONTACT URS CORPORATION (602) 371-1110", 20"x14" POLYETHYLENE
16. SIGN – "DANGER HAZARDOUS MATERIAL", 14"X10" POLYETHYLENE.
17. SIGN – CAUTION EAR AND EYE PROTECTION REQUIRED", 14"x10" POLYETHYLENE.
18. CONTRACTOR SHALL INSTALL CONCRETE CONTAINMENT CURBING ALONG PERIMETER OF THE CONTROL AREA AS SHOWN. CURB SHALL BE 4000 PSI WITH A UNIFORM WIDTH OF 8" AT A UNIFORM HEIGHT OF 15". CURBING SHALL BE MADE WATER TIGHT WITH THE EX FLOORING AND BE AFFIXED TO THE FLOORING WITH 3" EMBEDMENT ANCHORS @ 18" CENTERS.
19. PORTABLE FIRE EXTINGUISHER.
20. OWNERS EXISTING 6 FOOT HIGH CHAIN-LINK FENCING TO REMAIN IN PLACE. CONTRACTOR SHALL MODIFY FENCING TO ACCEPT INSTALLATION OF A 3-FOOT WIDE GATE PANEL AT LOCATION SHOWN.
21. OWNERS EXISTING 7 FOOT HIGH CHAIN-LINK FENCING TO REMAIN IN PLACE. CONTRACTOR SHALL RETROFIT, AND MODIFY FENCE TO ACCOMMODATE OWNERS EXISTING 6 FOOT WIDE SLIDING GATE PANEL. THIS PANEL SHALL REMAIN IN PLACE AND BE MODIFIED TO SAFELY AND SECURELY MOVE IN A HORIZONTAL DIRECTION TO ALLOW UNIMPEDED ENTRY TO AND FROM THE EQUIPMENT COMPOUND.
22. DEFINED ACCESS AND EGRESS PATH. PATH SHALL BE CLEARLY DEFINED EGRESS STRIPING WITH OSHA SAFETY YELLOW PAINT. PATH SHALL HAVE A MINIMUM WIDTH OF 44-INCHES.
23. PIPING SHALL BE INSTALLED OVERHEAD TO CLEAR PATHWAY FOR ACCESS AND EGRESS.

NOTES:

1. WARNING SIGNS AND NFPA PLACARDING OF CONTAINERS, TANKS AND VESSELS SHALL BE PROVIDED AND INSTALLED BY OTHERS.
2. PORTABLE FIRE EXTINGUISHERS SHALL BE PROVIDED BY OTHERS AND SHALL BE PLACED AS REQUIRED BY THE FIRE AUTHORITY.
3. SIGNS SHALL BE PROVIDED BY OTHERS
4. STREET NAMES, UTILITIES AND PROPERTY BOUNDARIES NOT SHOWN FOR CLARITY.
5. CONTAINMENT PROVIDED FOR CONTROL AREA IS FOR TEMPORARY CONTAINMENT ONLY. CONTAINMENT VOLUME PROVIDED IS 1,298 FT^3 (9,707 GALLONS BASED ON A CURB HEIGHT OF 15").
6. PRIOR TO PLACING EQUIPMENT CONTRACTOR SHALL SEAL ALL CRACKS/PENETRATIONS IN THE EXISTING CONCRETE FLOOR.
7. FLOOR SHALL BE PAINTED WITH A NON SKID EPOXY COATING PRIOR TO PLACEMENT OF EQUIPMENT.
8. NORTH AND EAST WALLS OF BLDG AT CONTROL AREA ARE WOOD FRAMED WITH CORRUGATED METAL SHEETING EXTERIOR.
9. FACILITY SPRINKLER SYSTEM AND ASSOCIATED SPRAY HEADS NOT SHOWN FOR CLARITY. SPRINKLER HEAD INVENTORY CONDUCTED BY URS SHOWED 14 ACTIVE HEADS AND 2 NON ACTIVE HEADS OVER THE CONTROL AREA.
10. CONTRACTOR SHALL INSTALL STAIRS OR ENGINEERED RAMPS TO BRIDGE OVER PIPING AND CONTAINMENT CURBING ALONG DEFINED INGRESS AND EGRESS PATH.

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 7-14-0 Arizona U.S.A. EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig. CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES	REVISIONS				REVISIONS			
TITLE	NO.	BY	DATE	DESCRIPTION	NO.	BY	DATE	DESCRIPTION
BASE MAP EXISTING FEATURES AND	0	JW	6-05	ISSUED FOR CONSTRUCTION				
DIMENSIONS ARE BASED ON URS	1	JW	8-05	SHOW SECTION D AND POST ALIGNMENT ALONG WALL				
FIELD OBSERVATIONS AND MEASUREMENTS,	2	MB	9-05	RE-ISSUED FOR CONSTRUCTION				
2004	3	MB	2-06	RE-ISSUED FOR PERMIT				
	AB	WN	8-08	AS-BUILTS				

ARCHITECTS SEAL ONLY FOR ACCESSIBILITY REQUIREMENTS

SCALE:	AS NOTED	DATE
DESIGNED BY:	MAB/JWB	2-06
DRAWN BY:	DHD/KLP	2-06
CHECKED BY:	PJS, JMW	2-06
APPROVED BY:	MAB	2-06
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

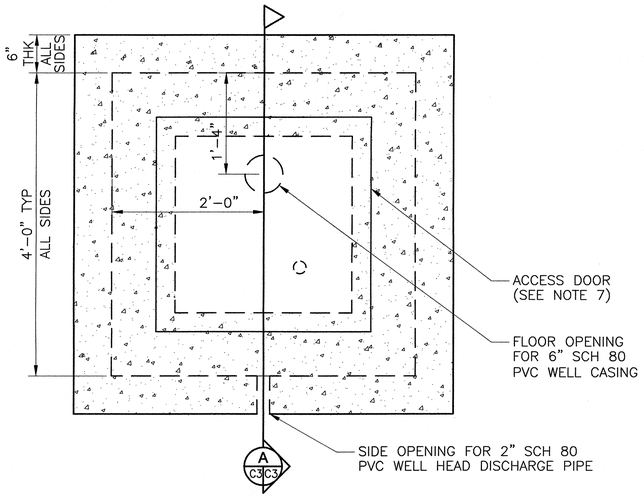
MISSION LINEN SUPPLY

MPE EQUIPMENT LAYOUT

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. C-2
REV. AB

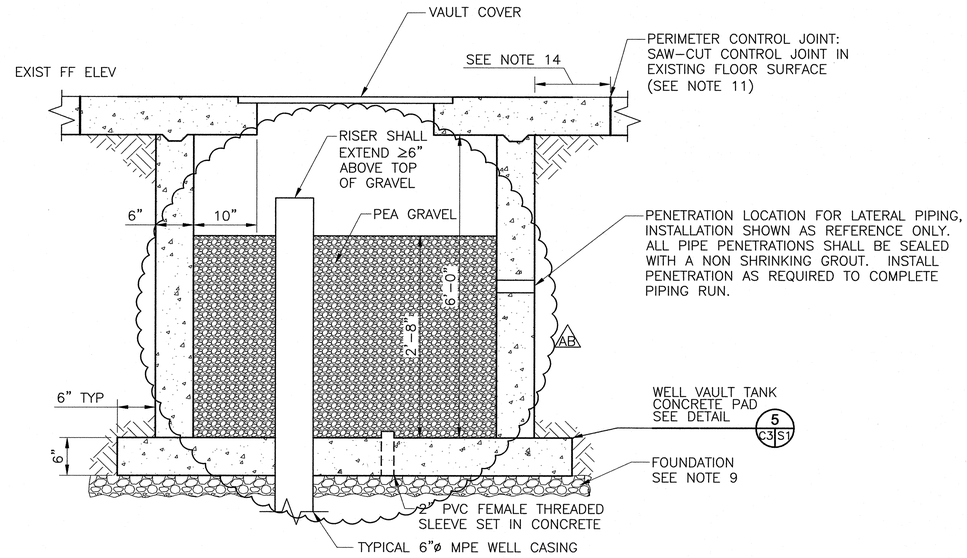
P:\mission linen\CADD\DESIGN\MPE_SYSTEM REV-3\C-2-R3.dwg 03-06-06



PLAN VIEW
TYPICAL INTERIOR WELL HEAD FLOOR VAULT

DETAIL 1 C1 C3

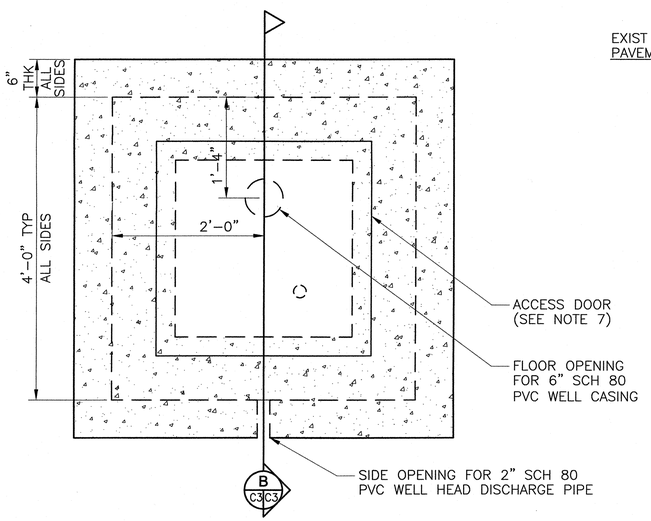
0 1 2
SCALE IN FEET



SECTION VIEW
TYPICAL INTERIOR WELL HEAD FLOOR VAULT

SECTION A C3 C3

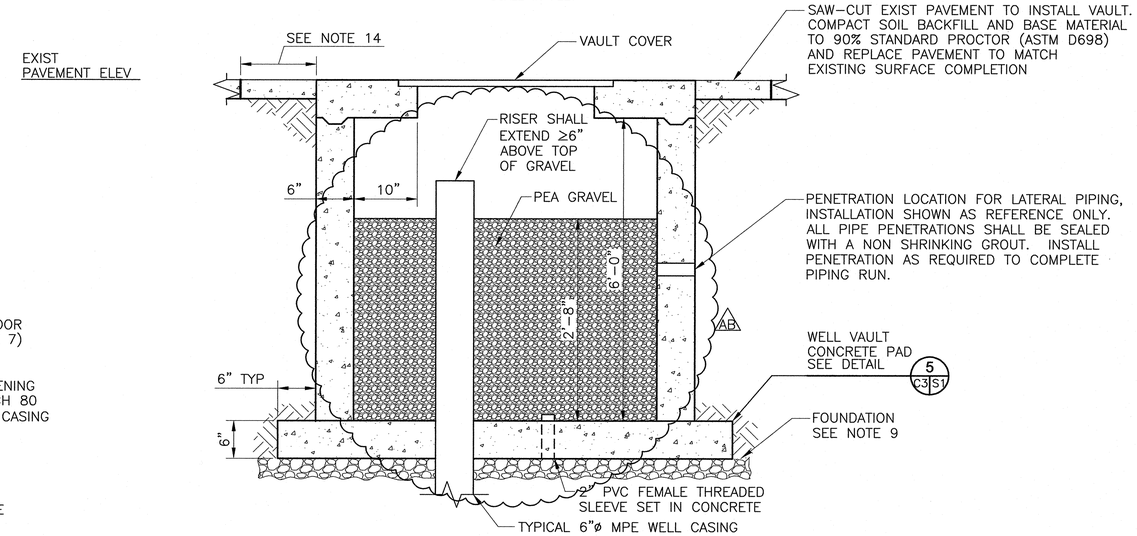
0 1 2
SCALE IN FEET



PLAN VIEW
TYPICAL EXTERIOR WELL HEAD FLOOR VAULT

DETAIL 2 C1 C3

0 1 2
SCALE IN FEET



SECTION VIEW
TYPICAL EXTERIOR WELL HEAD FLOOR VAULT

SECTION B C3 C3

0 1 2
SCALE IN FEET

NOTES:

1. EXCAVATION FOR WELL HEAD FLOOR VAULT MUST BE DONE WITH ACCOMPANYING WORKER BREATHING SPACE AND SOIL HEAD SPACE MONITORING FOR VOLATILE ORGANIC COMPOUNDS. CONTRACTOR SHALL IMPLEMENT ENGINEERING CONTROLS AS REQUIRED TO MITIGATE VAPOR GAS. CONTRACTOR SHALL UPGRADE LEVEL OF PERSONAL PROTECTION EQUIPMENT IN CONFORMANCE WITH THE SITE APPROVED HASP AS REQUIRED.
2. WELL HEAD FLOOR VAULT WILL BE 4' X 4' X 4' INSIDE DIMENSIONS.
3. VAULT SHALL BE PRECAST CONCRETE. SIMILAR TO OR PREAPPROVED AND EQUAL TO THE UTILITY VAULT IN FIGURE 504-WA.
4. ALL OPENINGS IN AND AROUND THE VAULT MUST BE COMPLETELY SEALED WITH RAMNECK OR APPROVED EQUAL TO ENSURE GAS-TIGHT JOINTS.
5. VAULT COVER WILL BE FLUSH WITH EXISTING BUILDING SLAB FF.
6. VAULT COVER MUST BE AASHTO H-20 RATED AND FURNISHED WITH ACCESS DOOR FRAME CAST DIRECTLY INTO THE COVER.
7. ACCESS DOOR WILL BE 34"x34" CLEAR OPENING, GALV STEEL, HEAVY DUTY (AASHTO H-20 RATED), RECESSED PADLOCK FOR SECURITY, SPRING-LOADED FOR MANUAL OPERATION, AND BOLTED FOR DIRECT TRAFFIC; DOOR WILL BE U.S. FOUNDRY AHS-30X36 (HIALEAH, FL). COVER SHALL BE WATER TIGHT AND BE EQUIPPED WITH PERMANENT GASKETING.
8. ACCESS DOOR WILL BE ORIENTED TO ALLOW AT LEAST 4-FT OF CLEARANCE FROM OPENING TO ADJACENT BUILDING WALLS OR OTHER OBSTRUCTIONS.
9. FOUNDATION WILL CONSIST OF COMPACTED SUBGRADE AND 6-IN THK COMPACTED AGGREGATE BASE COURSE.
10. SUBGRADE WILL BE COMPACTED TO 90% STANDARD PROCTOR (ASTM D698).
11. TO ACCOMMODATE WELL VAULT INSTALLATION THE CONTRACTOR SHALL SAW-CUT A PERIMETER CONTROL JOINT IN ALL LOCATIONS PRIOR TO DEMOLITION OF EXISTING SURFACES. AT MINIMUM THE CONTRACTOR SHALL INSTALL A 6" CONCRETE APRON AROUND THE PERIMETER OF THE WELL VAULT AFTER INSTALLING, LEVELING AND GROUNDING VAULT.
12. WELL CASING RISERS SHALL BE TEMPORARILY CAPPED WITH A REMOVABLE EXPANSION PLUG.
13. CONTRACTOR IS REQUIRED TO PROVIDE ALL SHORING, SHEETING, TRENCH BOXES, AND EQUIPMENT AS REQUIRED TO INSTALL SUBGRADE INFRASTRUCTURE. ALL EXCAVATIONS SHALL CONFORM TO OSHA 29 CFR PART 1926 SUBPART P.
14. PERIMETER EXCAVATION WIDTH VARIES BASED ON REQUIRED EXCAVATION SLOPE.

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 4-6-06 ARIZONA U.S.A. EXPIRES 06-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	2-06	RE-ISSUED FOR PERMIT
AB	WN	8-08	AS-BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE:	AS NOTED	DATE
DESIGNED BY:	MAB/JWB	2-06
DRAWN BY:	RJW	2-06
CHECKED BY:	PJS, JMW	2-06
APPROVED BY:	MAB	2-06
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

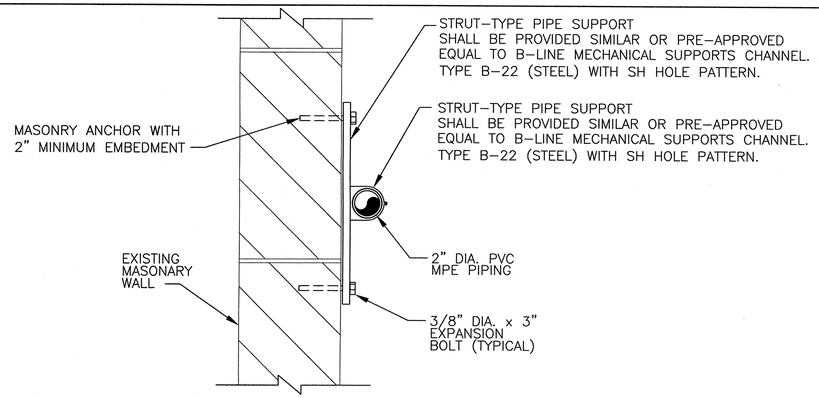
MISSION LINEN SUPPLY

FOUNDATIONS AND VAULTS

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. C-3
REV. AB

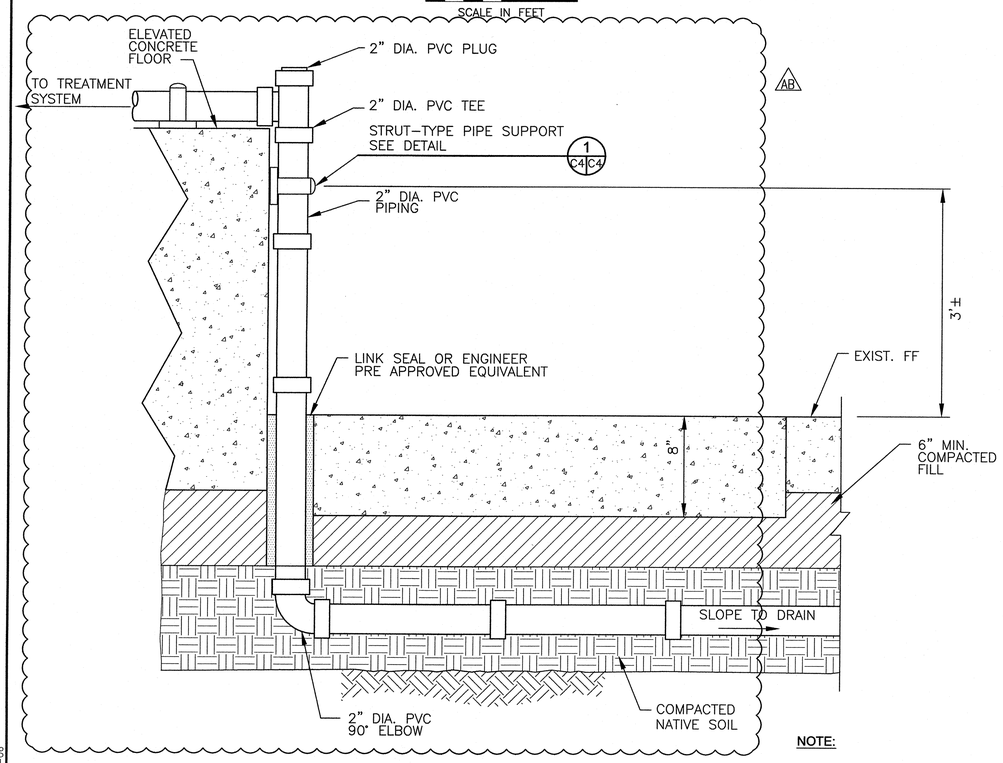
P:\mission linen\CADD\DESIGN_MPE_SYSYTEM\REV-1\C-3-R1.dwg 03-03-06



TYPICAL MASONARY WALL SUPPORT

DETAIL 1 C4|C4

0 0.5 1
SCALE IN FEET



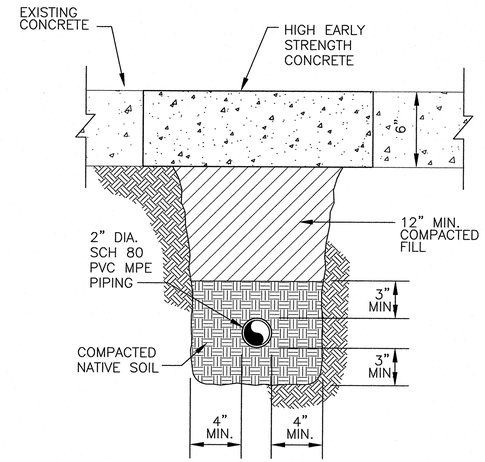
TYPICAL FLOOR PENETRATION

DETAIL 2 C2|C4

0 0.5 1
SCALE IN FEET

NOTE:

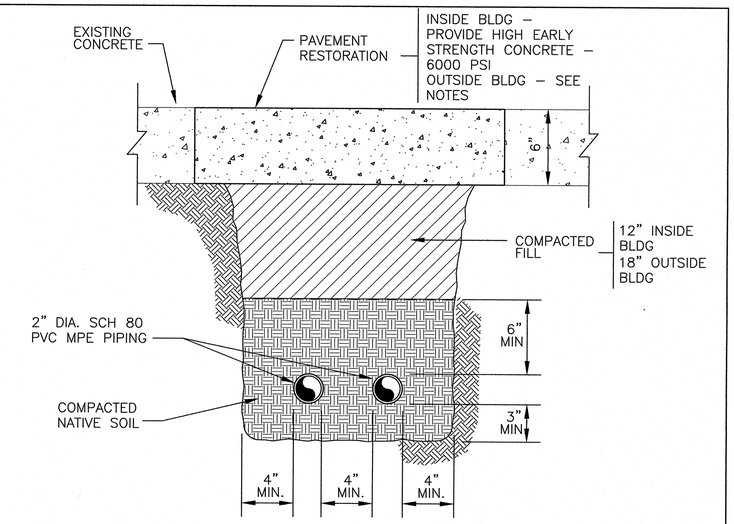
DUE TO DIFFERENCES IN PIPE AND CLEANOUT FRAME AND COVER, CONTRACTOR MAY PLACE UP TO 3 CLEANOUTS FOR EACH 8" FRAME AND COVER.



TYPICAL TRENCH SECTION (1 PIPE LATERAL)

SECTION A C1|C4

0 0.5 1
SCALE IN FEET



TYPICAL TRENCH SECTION (2 PIPE LATERAL)

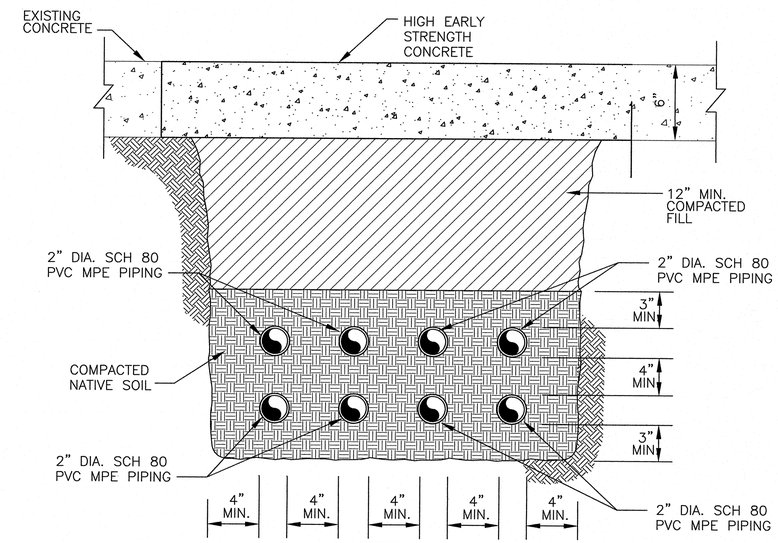
SECTION B C1|C4

0 0.5 1
SCALE IN FEET

NOTES:

1. UNLESS SPECIFIED OTHERWISE ALL PIPING SHALL BE SCH. 80 PVC.
2. CONCRETE SURFACE COMPLETION SHALL MATCH EXISTING FINISH FLOOR SURFACE ELEVATION.
3. ALL LATERAL PIPING SHALL SLOPE BACK TOWARD THE RESPECTIVE EXTRACTION WELL AT 1% MINIMUM CONTINUOUS SLOPE.
4. NATIVE SOIL SHALL BE PLACED AND COMPACTED COMPLETELY AROUND ALL NEW PIPE INSTALLATIONS IN ACCORDANCE WITH ASTM D 2321.
5. CROSS-SECTIONS SHOW SURFACE COMPLETIONS OF TYPICAL CONCRETE PAVEMENTS WITHIN THE BUILDING. ALL OTHER SURFACE COMPLETIONS SHALL MATCH EXISTING SURFACE COMPLETIONS.

   WHERE ASPHALT OR BITUMINOUS PAVEMENTS ARE ENCOUNTERED, ASPHALT SURFACE COMPLETIONS SHALL BE INSTALLED IN CONFORMANCE WITH MAG STANDARDS SECTIONS 601 AND 336. SUBGRADE PREPARATION FOR ASPHALT PAVEMENTS FOR APPLICABLE GRADING AND AGGREGATE BASE SHALL CONFORM TO MAG SECTIONS 301 AND 310. THE MINIMUM ASPHALTIC CONCRETE THICKNESS SHALL BE 3-INCHES.
6. CONTRACTOR IS REQUIRED TO PROVIDE ALL SHORING, SHEETING, TRENCH BOXES, AND EQUIPMENT AS REQUIRED TO INSTALL SUBGRADE INFRASTRUCTURE. ALL EXCAVATIONS SHALL CONFORM TO OSHA 29 CFR PART 1926 SUBPART P.



TYPICAL TRENCH SECTION (4 TO 8 PIPE LATERAL)

SECTION C C1|C4

0 0.5 1
SCALE IN FEET

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 4-30-09 ARIZONA U.S.A. EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig. CALL FOR THE BLUE STAKES 1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY) 1-800-782-5348

REFERENCES TITLE	REFERENCES TITLE

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	2-06	RE-ISSUED FOR PERMIT
AB	WN	8-08	AS-BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE:	AS NOTED	DATE
DESIGNED BY:	MAB/JWB	2-06
DRAWN BY:	KLP	2-06
CHECKED BY:	PJS, JMW	2-06
APPROVED BY:	MAB	2-06
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

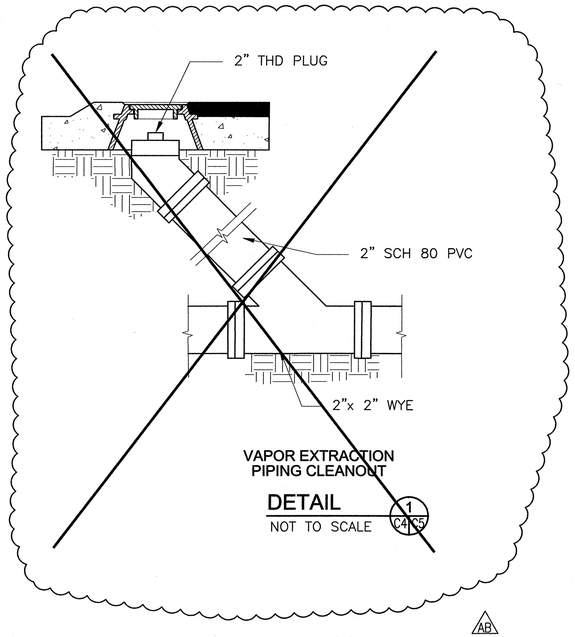
MISSION LINEN SUPPLY

TRENCHING SECTIONS AND DETAILS

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. C-4
REV. AB

P:\mission linen\CADD\DESIGN\REV-0\C-4-R0.dwg 02-20-06

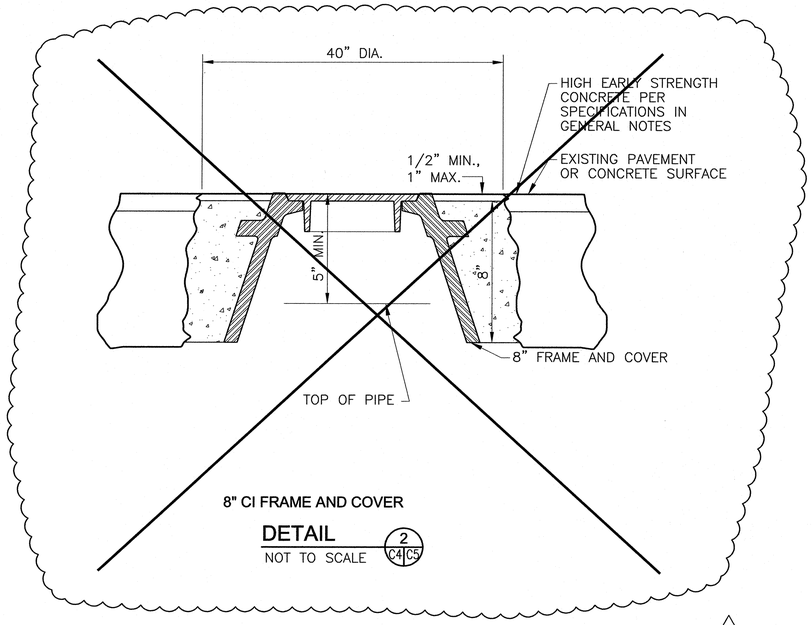


VAPOR EXTRACTION PIPING CLEANOUT

DETAIL 1 C4 C5

NOT TO SCALE

AB

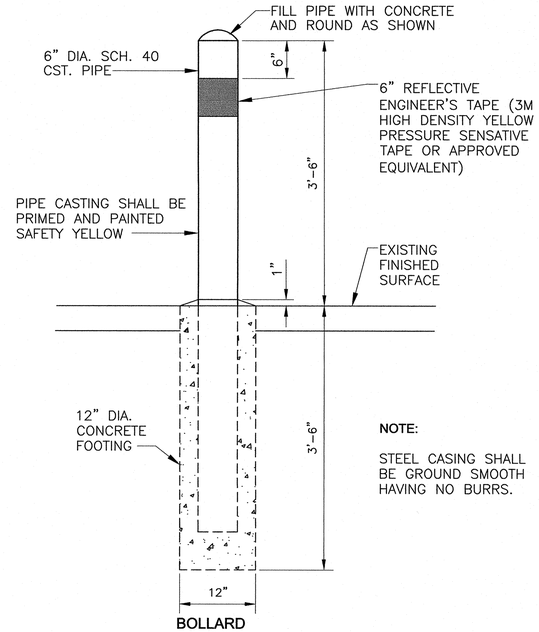


8" CI FRAME AND COVER

DETAIL 2 C4 C5

NOT TO SCALE

AB



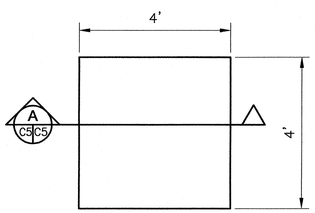
NOTE:

STEEL CASING SHALL BE GROUND SMOOTH HAVING NO BURRS.

BOLLARD

DETAIL 3 C2 C5

NOT TO SCALE



PLAN VIEW
ZEOLITE VESSEL PAD

DETAIL 5 C5

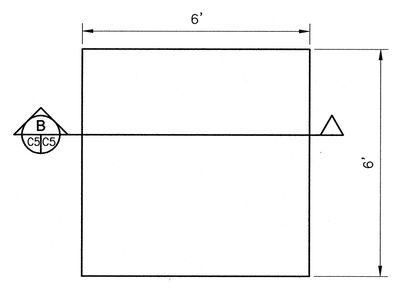
0 2 4
SCALE IN FEET

CONCRETE PAD NOTES

1. CONCRETE COMPRESSIVE STRENGTH SHALL BEE A MINIMUM OF 4,000 PSI @ 28 DAYS.

2. ALL REINFORCING SHALL CONFORM TO ASTM A 615, GR 60.

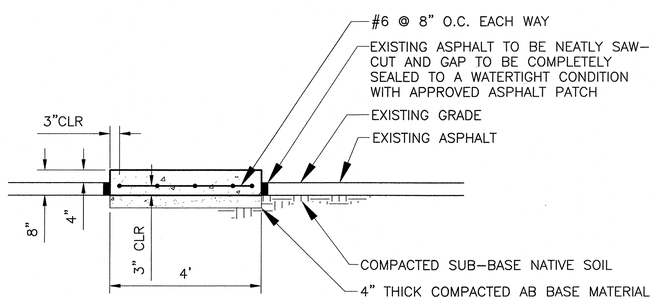
3. ALL EXPOSED EDGES SHALL BE TOOLED WITH A 1/2" RADIUS.



PLAN VIEW
CARBON VESSEL PAD

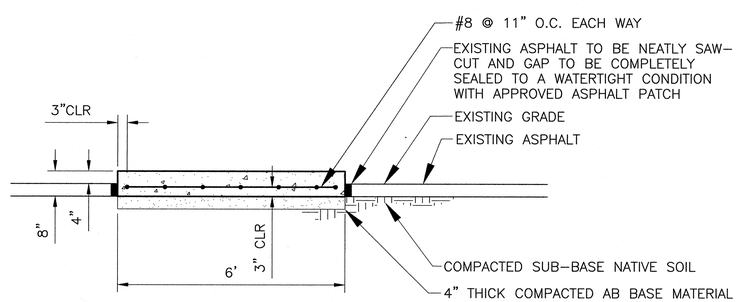
DETAIL 6 C5

0 2 4
SCALE IN FEET



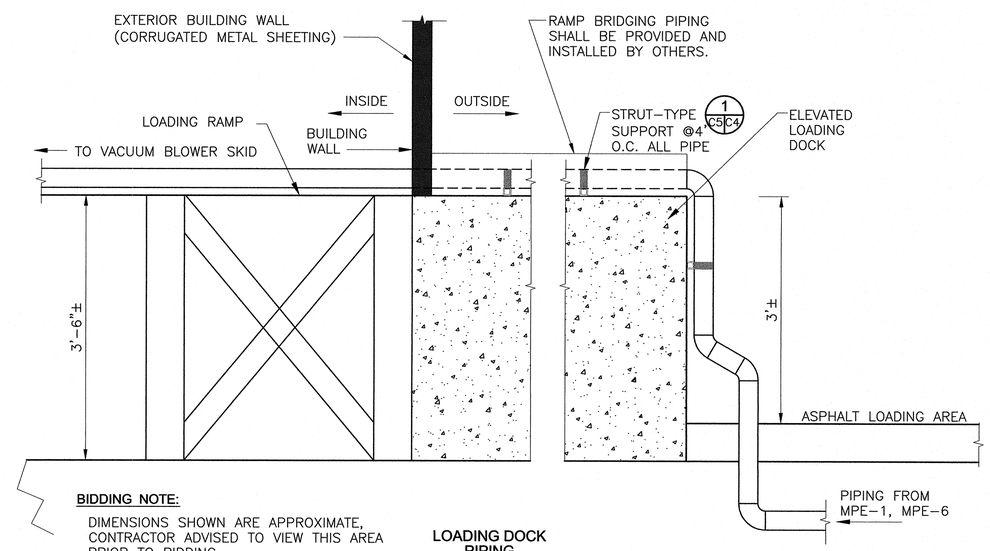
SECTION A C5 C5

0 2 4
SCALE IN FEET



SECTION B C5 C5

0 2 4
SCALE IN FEET



BIDDING NOTE:

DIMENSIONS SHOWN ARE APPROXIMATE, CONTRACTOR ADVISED TO VIEW THIS AREA PRIOR TO BIDDING.

LOADING DOCK PIPING

SECTION C C2 C5

NOT TO SCALE

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 1-16-08 ARIZONA U.S.A. EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig. CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	JW	8-05	REVISED SECTIONS A, B, AND ADDED D
2	MB	9-05	REVISED SECTION A
3	MB	2-06	RE-ISSUED FOR PERMIT
AB	WN	8-08	AS-BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE:	AS NOTED	DATE
DESIGNED BY:	MAB/JWB	2-06
DRAWN BY:	DHD/KLP	2-06
CHECKED BY:	PJS, JMW	2-06
APPROVED BY:	MAB	2-06
CLIENT APPROVAL BY:		

URS

7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

SECTIONS AND DETAILS

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

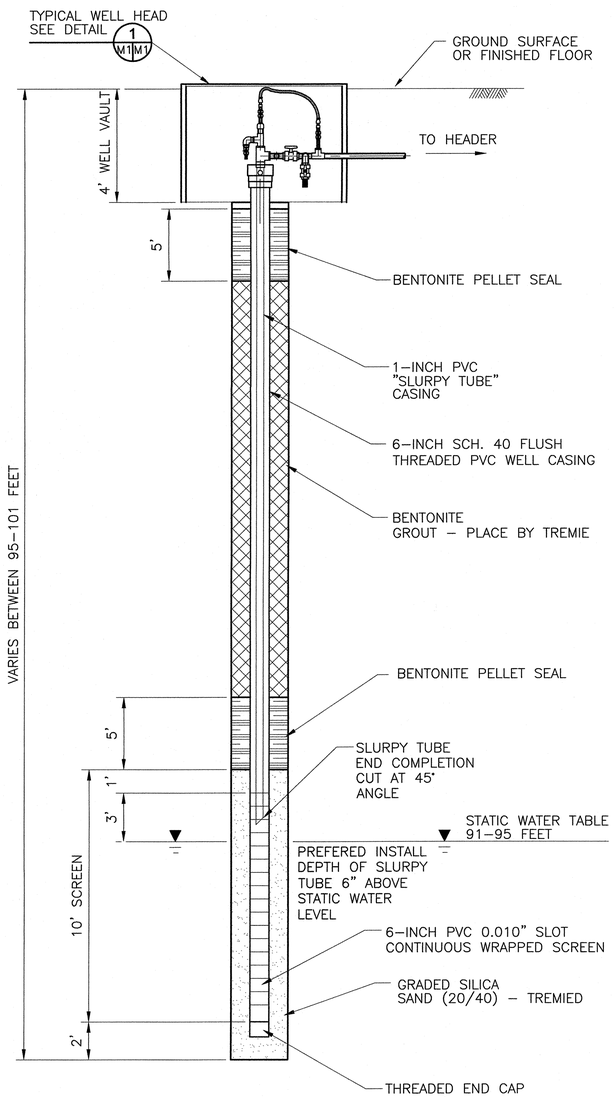
JOB NO. 22237188

DRAWING NO. C-5

REV. AB

P:\mission linen\CADD\DESIGN_MPE_SYSTEM\REV-3\C-5-R3.dwg 03-06

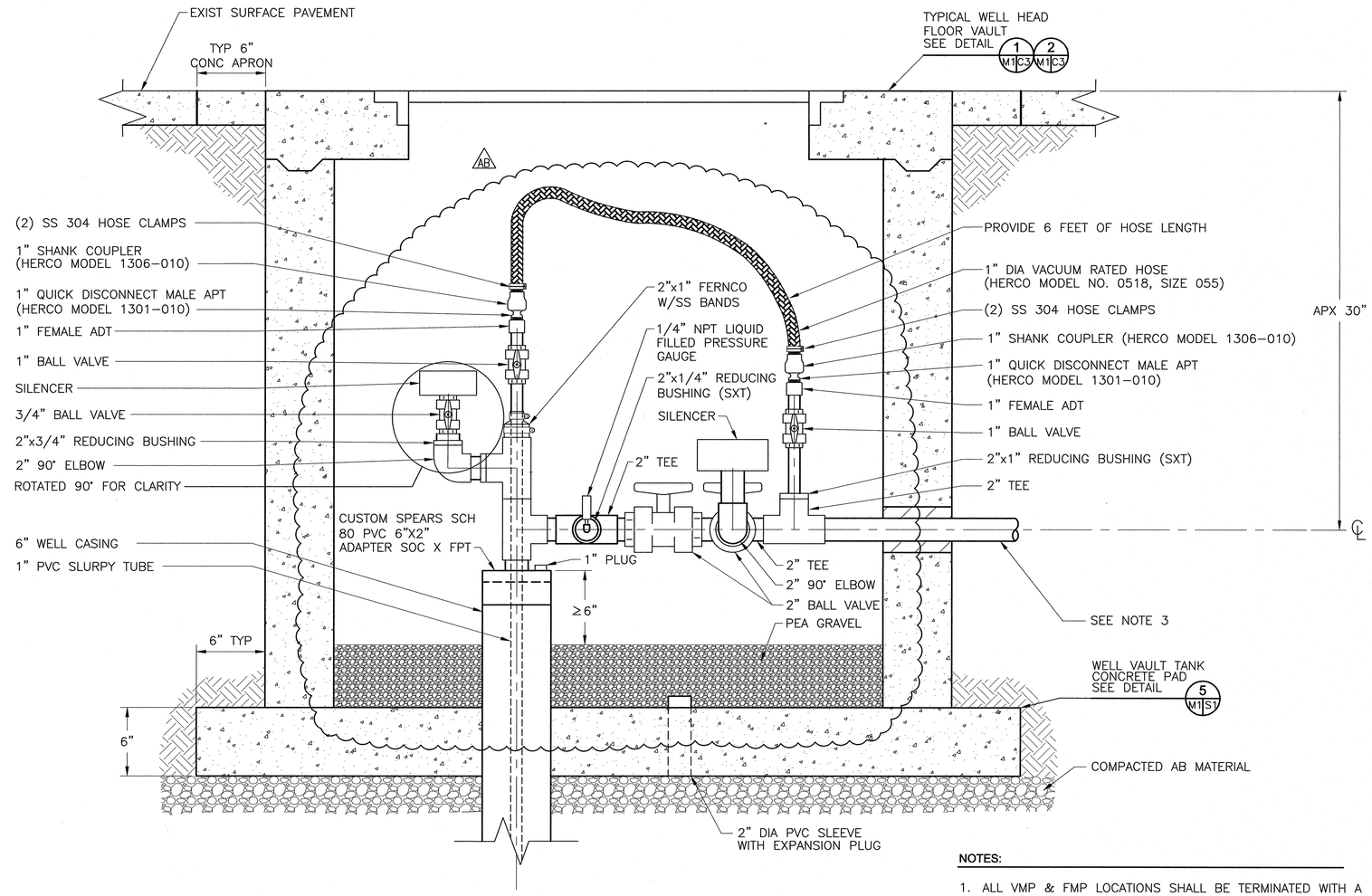
WELL SCHEDULE						
SYSTEM WELL ID	NORTHING	EASTING	DEPTH (FT. BGS)	TOP OF SCREEN (FT. BGS)	BOTTOM OF SCREEN (FT. BGS)	WATER TABLE (FT. BGS)
MPE-1	444392.27	997318.24	100.0	89.4	99.4	94.88
MPE-2	444424.23	997280.47	96.1	85.8	95.1	91.35
MPE-3	444454.27	997243.24	97.0	86.8	96.0	91.35
MPE-4	444444.29	997191.24	96.3	86.0	95.3	91.22
MPE-5	444404.29	997224.24	96.8	86.6	95.8	91.14
MPE-6	444481.34	997321.31	100.7	90.5	99.7	94.68



TYPICAL MPE WELL PROFILE

SECTION A M1

NOT TO SCALE



TYPICAL WELL HEAD

DETAIL 1 M1M1

0 .5 1

SCALE IN FEET

NOTES:

1. ALL VMP & FMP LOCATIONS SHALL BE TERMINATED WITH A THREADED PLUG - SCH 80 PVC 1/4" NPT.
2. UNLESS SPECIFIED OTHERWISE ALL PIPE & FITTINGS SHOWN ARE SCH 80 PVC.
3. PIPING SHALL BE SLOPED BACK TO EXTRACTION WELL AT A MIN OF 1%.

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 4-16-08 ARIZONA U.S.A. EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig. CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE
URS WELL CONSTRUCTION DETAIL	

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	2-06	RE-ISSUED FOR PERMIT
AB	WN	8-08	AS-BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE: AS NOTED		DATE
DESIGNED BY:	MAB/JWB	2-06
DRAWN BY:	KLP	2-06
CHECKED BY:	PJS, JMW	2-06
APPROVED BY:	MAB	2-06
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

MPE WELLS

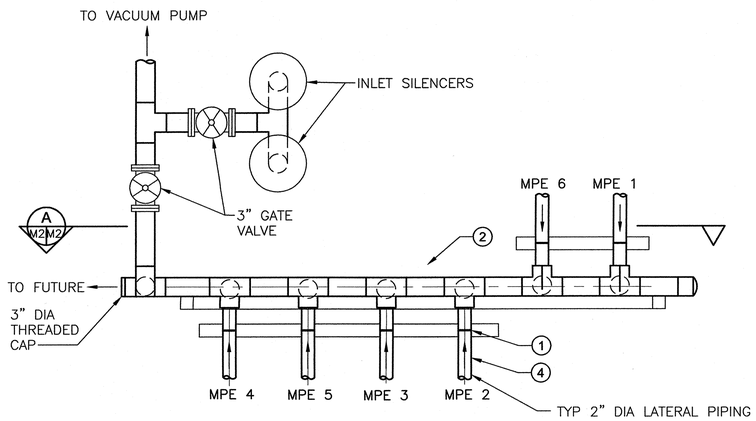
MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. M-1
REV. AB

P:\mission linen\CADD\DESIGN_MPE_SYSYTEM\REV-1\M-1-R1.dwg 03-03-06

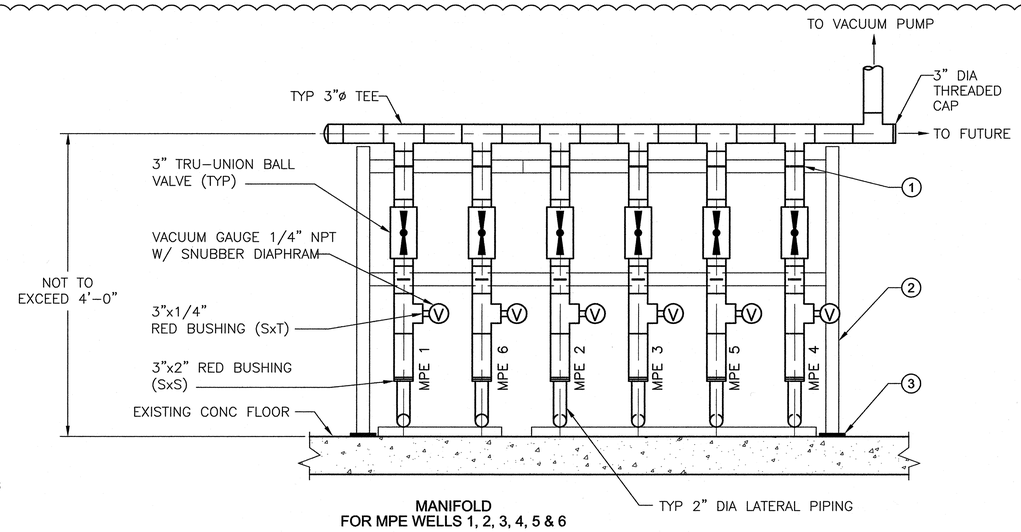
KEY NOTES:

1. TYP. B–2000 SERIES PIPE CLAMP, STEEL WITH ZINC COATING.
2. TYP. B 22 CHANNEL TYPE, ZINC COATED STEEL WITH SH CHANNEL HOLE PATTERN. ALL PIPE IN SUPPORT SYSTEM SHALL BE CONSTRUCTED OF B–LINE STRUT SYSTEM OR ENGINEER APPROVED EQUAL.
3. MODEL B–278 STEEL POST BASE WITH ZINC COATING APPLICABLE TO B–22 CHANNEL TYPE.
4. CONTRACTOR SHALL FIELD FIT PIPING AS NECESSARY TO COORDINATE MANIFOLD PIPING SECTIONS.
5. ALL FREESTANDING PIPING RUNS SHALL BE SUPPORTED EVERY 4–FEET OR AS DIRECTED BY ENGINEER. SUPPORTS SHALL BE INSTALLED AS SHOWN.
6. AS DIRECTED BY THE ENGINEER, THE CONTRACTOR SHALL FIELD FIT VAPOR PHASE CARBON MANIFOLD CONNECTIONS WITH CAMLOCK END CONNECTIONS. END CONNECTIONS MUST BE INSTALLED TO MATCH 4–INCH DIAMETER CAMLOCK CONNECTIONS INSTALLED ON VAPOR PHASE HOSE IN DETAIL 1, DRAWING M7.



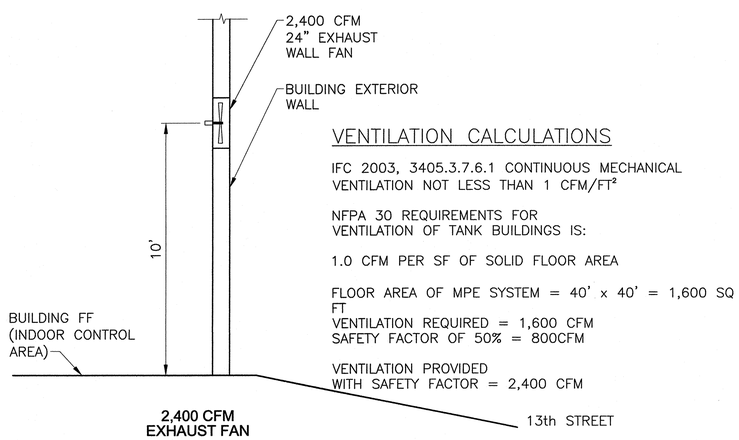
PLAN VIEW PIPING MANIFOLD

DETAIL 1 C2 M2 — 0 1 2 SCALE IN FEET



MANIFOLD FOR MPE WELLS 1, 2, 3, 4, 5 & 6

SECTION A M2 M2 — 0 1 2 SCALE IN FEET



2,400 CFM EXHAUST FAN

DETAIL 2 C2 M2 — 0 3 6 SCALE IN FEET

VENTILATION CALCULATIONS

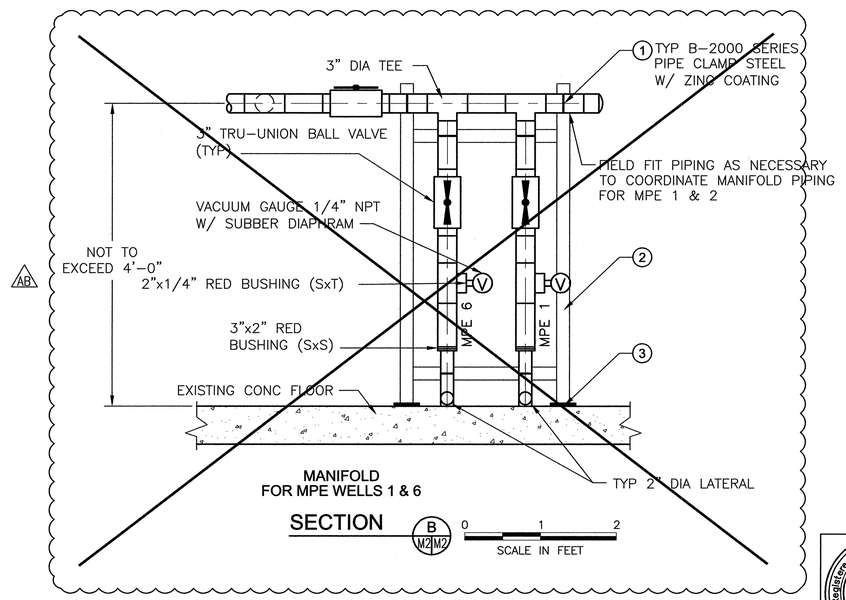
IFC 2003, 3405.3.7.6.1 CONTINUOUS MECHANICAL VENTILATION NOT LESS THAN 1 CFM/FT²

NFPA 30 REQUIREMENTS FOR VENTILATION OF TANK BUILDINGS IS:

1.0 CFM PER SF OF SOLID FLOOR AREA

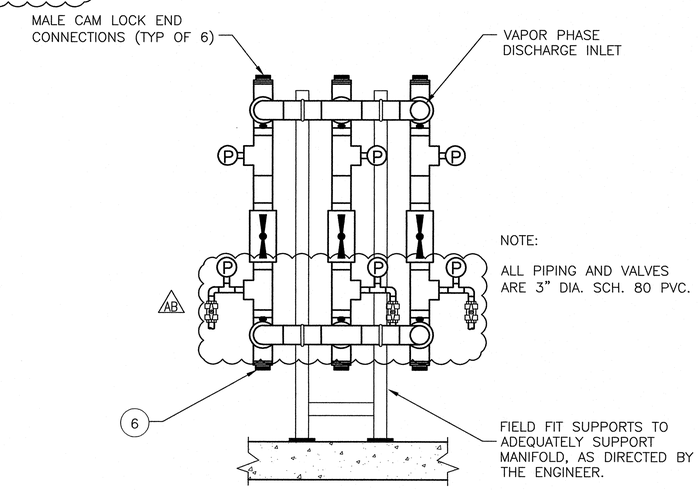
FLOOR AREA OF MPE SYSTEM = 40' x 40' = 1,600 SQ FT
VENTILATION REQUIRED = 1,600 CFM
SAFETY FACTOR OF 50% = 800CFM

VENTILATION PROVIDED WITH SAFETY FACTOR = 2,400 CFM



MANIFOLD FOR MPE WELLS 1 & 6

SECTION B M2 M2 — 0 1 2 SCALE IN FEET



NOTE:

ALL PIPING AND VALVES ARE 3" DIA. SCH. 80 PVC.

MANIFOLD FOR GAC VESSELS 1, 2 & 3

DETAIL 3 C2 M2 — NOT TO SCALE

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 7-15-09 ARIZONA USA
EXPIRES 09–30–2010

"AS-BUILT DRAWINGS"

Two working days before you dig. CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6–05	ISSUED FOR CONSTRUCTION
1	MB	9–05	RE–ISSUED FOR CONSTRUCTION
2	MB	2–06	RE–ISSUED FOR PERMIT
AB	WN	8–08	AS–BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

		DATE
SCALE:	AS NOTED	
DESIGNED BY:	MAB/JWB	2–06
DRAWN BY:	KLP	2–06
CHECKED BY:	PJS, JMW	2–06
APPROVED BY:	MAB	2–06
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

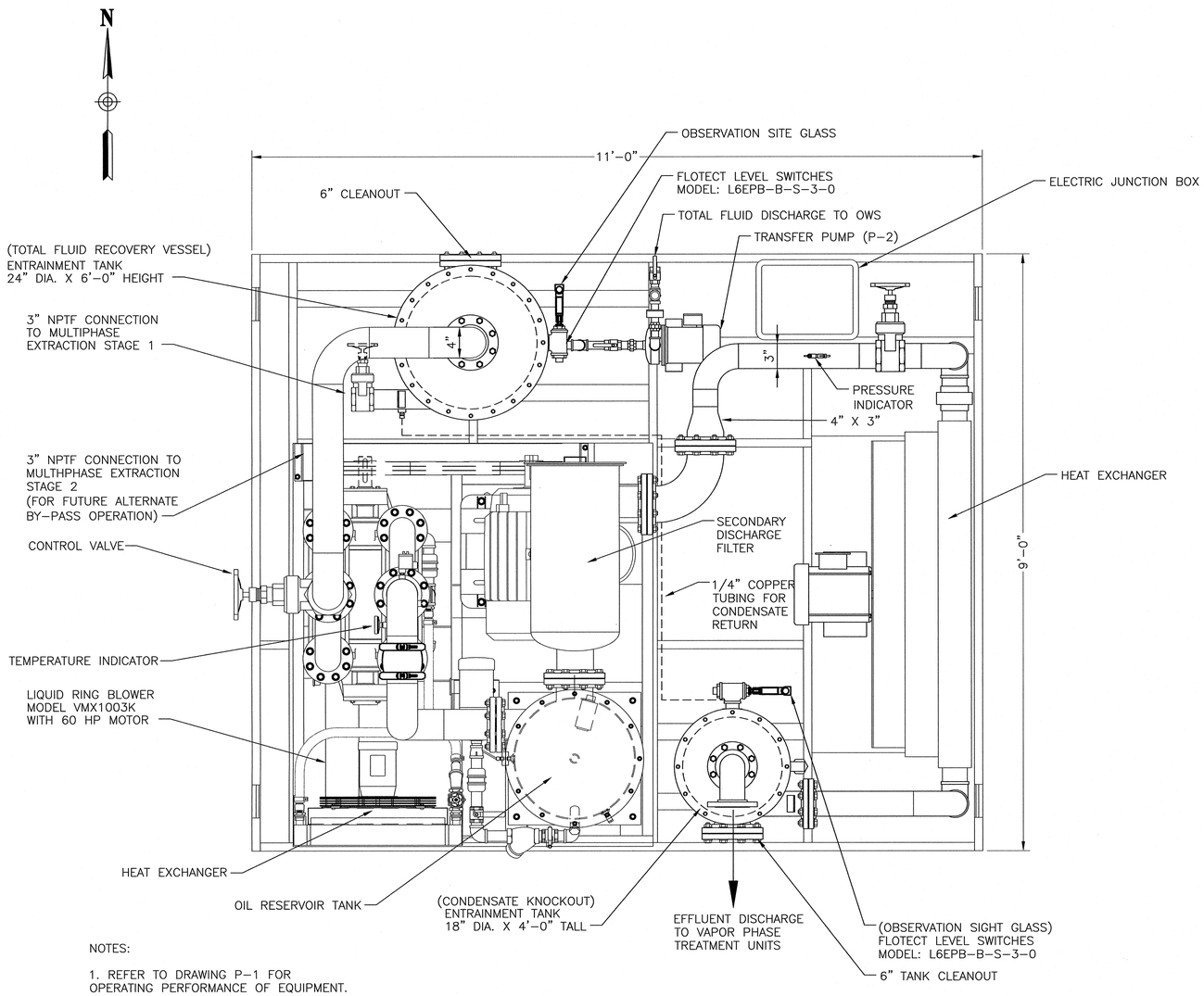
MISSION LINEN SUPPLY

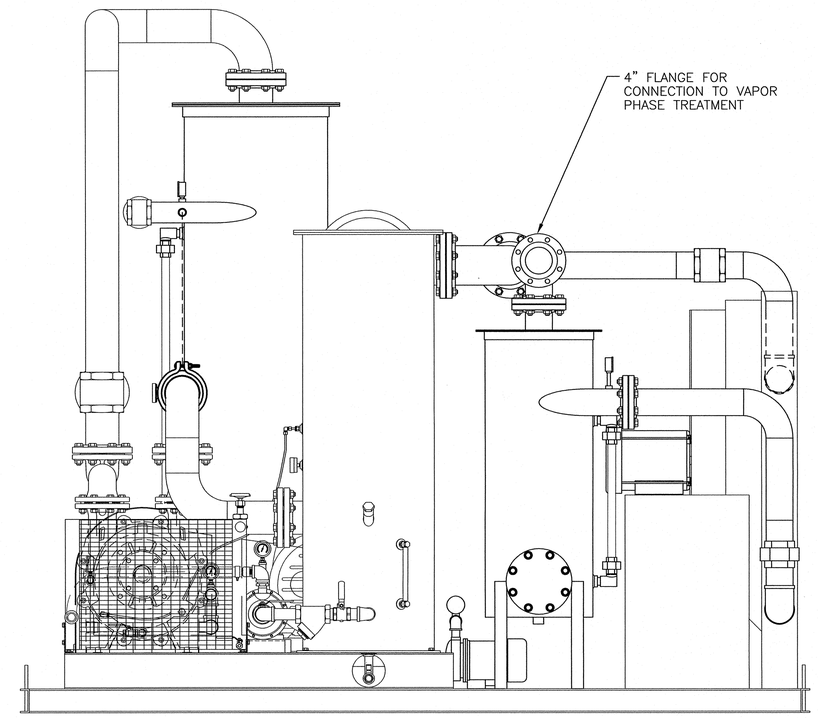
PIPING PLAN, DETAILS, AND SECTION AND EXHAUST FAN DETAIL

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. M-2
REV. AB

P:\mission linen\CADD\DESIGN_MPE_SYSTEM\REV-2\M-2-R2.dwg 03-03-06





ELEVATION

NOTES:

1. REFER TO DRAWING P-1 FOR OPERATING PERFORMANCE OF EQUIPMENT.

2. REFER TO DRAWING P-2 FOR CLARIFICATION OF PROCESS FLOW AS IT RELATES TO THE EQUIPMENT LAYOUT PROVIDED BY VENDOR.

3. CONTRACTOR SHALL SECURE EQUIPMENT SKID TO FINISHED FLOOR AS RECOMMENDED BY THE EQUIPMENT MANUFACTURER. VIBRATION PADS SHALL BE USED WHERE NECESSARY AND AS DIRECTED BY THE ENGINEER TO MINIMIZE VIBRATION INDUCED BY OPERATION OF EQUIPMENT.

VACUUM BLOWER SKID PACKAGE
CONCEPT ONLY
DETAIL SUPPLIED BY ENVIROSUPPLY & SERVICE

DETAIL 1 C2 M3
NOT TO SCALE

Two working days before you dig.
CALL FOR THE BLUE STAKES
1-800-STAKE-IT
1-800-782-5348
(OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE
ENVIROSUPPLY & SERVICE, INC. - EQUIPMENT DRAWINGS	

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	2-06	RE-ISSUED FOR PERMIT

REVISIONS NO.	BY	DATE	DESCRIPTION

Registered Professional Engineer (Environmental) CERTIFICATE NO. 41997 MICHAEL A. BARONE Expires 3-31-06 ARIZONA, U.S.A.

SCALE: AS NOTED	DATE
DESIGNED BY: MAB/JWB	2-06
DRAWN BY: KLP	2-06
CHECKED BY: PJS, JMW	2-06
APPROVED BY: MAB	2-06
CLIENT APPROVAL BY:	

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

MPE BLOWER AND PIPING SKID

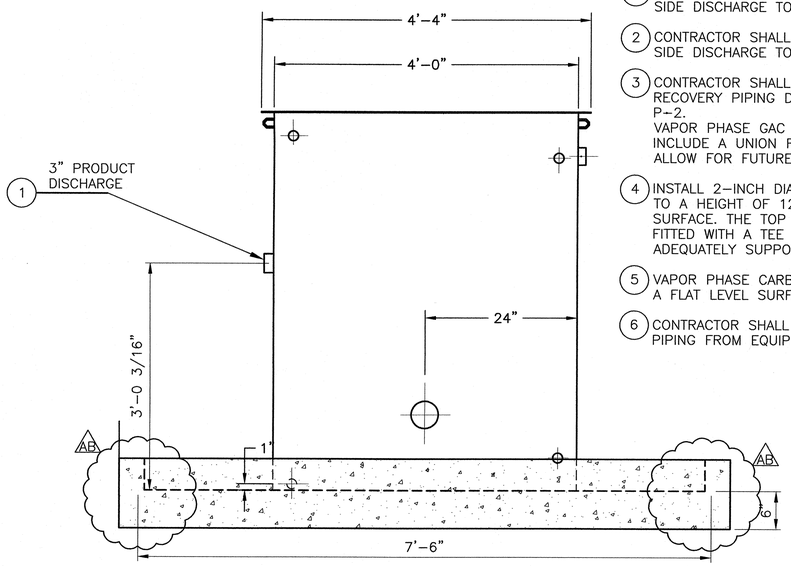
MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. M-3
REV. 1

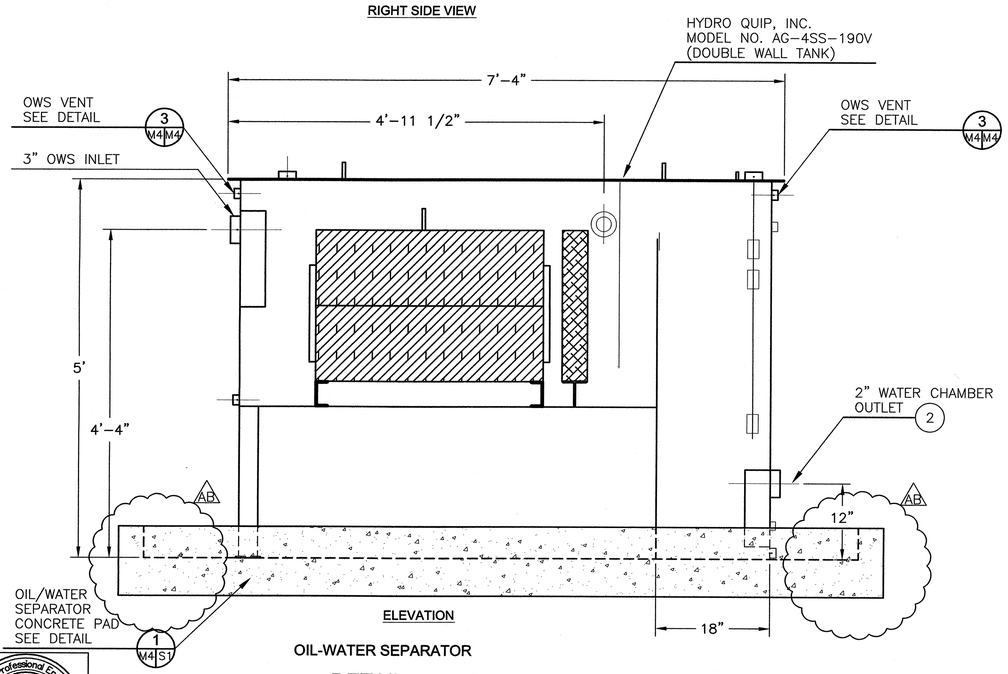
P:\mission linen\CADD\DESIGN_MPE_SYSTEM\REV-1\M-3-R1.dwg 02-20-06

KEY NOTES

1. CONTRACTOR SHALL INSTALL PIPING FROM PRODUCT SIDE DISCHARGE TO TRANSFER PUMP P–5.
2. CONTRACTOR SHALL INSTALL PIPING FROM WATER SIDE DISCHARGE TO PUMP P–6.
3. CONTRACTOR SHALL INSTALL THE TOTAL FLUID RECOVERY PIPING DISCHARGE FROM TRANSFER PUMP P–2.
   VAPOR PHASE GAC DRUM INLET PIPING SHALL INCLUDE A UNION FITTING AND BALL VALVE TO ALLOW FOR FUTURE DRUM CHANGEOUT.
4. INSTALL 2–INCH DIAMETER SCH 80 PVC VENT PIPING TO A HEIGHT OF 12 FEET ABOVE FINISHED GROUND SURFACE. THE TOP OF VENT PIPING SHALL BE FITTED WITH A TEE FITTING. VENT PIPING SHALL BE ADEQUATELY SUPPORTED TO PREVENT PIPE FAILURE.
5. VAPOR PHASE CARBON DRUM SHALL BE SECURED TO A FLAT LEVEL SURFACE.
6. CONTRACTOR SHALL CONNECT VENT DISCHARGE PIPING FROM EQUIPMENT.



RIGHT SIDE VIEW

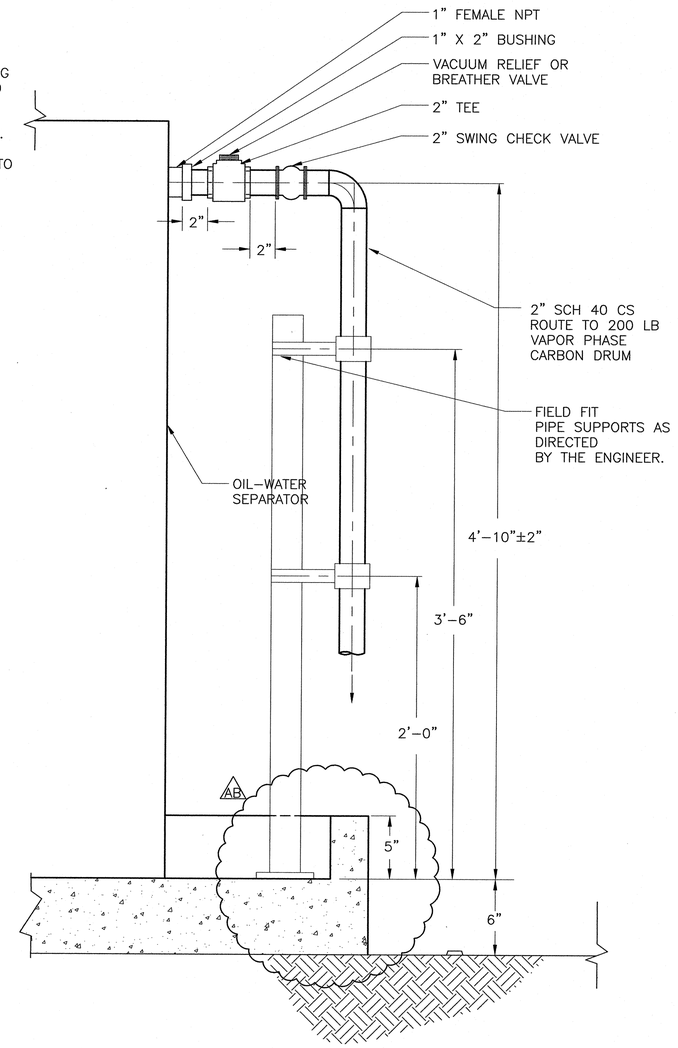


ELEVATION

OIL-WATER SEPARATOR

DETAIL 1 C2 M4

0 1 2
SCALE IN FEET

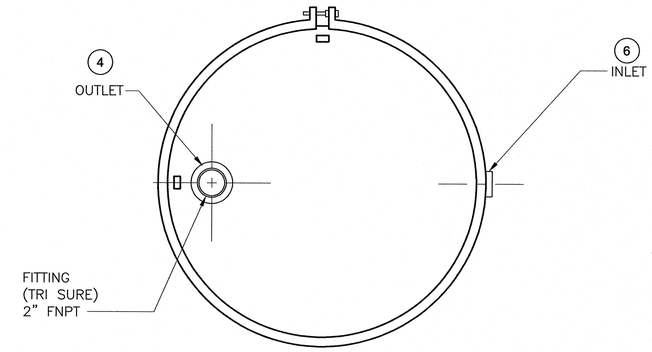


OIL/WATER SEPARATOR VENT
(TYPICAL OF 2)

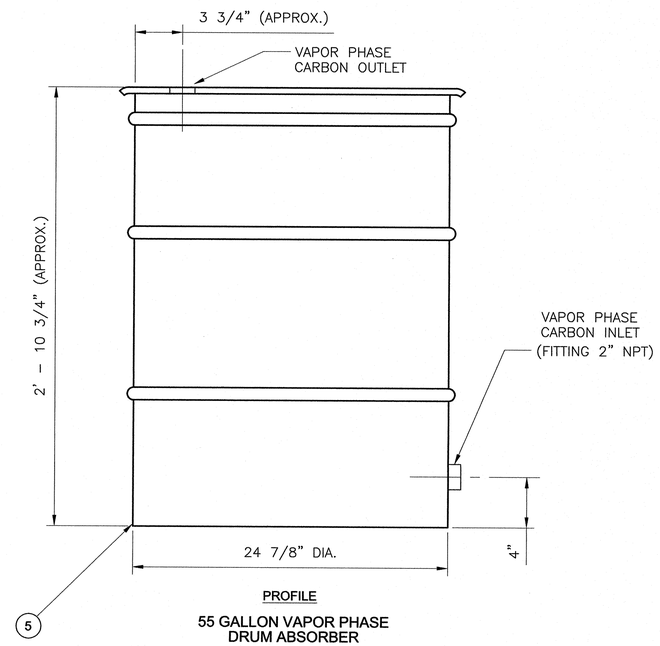
DETAIL 3 M4 M4

SCALE: 2" = 1'–0"

0 6 12 18
SCALE IN INCHES



PLAN



PROFILE

55 GALLON VAPOR PHASE DRUM ABSORBER

DETAIL 2 C2 M4

0 .5 1
SCALE IN FEET

NOTES:

1. OWS VENT SHALL INCLUDE VAPOR TREATMENT.
2. CONTRACTOR SHALL INSTALL OWS TANK GROUND AS RECOMMENDED BY THE EQUIPMENT MANUFACTURER AND IN CONFORMANCE WITH LOCAL, STATE AND FEDERAL CODE REQUIREMENTS.
3. OWS TANK INSTALLATION SHALL CONFORM TO CITY OF TUCSON, NFPA–30 AND IFC 2003 REQUIREMENTS.
4. EMERGENCY VENT SHALL BE NFPA APPROVED AND BE SET AT 2.5 PSIG. VENT SHALL BE INSTALLED AT A LOCATION APPROVED BY THE ENGINEER.
5. OWS AND VAPOR PHASE CARBON DRUM SHALL BE LABELED AS DIRECTED BY THE ENGINEER.

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 9-16-08 Arizona U.S.A. EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig. CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE
ENVIROSUPPLY & SERVICE, INC:	
HYDROGROUP, INC.	

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6–05	ISSUED FOR CONSTRUCTION
1	MB	9–05	RE–ISSUED FOR CONSTRUCTION
2	MB	2–06	RE–ISSUED FOR PERMIT
AB	WN	8–08	AS–BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE: AS NOTED		DATE
DESIGNED BY:	MAB/JWB	2–06
DRAWN BY:	KLP	2–06
CHECKED BY:	PJS, JMW	2–06
APPROVED BY:	MAB	2–06
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

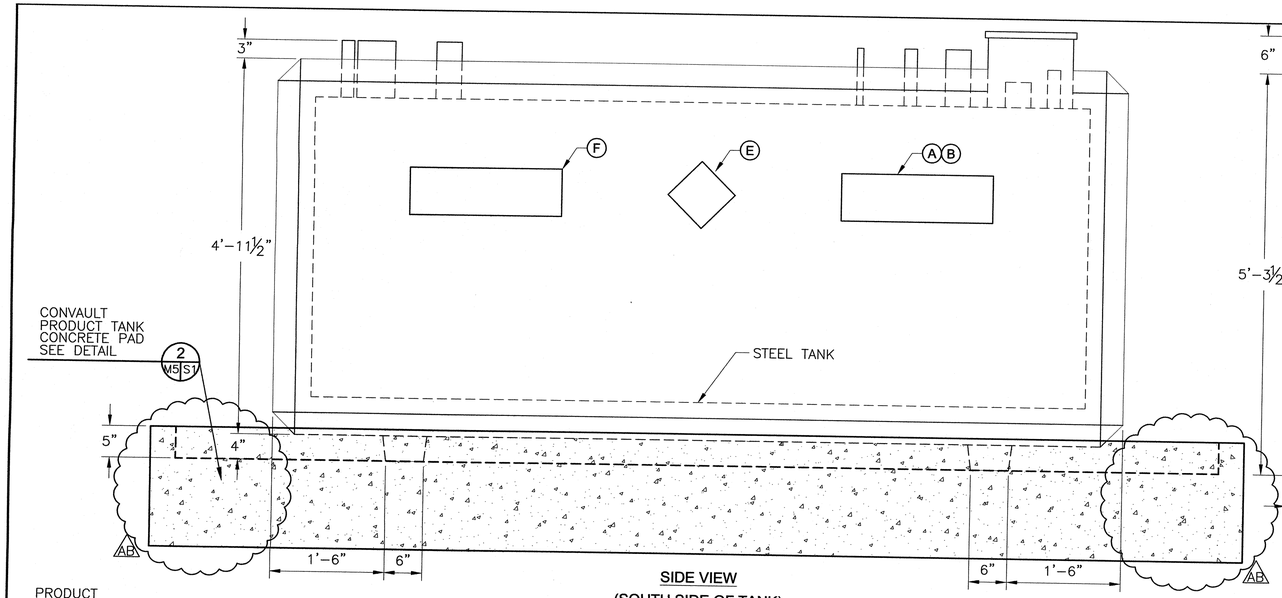
MISSION LINEN SUPPLY

OIL / WATER SEPARATOR DETAILS

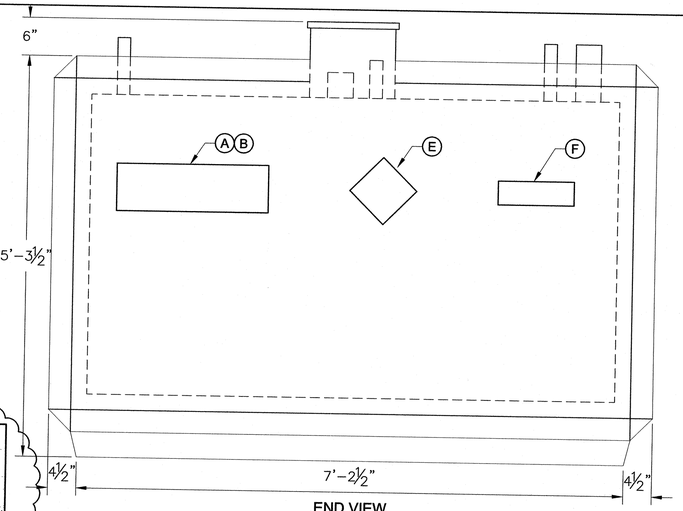
MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. M-4
REV. AB

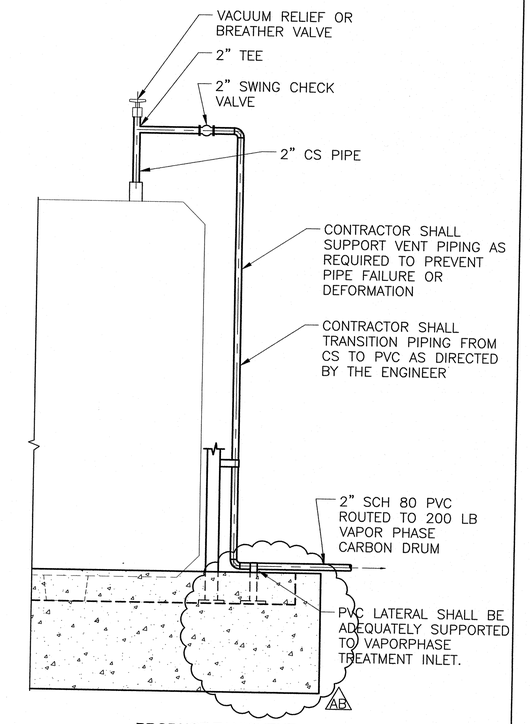
P:\mission linen\CADD\DESIGN_MPE_SYSTEM\REV-2\M-4-R2.dwg 02-20-06



SIDE VIEW
(SOUTH SIDE OF TANK)

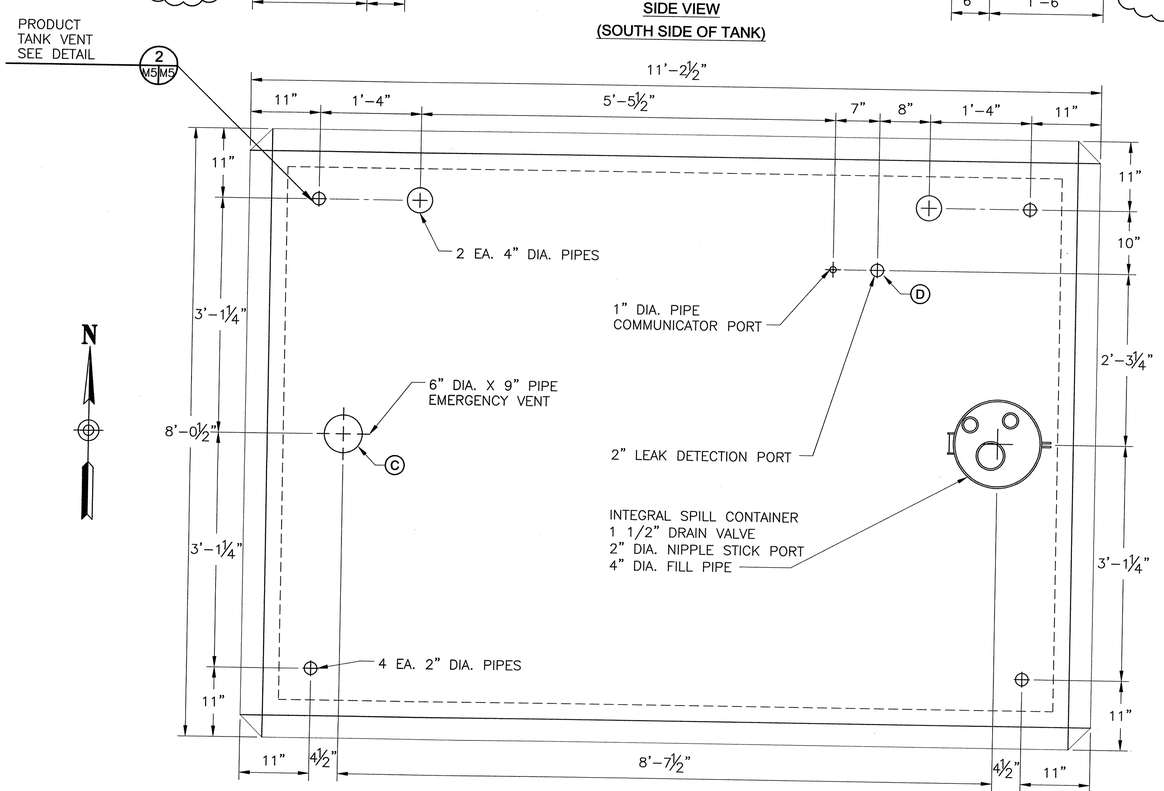


END VIEW
(EAST SIDE OF TANK)

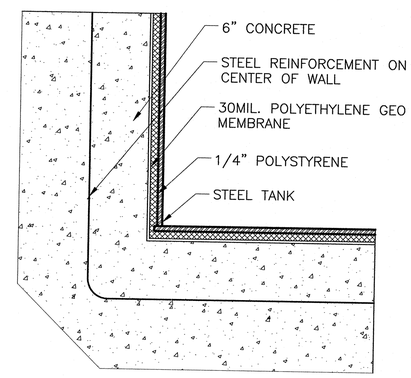


PRODUCT TANK VENT

DETAIL 2 M5 M5
NOT TO SCALE



PLAN VIEW



WALL DETAIL
NOT TO SCALE

CONVAULT TANK LABEL KEY		
Key	Label	Location(s)
A	NOMINAL CAPACITY – 2,000 GALLONS	N, W, E Sides of Tank
B	DANGER – CLASS II COMBUSTIBLE LIQUID	N, W, E Sides of Tank
	WASTE FUEL–OIL MIXTURE, NA 1993	
C	EMERGENCY VENT	Top of Tank
D	LEAK SENSOR PORT	Top of Tank
E	NFPA 704 PLACARD (7.5" X 7.5") – COMBUSTIBLE/2	E. SIDE OF TANK
F	NO SMOKING	W, E SIDE OF TANK
(N) NORTH, (W) WEST, (E) EAST		
TABLE NOTES		
1)	ALL LABELS SHALL BE SELF ADHESIVE, AND BE MANUFACTURED OF A DURABLE WEATHER RESISTANT MATERIAL WITH RED LETTERING ON A WHITE BACKGROUND.	
2)	LETTERING SHALL BE 3–INCHES IN HEIGHT AND HAVE A 1/2 INCH STROKE.	
3)	NFPA PLACARD SHALL BE IN CONFORMANCE WITH UFC STANDARD 79–3.	

CONVAULT PRODUCT TANK
DETAIL 1 C1 M5

0 1 2
SCALE IN FEET

NOTES:

1. TANK WILL BE 2,000–GALLON NOMINAL CAPACITY WITH INTEGRAL SECONDARY CONTAINMENT.
2. CONTRACTOR SHALL INSTALL TANK GROUND AS RECOMMENDED BY THE EQUIPMENT MANUFACTURER AND IN CONFORMANCE WITH LOCAL, STATE AND FEDERAL CODE REQUIREMENTS.
3. TANK INSTALLATION SHALL CONFORM TO CITY OF TUCSON REQUIREMENTS, NFPA 30 AND IFC 2003 WITH TUCSON AMMENDMENTS.
4. TANK IS A RECOVERY TANK ONLY AND SHALL NOT BE USED TO DISPENSE RECOVERED PRODUCT.
5. CONTAINMENT CURBING SHALL BE 5 INCHES IN HEIGHT AVOVE FINISHED SLAB SURFACE. CONTAINMENT SHALL PROVIDE CONTAINMENT FOR PRECIPITATION ONLY.
6. ALL UNUSED TANK PENETRATIONS SHALL BE TERMINATED WITH A THREADED PLUG AS DIRECTED BY THE ENGINEER.
7. EMERGENCY VENT SHALL BE NFPA AND API APPROVED AND SHALL PROVIDE PRESSURE RELIEF AT 2.5 PSIG.
8. TANK IS NOT FOR DISPENSING OPERATIONS AND SHALL SERVE AS PRODUCT STORAGE ONLY.

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 1-15-09 Arizona U.S.A. EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE
ENVIROSUPPLY, INC. UTILITY VAULT 2,000 GALLON, CONVAULT TANK DETAILS	

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6–05	ISSUED FOR CONSTRUCTION
1	MB	9–05	RE–ISSUED FOR CONSTRUCTION
AB	WN	8–08	AS–BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE: AS NOTED		DATE
DESIGNED BY:	MAB/JWB	9–05
DRAWN BY:	KLP	9–05
CHECKED BY:	PJS, JMW	9–05
APPROVED BY:	MAB	9–05
CLIENT APPROVAL BY:		

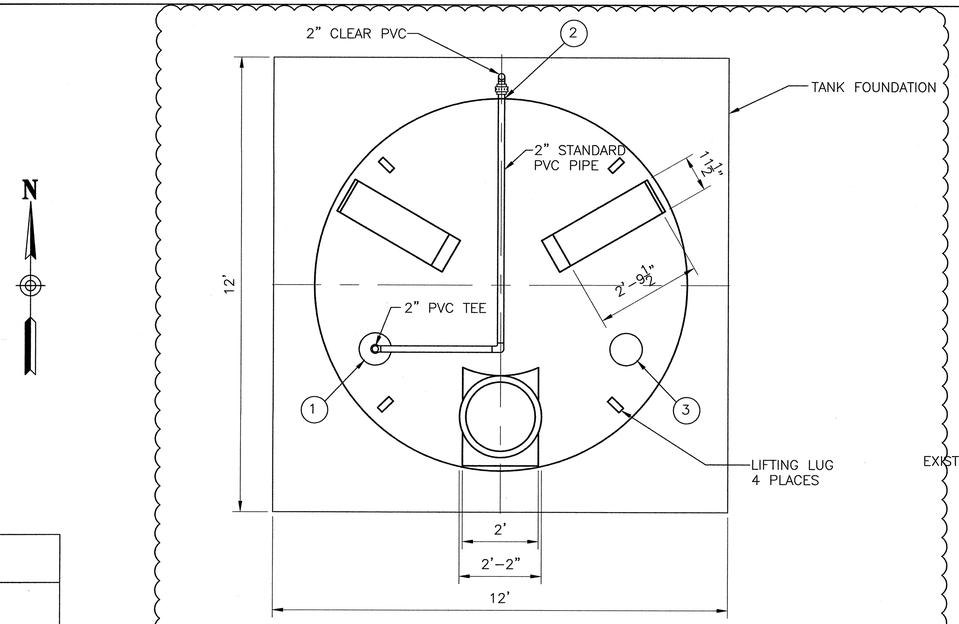
URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY
PRODUCT RECOVERY TANK

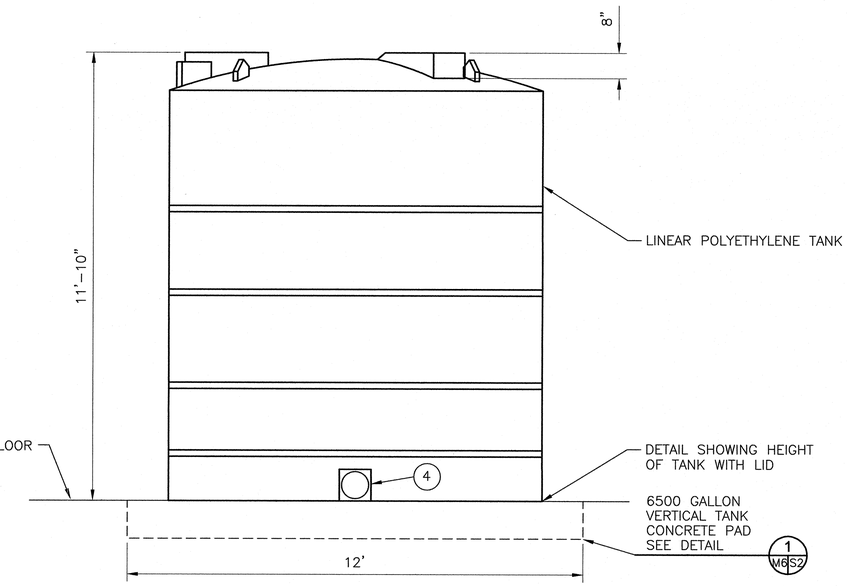
MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. M-5
REV. AB

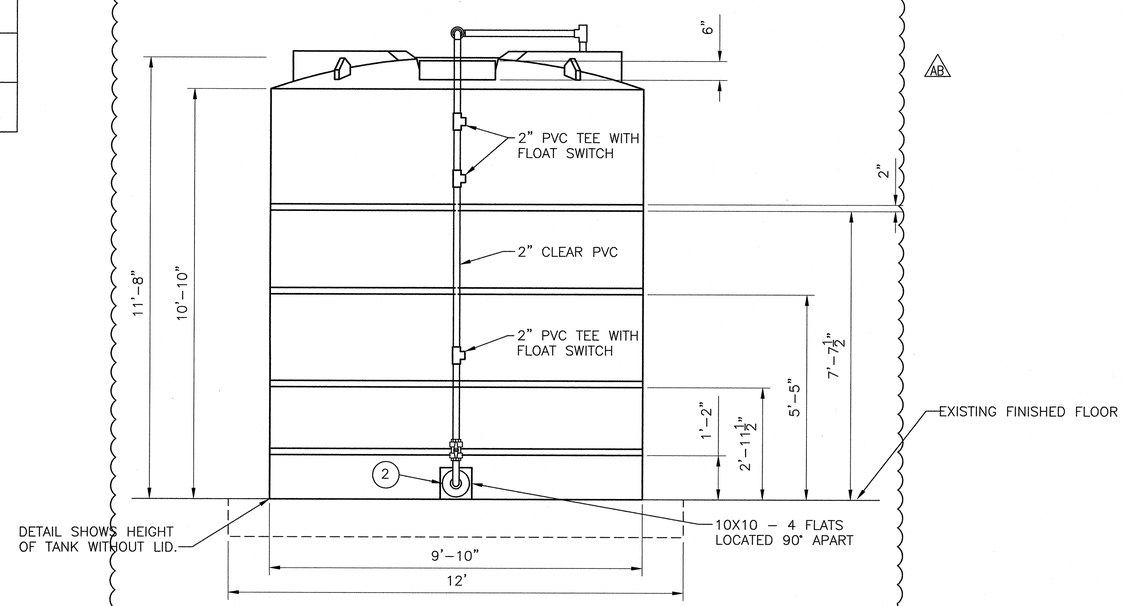
P:\mission linen\CADD\DESIGN\REV-1\M-5-R1.dwg 09-07-05



PLAN VIEW



WEST ELEVATION



NORTH ELEVATION

6500 GALLON VERTICAL TANK
CONCEPT ONLY
DETAIL SUPPLIED BY HERITAGE PRODUCTS

DETAIL 2 C2M6
NOT TO SCALE

N

TANK NOZZLE SCHEDULE

NOZZLE	SIZE	DESCRIPTION
1	2" X FEMALE NPT	ATM VENT [A]
2	2" X MALE NPT	TREATED WATER INLET
3	2" X FEMALE NPT	SPARE PENETRATION
4	2" X MALE NPT	DRAIN OUTLET

[A] VENT SHALL BE INSTALLED AND SUPPORTED AS DIRECTED BY THE ENGINEER.

NOTES:

1. CONTRACTOR SHALL SET TANK ON A LEVEL SURFACE ON THE EXISTING FINISHED FLOOR WITHIN THE SYSTEM ENCLOSURE INSIDE THE BUILDING. CONTRACTOR SHALL ENSURE THAT THE TANK IS PLUMB, VERTICAL AND LEVEL.

2. CONTRACTOR SHALL FIELD FIT AND SUPPORT ALL PIPE CONNECTIONS TO THE TANK AS REQUIRED.

3. ALL INFLOWS AND OUTFLOWS TO THE TANKS SHALL BE FITTED WITH AN ISOLATION VALVE.

4. NOZZLE PENETRATION NO.4 SHALL BE FITTED WITH A 2-INCH BALL VALVE (SLIP X SLIP, SOLVENT WELDED) TERMINATED WITH A THREADED END CAP.

5. ALL SPARE NOZZLE PENETRATIONS SHALL BE FITTED WITH A THREADED PLUG.

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Arizona U.S.A. EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE
HERITAGE PRODUCTS: ROTONICS MFG, INC.	
DRAWING NO. S-1112	
HERITAGE PRODUCTS SPECIFICATIONS.	

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	2-06	RE-ISSUED FOR PERMIT
AB	WN	8-08	AS-BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE: AS NOTED		DATE
DESIGNED BY:	MAB/JWB	2-06
DRAWN BY:	KLP	2-06
CHECKED BY:	PJS, JMW	2-06
APPROVED BY:	MAB	2-06
CLIENT APPROVAL BY:		

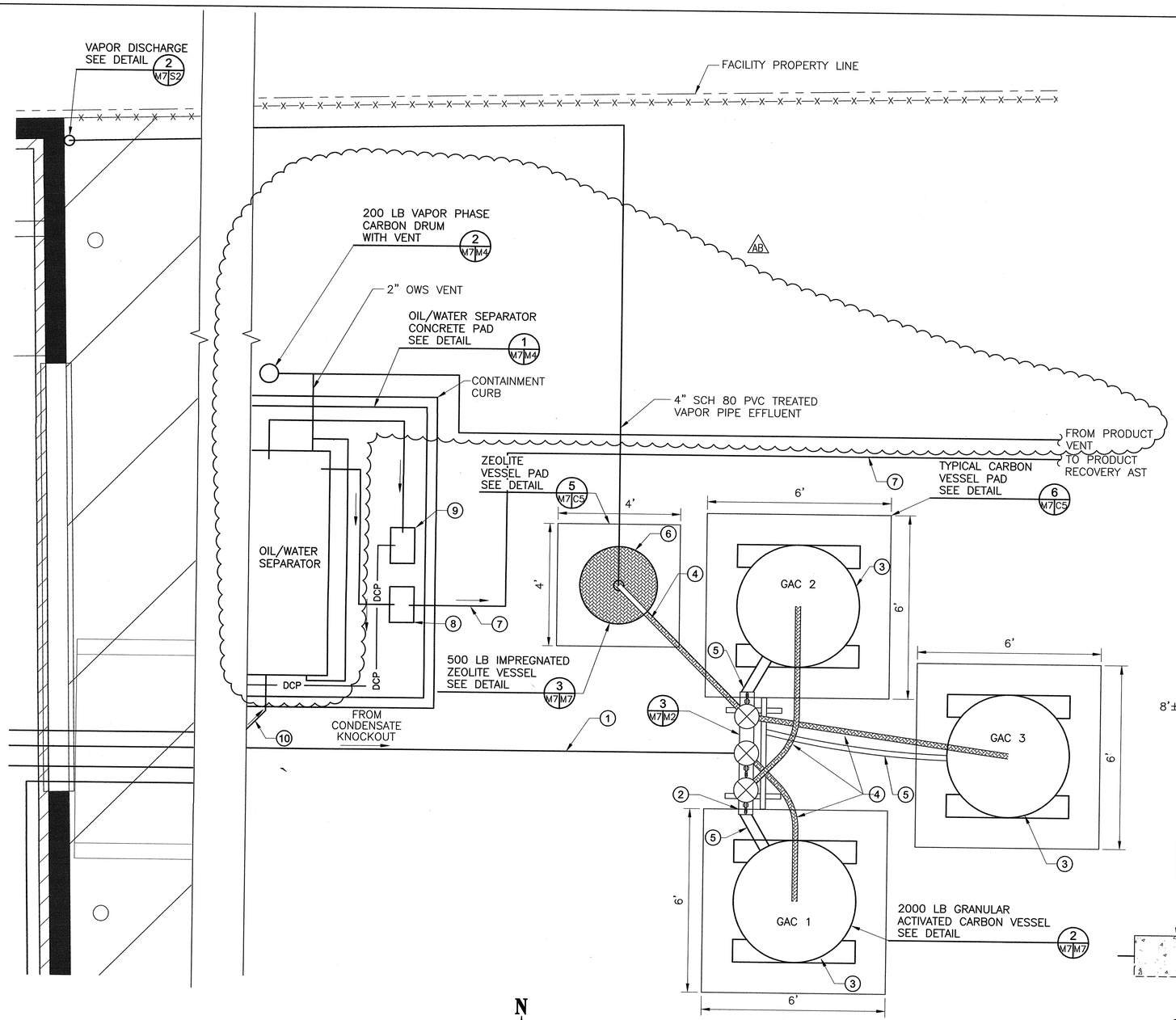
URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY
WATER RECOVERY TANK

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. M-6
REV. AB

P:\mission linen\CADD\DESIGN_MPE_SYSTEM\REV-1\M-6-R1.dwg 02-20-06



PLAN VIEW
VAPOR PHASE TREATMENT

DETAIL 1 C2 M7

0 2 4
SCALE IN FEET

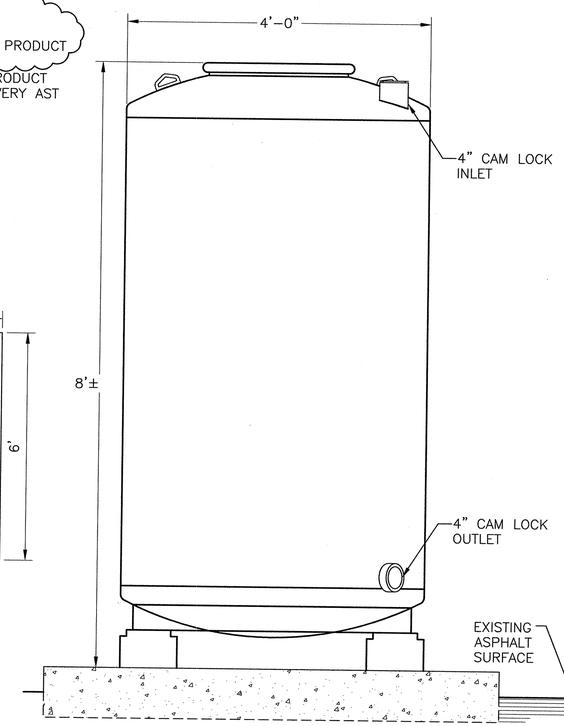
N

NOTES:

1. UNLESS OTHERWISE NOTED, ALL PIPING SHOWN IN THIS DRAWING IS SCH 80 PVC.
2. ALL VESSELS WILL BE EQUIPPED WITH 4" CAM LOCK FITTINGS.
3. CONTRACTOR SHALL FIELD FIT PIPING AND HOSE SUPPORTS AS DIRECTED BY THE ENGINEER.
4. OWS UNIT AND ASSOCIATED PIPING NOT SHOWN FOR CLARITY.
5. EXISTING MONITOR AND VENT WELLS NOT SHOWN FOR CLARITY.
6. LABELS FOR VESSELS SHALL BE PROVIDED BY OTHERS AND PLACED AS DIRECTED BY THE ENGINEER.

KEY NOTES:

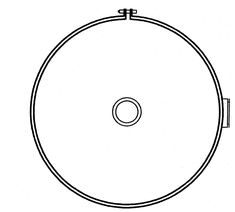
1. 4" SCH 80 PVC PIPE, ABOVE GROUND FROM CONDENSATE KNOCKOUT – VAPOR DISCHARGE.
2. 4" SCH 80 PVC PIPE MANIFOLD WITH CAM LOCK FITTINGS AND 2" TS PIPE RACK BOLTED TO GROUND SURFACE.
3. 2000–LB GRANULAR ACTIVATED CARBON VESSEL.
4. 4" INFLUENT HOSE, CAM LOCK.
5. 4" EFFLUENT HOSE, CAM LOCK.
6. 500–LB IMPREGNATED ZEOLITE VESSEL.
7. OWS PRODUCT DISCHARGE LINE – DOUBLE CONTAINED PIPE 1" CS PRIMARY PIPE WITHIN 3" SCH 80 PVC CONTAINMENT PIPE.
8. OWS PRODUCT PUMP
9. OWS WATER PUMP
10. OWS INFLOW



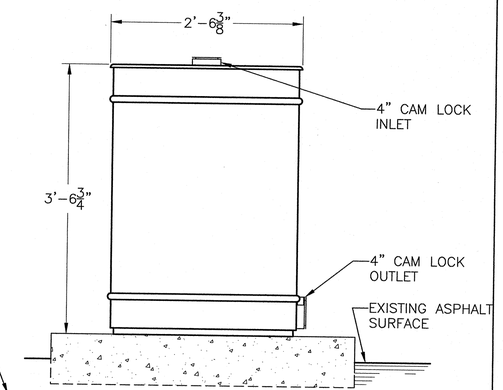
2000 LB GRANULAR ACTIVATED CARBON VESSEL

DETAIL 2 M7 M7

0 1 2
SCALE IN FEET



PLAN



PROFILE

500 LB IMPREGNATED ZEOLITE VESSEL

DETAIL 3 M7 M7

0 1 2
SCALE IN FEET

Registered Professional Engineer (Civil) CERTIFICATE NO. 46861 WILLIAM J. NEESE Date Signed 4-14-08 EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig. CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE
U.S. FILTER WESTATES – DETAILS	

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	9-05	RE-ISSUED FOR CONSTRUCTION
2	MB	2-06	RE-ISSUED FOR PERMIT
AB	WN	8-08	AS-BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE: AS NOTED	DATE
DESIGNED BY: MAB/JWB	2-06
DRAWN BY: RJW	2-06
CHECKED BY: PJS, JMW	2-06
APPROVED BY: MAB	2-06
CLIENT APPROVAL BY:	

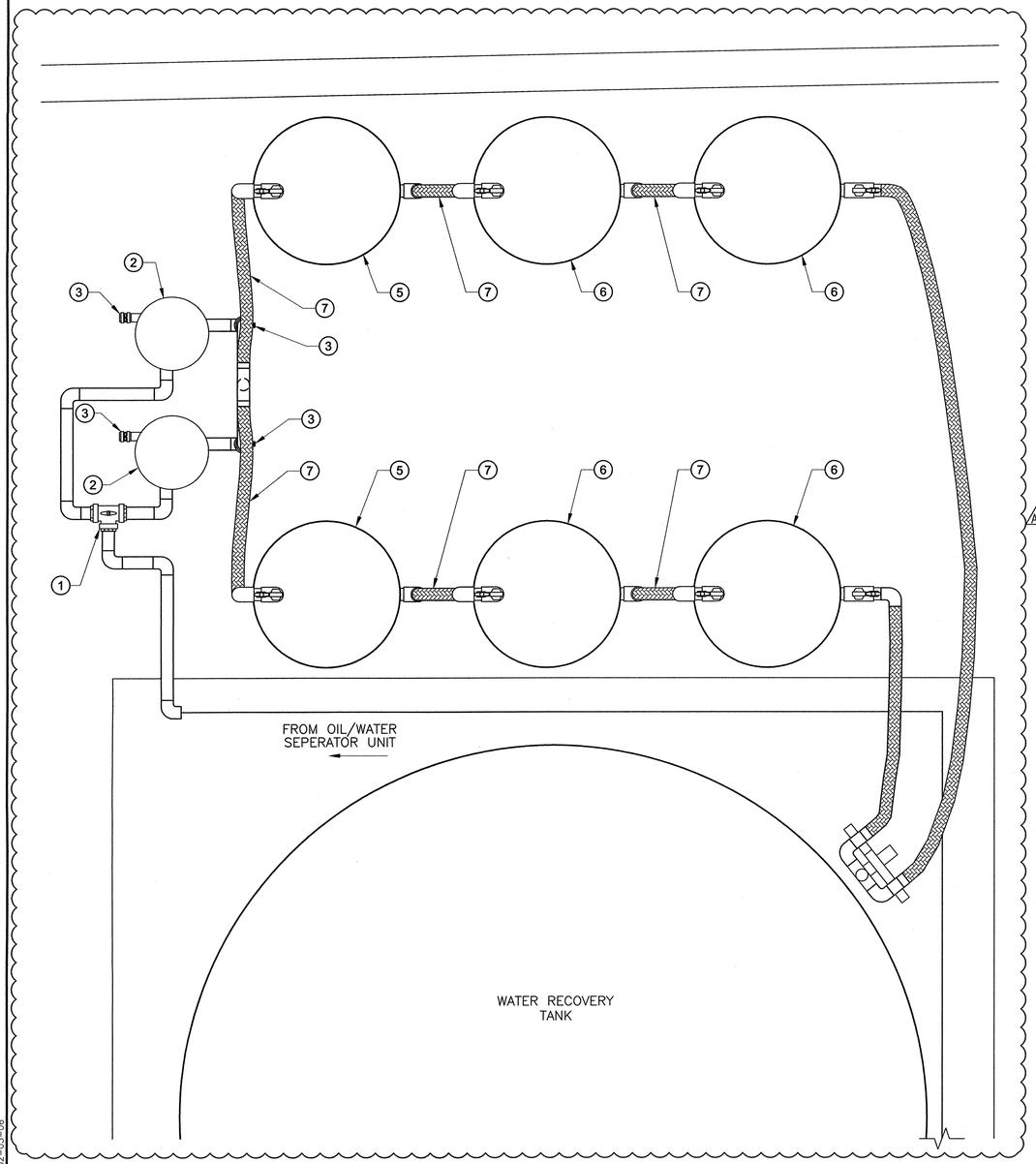
URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY
VAPOR PHASE TREATMENT (STAGE 1)

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. M-7
REV. AB

P:\mission linen\CADD\DESIGN_MPE_SYS\EM\REV-2\M-7-R2.dwg 03-03-06

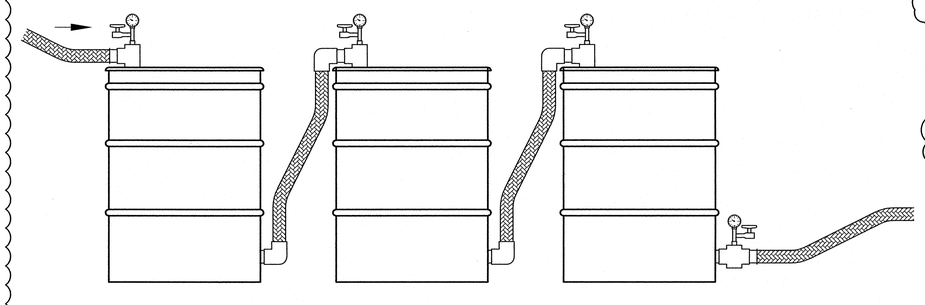


PLAN VIEW
LIQUID PHASE TREATMENT UNITS

DETAIL 1 M8 M8

0 1 2
SCALE IN FEET

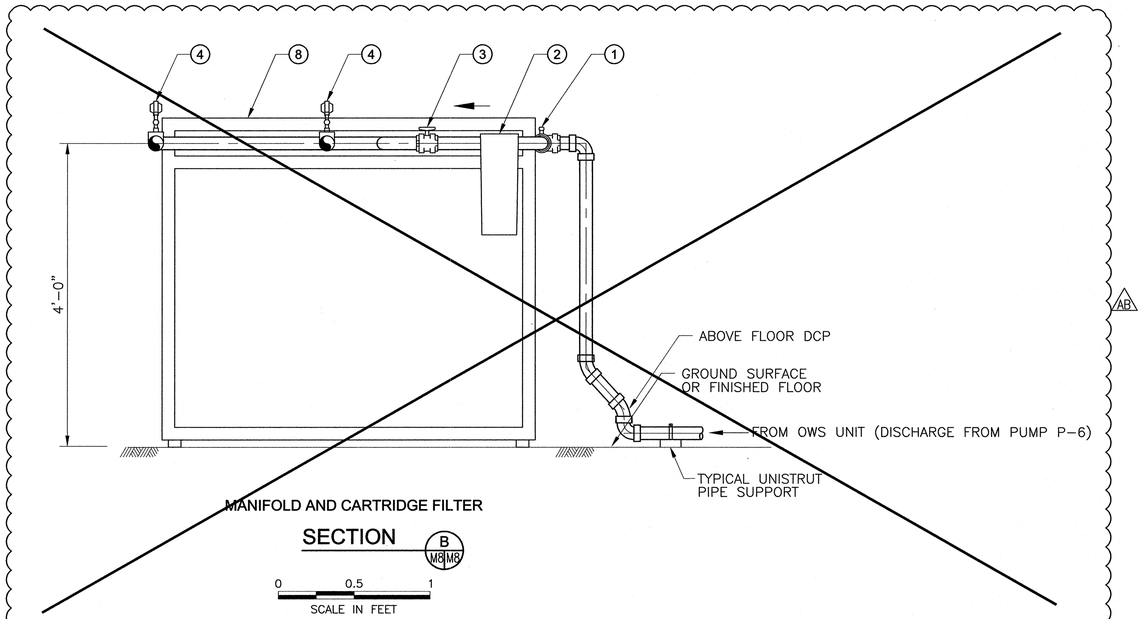
N



INTERCONNECTING HOSE KIT

SECTION A M8 M8

0 0.5 1
SCALE IN FEET



MANIFOLD AND CARTRIDGE FILTER

SECTION B M8 M8

0 0.5 1
SCALE IN FEET

KEY NOTES:

1. 2" T-PORT 3-WAY TRUE UNION BALL VALVE.
2. CUNO 1M2 FILTER HOUSING; POLYPRO HEAD WITH TRANSPARENT SUMP (INCLUDES 10 MICRON FILTER CARTRIDGE.
3. TRUE UNION BALL VALVE.
4. ~~2" VALVE WITH CAM LOCK FITTING.~~
5. 350-LB BIOMIN OILSORB VESSEL OR EQUIVALENT.
6. 200-LB CARBON ADSORPTION VESSEL.
7. 2" HOSE.
8. ~~2" TS PIPE RACK WITH SUPPORT BRACKETS AND FLOOR ANCHORS.~~

NOTES:

1. UNLESS OTHERWISE NOTED, ALL PIPING SHOWN IN THIS DRAWING IS SCH 80 PVC.
2. PIPING AT BOTH ENDS OF BIOMIN AND CARBON VESSELS MUST BE INSTALLED AT LEAST 12" ABOVE THE TOP OF VESSELS TO ENSURE THAT THE VESSELS ARE ALWAYS FILLED.
3. ALL BIOMIN AND CARBON VESSELS SHALL BE FURNISHED WITH 2" CAM LOCK VALVE AT INFLUENT AND EFFLUENT CONNECTIONS.
4. CONTRACTOR SHALL FIELD FIT ALL PIPING AND ADEQUATELY SUPPORT ALL PIPING AND VALVES AS DIRECTED BY THE ENGINEER.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 46861
WILLIAM J. NEESE
Date Signed 4-16-10
ARIZONA U.S.A.
EXPIRES 09-30-2010

"AS-BUILT DRAWINGS"

Two working days before you dig. CALL FOR THE BLUE STAKES
1-800-STAKE-IT
1-800-782-5348
(OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE

REVISIONS NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	MB	2-06	RE-ISSUED FOR PERMIT
AB	WN	8-08	AS-BUILTS

REVISIONS NO.	BY	DATE	DESCRIPTION

SCALE: AS NOTED		DATE
DESIGNED BY:	JWB	2-06
DRAWN BY:	RJW	2-06
CHECKED BY:	PJS, JMW	2-06
APPROVED BY:	MAB	2-06
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

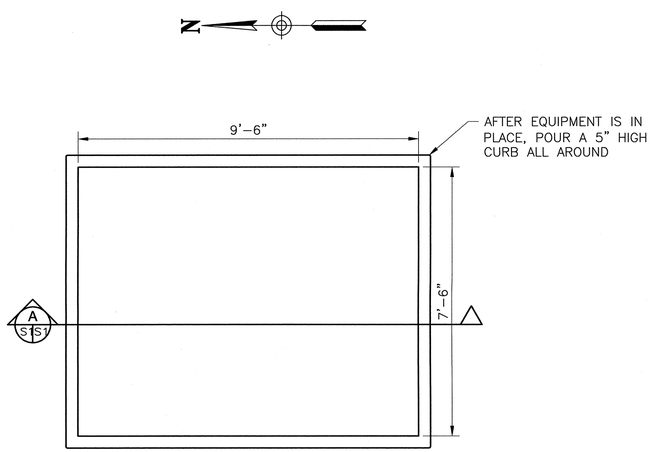
MISSION LINEN SUPPLY

LIQUID PHASE CARBON TREATMENT SYSTEM

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

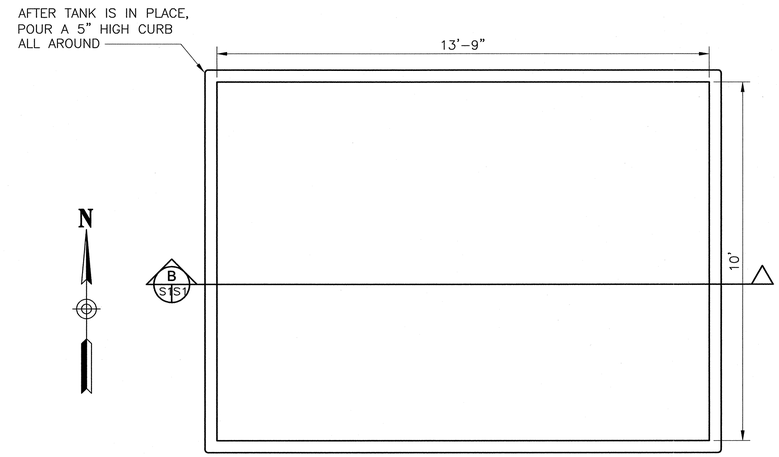
JOB NO. 22237188
DRAWING NO. M-8
REV. AB

P:\mission linen\CADD\DESIGN_MPE_SYSTEM\REV-1\M-8-R1.dwg 02-03-06



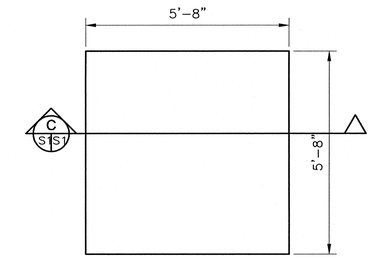
PLAN VIEW
OIL/WATER SEPARATOR CONCRETE PAD

DETAIL 1 M4 S1 — 0 2 4 SCALE IN FEET



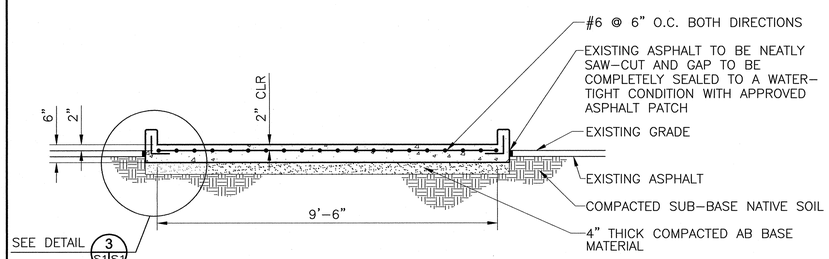
PLAN VIEW
CONVAULT PRODUCT TANK CONCRETE PAD

DETAIL 2 M5 S1 — 0 2 4 SCALE IN FEET

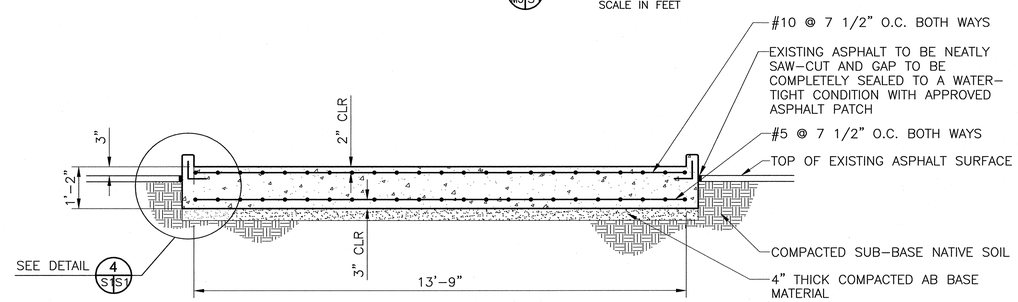


PLAN VIEW
WELL VAULT TANK CONCRETE PAD

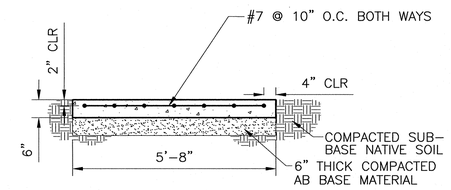
DETAIL 5 — S1 — 0 2 4 SCALE IN FEET



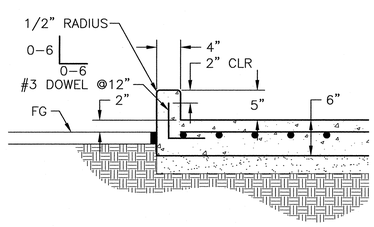
SECTION A S1 S1 — 0 2 4 SCALE IN FEET



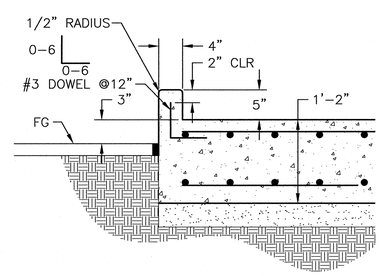
SECTION B S1 S1 — 0 2 4 SCALE IN FEET



SECTION C S1 S1 — 0 2 4 SCALE IN FEET



DETAIL 3 S1 S1 — 0 1 2 SCALE IN FEET



DETAIL 4 S1 S1 — 0 1 2 SCALE IN FEET

NOTES:

1. ALL CONCRETE SHALL BE 4.000 psi COMPRESSIVE STRENGTH @ 28 DAYS, AND REINFORCING STEEL SHALL BE GRADE 60, FY = Ksi.
2. ALL EXPOSED EDGES SHALL BE TOOLED WITH A 1/2" RADIUS.
3. CONCRETE SHALL HAVE A MEDIUM BROOM FINISH.
4. SURFACE OF CONCRETE SHALL BE FLAT, VERIFIABLE BY 10-FOOT STRAIGHT EDGE EACH WAY (EVEN ACROSS CONTROL JOINTS), FREE OF BIRD BATHS.
5. COMPACTION OF AB MATERIAL SHALL BE AT LEAST 98% AND WITHIN ±2% OF OPTIMUM MOISTURE OF STANDARD PROCTOR IN ACCORDANCE WITH ASTM D-698.
6. NATIVE SOIL SUB-BASE TO BE STABILIZED AND COMPACTED TO SPECIFICATIONS IN NOTE 5.

Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

Tres Rios Consulting Engineers

URS

7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

REFERENCES TITLE	REFERENCES TITLE

REVISIONS

NO.	BY	DATE	DESCRIPTION
0	JW	6-05	ISSUED FOR CONSTRUCTION
1	JB	9-05	RE-ISSUED FOR CONSTRUCTION
2	MB	2-06	RE-ISSUED FOR PERMIT
3	MB	2-08	DETAILS REVISED

REVISIONS

NO.	BY	DATE	DESCRIPTION

Registered Professional Engineer (Civil) CERTIFICATE NO. 37214 JEFFREY W. BOWER Date Signed 8 Feb 08 ARIZONA, U.S.A.

		DATE
SCALE:	AS NOTED	
DESIGNED BY:	MAB/JWB	2-06
DRAWN BY:	KLP/RJW	2-06
CHECKED BY:	PJS, JMW	2-06
APPROVED BY:	JWB	2-06
CLIENT APPROVAL BY:		

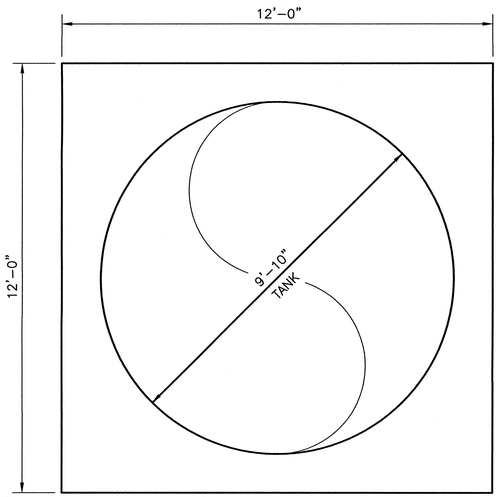
MISSION LINEN SUPPLY

CONCRETE PADS
STRUCTURAL DETAILS

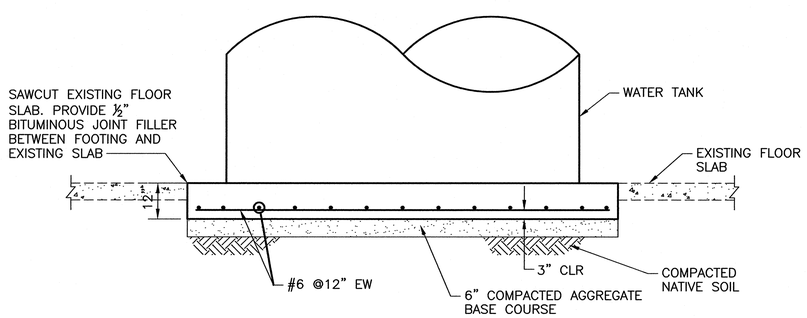
MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. S-1
REV. 3

P:\mission linen\CADD\DESIGN_MPE_SYSTEM\REV-3\S-1-R3.dwg 02-08-08



PLAN



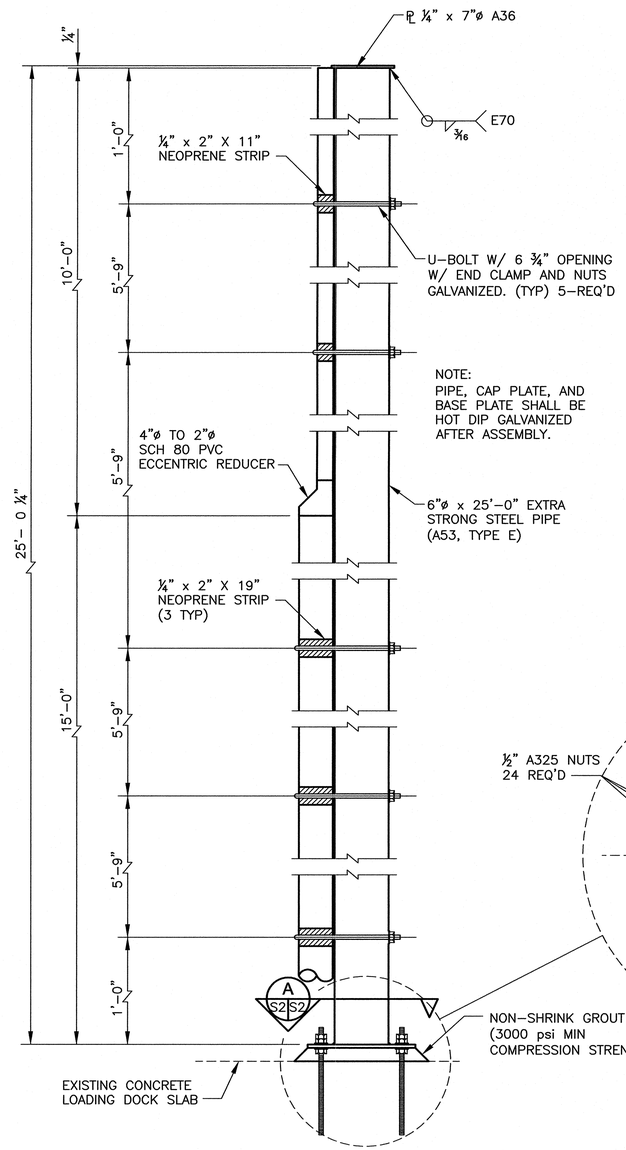
SECTION

WATER STORAGE TANK
FOUNDATION DETAIL

DETAIL

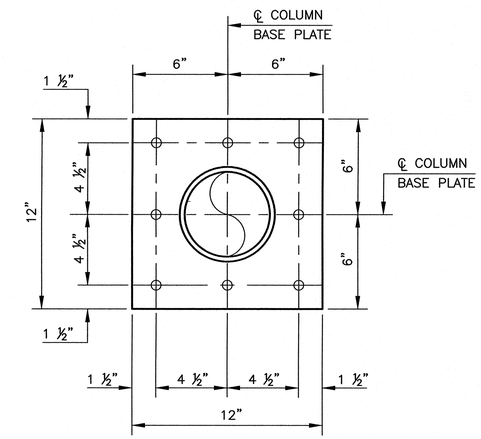
TANK FOUNDATION NOTES:

1. CONCRETE SHALL HAVE 3000psi MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS.
2. NATIVE SOIL AND ABC SHALL BE COMPACTED TO 95% DENSITY IN ACCORDANCE WITH ASTM D698



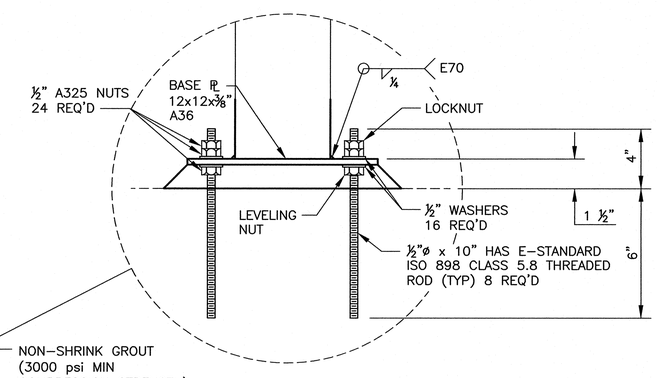
DISCHARGE STACK
SUPPORT DETAIL

DETAIL 2



BASE PLATE
DETAIL

VIEW A



Two working days before you dig, CALL FOR THE BLUE STAKES
1-800-STAKE-IT
1-800-782-5348
(OUTSIDE MARICOPA COUNTY)

REFERENCES TITLE	REFERENCES TITLE

REVISIONS NO.	BY	DATE	DESCRIPTION
0	DP	3-06	ISSUED FOR CONSTRUCTION

REVISIONS NO.	BY	DATE	DESCRIPTION

Registered Professional Engineer (Civil) CERTIFICATE NO. 27347 DAVID W. PERROTTI Date Signed 3-8-06 Arizona U.S.A.

SCALE: AS NOTED		DATE
DESIGNED BY:	DDM	3-06
DRAWN BY:	LMR	3-06
CHECKED BY:	DWP	3-06
APPROVED BY:	MAB	3-06
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY
TREATED WATER STORAGE TANK
FOUNDATION PLAN AND DISCHARGE STACK DETAILS

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. S-2
REV. 0

P:\mission linen\CADD\DESIGN\REV-2\C-5-R2.dwg 09-08-05

ELECTRICAL LEGEND

	EXPOSED CONDUIT		FUSED TERMINAL BLOCK
	UNDERGROUND CONDUIT DUCTBANK		FUSE
	GROUNDING ELECTRODE CONDUCTOR		GROUND ROD & WELL
W	OVERHEAD WATER	$M	MANUAL MOTOR STARTER
OHE	OVERHEAD ELECTRIC	60	MOTOR–NUMBER INDICATES HORSEPOWER
	ALARM BEACON (PLAN VIEW)		TERMINAL BLOCK
R	ALARM BEACON (SCHEMATIC)		PANELBOARD
	CONDUIT SEAL–OFF	JB	UNDERGROUND JUNCTION BOX
	CIRCUIT BREAKER		WATER BOND

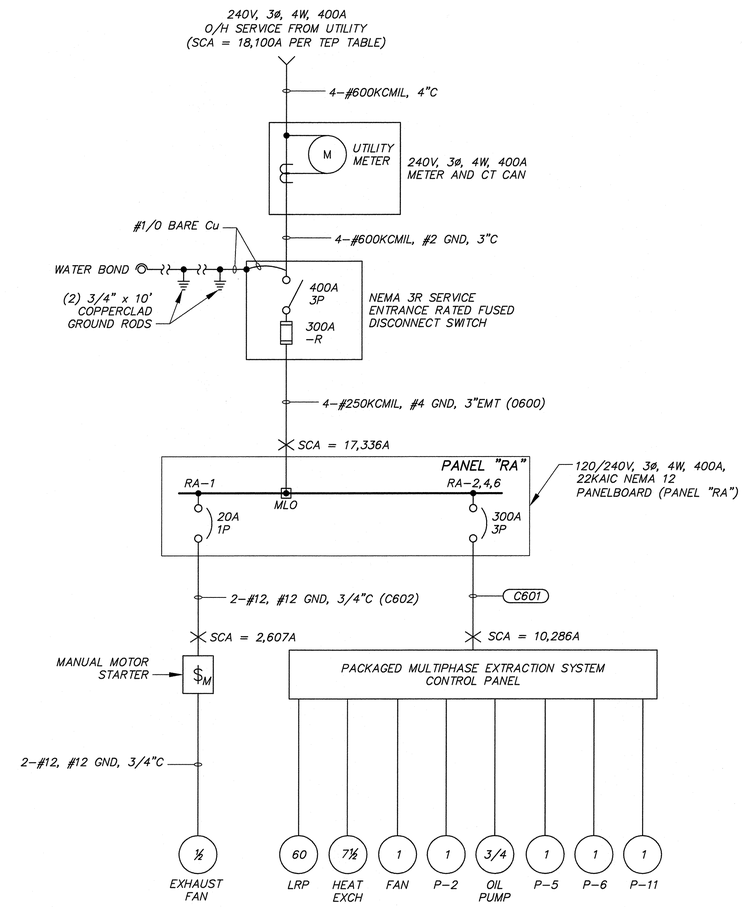
ABBREVIATIONS

2S	TWO SPEED	GRS	GALVANIZED RIGID STEEL CONDUIT	PS	PRESSURE SWITCH
AI	ANALOG INPUT	GFI	GROUND FAULT INDICATOR	PSH	PRESSURE SWITCH HIGH
AFF	ABOVE FINISHED FLOOR	GFP	GROUND FAULT PROTECTION	PW	POTABLE WATER
AFG	ABOVE FINISHED GRADE	GND	GROUND	REQ'TS	REQUIREMENTS
AO	ANALOG OUTPUT	H2O	WATER	RHSH	RELATIVE HUMIDITY SWITCH HIGH
APS	ARIZONA PUBLIC SERVICE	HWT	HOT WATER TANKS	RTU	REMOTE TERMINAL UNIT
ATS	AUTOMATIC TRANSFER SWITCH	INST	INSTRUMENT	RVNR	REDUCED VOLTAGE NON–REVERSING
C	CONDUIT	LFMC	LIQUIDTIGHT FLEXIBLE METAL CONDUIT	RW	RAW WATER
CB	CIRCUIT BREAKER	LIT	LEVEL INDICATING TRANSMITTER	SCA	SHORT CIRCUIT AMPS
CKT	CIRCUIT	LRP	LIQUID RING PUMP (EXTRACTION BLOWER)	SES	SERVICE ENTRANCE SECTION
CMU	CONCRETE MASONRY UNIT	LSH	LEVEL SWITCH HIGH	SPC	SPARE CONDUIT
COM	COMMON	LSHH	LEVEL SWITCH HIGH–HIGH	STT	SHIELDED TWISTED TRIAD
CPT	CONTROL POWER TRANSFORMER	LSL	LEVEL SWITCH LOW	SWBD	SWITCHBOARD
Cu	COPPER	MBJ	MAIN BONDING JUMPER	TEP	TUCSON ELECTRIC POWER
DIST	DISTRIBUTION	MCC	MOTOR CONTROL CENTER	TFR	TOTAL FLUID RECOVERY
DI	DISCRETE INPUT	MLO	MAIN LUG ONLY	TSH	TEMPERATURE SWITCH HIGH
DO	DISCRETE OUTPUT	MFR	MANUFACTURER	TSP	TWISTED SHIELDED PAIR
DWG	DRAWING	MIN	MINIMUM	TST	TWISTED SHIELDED TRIAD
EMT	ELECTRICAL METALLIC TUBING	MTS	MANUAL TRANSFER SWITCH	TTB	TELEPHONE TERMINAL BOARD
FCV	FLOW CONTROL VALVE	NPW	NON–POTABLE WATER	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
FIT	FLOW INDICATING TRANSMITTER	NTS	NOT TO SCALE	TW	TREATED WATER
FS	FLOW SWTICH	OWS	OIL WATER SEPARATOR	TWT	TREATED WATER TANK
FVNR	FULL VOLTAGE NON–REVERSING	PIT	PRESSURE INDICATING TRANSMITTER	TYP	TYPICAL
FVR	FULL VOLTAGE REVERSING	PLC	PROGRAMMABLE LOGIC CONTROLLER	VFD	VARIABLE FREQUENCY DRIVE
GAC	GRANULATED ACTIVATED CARBON	PQM	POWER QUALITY METER	WEQ	WASTEWATER EQUALIZATION TANK
GEC	GROUNDING ELECTRODE CONDUCTOR	PR	PAIR	WP	WEATHERPROOF
GFCI	GROUND FAULT CIRCUIT INTERRUPTER	PRT	PRODUCT RECOVERY TANK		

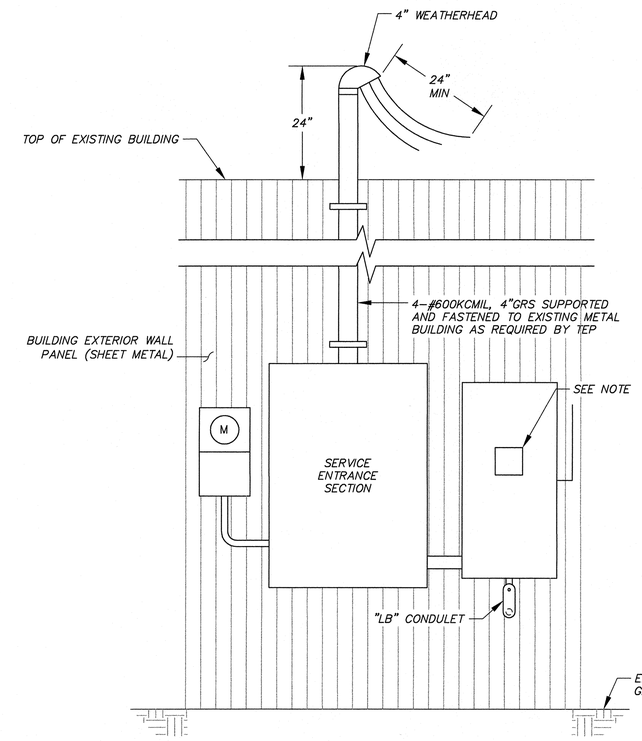
TEP CONTACT : MIKE KAISER (520–918–8244)

240V, 3 ϕ LOAD CALCULATIONS

LOAD DESCRIPTION	KVA	H.P.	AMPS
LRP	--	60	154.0
HEAT EXHANGE PUMP	--	7.5	22.0
FAN	--	1	4.2
PUMP P-2	--	1	4.2
OIL PUMP	--	0.75	3.2
PUMP P-5	--	1	4.2
PUMP P-6	--	1	4.2
PUMP P-11	--	1	4.2
EXHAUST FAN	--	0.5	9.8
		SUBTOTAL =	210.0
		+25% OF LARGEST MOTOR (60HP) =	38.5
		MINIMUM SERVICE SIZE =	248.5
		SELECTED SERVICE SIZE =	400A



SINGLE LINE DIAGRAM



NOTE: FASTEN NAMEPLATE TO MAIN DISCONNECT SWITCH WITH STAINLESS STEEL SCREWS. NAMEPLATE MUST BE FABRICATED FROM WHITE PLASTIC LAMICOID WITH BLACK TEXT "THIS SERVICE DISCONNECT SERVES THE ENTIRE FACILITY WITH THE EXCEPTION OF THE REMEDIATION SYSTEM. A SEPERATE SERVICE WITH MAIN DISCONNECT IS LOCATED APPROX. 80–FEET EAST THATSERVES THE REMEDIATION FACILITY."

SERVICE ENTRANCE SECTION ELEVATION

Registered Professional Engineer (Electrical) CERTIFICATE NO. 30025 DARWIN REYNOLDS Date Signed 3/31/11 ARIZONA, U.S.A.

RECORD DRAWING

THIS RECORD DOCUMENT HAS BEEN PREPARED BASED UPON INFORMATION PROVIDED BY THE CONTRACTOR (AS DENOTED BY "AB"). THIS INFORMATION MAY OR MAY NOT BE ACCURATE OR COMPLETE. FURTHERMORE, THE CONSULTANT HAS NOT VERIFIED ALL INFORMATION INDICATED ON THIS DOCUMENT. THE CONSULTANT SHALL NOT BE HELD RESPONSIBLE FOR ANY ERRORS OR OMISSIONS ON THIS DOCUMENT. THIS DOCUMENT IS FOR GENERAL INFORMATION PURPOSES ONLY. ANY OTHER USE OF THIS DOCUMENT IS AT YOUR SOLE RISK!

Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

DARcor
11811 N. TATUM BLVD
SUITE 2700
PHOENIX, AZ 85028
Ph: (602) 795-2699
Fax: (602) 795-2647

REFERENCES TITLE	REFERENCES TITLE
BASE MAP EXISTING FEATURES AND	
DIMENSIONS ARE BASED ON URS	
FIELD OBSERVATIONS AND MEASUREMENTS,	
2004	

REVISIONS NO.	BY	DATE	DESCRIPTION	REVISIONS NO.	BY	DATE	DESCRIPTION
△				△			
△				△			
△				△			
△				△			
△				△			

Registered Professional Engineer (Electrical) CERTIFICATE NO. 30025 DARWIN REYNOLDS Date Signed 3/6/06 ARIZONA, U.S.A.

SCALE: AS NOTED		DATE
DESIGNED BY:	DAR	MAR 2006
DRAWN BY:	CS	MAR 2006
CHECKED BY:	DAR	MAR 2006
APPROVED BY:	DAR	MAR 2006
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

SINGLE LINE DIAGRAM & LEGEND

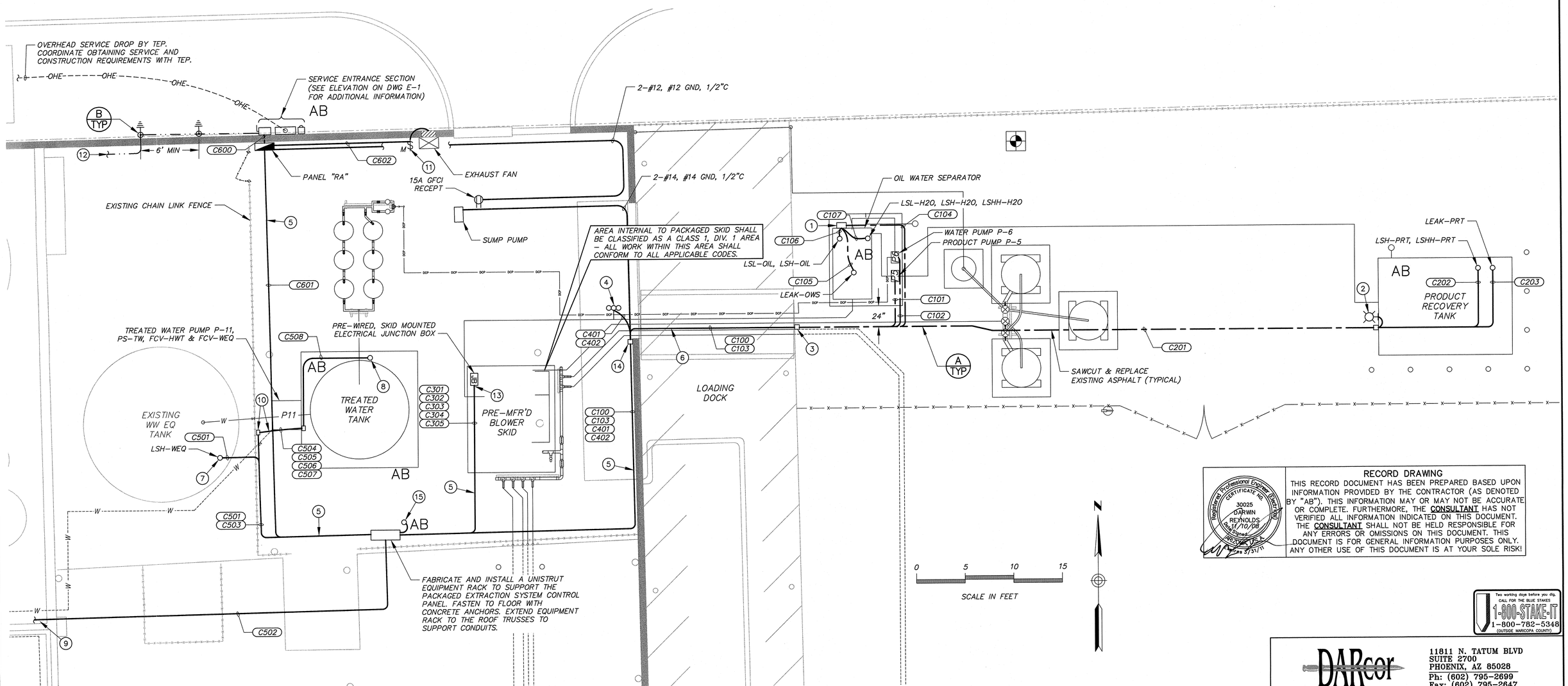
MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. E-1
REV. C

File: 05019-E1.dwg
Saved: Nov 10, 2008

KEYED NOTES

1. INSTALL 12"x12"x4" NEMA 3R JUNCTION BOX AND MANUFACTURER FURNISHED ALARM BEACON ON SIDE OF OIL WATER SEPARATOR. EXTEND CONDUIT C108 12-INCHES ABOVE TOP OF OIL WATER SEPARATOR FOR ALARM BEACON.
2. INSTALL 6"x6"x4" NEMA 3R JUNCTION BOX AND MANUFACTURER FURNISHED ALARM BEACON ON SIDE OF CONCRETE PRODUCT RECOVERY TANK. EXTEND CONDUIT C204 12-INCHES ABOVE TOP OF TANK FOR ALARM BEACON.
3. INSTALL A 12"x12"x4" NEMA 3R JUNCTION BOX ON SIDE OF LOADING DOCK FOR CONDUITS C100, C101, C102, C103, C104 AND C201.
4. APPROXIMATE LOCATION OF MANUFACTURER FURNISHED TSH-GAC, RHE-GAC AND PSH-GAC INSTRUMENTS ON VAPOR LINE TO GAC UNITS. COORDINATE WITH MECHANICAL CONTRACTOR AND CIVIL/MECHANICAL ENGINEER FOR EXACT LOCATION.
5. INSTALL CONDUIT(S) OVERHEAD SUSPENDED FROM EXISTING RAFTERS. UTILIZE P1000 UNISTRUT AND ALL-THREAD TO CONSTRUCT CONDUIT HANGERS AT 8-FOOT INTERVALS TO SUPPORT CONDUIT.
6. INSTALL CONDUITS ON FLOOR OF EXISTING LOADING DOCK. UTILIZE P3000 UNISTRUT AND CONCRETE ANCHORS AT 5-FOOT INTERVALS TO SUPPORT CONDUIT.
7. INSTALL FLOAT SWITCH (LSH-WEQ) IN EXISTING WASTEWATER EQUALIZATION TANK TO STOP TRANSFER PUMP P-11 IF LEVEL IN THE STORAGE TANK GETS TOO HIGH. TERMINATE FLOAT SWITCH CABLE IN JUNCTION BOX MOUNTED ON TOP OF THE TANK. UTILIZE "CGB" TYPE CORD CONNECTOR FOR FLOAT SWITCH CABLE WHERE IT ENTERS THE JUNCTION BOX. ROUTE CONDUIT C501 OVERHEAD FROM TANK TO CONTROL PANEL BY FASTENING CONDUIT TO ROOF TRUSSES.
8. INSTALL MANUFACTURER FURNISHED FLOAT SWITCHES IN TREATED WATER STORAGE TANK. TERMINATE FLOAT SWITCH CABLES IN JUNCTION BOX MOUNTED ON TOP OF THE TANK. UTILIZE "CGB" TYPE CORD CONNECTORS FOR EACH FLOAT SWITCH CABLE WHERE IT ENTERS THE JUNCTION BOX. ROUTE CONDUIT C508 OVERHEAD FROM TANK TO CONTROL PANEL BY FASTENING CONDUIT TO ROOF TRUSSES.
9. CONTINUE CONDUIT C502 APPROXIMATELY 50-FEET TO FLOW SWITCH FS-HWT ON HOT WATER TANKS CITY WATER SUPPLY LINE. COORDINATE WITH CIVIL/MECHANICAL ENGINEER FOR EXACT LOCATION TO INSTALL FLOW SWITCH AT TIME OF CONSTRUCTION. FASTEN CONDUIT TO ROOF TRUSSES INDOORS AND TO EXTERIOR WALL OF BUILDING OUTDOORS.
10. INSTALL 6"x6"x4" NEMA 1 JUNCTION BOX ON UNISTRUT MOUNTING STAND AT +12" ABOVE FLOOR. COORDINATE WITH MECHANICAL CONTRACTOR AND CIVIL/MECHANICAL ENGINEER FOR EXACT LOCATION OF SOLENOID OPERATED VALVES (FCV-HWT AND FCV-WEQ), PRESSURE GAUGE, PRESSURE SWITCH (PS-TW) AND PUMP P-11 AT TIME OF CONSTRUCTION. INSTALL CONDUITS C504, C505, C506 FROM JUNCTION BOX TO EACH PIECE OF EQUIPMENT.
11. INSTALL SQUARE D CLASS 2510 MODEL FG5 MANUAL MOTOR STARTER FOR TREATMENT ROOM EXHAUST FAN ON WALL AT +42" AFF.
12. CONTINUE #1/0 BARE COPPER GROUND TO WATER BOND ON CITY WATER SERVICE PIPE (APPROX 50-FEET).
13. FABRICATE AND INSTALL A UNISTRUT CONDUIT SUPPORT STRUCTURE FROM FLOOR TO ROOF TRUSSES. ATTACH SUPPORT STRUCTURE TO CONCRETE FLOOR WITH CONCRETE ANCHORS. INSTALL CONDUIT SEAL-OFF FITTING ON EACH CONDUIT BEFORE ENTERING MFR'S ELECTRICAL JUNCTION BOX.
14. INSTALL A 8"x8"x4" NEMA 1 JUNCTION BOX ON WALL OR CEILING NEAR LOADING DOCK DOOR FOR CONDUITS C100, C103, C401 AND C402.
15. INSTALL ROOM FLOODED ALARM FLOAT SWITCH ON LEG OF CONTROL PANEL MOUNTING STAND. ALARM TO ACTIVATE WHEN LIQUID LEVEL IN ROOM RISES TO 1/2-INCH. INSTALL 2-#14, #14 GND, 1/2"C FROM FLOAT SWITCH TO CONTROL PANEL AND TERMINATE ALARM ON TERMINALS 7, 10 & 11 WHERE UNUSED HIGH HUMIDITY ALARM WAS TO TERMINATE. RELABEL "HIGH HUMIDITY" ALARM AS "ROOM FLOODED"



RECORD DRAWING

THIS RECORD DOCUMENT HAS BEEN PREPARED BASED UPON INFORMATION PROVIDED BY THE CONTRACTOR (AS DENOTED BY "AB"). THIS INFORMATION MAY OR MAY NOT BE ACCURATE OR COMPLETE. FURTHERMORE, THE **CONSULTANT** HAS NOT VERIFIED ALL INFORMATION INDICATED ON THIS DOCUMENT. THE **CONSULTANT** SHALL NOT BE HELD RESPONSIBLE FOR ANY ERRORS OR OMISSIONS ON THIS DOCUMENT. THIS DOCUMENT IS FOR GENERAL INFORMATION PURPOSES ONLY. ANY OTHER USE OF THIS DOCUMENT IS AT YOUR SOLE RISK!

Registered Professional Engineer (Electrical) CERTIFICATE NO. 30025 DARWIN REYNOLDS 3/11/10/08 Date Signed ARIZONA, U.S.A. 3/31/11

Two working days before you dig. CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

DARcor
11811 N. TATUM BLVD
SUITE 2700
PHOENIX, AZ 85028
Ph: (602) 795-2699
Fax: (602) 795-2647

REFERENCES TITLE	REFERENCES TITLE
BASE MAP EXISTING FEATURES AND DIMENSIONS ARE BASED ON URS FIELD OBSERVATIONS AND MEASUREMENTS, 2004	

REVISIONS NO.	BY	DATE	DESCRIPTION

REVISIONS NO.	BY	DATE	DESCRIPTION

Registered Professional Engineer (Electrical) CERTIFICATE NO. 30025 DARWIN REYNOLDS 3/8/08 Date Signed ARIZONA, U.S.A.

SCALE: AS NOTED		DATE
DESIGNED BY:	DAR	MAR 2006
DRAWN BY:	CS	MAR 2006
CHECKED BY:	DAR	MAR 2006
APPROVED BY:	DAR	MAR 2006
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

ELECTRICAL SITE PLAN

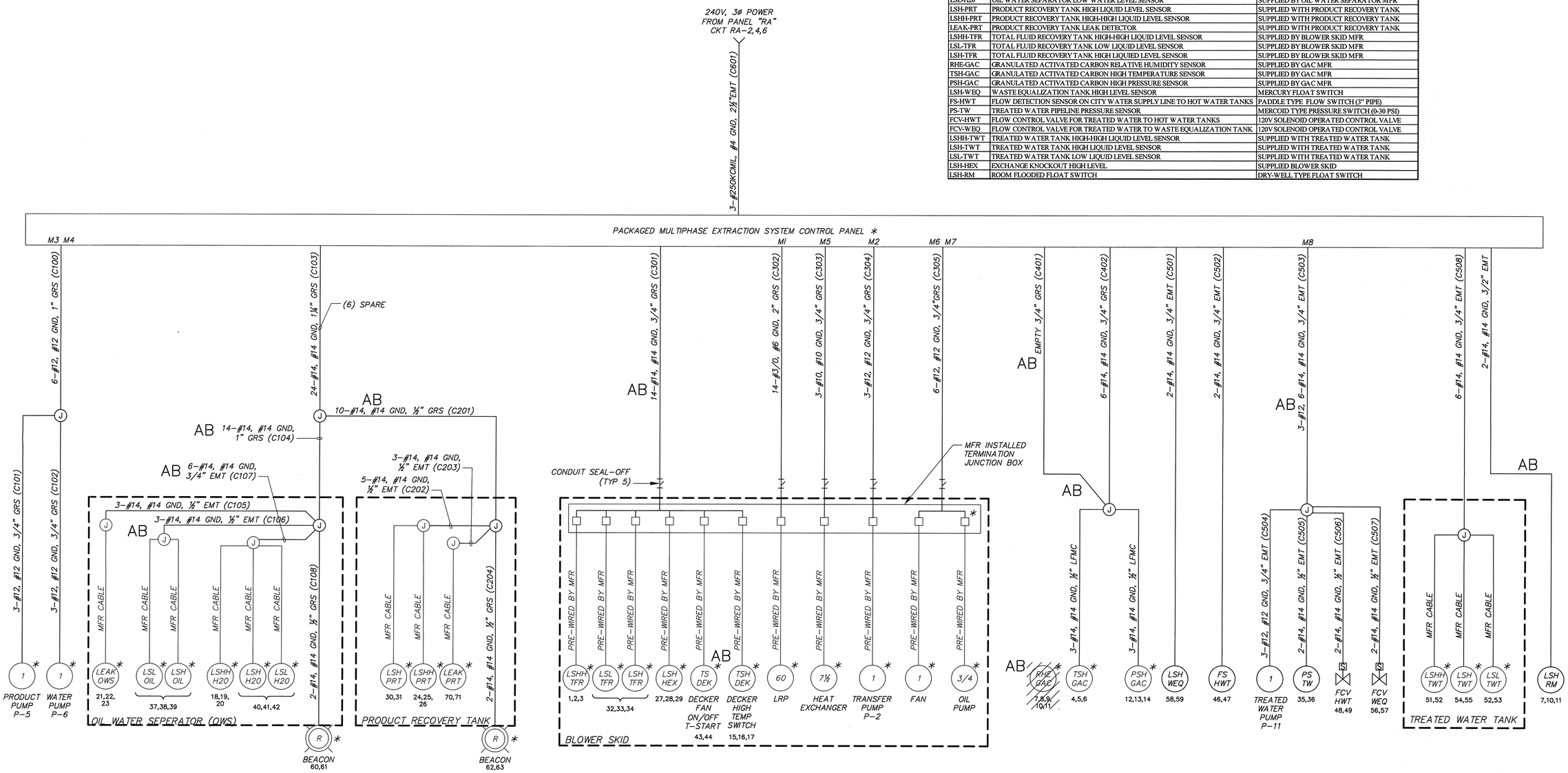
MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. E-2
REV. C

Saved: Nov 10, 2008 File: 05019-E2.dwg

INSTRUMENT SCHEDULE

FIELD TAG	INSTRUMENT DESCRIPTION	REMARKS
LEAK-OWS	OIL WATER SEPARATOR LEAK DETECTOR	SUPPLIED BY OIL WATER SEPARATOR MFR
LSL-OIL	OIL WATER SEPARATOR LOW OIL LEVEL SENSOR	SUPPLIED BY OIL WATER SEPARATOR MFR
LSH-OIL	OIL WATER SEPARATOR HIGH OIL LEVEL SENSOR	SUPPLIED BY OIL WATER SEPARATOR MFR
LSHH-H20	OIL WATER SEPARATOR HIGH-HIGH WATER LEVEL SENSOR	SUPPLIED BY OIL WATER SEPARATOR MFR
LSH-H20	OIL WATER SEPARATOR HIGH WATER LEVEL SENSOR	SUPPLIED BY OIL WATER SEPARATOR MFR
LSL-H20	OIL WATER SEPARATOR LOW WATER LEVEL SENSOR	SUPPLIED BY OIL WATER SEPARATOR MFR
LSH-PRT	PRODUCT RECOVERY TANK HIGH LIQUID LEVEL SENSOR	SUPPLIED WITH PRODUCT RECOVERY TANK
LSHH-PRT	PRODUCT RECOVERY TANK HIGH-HIGH LIQUID LEVEL SENSOR	SUPPLIED WITH PRODUCT RECOVERY TANK
LEAK-PRT	PRODUCT RECOVERY TANK LEAK DETECTOR	SUPPLIED WITH PRODUCT RECOVERY TANK
LSHH-TFR	TOTAL FLUID RECOVERY TANK HIGH-HIGH LIQUID LEVEL SENSOR	SUPPLIED BY BLOWER SKID MFR
LSL-TFR	TOTAL FLUID RECOVERY TANK LOW LIQUID LEVEL SENSOR	SUPPLIED BY BLOWER SKID MFR
LSH-TFR	TOTAL FLUID RECOVERY TANK HIGH LIQUIED LEVEL SENSOR	SUPPLIED BY BLOWER SKID MFR
RHE-GAC	GRANULATED ACTIVATED CARBON RELATIVE HUMIDITY SENSOR	SUPPLIED BY GAC MFR
TSH-GAC	GRANULATED ACTIVATED CARBON HIGH TEMPERATURE SENSOR	SUPPLIED BY GAC MFR
PSH-GAC	GRANULATED ACTIVATED CARBON HIGH PRESSURE SENSOR	SUPPLIED BY GAC MFR
LSH-WEQ	WASTE EQUALIZATION TANK HIGH LEVEL SENSOR	MERCURY FLOAT SWITCH
FS-HWT	FLOW DETECTION SENSOR ON CITY WATER SUPPLY LINE TO HOT WATER TANKS	PADDLE TYPE FLOW SWITCH (3" PIPE)
PS-TW	TREATED WATER PIPELINE PRESSURE SENSOR	MERCOID TYPE PRESSURE SWITCH (0-30 PSI)
FCV-HWT	FLOW CONTROL VALVE FOR TREATED WATER TO HOT WATER TANKS	120V SOLENOID OPERATED CONTROL VALVE
FCV-WEQ	FLOW CONTROL VALVE FOR TREATED WATER TO WASTE EQUALIZATION TANK	120V SOLENOID OPERATED CONTROL VALVE
LSHH-TWT	TREATED WATER TANK HIGH-HIGH LIQUID LEVEL SENSOR	SUPPLIED WITH TREATED WATER TANK
LSH-TWT	TREATED WATER TANK HIGH LIQUID LEVEL SENSOR	SUPPLIED WITH TREATED WATER TANK
LSL-TWT	TREATED WATER TANK LOW LIQUID LEVEL SENSOR	SUPPLIED WITH TREATED WATER TANK
LSH-HEX	EXCHANGE KNOCKOUT HIGH LEVEL	SUPPLIED BLOWER SKID
LSH-RM	ROOM FLOODED FLOAT SWITCH	DRY-WELL TYPE FLOAT SWITCH



RECORD DRAWING

THIS RECORD DOCUMENT HAS BEEN PREPARED BASED UPON INFORMATION PROVIDED BY THE CONTRACTOR (AS DENOTED BY "AB"). THIS INFORMATION MAY OR MAY NOT BE ACCURATE OR COMPLETE. FURTHERMORE, THE CONSULTANT HAS NOT VERIFIED ALL INFORMATION INDICATED ON THIS DOCUMENT. THE CONSULTANT SHALL NOT BE HELD RESPONSIBLE FOR ANY ERRORS OR OMISSIONS ON THIS DOCUMENT. THIS DOCUMENT IS FOR GENERAL INFORMATION PURPOSES ONLY. ANY OTHER USE OF THIS DOCUMENT IS AT YOUR SOLE RISK!

Registered Professional Engineer (Electrical) CERTIFICATE NO. 30025 DARWIN REYNOLDS Date Signed 11/10/08 ARIZONA U.S.A. Expires 3/31/11

* INDICATES EQUIPMENT FURNISHED BY ENVIROSUPPLY AS PART OF PRE-PURCHASED EXTRACTION SYSTEM PACKAGE

Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

DARcor
11811 N. TATUM BLVD
SUITE 2700
PHOENIX, AZ 85028
Ph: (602) 795-2699
Fax: (602) 795-2647

REFERENCES TITLE	REFERENCES TITLE
BASE MAP EXISTING FEATURES AND DIMENSIONS ARE BASED ON URS FIELD OBSERVATIONS AND MEASUREMENTS, 2004	

REVISIONS NO.	BY	DATE	DESCRIPTION	REVISIONS NO.	BY	DATE	DESCRIPTION
△				△			
△				△			
△				△			
△				△			
△				△			

Registered Professional Engineer (Electrical) CERTIFICATE NO. 30025 DARWIN REYNOLDS 3/8/06 Date Signed ARIZONA U.S.A.

SCALE: AS NOTED		DATE
DESIGNED BY:	DAR	MAR 2006
DRAWN BY:	CS	MAR 2006
CHECKED BY:	DAR	MAR 2006
APPROVED BY:	DAR	MAR 2006
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

CONTROL LINE DIAGRAM

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. E-3
REV. C

Saved: Nov 10, 2008 File: 05019-E3.dwg

ELECTRICAL SPECIFICATIONS

1.01 GENERAL ELECTRICAL REQUIREMENTS

A. THE COMPLETED INSTALLATION SHALL CONFORM TO ALL APPLICABLE FEDERAL, STATE AND LOCAL CODE ORDINANCES AND REGULATIONS. CONTRACTOR SHALL OBTAIN NECESSARY PERMITS AND INSPECTIONS REQUIRED BY THE GOVERNING AUTHORITIES. ALL WORK SHALL BE DONE IN A NEAT, WORKMANLIKE, FINISHED AND SAFE MANNER, ACCORDING TO THE LATEST PUBLISHED N.E.C.A STANDARDS OF INSTALLATION, UNDER COMPETENT SUPERVISION. INSTALL GROUNDING AS REQUIRED BY THE NATIONAL ELECTRIC CODE (2002).

B. VISIT THE SITE PRIOR TO BIDDING TO BECOME FAMILIAR WITH EXISTING CONDITIONS AND ALL OTHER FACTORS THAT MAY AFFECT THE EXECUTION OF THIS WORK. INCLUDE ALL RELATED COSTS IN THE INITIAL BID PROPOSAL.

C. LABOR, MATERIALS, APPARATUS, AND APPLIANCES ESSENTIAL TO THE COMPLETE FUNCTIONING OF SYSTEMS DESCRIBED AND INDICATED HEREIN, OR WHICH MAY BE REASONABLY IMPLIED AS ESSENTIAL, WHETHER MENTIONED IN THE CONTRACT DOCUMENTS OR NOT, SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR. IN CASE OF DOUBT AS TO THE WORK INTENDED, OR IN THE EVENT OF NEED FOR EXPLANATION THEREOF, CONTRACTOR SHALL REFER TO THE ENGINEER FOR SUPPLEMENTAL INSTRUCTIONS.

D. ALL ITEMS NOT SPECIFICALLY MENTIONED IN THESE SPECIFICATIONS OR NOTED ON THE DRAWINGS, OR ON SHOP DRAWINGS, BUT WHICH ARE NECESSARY TO MAKE A COMPLETE AND SATISFACTORY, WORKING ELECTRICAL/INSTRUMENTATION INSTALLATION, SHALL BE DEEMED TO BE INCLUDED HEREIN.

E. ALL ELECTRICAL EQUIPMENT SHALL BE CAPABLE OF OPERATING SUCCESSFULLY AT FULL–RATED LOAD, WITHOUT FAILURE, AT AN AMBIENT AIR TEMPERATURE OF 50 DEGREES C, AND SPECIFICALLY RATED FOR AN ALTITUDE OF 1200 FEET. WHERE THESE CRITERIA CANNOT BE MET, ANCILLARY EQUIPMENT AND/OR SPECIAL DERATING FACTORS AS APPROVED BY THE ENGINEER SHALL BE UTILIZED.

F. ALL MATERIALS SHALL BE NEW AND OF THE BEST QUALITY, MANUFACTURED IN ACCORDANCE WITH NEMA, ANSI, U.L. OR OTHER APPLICABLE STANDARDS. THE USE OF MANUFACTURER'S NAMES, MODELS AND NUMBERS IS INTENDED TO ESTABLISH STYLE, QUALITY, APPEARANCE USEFULNESS AND BID PRICE. PROPOSED SUBSTITUTIONS SHALL BE SUBMITTED IN WRITING AND REVIEWED BY THE ENGINEER BEFORE ORDERING.

G. PROTECT ALL ELECTRICAL MATERIAL AND EQUIPMENT INSTALLED UNDER THIS CONTRACT AGAINST DAMAGE BY OTHER TRADES, WEATHER CONDITIONS OR ANY OTHER CAUSES. EQUIPMENT FOUND DAMAGED OR IN OTHER THAN NEW CONDITION WILL BE REJECTED AS DEFECTIVE.

H. LEAVE THE SITE CLEAN, REMOVE ALL DEBRIS, EMPTY CARTONS, TOOLS, CONDUIT, WIRE SCRAPS AND ALL MISCELLANEOUS SPARE EQUIPMENT AND MATERIALS USED IN THE WORK DURING CONSTRUCTION. ALL COMPONENTS SHALL BE FREE OF DUST, GRIT AND FOREIGN MATERIALS, LEFT AS NEW BEFORE FINAL ACCEPTANCE OF WORK.

I. THE CONTRACTOR SHALL PERFORM ALL NECESSARY SAW CUTTING, CORE DRILLING, EXCAVATING, REMOVAL, SHORING, BACKFILLING AND ETC. REQUIRED FOR THE PROPER LAYING OF CONDUITS WHETHER INSIDE OR OUTSIDE OF THE BUILDING(S) AND STRUCTURE(S). THE CONTRACTOR SHALL REPAIR AND PATCH WHERE DEMOLITION HAS TAKEN PLACE IN A MANNER TO MATCH EXISTING ORIGINAL STRUCTURE.

J. PRODUCT DATA: SUBMIT MINIMUM OF SIX (6) COPIES. PROVIDE NAME OF MANUFACTURER, BRAND NAME, AND CATALOG NUMBER OF EACH ITEM. SUBMIT SYSTEMS AS COMPLETE SUBMITTALS, AT ONE TIME, WITH ITEMS ARRANGED IN NUMERICAL SEQUENCE CORRESPONDING WITH EACH SPECIFICATION SECTION AND ARTICLE OF EACH SECTION. LISTING ITEMS "AS SPECIFIED" WITHOUT BOTH MAKE AND MODEL OR TYPE DESIGNATION IS NOT ACCEPTABLE.

K. CONTRACTOR SHALL COORDINATE WITH ALL OTHER TRADES TO AVOID CONFLICTS AND INTERFERENCES. NO EXTRA COMPENSATION WILL BE ALLOWED FOR CHANGES MADE NECESSARY DUE TO INTERFERENCE BETWEEN WORK OF VARIOUS TRADES.

L. RECORD DRAWINGS: ON COMPLETION OF WORK, CONTRACTOR SHALL FURNISH A COMPLETE SET OF RECORD DRAWINGS AND SHOP DRAWINGS WHICH PROPERLY REFLECT FINAL LOCATIONS AND SIZES OF CONDUIT, EQUIPMENT FIXTURES, CONTROLS, ETC., AS ACTUALLY INSTALLED. WHERE NECESSARY TO LOCATE CONCEALED EQUIPMENT, DIMENSIONS SHALL BE INCLUDED ON THESE DRAWINGS.

M. OPERATING AND MAINTENANCE MANUALS: CONTRACTOR SHALL PROVIDE OPERATING AND MAINTENANCE MANUALS FOR EQUIPMENT AND MATERIALS FURNISHED UNDER THIS CONTRACT. SUBMIT 4 COPIES OF OPERATING AND MAINTENANCE DATA BOOKS FOR REVIEW TWO WEEKS BEFORE FINAL INSPECTION OF THE PROJECT. ASSEMBLE DATA IN A SINGLE COMPLETE INDEXED VOLUME.

N. REFER TO OTHER PLANS FOR EXACT LOCATION OF EQUIPMENT AND MECHANICAL FEATURES.

O. TYPICAL DETAILS APPLY IN ALL CASES WHETHER SPECIFICALLY REFERRED TO OR NOT.

P. EXISTING UNDERGROUND UTILITIES ARE BASED ON DRAWINGS PROVIDED TO US BY THE CIVIL ENGINEER AT TIME OF DESIGN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO UNDERGROUND OBSTRUCTIONS AND UTILITIES ENCOUNTERED DURING CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING BLUE–STAKE AND POT–HOLING TO VERIFY ALL EXISTING UNDERGROUND OBSTRUCTIONS.

Q. DARCOR & ASSOCIATES INC., ITS OWNERS, OR EMPLOYEES WILL NOT BE HELD RESPONSIBLE FOR ANY DAMAGE TO PROPERTY CAUSED BY OTHERS DURING OR RESULTING FROM CONSTRUCTION OF THIS PROJECT.

R. THE ENGINEER WILL NOT BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, PROCEDURES OR SAFETY PRECAUTIONS OR PROGRAMS UTILIZED DURING CONSTRUCTION, AND WILL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

1.02 RACEWAYS

A. ALL UNDERGROUND CONDUIT TO BE SCHEDULE 40 PVC. MINIMUM DEPTH 24", MINIMUM SIZE 3/4". ALL CONDUIT EXPOSED TO BE TYPE EMT OR GRS, AS INDICATED.

B. CONDUIT SHALL BE BURIED MINIMUM OF 24–INCHES BELOW FINISHED GRADE TO TOP OF CONDUIT(S). WHERE CONDUIT STUBS UP OUT OF THE GROUND TO ELECTRICAL EQUIPMENT, THE CONDUIT SWEEP AND CONDUIT LEAVING THE EARTH MUST BE PVC COATED GALVANIZED RIGID STEEL CONDUIT OR WRAPPED WITH 20–MIL RUBBER TAPE HALF–LAPPED TO A THICKNESS OF 40–MILS.

C. ALL EMT CONNECTORS AND COUPLINGS SHALL BE COMPRESSION TYPE. SET SCREW TYPE FITTINGS ARE NOT ACCEPTABLE.

D. AFTER UNDERGROUND CONDUIT IS IN PLACE, NOTIFY THE ENGINEER PRIOR TO BACKFILL OR CONCRETE POUR FOR INSPECTION.

E. ALL JOINTS BETWEEN PVC CONDUIT, COUPLINGS, & FITTINGS SHALL BE PREPARED WITH PURPLE PRIMER AND CEMENTED TOGETHER WITH GRAY PVC CEMENT.

F. CONDUIT ROUTING IS DIAGRAMMATIC ONLY. CONTRACTOR SHALL INSTALL CONDUIT TO AVOID CONFLICT WITH UTILITIES, LANDSCAPING, CONCRETE, ASPHALT CONCRETE, STRUCTURES, PIPE, WIRES, CURBS, SIDEWALKS, AND FENCING. ALL CONDUITS SHALL BE PLACED WITHIN THE PROPERTY UNLESS OTHERWISE APPROVED.

1.03 WIRES AND CABLES (600V OR LESS)

A. ALL CIRCUIT CONDUCTORS SHALL BE "XHHW" STRANDED COPPER.

B. SPLICES ARE NOT ALLOWED, EXCEPT WHERE INDICATED OR APPROVED BY THE ENGINEER.

1.04 ELECTRICAL ENCLOSURES

A. ELECTRICAL ENCLOSURES SHALL BE FURNISHED WITH NEMA RATING AS INDICATED OR AS REQUIRED BY NEC.

B. UNLESS OTHERWISE INDICATED, JUNCTION BOXES INSTALLED OUTDOORS OR ON GRS CONDUITS SHALL BE CAST STEEL TYPE "FS" OR TYPE "FD" WITH WEATHERPROOF BLANK COVERS.

C. JUNCTION BOXES INSTALLED INDOORS FOR EMT CONDUIT MAY BE STAMPED STEEL WITH BLANK COVER. SIZE AS REQUIRED BY NEC.

1.05 SERVICE ENTRANCE SECTION (COMBINATION METER/MAIN)

A. SERVICE ENTRANCE SECTION SHALL BE NEMA 3R WITH PADLOCKABLE OUTER DOORS AND SHALL BE MOUNTED ON BUILDING WALL AS INDICATED OR AS REQUIRED BY TEP.

B. SERVICE ENTRANCE SECTIONS SHALL BE FURNISHED WITH AN INCOMING LINE SECTION SUITABLE FOR OVERHEAD SERVICE, A SEPARATE BARRIERED–OFF UTILITY METERING COMPARTMENT AND MAIN FUSED PULLOUT DISCONNECT. LUGS SHALL BE PROVIDED IN THE INCOMING LINE SECTION FOR CONNECTION OF THE SERVING UTILITY'S CABLES.

C. MECHANICAL TYPE TERMINALS SHALL BE PROVIDED FOR ALL LINE AND LOAD TERMINATIONS SUITABLE FOR COPPER CABLE RATED FOR 75 DEGREES C. SMALL WIRING, NECESSARY FUSE BLOCKS AND TERMINAL BLOCKS WITHIN THE ASSEMBLY SHALL BE FURNISHED AS REQUIRED.

D. FURNISH AND INSTALL SERVICE ENTRANCE SECTION AS INDICATED AND IN ACCORDANCE WITH THE SERVING UTILITY'S REQUIREMENTS, THE NEC AND ALL APPLICABLE LOCAL CODES AND REGULATIONS.

E. INSTALL GROUNDING AS INDICATED ON THE DRAWINGS OR AS REQUIRED BY THE SERVING UTILITY COMPANY.

F. BEFORE ENERGIZING, REMOVE ALL SCRAPS OF WIRE, DUST, DIRT AND ANY OTHER FOREIGN MATERIAL. INSPECT EQUIPMENT FOR PROPER INSTALLATION AS RECOMMENDED IN THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. INSPECT ALL BUS BOLTS AND CABLE CONNECTIONS TO INSURE THAT THEY ARE TIGHT AND TERMINATED PROPERLY. INSPECT ALL OVERCURRENT DEVICES FOR DAMAGE AND LOOK FOR COMPONENTS THAT MAY HAVE LOOSENED DURING SHIPMENT.

1.06 GROUNDING

A. CONTACT SURFACES SHALL BE THOROUGHLY CLEANED AND PAINT SCRAPED TO BARE METAL BEFORE CONNECTIONS ARE MADE TO INSURE GOOD METAL–TO–METAL CONTACT.

B. THE SERVICE GROUNDING ELECTRODE CONDUCTOR, SIZE AS INDICATED, SHALL BE INSTALLED AS INDICATED ON THE DRAWINGS. THIS GROUND SHALL BE EXTENDED TO THE MAIN WATER SERVICE METAL PIPE. PROVIDE A PROPERLY SIZED BONDING SHUNT STRAP AROUND THE METER AND DIELECTRIC UNIONS IN THE WATER PIPE.

C. ALL BONDS BETWEEN THE GROUNDING ELECTRODE CONDUCTORS AND THE GROUNDING ELECTRODES MUST BE ACCESSIBLE FOR INSPECTION AND ROUTINE MAINTENANCE. BURIED GROUND CONNECTIONS WILL NOT BE ACCEPTED.

D. RESISTANCE BETWEEN GROUND AND ABSOLUTE EARTH SHALL NOT EXCEED 25 OHMS AND SHALL BE MEASURED USING THE FALL OF POTENTIAL METHOD WITH A THREE OR FOUR TERMINAL GROUND RESISTANCE TESTER. A MINIMUM OF TEN (10) GROUND RESISTANCE TESTS SHALL BE MEASURED AT 30–FOOT INTERVALS FROM THE SERVICE GROUNDING ELECTRODE. THE TEST RESULTS SHALL BE PLOTTED ON A CURVE AND SUBMITTED IN THE REPORT. THE GROUND RESISTANCE TEST SHALL BE CONDUCTED IN THE PRESENCE OF THE ENGINEER BEFORE EQUIPMENT IS PLACED IN OPERATION.

1.07 OVERCURRENT PROTECTIVE DEVICES

A. BE RATED FOR AIC COMPATIBLE WITH RATINGS OF THE ELECTRICAL EQUIPMENT THEY ARE TO BE USED IN AND AS INDICATED ON THE DRAWINGS.

B. BE CLEARLY LABELED WITH LOAD DESCRIPTION.

C. SERVICE DISCONNECT SHALL CONTAIN REJECTION TYPE FUSES AS REQUIRED BY UTILITY AND HAVE A LABEL INDICATING "SERVICE DISCONNECT".

1.08 FIELD INSTRUMENTS

A. INSTALL A PRESSURE SWITCH (PS–TW) ON TREATED WATER PUMP P–11 DISCHARGE LINE. INCLUDE ½" BALL VALVE FOR ISOLATION. PRESSURE SWITCH SHALL BE NEMA 1 WITH 316 SS BOURDON TUBE, 0–100 PSIG RANGE, ADJUSTABLE DEADBAND AND MERCURY TYPE SWITCH CONTACTS. MERCOID MODEL DA–541 OR APPROVED EQUAL.

B. INSTALL A PRESSURE GAUGE ON THE TREATED WATER PUMP P–11 DISCHARGE LINE. INCLUDE A ½" ISOLATION BALL VALVE. PRESSURE GAUGE SHALL BE 2" DIAMETER SILICON FILLED WITH 304 SS CASE. RANGE SHALL BE 0–100 PSI. GAUGE SHALL BE AMETEK US GAUGE MODEL 1550 OR APPROVED EQUAL.

C. FLOAT SWITCHES SHALL BE POLYPROPYLENE MECHANICAL/TYPE SWITCH WITH CABLE OF SUFFICIENT LENGTH TO REACH JUNCTION BOX WITHOUT SPLICING. FLOAT SWITCHES SHALL BE TYPE ENM–10 AS MFR'D BY FLYGT OR EQUAL.

D. FLOW SWITCH (FS–HWT) SHALL BE A PADDLE TYPE FLOW SWITCH WITH A 302 SS PADDLE, CAM ASSEMBLY, PERMANENT MAGNET HERMETICALLY SEALED, MAGNETIC REED SWITCH AND 316 SS HOUSING. SWITCH CONTACTS SHALL BE SPDT AND UL RATED 10A AT 125/250VAC MINIMUM. FLOW SWITCH SHALL BE CAPABLE OF INSTALLATION IN A 3–INCH PIPELINE WITH PROCESS (POTABLE WATER) PRESSURES UP TO 200 PSIG. PADDLE SHALL BE CUT TO PROPER LENGTH AS RECOMMENDED BY THE MANUFACTURER TO CAUSE LESS THAN 3 PSIG PRESSURE DROP IN A 3–INCH PIPELINE. SWITCH SHALL ACTIVATE WHEN PROCESS LIQUID VELOCITY REACHES 0.5 FT PER SECOND. FLOW SWITCH SHALL BE A MODEL V8 AS MANUFACTURED BY FLOTECT OR APPROVED EQUAL.

1.09 PANELBOARDS

A. BE INSTALLED WHERE INDICATED, CONTAIN A GROUND BUS KIT, HAVE NEUTRALS GROUPED ON A COMMON BAR, HAVE DEAD FRONT CONSTRUCTION, HAVE TERMINALS RATED UL FOR COPPER AND ALUMINUM, BE UL LISTED AND HAVE COPPER BUS BARS OF 98% CONDUCTIVITY AND MINIMUM CROSS SECTIONAL AREA BASED ON UL 67 FOR HEAT RISE.

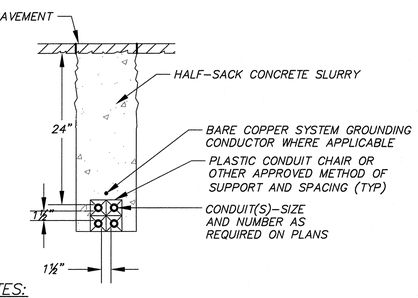
B. COMPLETE PANELBOARD SCHEDULE BY ACCURATELY TYPING IN A BRIEF LOAD DESCRIPTION FOR THE APPROPRIATE CIRCUIT NUMBER. PLACE A COPY OF THE PANELBOARD SCHEDULE IN THE POCKET OF THE PANELBOARD DOOR.

C. PANELBOARD CIRCUITING SHALL BE AS INDICATED ON THE DRAWINGS WHENEVER POSSIBLE. ADDITIONAL LOADS SHALL BE BALANCED LOADS BETWEEN PHASES AND THE NEUTRAL.

D. HAVE BOLT–ON TYPE BRANCH CIRCUIT BREAKERS.

E. HAVE VOLTAGE, PHASES AND SHORT CIRCUIT INTERRUPTING CAPACITY (AIC) AS INDICATED.

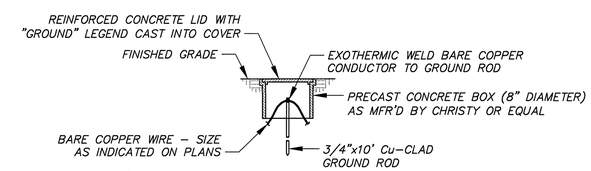
F. HAVE SURFACE MOUNTED ENCLOSURE WITH NEMA 12 RATING.



NOTES:

1. ALL DIMENSIONS INDICATED ABOVE ARE MINIMUM.
2. SPARE CONDUITS MUST BE LOCATED ON TOP OF DUCTBANKS.
3. THIS DETAIL APPLIES IN ALL CASES WHETHER SPECIFICALLY REFERRED TO OR NOT.
4. THIS DETAIL DOES NOT APPLY TO UTILITY DUCTBANKS.

A TYP — UNDERGROUND CONDUIT DUCTBANK DETAIL
NTS



B TYP — TYPICAL GROUND ROD AND WELL DETAIL
NTS

RECORD DRAWING
THIS RECORD DOCUMENT HAS BEEN PREPARED BASED UPON INFORMATION PROVIDED BY THE CONTRACTOR (AS DENOTED BY "AB"). THIS INFORMATION MAY OR MAY NOT BE ACCURATE OR COMPLETE. FURTHERMORE, THE CONSULTANT HAS NOT VERIFIED ALL INFORMATION INDICATED ON THIS DOCUMENT. THE CONSULTANT SHALL NOT BE HELD RESPONSIBLE FOR ANY ERRORS OR OMISSIONS ON THIS DOCUMENT. THIS DOCUMENT IS FOR GENERAL INFORMATION PURPOSES ONLY. ANY OTHER USE OF THIS DOCUMENT IS AT YOUR SOLE RISK!

Registered Professional Engineer (Electrical) CERTIFICATE NO. 30025 DARWIN REYNOLDS 11/10/08 Signature Date ARIZONA U.S.A. Expires 3/31

Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT 1-800-782-5348 (OUTSIDE MARICOPA COUNTY)

DARcor
11811 N. TATUM BLVD
SUITE 2700
PHOENIX, AZ 85028
Ph: (602) 795-2699
Fax: (602) 795-2647

REFERENCES TITLE	REFERENCES TITLE
BASE MAP EXISTING FEATURES AND DIMENSIONS ARE BASED ON URS FIELD OBSERVATIONS AND MEASUREMENTS, 2004	

REVISIONS NO.	BY	DATE	DESCRIPTION	REVISIONS NO.	BY	DATE	DESCRIPTION
△				△			
△				△			
△				△			
△				△			
△				△			

Registered Professional Engineer (Electrical) CERTIFICATE NO. 30025 DARWIN REYNOLDS 3/8/06 Signature Date ARIZONA U.S.A. Expires 3/31

SCALE: AS NOTED		DATE
DESIGNED BY:	DAR	MAR 2006
DRAWN BY:	CS	MAR 2006
CHECKED BY:	DAR	MAR 2006
APPROVED BY:	DAR	MAR 2006
CLIENT APPROVAL BY:		

URS
7720 N. 16th Street Suite 100
Phoenix, Arizona 85020
(602) 371-1100

MISSION LINEN SUPPLY

ELECTRICAL SPECIFICATION AND DETAIL

MULTI-PHASE EXTRACTION SYSTEM
301 South Park Avenue
Tucson, Arizona 85719

JOB NO. 22237188
DRAWING NO. E-4
REV. C

Saved: Nov 10, 2008 File: 05019-E4.dwg

Appendix B

LVZ ERA Information

B-1 LVZ SVE Pilot Test Tech Memo

B-2 LVZ ERA Work Plan

B-3 Air Quality Operating Permit 2144

B-4 LVZ ERA Operation and Maintenance Plan

TO: Scott Green, Project Manager, Superfund Programs Unit, Arizona Department of Environmental Quality

FROM: Janet Workman, Principal Engineer, URS Corporation

CC: James Sakrison, Esq.
Mr. Tony Mancuso
Joseph Drazek, Esq.
Mr. Donald Moore

DATE: June 2, 2014

SUBJECT: Summary of Soil Vapor Extraction Pilot Test in the Lower Vadose Zone
Park Euclid WQARF Site - 301 South Park Avenue, Tucson, Arizona

Registered Professional Engineer (Chemical)
CERTIFICATE NO.
37331
JANET M.
WORKMAN
Date Signed 6-2-14
ARIZONA, USA
EXPIRES 03-31-2017

URS Corporation (URS) prepared this technical memorandum on behalf of The Park - Euclid Group (The Group) to present results from the lower vadose zone (LVZ) soil vapor extraction (SVE) pilot test (Pilot Test) conducted at Mission Linen Supply's 301 South Park Avenue plant (the Mission Plant) which falls within the boundaries of the Park Euclid WQARF Site (the Site) in Tucson, Arizona (Figure 1). This technical memorandum summarizes the Pilot Test field activities, notable findings, and recommendations of the path forward for the remediation of chlorinated solvents from the LVZ. It is presented in the following sections:

1. Site Background
2. Summary of Pilot Test Activities
3. Pilot Test Results and Data Evaluation
4. Recommendations and Proposed Remedial Approach
5. References

Group representatives held a meeting on May 1, 2014 with Arizona Department of Environmental Quality (ADEQ) representatives and Tony Young (Assistant Attorney General) to discuss various project specifics, including schedule, the long-term monitoring program, groundwater modeling efforts, and the status and progress of the Feasibility Study (FS). Associated with the FS, URS presented preliminary findings from the Pilot Test. This technical memorandum presents final Pilot Test results and further details the findings and conclusions, which will be used to design a proposed Early Response Action (ERA) for the LVZ and to support FS evaluations. Results and attachments contained within this technical memorandum supersede those presented at the May 1, 2014 meeting.

Field activities and results are presented in detail in Praxis's *PneuLog® Evaluation & SVE Pilot Study Report* included as Attachment A. Manual field measurements are presented in Attachment B and laboratory data reports are included in Attachment C.

1.0 SITE BACKGROUND

The FS Work Plan (URS, 2013) recommended that a short term pilot test of SVE be performed in the LVZ to evaluate the potential application of this technology to remove documented soil contamination in this interval that may be acting as a source of contamination to the Regional Aquifer. The LVZ is present from approximately 110 to 200 feet below ground surface (bgs) beneath the perched aquifer and above the Regional Aquifer.

The LVZ was characterized by ADEQ and its consultants as reported in the Remedial Investigation (RI) Report (Tetra Tech GEO, 2011). Three soil vapor wells (i.e., VML-1, VML-2, and VEL-3) have been completed in this zone in the immediate vicinity of the Mission Plant. The RI documented significant soil and vapor concentrations of petroleum hydrocarbons and volatile organic compounds (VOCs) in the LVZ above the Regional Aquifer in the immediate vicinity of the Mission Plant, particularly in the interval from 165 to 190 feet below ground surface. Monitoring well locations in the vicinity of the Mission Plant are shown in Figure 2.

Documented VOC contamination in the onsite LVZ wells screened just above the Regional Aquifer, along with groundwater contaminant concentrations detected in samples from onsite Regional Aquifer well PER-14A, suggests that VOCs in the LVZ serve as a source of contamination to the Regional Aquifer in the vicinity of well PER-14A. The primary contaminants of concern in the LVZ include the dry cleaning solvent tetrachloroethene (PCE) and its degradation products, primarily trichloroethene (TCE) and cis-1,2-dichloroethene (cDCE).

2.0 SUMMARY OF PILOT TEST ACTIVITIES

The Pilot Test was conducted to characterize subsurface conditions and contaminant vapor concentrations in the LVZ and evaluate the efficacy of SVE in the LVZ. The Pilot Test was conducted from January 27 to 31, 2014 and included:

- Baseline vapor sampling;
- PneuLog testing at PER-14A and VEL-03;
- Step testing and an extended extraction test at VEL-03;
- PneuLog testing at VEL-03 at the end of the extraction period; and
- Rebound vapor sampling approximately 15 and 30 days following ceased extraction.

Baseline vapor sampling activities were conducted on January 27, 2014 prior to conducting any SVE activities. Vapor samples were collected from the four depth intervals of LVZ vapor well clusters VML-01 and VML-02, as well as from VEL-03 and PER-14A, to provide baseline data of equilibrated ambient conditions.

PneuLog testing was performed at wells PER-14A and VEL-03 prior to the 72-hour extraction test and again at VEL-03 during hour 62 of the extraction test. PneuLog testing measures the air permeability and contaminant concentration profiles in wells screened in the vadose zone. After the PneuLog equipment was placed in the well, continuous flow and total concentration (using a photoionization detector [PID]) profiles were measured along the screen, per the standard operating procedure described in Attachment A. Vapor samples were collected in Tedlar bags at depths along the length of the screen where changes in flow were observed or at a spacing of about 5 feet.

The SVE test included a step-flow test at five different extraction rates followed by 62.5 hours of extraction at a relatively constant rate. The extraction period lasted 76 hours and included three interruptions in power that were 8.6, 2.0, and 2.9 hours in duration. The step test evaluated the extraction rate at VEL-03 as a function of the applied wellhead vacuum, allowing the flow rate to equilibrate after each change in applied vacuum before measurements were taken. The extraction test started on the afternoon of January 28 and ended 76 hours later on the evening of January 31, 2014. Continuous flow and vacuum monitoring were performed with a datalogger at well VEL-03 and continuous vacuum monitoring was performed at each of the four individual LVZ monitoring wells nested at the VML-02 cluster.

3.0 PILOT TEST RESULTS AND DATA EVALUATION

This section summarizes the activities and measurements during the SVE testing. Activities included baseline vapor sampling before extraction, the step extraction test, extended extraction period, and rebound of vapor concentrations after the extraction was terminated. Measurements included vapor concentrations across the site, the extraction rate, and subsurface vacuums in monitoring locations.

3.1 Baseline Sampling

The highest PCE vapor concentration from LVZ baseline samples was detected in VML-02 at 631 parts per million by volume (ppmv) at 170 feet bgs. In general, the PCE vapor concentrations at VML-01 were an order of magnitude lower than VML-02, ranging from 1 to 31 ppmv with the highest concentration also found at 170 feet bgs. This is consistent with PneuLog testing where the highest PCE vapor concentration at VEL-03 was detected near 170 feet bgs. The maximum cDCE concentration (i.e., 643 ppmv) was also found in VML-02 at 170 feet bgs. The cDCE vapor concentrations detected in VML-01 were generally two to three orders of magnitude lower than observed in the suspected source zone in vicinity of former well MP-1 at wells VEL-03 and VML-02.

3.2 PneuLog Testing

This section summarizes the results from the PneuLog testing performed at wells PER-14A and VEL-03.

PER-14A Pre-Extraction

The first PneuLog test was performed in PER-14A on January 27, 2014 after about one hour of vapor extraction. During the test, a vacuum of 44.5 inches of water (inH_2O) was applied yielding a total extraction rate of approximately 6 standard cubic feet per minute (scfm). The permeability of the screened zone at PER-14A could not be assessed via airflow profiling as flow rates were below the threshold for measuring flow with the PneuLog detector in a five-inch diameter well. Therefore, a pitot tube was used to estimate the flow rate at the wellhead.

Vapor samples were collected from five depth intervals at PER-14A. The highest total concentration was detected at the top of the screen and with an extraction rate of 6 scfm yields a mass extraction rate of 2.0 pounds per day. About three-quarters of the total concentration in this well was cDCE, suggesting that anaerobic degradation is taking place in the vicinity.

VEL-03 Pre-Extraction

PneuLog testing was performed in VEL-03 on the morning of January 28, 2014 just before the step extraction test and the 72-hour extraction test. During the PneuLog testing, a vacuum of 25 inH_2O was applied at VEL-03 yielding a total extraction rate of 54.5 scfm. Airflow profiling indicated distinct flow zones along the screen interval with an overall modestly permeable screened interval suggesting that there are few significant mass transfer constraints to limit remediation by SVE, except for the limited extraction at the bottom of the screen interval.

Vapor samples were collected from seven depth intervals at VEL-03. The highest concentrations were found near the top of the screen exceeding 600 ppmv, where concentrations decreased with depth, and the lowest measured concentration of 322 ppmv was detected at the bottom. A majority of the VOC vapors were comprised of cDCE at the top of the well screen; however, approximately equal parts of cDCE and PCE were present at the bottom of the well. Overall, a mass extraction rate of 20 pounds per day was estimated from a total vapor concentration of 589 ppmv at the wellhead and an extraction rate of 54.5 scfm.

VEL-03 Near Shutdown

PneuLog testing was repeated in VEL-03 on January 31, 2014 after the step extraction test during the final hour of the 72-hour extraction test. During the PneuLog, a vacuum of 22.2 inH_2O was applied yielding a total extraction rate of 52 scfm. Permeability and airflow profiling results at VEL-03 before the step test and near the end of the extraction test were very similar, having identified (1) a high permeability interval near the top of the screen, (2) a moderately permeable soil from 159 to 171 feet bgs, (3) a high permeability interval from 171 to 180 feet bgs, and (4) a low permeability interval from 180 to 189 feet bgs.

Vapor samples were again collected at seven depths similar to those during the initial log. The highest concentrations were again found near the top of the screen, but had decreased from about 600 ppmv to approximately 350 ppmv. As observed previously, the total concentration decreased with depth to the bottom of the screen where the lowest measured total concentration

of 97 ppmv was observed at the bottom of the well, considerably lower than the initially measured concentration of 322 ppmv. A total vapor concentration of 338 ppmv at the wellhead and an extraction rate of 51.9 scfm yield a mass extraction rate of approximately 11 pounds per day.

Comparing cumulative vapor concentrations at VEL-03 from before and near the end of the extraction test, concentrations were generally reduced by about 45% near the top of the screen and 70% near the bottom of the screen. The more persistent concentrations near the top of the screen may be indicative that the vapor source is closer to and/or greater near the top of the screen.

3.3 Soil Vapor Extraction Test

The step test at VEL-03 included measuring the resulting flow rate for five different applied wellhead vacuums. Plotting these five values presented a linear relationship with a strong degree of correlation, having a coefficient of determination (R^2 value) of 0.99. The linear relationship between the extracted flow rate and applied vacuum at the wellhead as determined empirically from the step test data is represented by the following equation:

$$Extraction(scfm) = 2.45 \times Vacuum(inH_2O) - 1.96$$

The extended extraction test was conducted from the afternoon of January 28 through the evening of January 31, 2014 and involved continuous flow and vacuum monitoring using dataloggers at well VEL-03 and in the four monitoring screens of VML-02. The extraction rate ranged from 53 to 57 scfm with an applied wellhead vacuum of 25 to 27 inH_2O. The total soil vapor volume extracted from VEL-03 during the testing was approximately 207,400 cubic feet.

The highest vacuum response at the VML-02 cluster was observed at the deepest interval (at 190 feet bgs) representing about 35% of the applied vacuum at VEL-03. Vacuums representing approximately 22% of the applied vacuum were observed at depths of 150 and 170 feet bgs, and a vacuum approximately 5% of the applied vacuum was recorded at a depth of 130 feet bgs (about 30 feet above the top of the extraction screen). Monitoring of subsurface vacuums continued after the termination of the extraction test and returned to equilibrium rapidly. Comparing the applied vacuum at VEL-03 with the deeper vacuums observed at VML-02, vacuum radii of influence were estimated at 186 feet and 66 feet for depths of 190 and 170 feet bgs, respectively, following the typical rule-of-thumb where a radius of influence based on vacuum response is 1% of the applied vacuum on a logarithmic scale. During the test, a slight vacuum was observed in the nested well cluster VML-01 at depths of 150 to 170 feet bgs at a distance of about 112 feet from the extraction well, but the vacuum did not vary significantly from that observed under baseline conditions prior to the start of the extraction test.

The cumulative contaminant masses extracted were calculated from measured extraction rates and vapor concentrations. Over the 76-hour test, approximately 12 pounds of PCE and 10

pounds of cDCE were extracted, with stable mass extraction rates of approximately 4.5 and 3.7 pounds per day for PCE and cDCE, respectively.

The contaminated vapor pore volume was estimated by extrapolating the linear trend of the early data exhibiting linear concentration decay to a vapor concentration of zero. During this early extraction period, the impact of mass transfer constraints and retardation from partitioning to other phases are minimal as the flushing time is rapid compared to the time for re-equilibration. Assuming a soil porosity of 0.40 with 25 percent water saturation for a vapor porosity of approximately 0.30, the contaminated soil volume is roughly 3.3 times the contaminated soil vapor volume, or about 36,400 cubic yards.

Assuming uniform distribution, the contamination is estimated to occupy a radius of approximately 59 feet assuming a 90-foot thickness. This is a simplifying assumption because, as was noted previously, the vapor source varies in distribution and was observed to be greater near the top of the screen (i.e., 160 feet bgs) than near the bottom of the screen (i.e., 190 feet bgs). Furthermore, vapor sampling from the nested wells at the VML-02 cluster indicate varying VOC concentrations with depth where concentrations are greatest at 170 feet bgs, followed by 150 feet bgs, and then 190 feet bgs, with the least VOCs at the 130 feet bgs interval.

3.4 SVE Modeling

Praxis used vapor concentration data along with the flow history to calibrate a two-region (mobile-immobile) soil model to estimate the VOC contaminant mass in the LVZ source area beneath the Mission Plant, quantify mass transfer constraints, and evaluate possible future extraction strategies. The volume of contaminated soils was estimated from the volume of vapors extracted from mobile soils during the initial concentration decay, whereas the subsequent concentration rebound was used to estimate the volume and mass transfer characteristics of the immobile soils (i.e., source zone) that will define the duration of extraction to attain cleanup goals. The fraction of the soil characterized as mobile is 0.33, which is the portion of the soil with higher permeability materials that are conducive to airflow as determined from the PneuLog profiles. Average initial PCE vapor concentrations in both zones were calibrated to 220 ppmv based on the Tedlar bag samples.

The volume of the contaminated soil was estimated to be 36,400 cubic yards, corresponding to a radius of roughly 59 feet contaminated soil cylinder given a thickness of 90 feet. For the assumed soil properties and initial PCE vapor concentrations, the representative contaminated volume yields an initial PCE mass estimate of 63 pounds. Because approximately 12 pounds of PCE were extracted during the 3-day test, approximately 50 pounds of PCE are estimated to remain in the LVZ source area. After completing the fit to the PCE data, the model was matched to the cDCE data. Using the same contaminated soil volume of 36,400 cubic yards, Praxis estimated an initial cDCE mass estimate of 61 pounds for an estimated 50 pounds remaining in the LVZ source area.

Praxis also used the calibrated model to forecast future potential SVE performance assuming operating at a continuous rate of 52.7 scfm. Modeling results predicted that PCE vapor concentrations in the source soil would be reduced to less than 1 ppmv within 9 months of continuous operation; however, this does not take into account the potential for vapors volatilizing from underlying contaminated groundwater.

4.0 RECOMMENDATIONS AND PROPOSED REMEDIAL APPROACH

Based on the PneuLog test profiles, extended extraction test data, and modeling to interpret the observed subsurface vapor concentrations and masses extracted, Praxis recommended that SVE be initiated at VEL-03 and operated for a period of approximately 9 months to remove most of the remaining VOC mass in the LVZ source area. Based on Praxis' analysis and recommendation, the Group made a recommendation to ADEQ that SVE be initiated in the LVZ prior to completing the FS to mitigate a potential ongoing source of VOC contamination to the Regional Aquifer. Based on ADEQ's preliminary agreement with this approach, URS is currently preparing an ERA Work Plan. The ERA Work Plan is scheduled for submittal in early June 2014 and proposes to extract vapors from VEL-03 to remove contamination from the LVZ in the vicinity of the "Old Well" and MP-1. Extracted vapors would be routed through the existing activated carbon treatment system. Results of the PneuLog and SVE testing will also be used to inform the development of remedies within the FS.

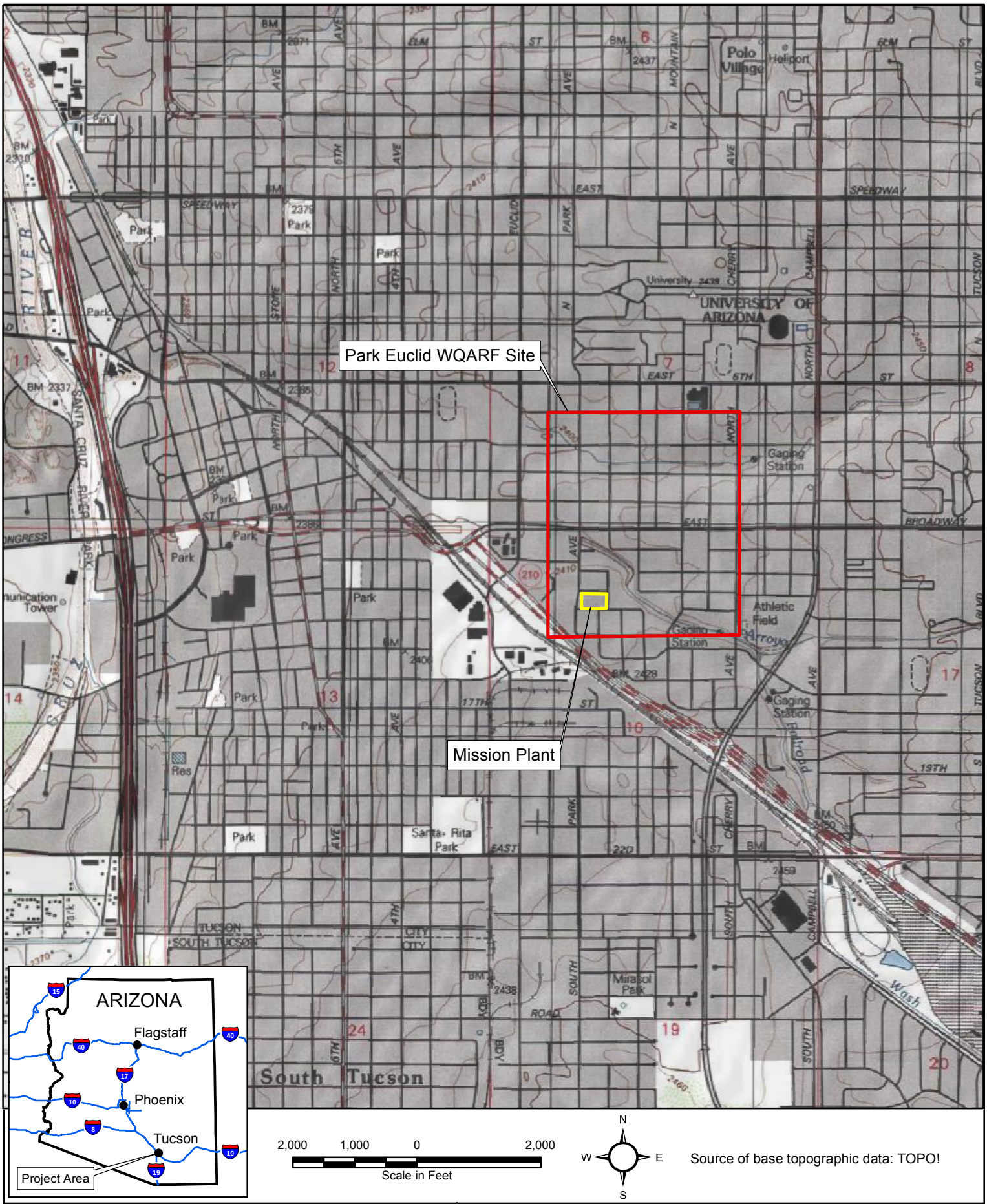
5.0 REFERENCES

Tetra Tech GEO, 2011. Final Remedial Investigation Report, Park-Euclid WQARF Site, Tucson, Arizona. Prepared for: Arizona Department of Environmental Quality. November 15.

URS, 2013. Work Plan, Feasibility Study and Associated Activities, Park-Euclid WQARF Site, Tucson, Arizona, URS Corporation, June 21.

ATTACHMENTS

Attachment A	Praxis - PneuLog® Evaluation & SVE Pilot Study Report
Attachment B	Manual Field Measurements
Attachment C	Laboratory Reports



Source of base topographic data: TOPO!

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

Date: May 2014

SITE LOCATION
PARK-EUCLID WQARF SITE
301 SOUTH PARK AVENUE
TUCSON, ARIZONA

Y:/GIS/Projects/Mission/Park_Euclid/Proj13/FS_Final/Fig1_SiteLocation.mxd

Figure 1

Aerial Photography Source: Pima County, Arizona GIS 2010

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

Date: May 2014

WELL LOCATIONS AT MISSION PLANT AREA
PARK-EUCLID WQARF SITE
301 SOUTH PARK AVENUE
TUCSON, ARIZONA

Proj/Mission.../Park_Euclid/Proj13/FS_Final/Fig2_Plant_Wells.mxd

Figure 2

PRAXIS
ENVIRONMENTAL TECHNOLOGIES, INC.

PneuLog® EVALUATION & SVE PILOT STUDY REPORT

PARK-EUCLID WQARF SITE
Tucson, Arizona

Version 2.0, May, 2014

Prepared for:

URS, Inc.
Denver, Colorado

Prepared by:

PRAXIS Environmental Technologies, Inc.
1440 Rollins Road
Burlingame, California 94010

TABLE OF CONTENTS

Page

SECTION 1 – **INTRODUCTION** 1

SECTION 2 – **PNEULOG® PROFILES** 3
PER-14A Pre-Pilot Test (27-Jan-14) 3
VEL-03 Pre-Pilot Test (28-Jan-14) 6
VEL-03 Pilot Test Shutdown (31-Jan-14) 10
PneuLog Profile Summary 14

SECTION 3 – **SVE TESTING RESULTS** 18
Baseline Vapor Sampling 19
Step Extraction Test Results 20
Extended Extraction Test in VEL-03 21

SECTION 4 – **MONITORING WELL VACUUM READINGS** 33

SECTION 5 – **SVE MODELING** 36
Fit of Two Region Model to Field Data 37
Evaluation of Two Region Model Input Parameters 41
Forecast for Future SVE Operations 42

SECTION 6 – **RECOMMENDATIONS** 44

APPENDIX A – **PneuLog Standard Operating Procedure**

APPENDIX B – **Gas Chromatography Results**

APPENDIX C – **Two-Region SVE Model**

LIST OF FIGURES

Figure	Title	Page
1-1	Location of Wells at the Park-Euclid WQARF Site	1
2-1	PER-14A PneuLog Flow and Interpreted Permeability Profile (Pre-Pilot Test)	4
2-2	PER-14A PneuLog Concentrations and Interpreted Soil Concentration Profile (Pre-Pilot Test)	6
2-3	VEL-03 PneuLog Flow and Interpreted Permeability Profile (Pre-Pilot Test)	7
2-4	VEL-03 PneuLog Concentrations and Interpreted Soil Concentration Profile (Pre-Pilot Test)	9
2-5	VEL-03 PneuLog Interpreted Soil Concentration Profiles for c1,2-DCE and PCE (Pre-Pilot Test)	10
2-6	PneuLog Flow and Interpreted Permeability Profile (End of Extraction)	11
2-7	PneuLog Concentrations and Interpreted Soil Concentration Profile (End of Extract)	12
2-8	VEL-03 PneuLog Interpreted Soil Concentration Profiles for c1,2-DCE and PCE (End of Extraction)	14
2-9	Comparison of Measured Flow Profiles in VEL-03	15
2-10	Comparison of Calculated Effective Permeability Profiles in VEL-03	15
2-11	Comparison of Measured Vapor Concentration Profiles in VEL-03	16
2-12	Comparison of Calculated c1,2-DCE Vapor Concentration Profiles in VEL-03	17
2-13	Comparison of Calculated PCE Vapor Concentration Profiles in VEL-03	17
3-1	Extraction Rate in VEL-03 as a Function of Applied Vacuum	20
3-2	Vapor Concentration History in the Extracted Vapors from VEL-03 (Time)	21
3-3	Vapor Concentration History in the Extracted Vapors from VEL-03 (Volume)	22
3-4	Linear Correlation to Early Extraction Data at VEL-03	23
3-5	Vapor Concentration History in VML-02 during the Extended Extraction Test	25
3-6	Comparison of PCE Vapor Concentrations in the VEL-03 PneuLogs and VML-02 during the Extended Extraction Test	26
3-7	Vapor Concentration History in VML-01 during the Extended Extraction Test	28
3-8	Vapor Concentration Rebound in VEL-03 after the Extended Extraction Test	29
3-9	Vapor Concentration Rebound in VML-02 after the Extended Extraction Test	30
3-10	Vapor Concentration Rebound in VML-01 after the Extended Extraction Test	31
3-11	Cumulative Mass in the Extracted Vapors from VEL-03	32
4-1	Subsurface Vacuum Responses during the Extended Extraction Test	33
4-2	Subsurface Vacuum Responses as a Function of Distance and Depth	34
4-3	Subsurface Vacuum Responses during the Purging of PER-14A	35
5-1	Model Fit to PCE Concentrations in Extracted Soil Vapors	38
5-2	Model Fit to cis-1,2-DCE Concentrations in Extracted Soil Vapors	39
5-3	Estimated Effective Source Area	41
5-4	Forecasts of PCE Concentrations and Remaining Mass during Additional SVE	43
5-5	Forecasts of c1,2-DCE Concentrations and Remaining Mass during Additional SVE	43

LIST OF TABLES

Table	Title	Page
1-1	Summary of Field Activities and Vapor Sampling	2
2-1	Results of Chemical Analyses on PER-14A PneuLog Vapor Samples (Pre-Pilot Test).	5
2-2	Results of Chemical Analyses on VEL-03 PneuLog Vapor Samples (Pre-Pilot Test)	8
2-3	Results of Chemical Analyses on VEL-03 PneuLog Vapor Samples (End of Extract)	12
3-1	Summary of Vapor Extraction Applied to VEL-03	18
3-2	Summary of Baseline Vapor Sampling Results	19
3-3	Flow Data Collected during the Step Extraction Rate Test in VEL-03	20
3-4	Vapor Concentrations from Samples Collected in PER-14A	29
5-1	Parameters for Two-Region Modeling of Extraction during the SVE Pilot Test	39

PneuLog® EVALUATION & SVE PILOT STUDY REPORT
Park-Euclid WQARF Site, Tucson, Arizona

1. INTRODUCTION

The purpose of this effort was to characterize subsurface conditions and contaminant vapor concentrations in the lower vadose zone (LVZ) beneath a perched aquifer at the Park-Euclid WQARF Site in Tucson, Arizona. The primary contaminant of concern in the LVZ is the dry cleaning solvent tetrachloroethylene (PCE) and its degradation products, primarily trichloroethylene (TCE) and cis-1,2-dichloroethylene (c1,2-DCE). The data will be used in a feasibility study to select a remedy for the LVZ. PneuLog testing was performed in two wells and preceded a 72-hour extraction test in one of the wells and a second PneuLog in the extraction well at the end of the extraction period. PneuLog measures the air permeability and contaminant concentration profiles in wells screened in the vadose zone. The SVE test consisted of baseline sampling, a step flow test at five different extraction rates, 62.5 hours of extraction nearly continuous extraction, and 31 days of rebound (no extraction). The extraction period of 76.0 hours included three interruptions in power that were 8.6, 2.0, and 2.9 hours in duration. This report summarizes the data collection and provides an interpretation of the collected data as it applies to SVE at the site. A summary of the field tasks performed by Praxis during this effort is provided in Table 1-1. Locations of wells at the site are illustrated in Figure 1-1.

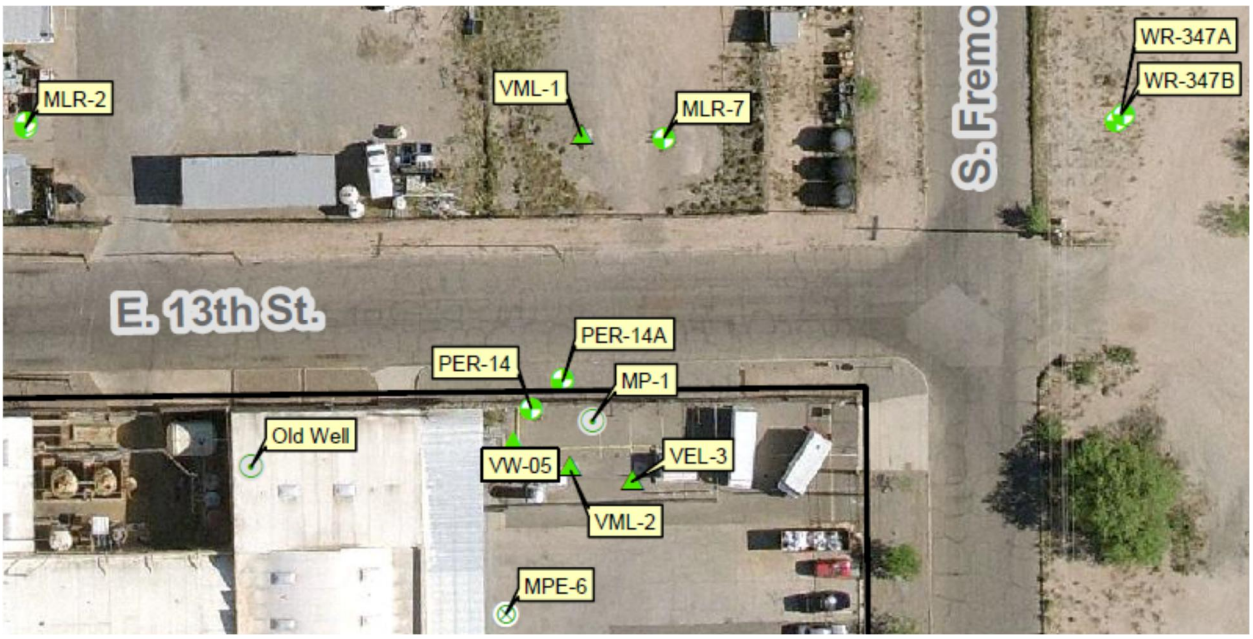


Figure 1-1. Location of Wells at the Park-Euclid WQARF Site

Table 1-1. Summary of Field Activities and Vapor Sampling

DAY	TASK DESCRIPTION	Tedlar	Field Dup	Equip Blank	Summa
1/27/14	Setup & Baseline Sampling (9:30-12:30)	10	1	1	1
Mon	Baseline vacuum monitoring & more (12:30-13:30)				
	Setup for PneuLog on PER-14A (13:30-15:00)				
	PneuLog PER-14A (15:00-17:00)	5	1	1	3
1/28/14	Setup extraction on VEL-3				
Tue	Setup Monitor VML-2 (8:00-9:30)				
	Step Extraction Test (10:54-12:30)	1			1
	PneuLog VEL-3 (12:30-13:45)	7	1	1	3
	SVE Pilot Test Start (14:45)				
	Sample VML-1 (14:45-15:15)	4			
	Sample VML-2 & VEL-3 (15:45-16:15)	5	1		
	Datalogger shows system shutdown at 18:59				
1/29/14	Datalogger indicates system startup at 3:32 am				
Wed	Datalogger shows system shutdown at 5:23 am				
	Restart SVE system at 7:22 am				
	Sample VML-2 & VEL-3 (8:45-9:15)	5		1	
	Reconfigure vacuum gauges for range (9:30-10:30)				
	Sample VML-1 (14:30-15:00)	4		1	
	Sample VML-2 & VEL-3 (15:15-15:45)	5	1	1	1
	Datalogger shows system shutdown at 19:10				
	System found down 22:00; restart at 22:06				
	Sample VML-2 & VEL-3 (22:25-22:55)	5			
1/30/14	Sample VML-2 & VEL-3 (8:30-9:00)	5	1	1	
Thu	Sample VML-1 (15:15-15:45)	4			1
	Sample VML-2 & VEL-3 (16:00-16:30)	5	1	1	1
	Sample VML-2 & VEL-3 (22:00-22:30)	5			
1/31/14	Sample VML-2 & VEL-3 (7:00-7:30)	5			
Fri	Sample VML-1 (15:15-15:45)	4			
	Sample VML-2 & VEL-3 (16:00-16:30)	5	1	1	1
	Pause extraction in VEL-3 at 17:04				
	Insert PneuLog in VEL-3, restart extraction 17:08				
	PneuLog VEL-3 (17:10-18:00)	7	1	1	
	SVE Pilot Test Extraction Termination (18:47)	1			
2/1/14	Rebound Vapor Sampling (12:00-13:00)	10	2	1	1
Sat	Demobilize from Site				
2/13/14	Rebound Vapor Sampling after 13 days	10	1	1	1
3/3/14	Rebound Vapor Sampling after 31 days	10	1	1	1
	Vapor Sampling Totals	122	13	13	15

Throughout the field effort, vapor samples were collected in Tedlar bags for later analysis with a gas chromatograph (GC) as described in the PneuLog SOP provided in Appendix A. In addition, 15 Summa canister samples were collected as duplicates to the Tedlar bag samples and submitted to a certified laboratory for analysis by EPA Method TO-15 to provide quality assurance on the Tedlar bag results and to provide definitive identification of individual compounds. Vapor sampling and analyses with Tedlar bags also included field duplicates and sampling equipment blanks as indicated in Table 1-1. The results from all duplicate samples were within 15% of the primary sample results and all sampling equipment blank results were less than 1% of the concentrations detected in primary samples collected before and after the blank. The GC results from analyses of Tedlar bag samples are tabulated in Appendix B. Appendix B also includes plots illustrating the excellent correlation between the Tedlar bag and Summa canister data.

2. PNEULOG PROFILES

PneuLog testing was performed in wells PER-14A and VEL-03 before the 72-hour extraction test was initiated in VEL-03. A second PneuLog was performed in VEL-03 during hour 62 of the extraction test immediately before extraction was terminated. PER-14A was constructed with five-inch diameter schedule 80 PVC casing and screen and is screened from 178 feet below ground surface (ft bgs) and into the underlying aquifer to a depth of 248 ft bgs. The deeper aquifer is found at approximately 200 ft bgs. VEL-03 was constructed with four-inch diameter schedule 80 PVC casing and screen and is screened from 160 to 190 ft bgs. The standard operating procedure for profiling wells with PneuLog is provided in Appendix A. This procedure was followed in the field without exception. After the PneuLog equipment was placed in the well, continuous flow and total concentration (using a photoionization detector [PID]) profiles were measured along the screen. Vapor samples were collected in Tedlar bags at depths along the length of the screen where changes in flow were observed or at a spacing of about 5 feet. As indicated in Table 1-1, Summa canister samples were collected as duplicates to the Tedlar bags by URS and shipped to a certified laboratory for analyses.

The Tedlar bag samples were transported to Praxis' laboratory and analyzed within 60 hours of collection with a calibrated gas chromatograph (GC) using a modified EPA Method 18 for GC analyses of volatile organic compounds in air. The GC is a Hewlett Packard 6890 with flame ionization detector (FID). The quality of the data is commensurate with field screening although Summa canister samples collected as duplicates validated the results as described in Section 3. Throughout the logging of each screen, total chemical concentrations were monitored by a photoionization detector (PID). As described in this memorandum, the continuous vapor concentration profiles from the PID were calibrated using the results of GC analyses.

Well PER-14A Pre-Pilot Test (27-Jan-14)

The first PneuLog was performed in PER-14A on 27-Jan-14 after about one hour of vapor extraction. During the test, a vacuum of 44.5 inches of water (inH_2O) was applied yielding a total extraction rate of approximately 6 standard cubic feet per minute (scfm). This flow measurement was made with a 1.5-inch pitot tube and the flow is below the threshold flow rate for measuring flow with the PneuLog detector in a five-inch diameter well. The PneuLog measured cumulative airflow profile of zero is presented in Figure 2-1 along with designations

for depths of discrete vapor sampling. The PneuLog flow was measured as zero along the full length of the screen interval. The interpreted effective permeability profile is presented adjacent to the cumulative flow measurement in Figure 2-1. The effective permeability profile was generated from the measured flow of 6 scfm divided by the length of the exposed screen interval (23 feet) and then divided again by the applied wellhead vacuum (44.5 inH2O). In general, an effective permeability less than 0.01 scfm/ft/inH_2O is indicative of clayey silts/sands or clays or soils with high water contents of any type.

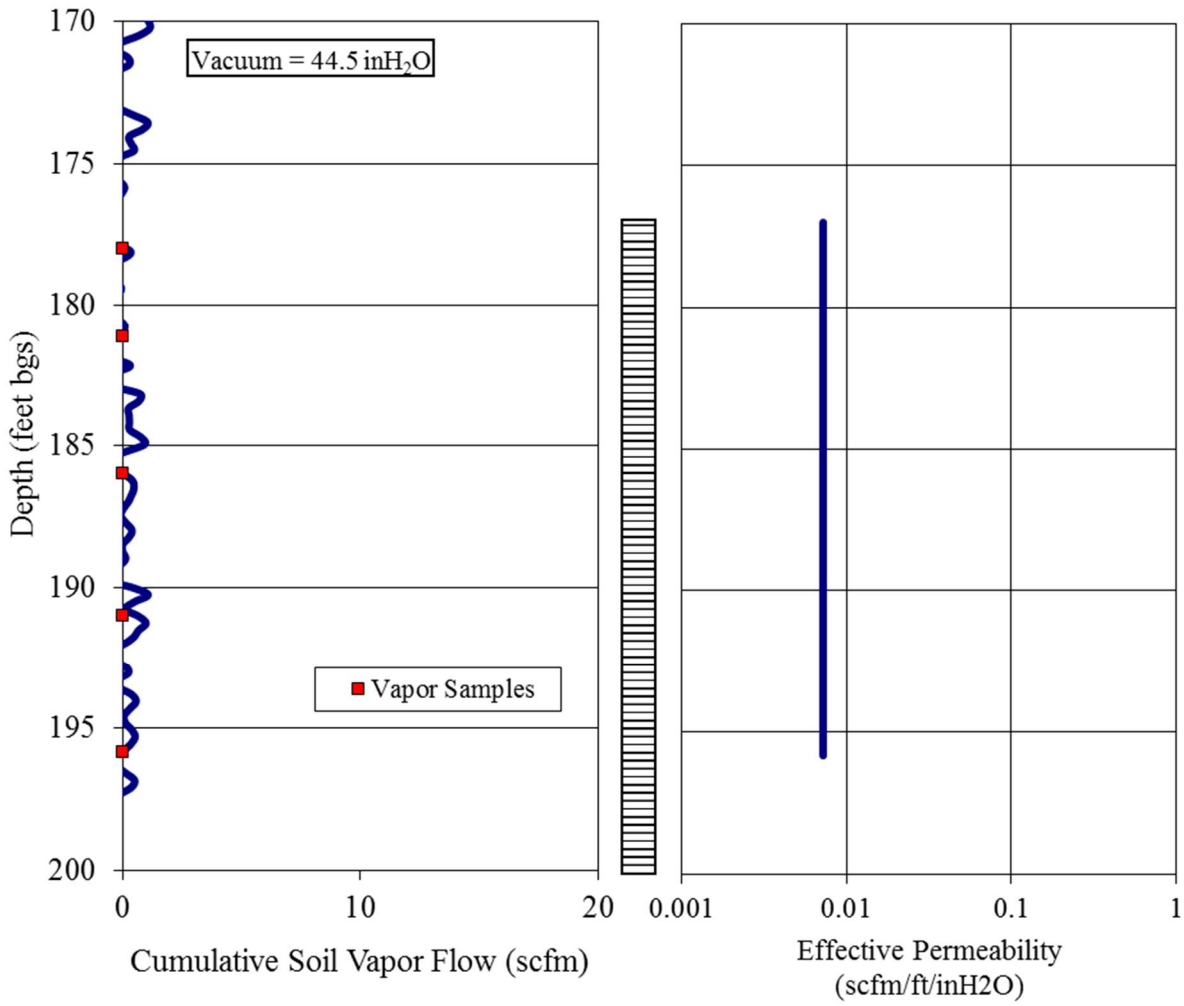


Figure 2-1. PER-14A PneuLog Flow and Interpreted Permeability Profile (Pre-Pilot Test)

Vapor samples were collected in Tedlar bags to determine compound-specific vapor concentration profiles and to calibrate the continuous total concentration profile measured by the PID. Table 2-1 summarizes the results from the analyses. The GC calibration included 1,1-DCE, c1,2-DCE, t1,2-DCE, TCE and PCE and these compounds were detected at the site but only c1,2-DCE, TCE and PCE are reported in the PneuLog tables as 1,1-DCE and t1,2-DCE were detected at much lower concentrations and were not detected in the Summa canister because of high detection limits.

Table 2-1. Results of Chemical Analyses on PER-14A PneuLog Vapor Samples (Pre-Pilot Test)

Depth (feet)	c1,2-DCE (ppm)	TCE (ppm)	PCE (ppm)	Total (ppm)	Cumulative Flow (scfm)
Tedlar					
178.0	416	20	99	539	~6
181.2	281	16	105	404	-
186.0	263	15	101	381	-
191.0	307	16	92	417	-
195.8*	253	15	94	364	-
Summa					
178.0	570	18	100	688	~6
191.0	280	16	100	396	-
195.8*	220	13	92	325	-

* Sample collected after power outage and extraction re-start (45 min delay)

The measured vapor concentrations as a function of depth are illustrated in Figure 2-2. The first profile represents the continuous PID measurement calibrated to the plotted GC results for the total concentration. The PID response calibrated well with the GC analyses although the calibration appeared to drift deeper in the well. However, a brief power outage occurred when the PneuLog probe was at the bottom depth and also before the vapor sample was collected at 195.8 ft bgs. The power outage resulted in a 15-minute cessation of extraction in the well. After restoring power and extracting for 15 minutes, the bottom vapor sample was collected. Hence, the trend of increasing concentration at the bottom of the well exhibited by the PID may be more representative of conditions in the well. The second figure presents the interpreted total soil gas concentration. Without a flow profile, the soil concentration profile is effectively the same as the GC analyses. This screen interval spans low permeability material as indicated by the low extraction rate and therefore presents a substantial mass transfer constraint during SVE. The highest total concentration was detected at the top of the screen and with an extraction rate of 6 scfm yields a mass extraction rate of 2.0 pounds per day.

About three-quarters of the total concentration in this well was c1,2-DCE. This observation suggests anaerobic degradation is taking place in the vicinity and is consistent with the low permeability material encountered. For a c1,2-DCE vapor concentration of 253 ppm, the equilibrium concentration of c1,2-DCE dissolved in water is about 3,200 parts per billion (ppb) based on Henry's Law. For TCE, the deep vapor concentration of 15 ppm represents a potential porewater concentration of 220 ppb. Similarly, for a PCE vapor concentration of 94 ppm, the equilibrium concentration of PCE dissolved in water is about 600 parts per billion (ppb). Hence, if the deep vapors are in equilibrium with underlying groundwater, then groundwater concentrations for c1,2-DCE, TCE and PCE are on the order of 3,200; 220; and 600 ppb (or micrograms per liter), respectively. Peak groundwater concentrations detected in PER-14A during 2012 were 2,200; 70; and 400 micrograms per liter for c1,2-DCE; TCE and PCE, respectively.

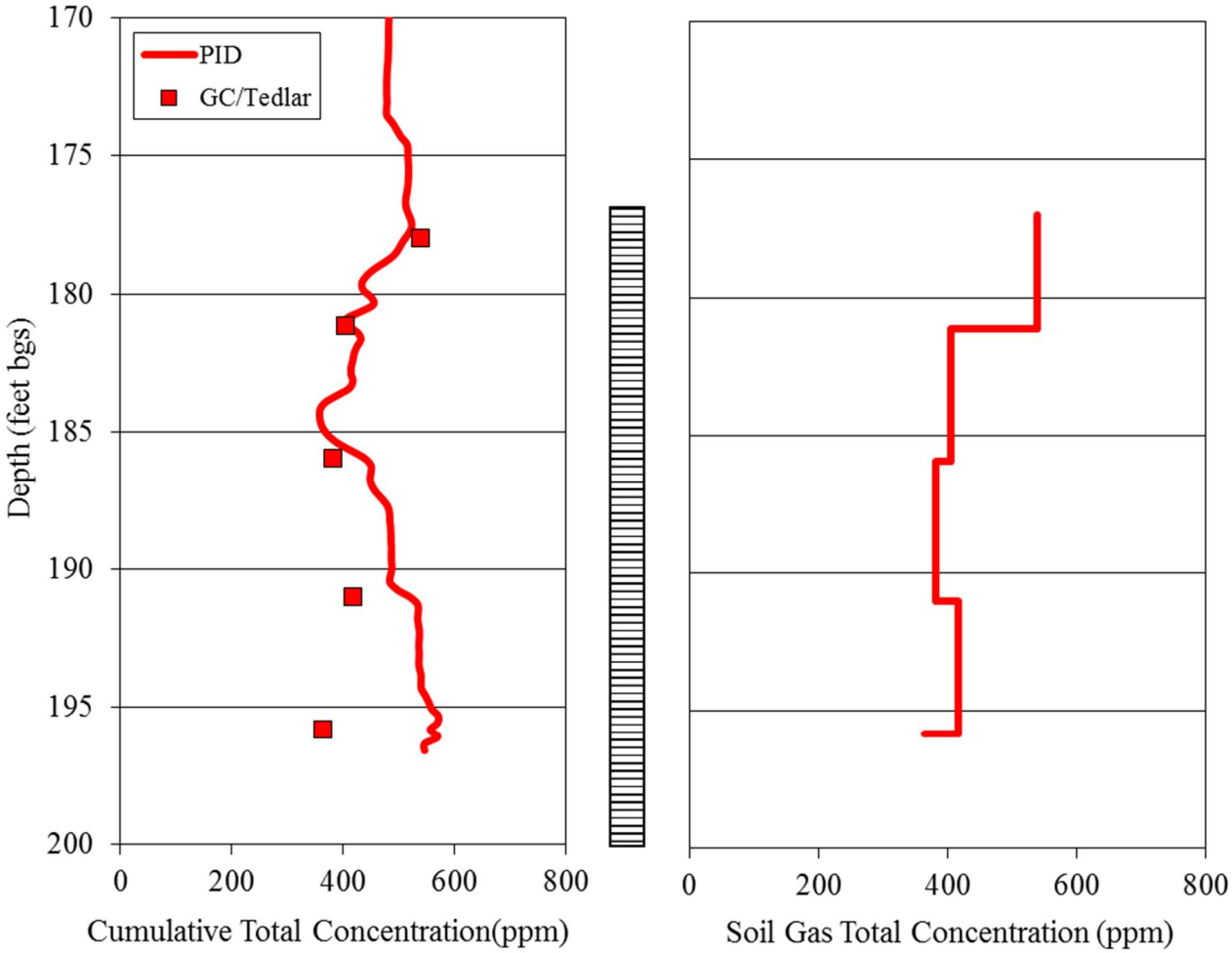


Figure 2-2. PER-14A PneuLog Concentrations and Interpreted Soil Concentration Profile (Pre-Pilot Test)

Well VEL-03 Pre-Pilot Test (28-Jan-14)

PneuLog testing was performed in VEL-03 on the morning of 28-Jan-14 just before the step extraction test and the 72-hour extraction test. During the PneuLog, a vacuum of 25 inH_2O was applied yielding a total extraction rate of 54.5 scfm. The measured cumulative airflow profile is shown in Figure 2-3 along with designations for depths of discrete vapor sampling illustrating the objective of sampling at the top and bottom of major flow intervals. The flow at the very bottom of the well was zero and the cumulative flow increased upward towards the top of the well screen as flow was added from permeable intervals. The cumulative flow at the top of the screen was equivalent to the measured wellhead extraction rate since blank casing connected the screen to the surface. The interpreted effective permeability profile is presented adjacent to the cumulative flow measurement in Figure 2-3. The effective permeability profile was generated from the changes in flow observed over depth intervals divided by the thickness of the interval and then divided again by the applied wellhead vacuum. The data are plotted on a logarithmic scale to reveal order-of-magnitude changes in permeability. In general, an effective permeability

greater than 0.1 scfm/ft/inH_2O is indicative of a sandy material, values from 0.01 to 0.1 scfm/ft/inH_2O are indicative of silty material, and values less than 0.01 scfm/ft/inH_2O are indicative of clayey silts/sands or clays or material of any type with a high moisture content.

Figure 2-3 illustrates distinct flow zones along the screen interval. At the top of the screen, a permeable 3-foot interval yielded about 11 scfm representing around 20% of the total flow rate. Note, the sand pack extends 2 feet above the top of the screen and the calculated effective permeability includes this additional interval open to extraction. Flow data from 159 to 172 ft bgs indicated moderately permeable soils where approximately 13 scfm were extracted. In the interval from 172 to 179 ft bgs approximately 30 scfm were extracted indicating more permeable soils with some interbedding. Thin, one- to two-foot-thick permeable intervals were encountered at 172, 175 and 177 ft bgs. Below 179 feet bgs and down to 189 ft bgs at the bottom of the screen, a low permeability interval was encountered that produced no measurable vapor flow (< 2 scfm). In summary, the interval from the top of the screen to 189 ft bgs was modestly permeable suggesting few significant mass transfer constraints are present to limit remediation by SVE, if required, other than the lack of extraction in the bottom of the screen interval.

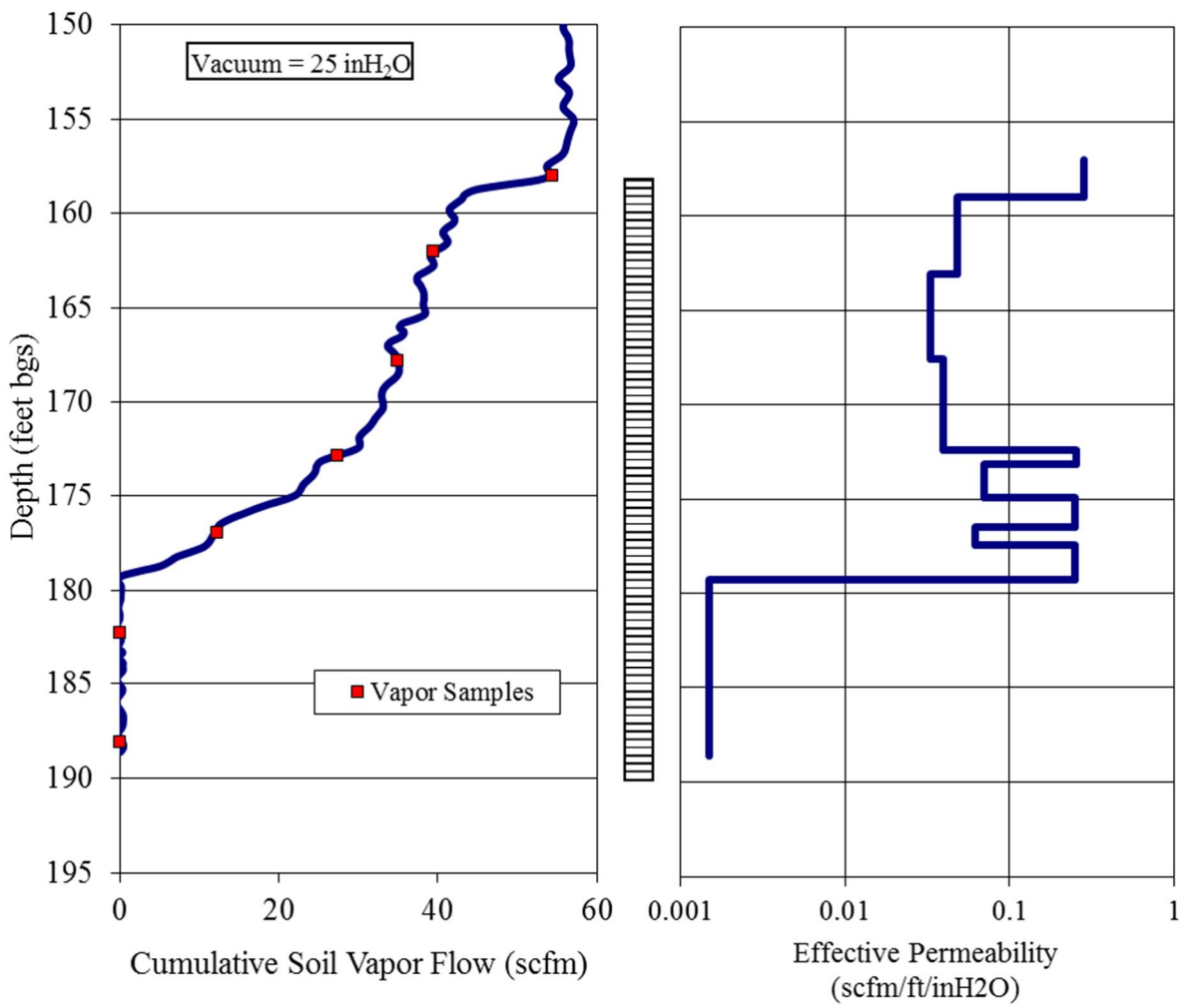


Figure 2-3. VEL-03 PneuLog Flow and Interpreted Permeability Profile (Pre-Pilot Test)

Vapor samples were collected in Tedlar bags from 7 depths along the screen. The depths are shown on Figure 2-3 along with the cumulative flow. The samples were analyzed as described previously and used to determine compound-specific vapor concentration profiles and to calibrate the continuous total concentration profile measured by the PID. Table 2-2 summarizes the results. The measured vapor concentrations as a function of depth are provided in the first profile of Figure 2-4 and illustrate an excellent correlation between the PID response and the GC results. The second figure presents the interpreted total soil gas concentration adjacent to the screen calculated from a balance on the flow and concentration changes over distinct intervals.

Table 2-2. Results of Chemical Analyses on VEL-03 PneuLog Vapor Samples (Pre-Pilot Test)

Depth (feet)	c1,2-DCE (ppm)	TCE (ppm)	PCE (ppm)	Total (ppm)	Cumulative Flow (scfm)
Tedlar					
158.0	336	29	221	589	54.5
162.0	359	30	223	616	39.5
167.8	374	26	184	587	35.0
172.9	333	21	158	515	27.3
177.0	237	18	158	416	12.2
182.3	179	17	158	356	0.0
188.1	145	17	159	322	0.0
Summa					
158.0	330	28	220	578	54.5
172.9	330	22	170	522	27.3
188.1	110	13	130	253	0.0

The highest cumulative total concentrations were found near the top of the screen and exceeded 600 ppm while the concentration decreased with depth to the bottom of the screen. The lowest measured cumulative total concentration was 322 ppm at the bottom. The interpreted soil gas total concentration profile takes into account the impact of flow on the concentration changes. At the top of the screen, the influx of flow (~11 scfm) lowered the cumulative total concentration from 616 to 589 ppm yielding a calculated soil concentration profile of about 500 ppm. Recall the soil interval from 163 to 172 ft bgs yielded a small flow but observe that the cumulative total concentration increased from 172 to 163 ft bgs indicating this influent vapor was much more contaminated than the deeper vapors. The calculated soil vapor concentrations in this interval are over 900 ppm. The calculated total soil concentration decreased from over 1,000 ppm at a depth of 172 ft bgs to 356 ppm at the bottom of the flow interval (179 ft bgs). From 179 ft bgs to the bottom of the screen interval at 189 ft bgs the calculated total soil vapor concentration was relatively constant at 356 ppm. The total vapor concentration at the bottom of the screen was 322 ppm.

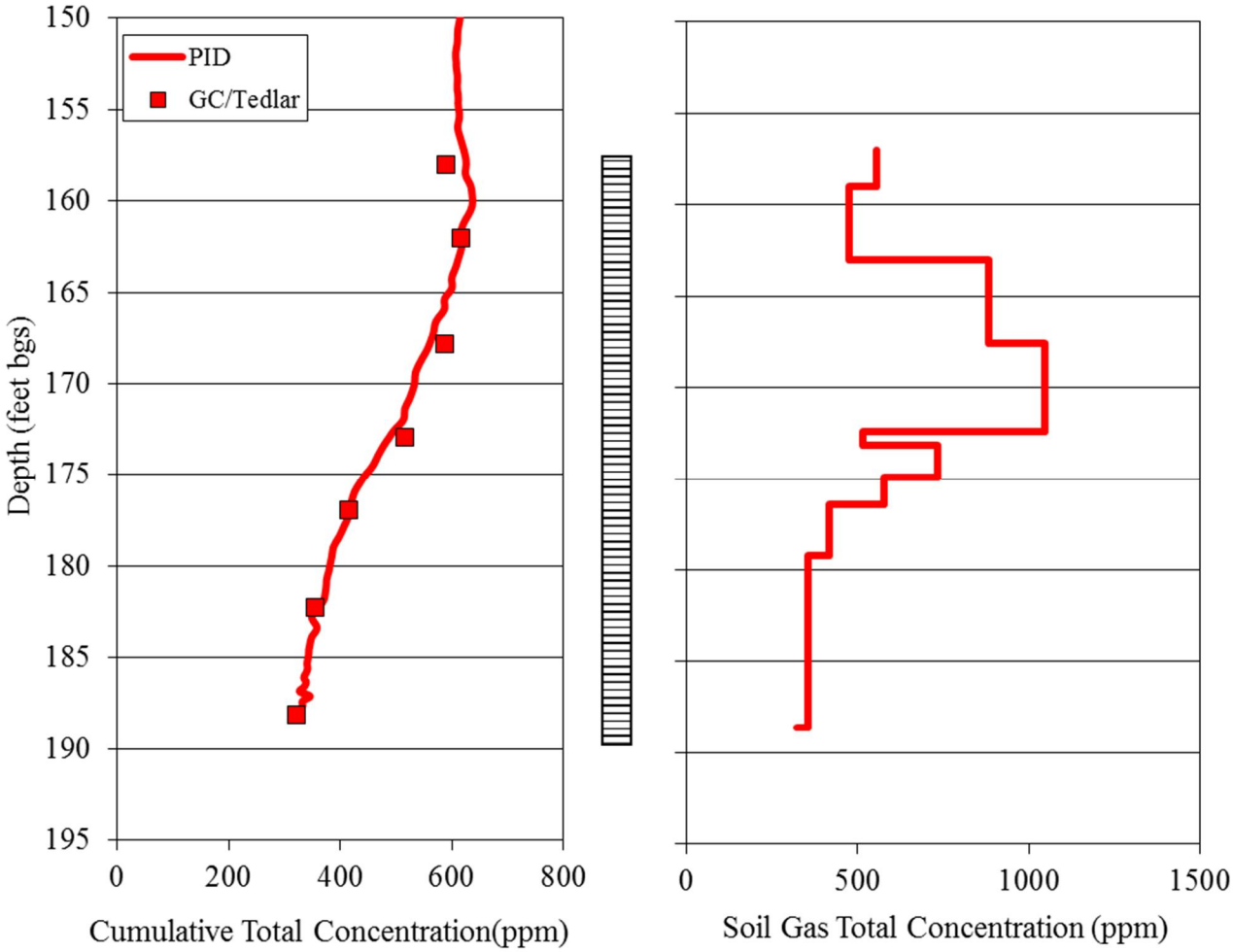


Figure 2-4. VEL-03 PneuLog Concentrations and Interpreted Soil Concentration Profile (Pre-Pilot Test)

At the top of the well screen, the majority of the cumulative total vapor concentration consisted of c1,2-DCE; however, at the bottom of the well, the total was approximately equal parts c1,2-DCE and PCE. Also, the PCE concentrations reported in Table 2-2 indicate the PCE concentration was essentially constant from 172 ft bgs to the bottom of the well. To interpret these observations, individual soil vapor concentration profiles were calculated for c1,2-DCE and PCE and are plotted in Figure 2-5. The results indicate a relatively high soil vapor concentration of PCE (583 ppm) and low concentration of c1,2-DCE (220 ppm) from 163 to 168 ft bgs. However, in the interval from 168 to 172 ft bgs the trend was reversed with c1,2-DCE at 636 ppm and PCE at 350 ppm. These trends suggest PCE resides in a lesser permeable interval from 163 to 168 ft bgs that is being degraded to c1,2-DCE outside this interval.

A total vapor concentration of 589 ppm at the wellhead and an extraction rate of 54.5 scfm yield a mass extraction rate of 20 pounds per day.

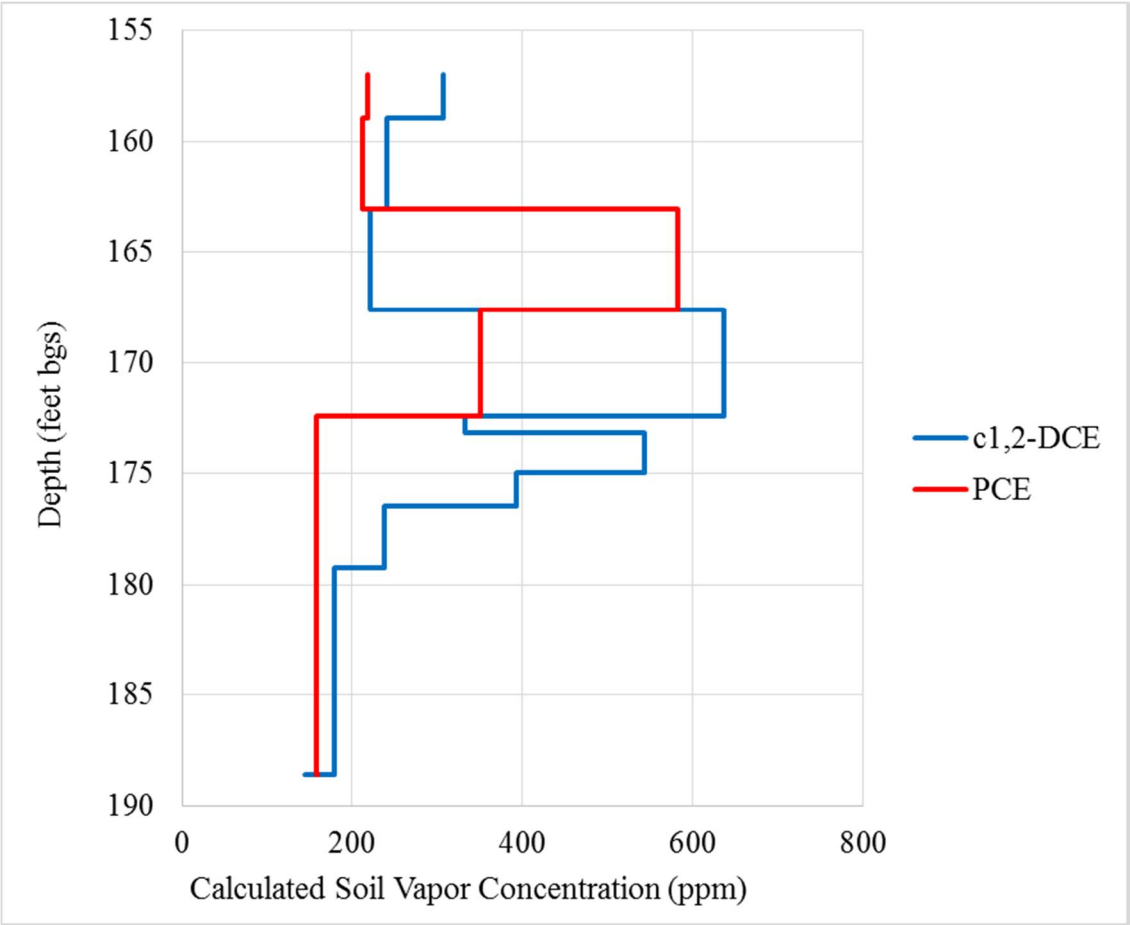


Figure 2-5. VEL-03 PneuLog Interpreted Soil Concentration Profiles for c1,2-DCE and PCE (Pre-Pilot Test)

Well VEL-03 Pilot Test Extraction Shutdown (31-Jan-14)

PneuLog testing was repeated in VEL-03 on 31-Jan-14 after the step extraction test and the 72-hour extraction test. The PneuLog was performed during the final hour of the 72-hour extraction test. During the PneuLog, a vacuum of 22.2 inH_2O was applied yielding a total extraction rate of 52 scfm. The measured cumulative airflow profile is presented in Figure 2-6 along with designations for depths of cumulative vapor sampling. The interpreted effective permeability profile is presented adjacent to the cumulative flow measurement in Figure 2-6. The profiles of Figure 2-6 are very similar to those in Figure 2-3. A high permeability interval was identified at the top of the screen. A moderately permeable soil was detected from 159 to 171 ft bgs. A high permeability interval was identified from 171 to 180 ft bgs with some interbedding. No appreciable flow was produced from 180 to 189 ft bgs at the bottom of the screen.

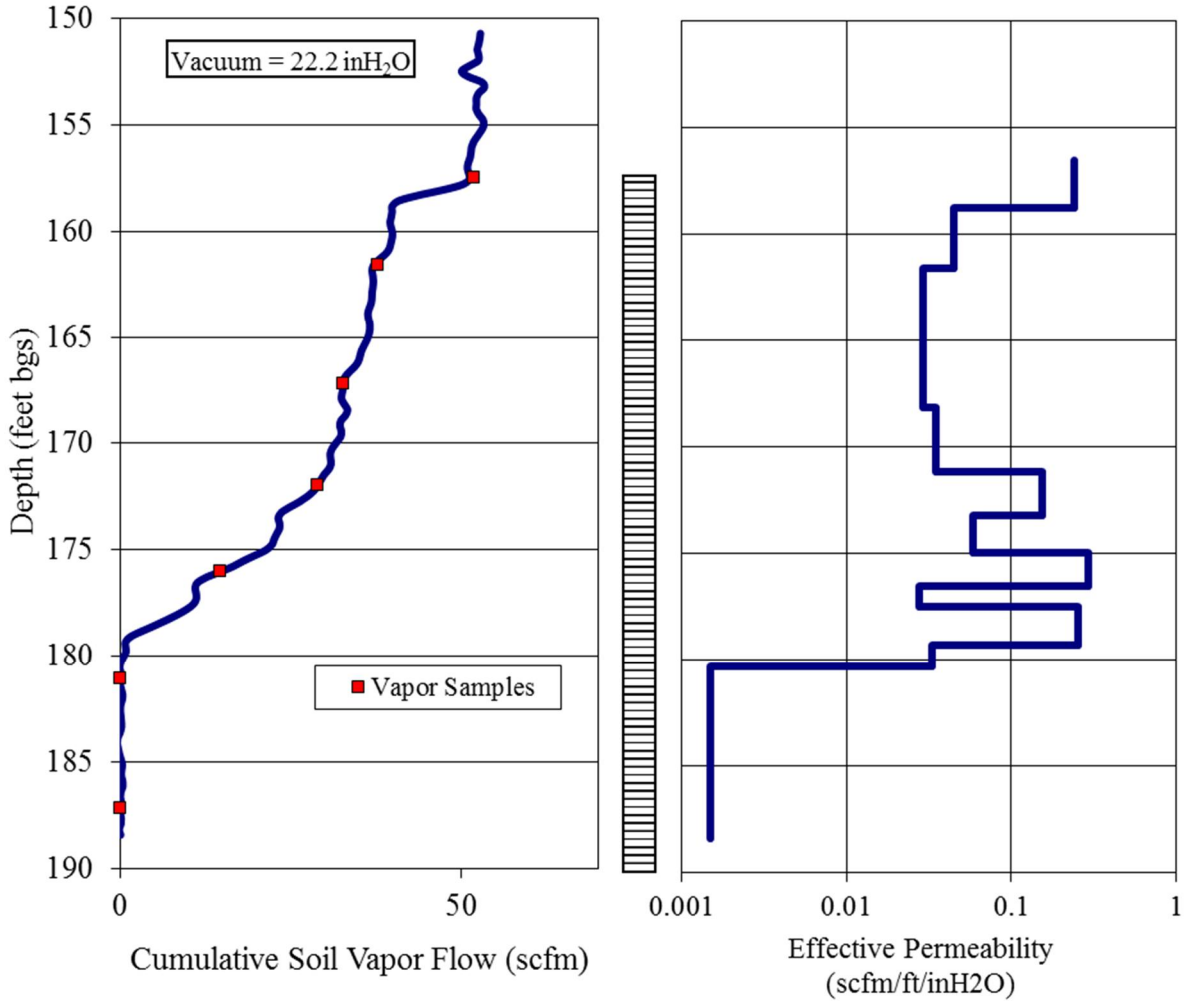


Figure 2-6. PneuLog Flow and Interpreted Permeability Profile (End of Extraction)

As indicated in Figure 2-6, vapor samples were collected in Tedlar bags from 7 depths along the screen; similar to those in the initial log. These vapor samples were analyzed to determine compound-specific vapor concentration profiles and to calibrate the continuous total concentration profile measured by the PID. No Summa canister samples were collected during this activity. Table 2-3 summarizes the results from these analyses. The measured vapor concentrations as a function of depth are provided in the first profile of Figure 2-7 and illustrate an excellent correlation between the PID response and the GC results. The second profile presents the interpreted total soil gas concentration adjacent to the screen calculated from a balance on the flow and concentration changes over distinct intervals.

Table 2-3. Results of Chemical Analyses on VEL-03 PneuLog Vapor Samples (End of Extraction)

Depth (feet)	c1,2-DCE (ppm)	TCE (ppm)	PCE (ppm)	Total (ppm)	Cumulative Flow (scfm)
Tedlar					
157.5	185	17	133	338	51.9
161.6	209	18	122	349	37.8
167.2	105	11	92	209	32.7
172.0	79	11	84	174	29.0
176.0	81	10	84	175	14.7
181.1	85	10	89	185	0.0
187.2	36	5	56	97	0.0

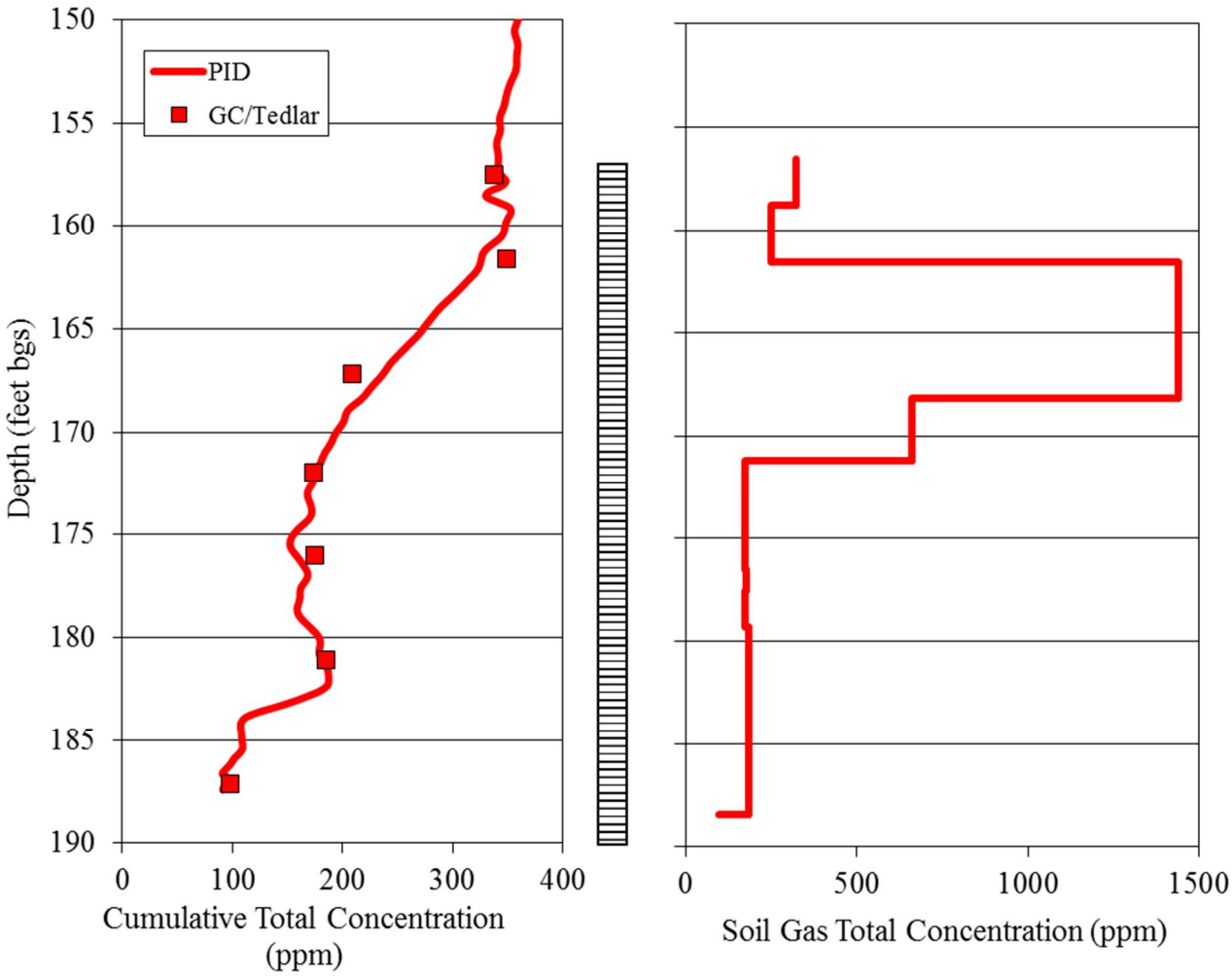


Figure 2-7. PneuLog Concentrations and Interpreted Soil Concentration Profile (End of Extraction)

The highest cumulative total concentrations were found near the top of the screen and had fallen from the initial 600 ppm to about 350 ppm. As in the initial profile, the total concentration decreased with depth to the bottom of the screen. The lowest measured cumulative total concentration was 97 ppm at the bottom, significantly less than the 322 ppm measured in the initial profile. The interpreted soil gas total concentration profile takes into account the impact of flow on the concentration changes. At the top of the screen, the influx of flow lowered the cumulative total concentration from 349 to 338 ppm yielding a calculated soil concentration profile of about 300 ppm. The soil interval from 161 to 168 ft bgs yielded a small flow but observe that the cumulative total concentration increased from 168 ft bgs (209 ppm) to 161 ft bgs (349 ppm) indicating this small flow of influent vapor was much more contaminated than the deeper vapors. The calculated soil vapor concentration in this interval is over 1,400 ppm. The calculated total soil concentration decreased sharply from over 1,400 ppm at a depth of 168 ft bgs to 170 ppm at the top of the flow interval (172 ft bgs). From 172 ft bgs to the bottom of the screen interval at 189 ft bgs the calculated total soil vapor concentration was relatively constant at 185 ppm. The total vapor concentration at the bottom of the screen was 97 ppm.

At the top of the well screen, the over half of the cumulative total vapor concentration consisted of c1,2-DCE; however, at the bottom of the well, the PCE concentration was over half of the total. To interpret these observations, individual soil vapor concentration profiles were calculated for c1,2-DCE and PCE and are plotted in Figure 2-8. The results indicate a relatively high soil vapor concentration of c1,2-DCE (1,000 ppm) across the lesser permeable interval from 161 to 168 ft bgs whereas a relatively low concentration of PCE (350 ppm) was calculated. A similar trend was observed in the interval from 168 to 171 ft bgs. The two compounds had similar, realtively constant soil concentrations (~85 ppm) in the interval from 171 ft bgs to the bottom of the screen interval.

These concentration profiles are expected to be indicative of longer term soil vapor extraction if applied in this well. In addition, the concentrations measured at the bottom of the screen may be indicative of underlying groundwater concentrations although this depth is separated from the water table by about 10 feet. For a c1,2-DCE vapor concentration of 36 ppm, the equilibrium concentration of c1,2-DCE dissolved in water is about 460 parts per billion (ppb) based on Henry's Law. Similarly, for a PCE vapor concentration of 56 ppm, the equilibrium concentration of PCE dissolved in water is about 360 parts per billion (ppb). Hence, if the deep vapors are in equilibrium with underlying groundwater, then groundwater concentrations for c1,2-DCE and PCE in the vicinity of VEL-03 are on the order of 460 and 360 ppb, respectively.

A total vapor concentration of 338 ppm at the wellhead and an extraction rate of 51.9 scfm yield a mass extraction rate of 11 pounds per day.

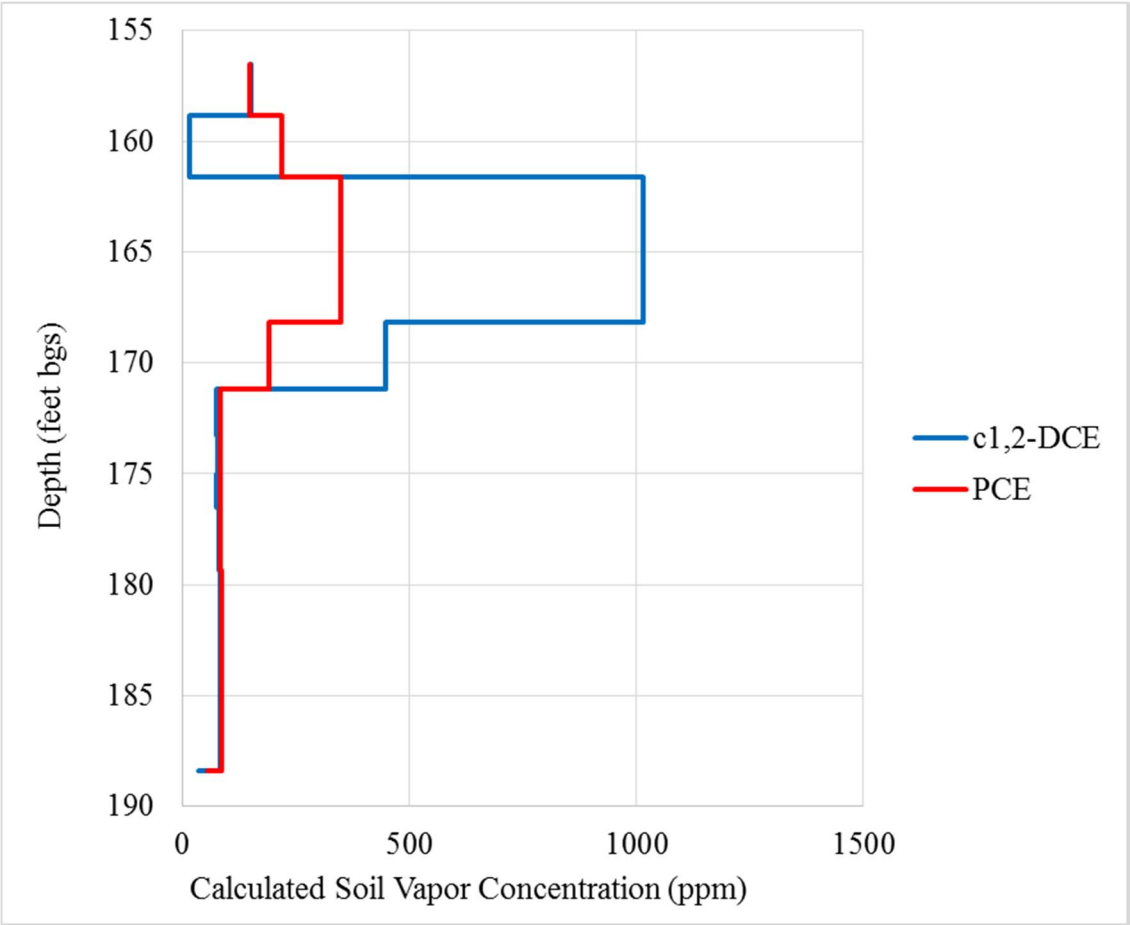


Figure 2-8. VEL-03 PneuLog Interpreted Soil Concentration Profiles for c1,2-DCE and PCE (End of Extraction)

PneuLog Profile Comparison and Summary

This section plots comparisons of the profiles from the two PneuLog events in VEL-03. Figure 2-9 provides the measured cumulative flow profiles from VEL-03. The profiles are nearly identical with the exception of a slightly lower total extraction rate during the initial log. The calculated profile of effective soil permeability to air flow is plotted in Figure 2-10 and as expected the two profiles are very similar. The only difference of note is the increased thickness of the permeable interval found at about 172 ft bgs and underneath the thick, modestly permeable interval from 159 to 172 ft bgs.

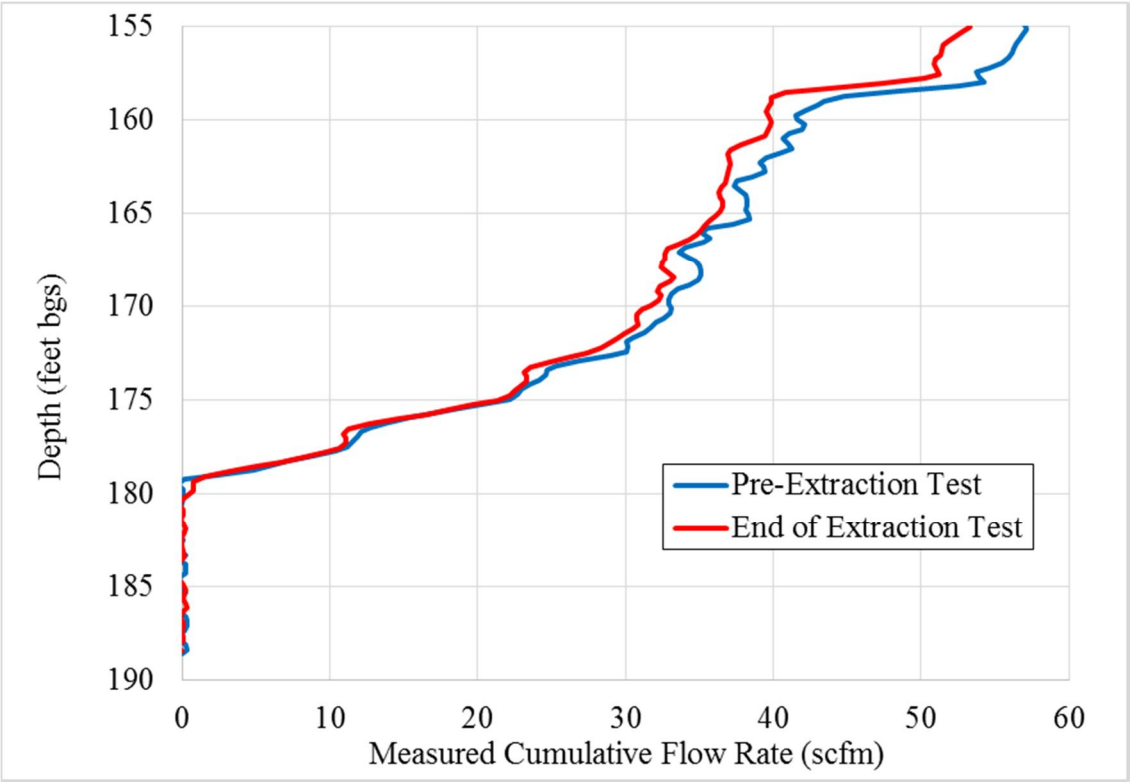


Figure 2-9. Comparison of Measured Flow Profiles in VEL-03

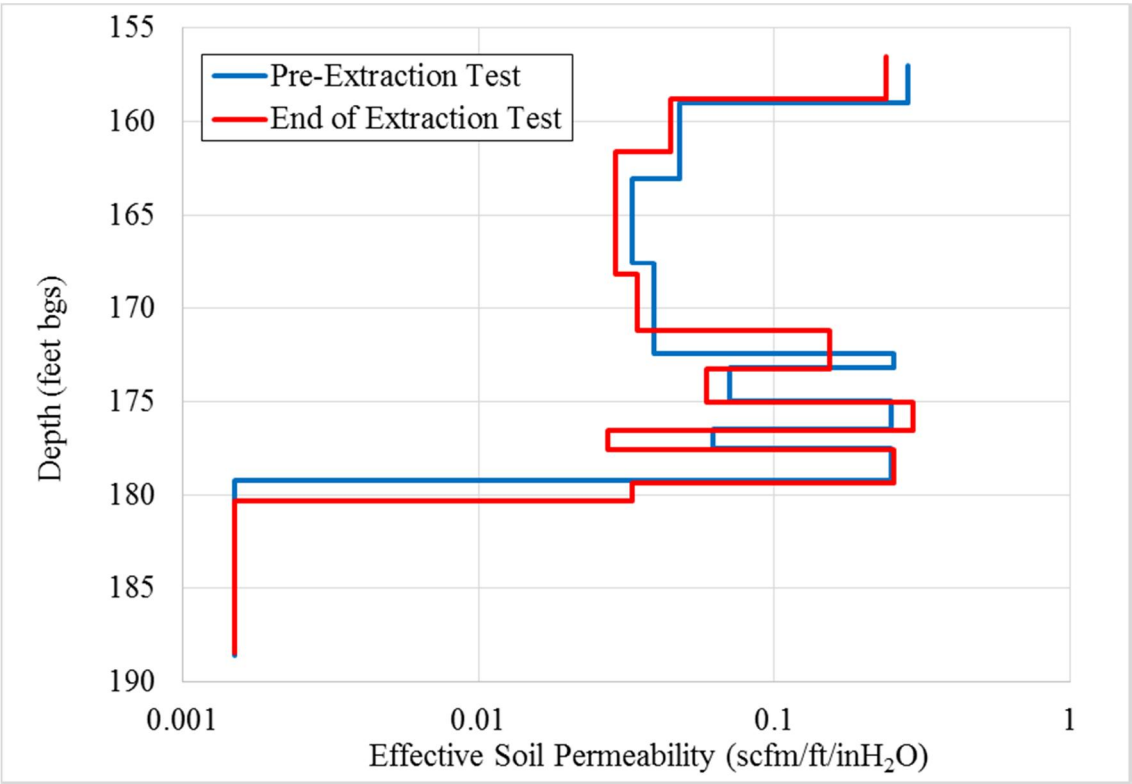


Figure 2-10. Comparison of Calculated Effective Permeability Profiles in VEL-03

Figure 2-11 provides the measured cumulative vapor total concentration profiles from VEL-03. The profiles have a similar shape but, in general, the concentrations were reduced by about 45% based on the concentrations measured at the top of the screen. Concentrations at the bottom of the screen were reduced by 70%. Hence, concentrations at the top of the screen were more persistent than those at the bottom suggesting the source of vapors is closer to the top of the screen. In addition to the magnitude of concentration reductions, the concentration profiles also differed in that the interval from 179 to 184 ft bgs yielded elevated concentrations compared to the values above and below suggesting this interval harbors residual contamination. Recall, the flow was effectively zero across this interval.

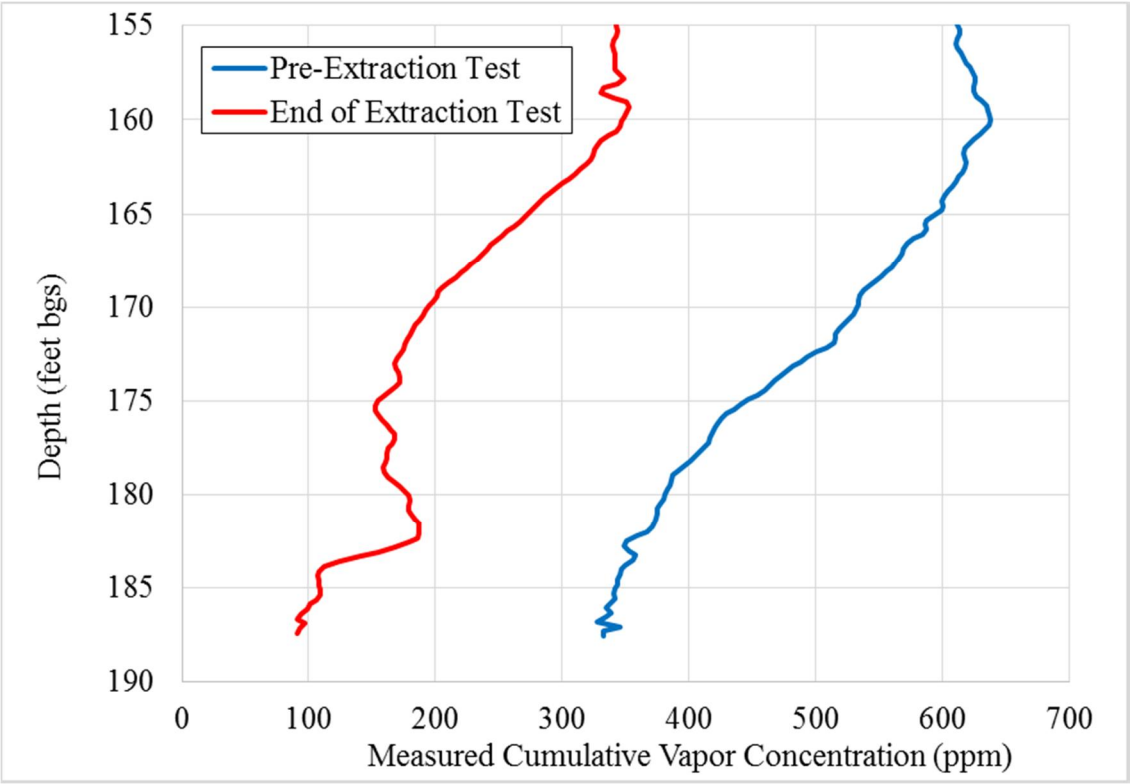


Figure 2-11. Comparison of Measured Vapor Concentration Profiles in VEL-03

The interpreted soil vapor concentration profiles for c1,2-DCE and PCE are plotted in Figures 2-12 and 2-13, respectively. The change in the interpreted c1,2-DCE concentration profile during the extraction period was significant. Both the magnitudes and trends in the concentration varied. The concentration in the interval from 161 to 168 ft bgs increased whereas the wellhead concentration decreased as did the concentrations below 168 ft bgs to the bottom of the screen. These observations indicate the extraction period fully developed the soil concentration profile revealing that the lesser permeability interval from 161 to 168 ft bgs harbors a source of contaminated vapors. Conversely, the calculated PCE soil vapor concentration profile decreased across the full screen interval. However, the highest PCE concentration was also detected in the interval from 161 to 168 ft bgs.

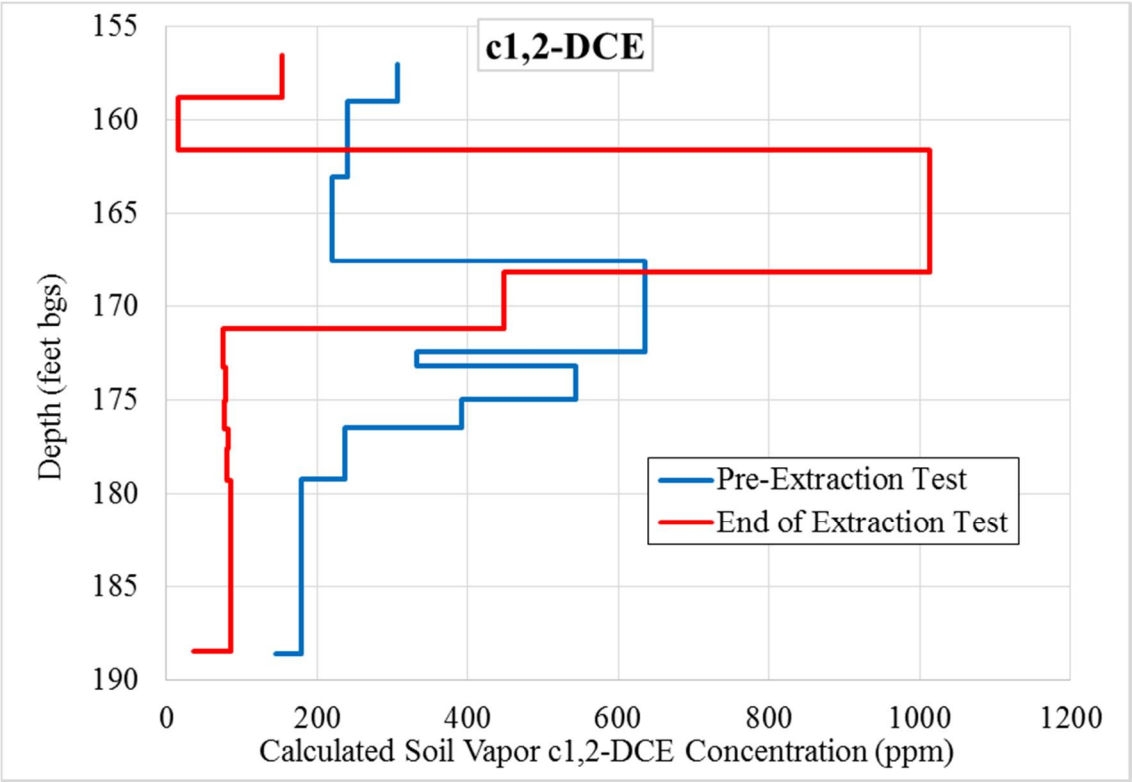


Figure 2-12. Comparison of Calculated c1,2-DCE Vapor Concentration Profiles in VEL-03

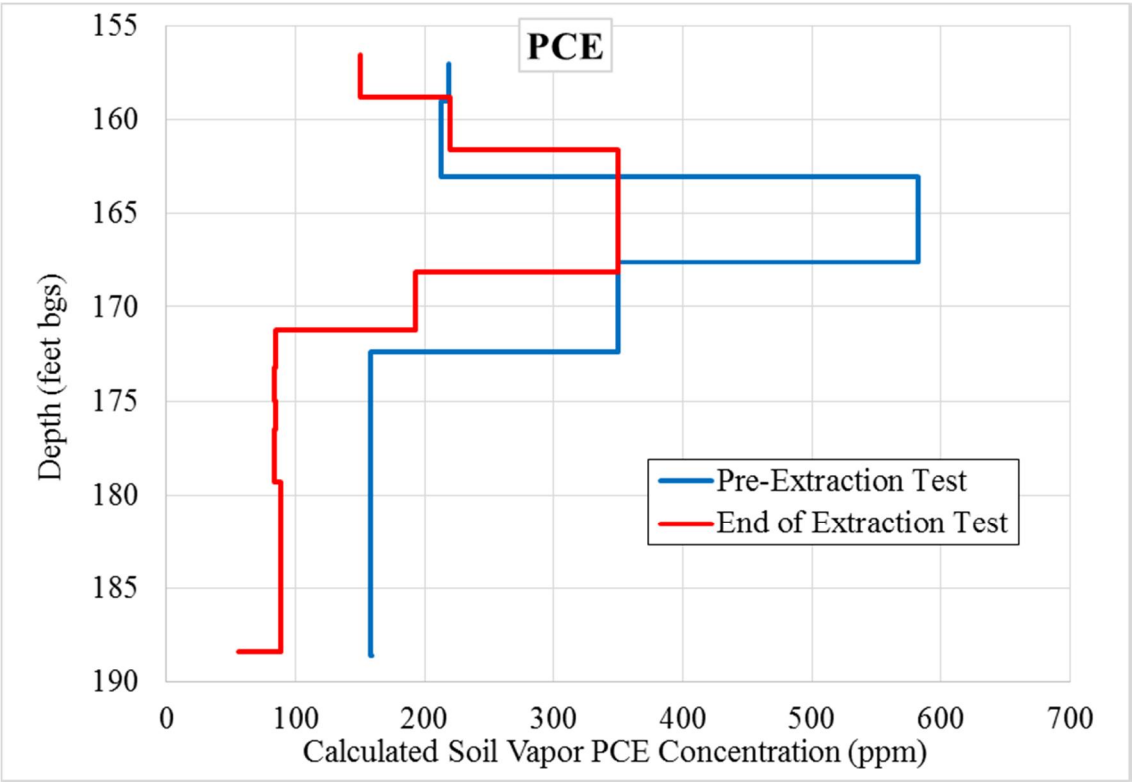


Figure 2-13. Comparison of Calculated PCE Vapor Concentration Profiles in VEL-03

3. SVE TESTING RESULTS

This section summarizes the activities and measurements during the SVE testing. Activities included baseline vapor sampling before extraction, the step extraction test, extended extraction period (~72 hours), and rebound of vapor concentrations after the extraction was terminated. Measurements included vapor concentrations across the site, the extraction rate, and subsurface vacuums in monitoring locations.

Vapor sampling activities at the site started with baseline vapor sampling across the LVZ on 27-Jan-14 and PneuLog of PER-14A, as described in Section 2. Active extraction in VEL-03 to evaluate SVE was initiated on 28-Jan-14 with the step extraction test. The step test was performed with the PneuLog device placed in the well such that the initial PneuLog in VEL-03, described in Section 2, was performed without interruption of flow between the step test and the end of the PneuLog. Removal of the PneuLog device from the well coincided with a one hour interruption in flow as the testing transitioned to the extended vapor extraction test of approximately 72 hours. During the extended extraction test, interruptions in power resulted in three flow interruptions of 8.5, 2.0 and 3.0 hours duration. The vapor extraction in VEL-03 is summarized below in Table 3-1. The elapsed time is referenced to the start of the step testing. The flow in Table 3-1 is the vapor extraction rate at the date and time indicated and carried forward to the next event in the table. For example, the flow during Step Test 1 was 57.7 scfm and endured from 0.0 to 0.43 elapsed hours when the flow was decreased to 49.4 scfm for Step 2. The total duration of the SVE testing was 80 hours during which active extraction operated for 65.3 hours and four periods of dormancy totaled 14.6 hours.

Table 3-1. Summary of Vapor Extraction Applied to VEL-03

Date	Time	Elapsed (hrs)	Flow (scfm)	Notes
1/28/2014	10:54	0	57.7	Step Test 1
1/28/2014	11:20	0.43	49.4	Step Test 2
1/28/2014	11:30	0.60	38.9	Step Test 3
1/28/2014	11:40	0.77	28.0	Step Test 4
1/28/2014	11:46	0.87	20.4	Step Test 5
1/28/2014	11:55	1.02	57.5	Initial PneuLog
1/28/2014	13:40	2.77	0	Remove PneuLog
1/28/2014	14:45	3.85	55.2	Start Extraction Test
1/28/2014	18:58	8.07	0	Power Outage
1/29/2014	3:33	16.65	55.2	Power Returned
1/29/2014	5:23	18.48	0	Breaker Trip
1/29/2014	7:22	20.47	52.7	Power Restart
1/29/2014	19:10	32.27	0	Power Outage
1/29/2014	22:06	35.20	51.9	Power Returned
1/31/2014	18:47	79.88	0	End of Extraction

Baseline Vapor Sampling

Prior to any SVE activities, vapor samples were collected across the site to provide baseline data of current equilibrium under ambient conditions. Results of analyses on these samples are provided in Table 3-2. As indicated in the table, Tedlar bag samples were collected at all monitored locations and duplicate Summa canister samples were collected in two locations. The sample collection followed the procedures described in the FS Work Plan. The purging requirements for wells VEL-03 (4-inch diameter) and PER-14A (5-inch diameter) necessitated the use of the SVE blower to complete the purging of three well volumes in a practical manner.

Table 3-2. Summary of Baseline Vapor Sampling Results
(all concentrations reported in ppmV)

Location	**Tedlar Bags**			**Ratio**	**Summa Canisters**		
	c1,2-DCE	TCE	PCE	c12DCE/PCE	c1,2-DCE	TCE	PCE
VEL-03	371	35.6	265	1.40	-	-	-
PER-14A	416	19.6	99.5	4.19	570	18	100
VML-02-130	4.7	2.2	33.0	0.14	-	-	-
VML-02-150	221	30.8	258	0.86	-	-	-
VML-02-170	643	98.3	631	1.02	-	-	-
VML-02-190	216	19.9	162	1.33	250	2.4	190
VML-01-130	0.509	0.065	2.28	0.22	-	-	-
VML-01-150	0.527	0.470	6.97	0.08	-	-	-
VML-01-170	1.62	2.96	30.7	0.05	-	-	-
VML-01-190	0.169	0.087	0.973	0.17	-	-	-

The highest PCE vapor concentration in the LVZ was 630 ppm detected in VML-02 at a depth of 170 ft bgs. The lowest baseline PCE concentration within the property was 33 ppm at a depth of 130 ft bgs in VML-02. North of the property at monitoring well VML-01, the PCE vapor concentrations were an order of magnitude less ranging from 1 to 31 ppmV with the highest concentration found also at a depth of 170 ft bgs. The highest PCE vapor concentrations in the PneuLog profiles of VEL-03 were also detected around a depth of 170 ft bgs (see Figure 2-13).

The highest c1,2-DCE vapor concentration in the LVZ of 643 ppm was also found in VML-02 at a depth of 170 ft bgs. The lowest baseline c1,2-DCE concentration within the property was 4.7 ppm at a depth of 130 ft bgs in VML-02. The c1,2-DCE vapor concentrations detected in VML-01, located North of the property, were two to three orders of magnitude lower than the source zone. The vapor concentration ratio of c1,2-DCE to PCE varies substantially across the site. In the suspected source area around VML-02 in the depth interval 150 to 190 ft bgs the ratio was close to one. A ratio of one was also found in the longer screen of VEL-03. However, the ratio exceeded four in PER-14A where the soils had a low permeability. These observations suggest anaerobic degradation of PCE to c1,2-DCE is active in the source area or another source of c1,2-

DCE exists. Conversely, around VML-01 North of the site, the ratio is a factor of ten less suggesting degradation is less active.

Step Extraction Test Results

Before the start of the extended duration extraction test and after the PneuLog test in VEL-03, a step test was performed to assess the extraction rate from VEL-03 as a function of the applied wellhead vacuum. The measured data are supplied in Table 3-3 and plotted in Figure 3-1. Figure 3-1 includes a fit to the measured data allowing the prediction of the extraction rate for other applied vacuums at the wellhead. The extraction rate was measured with a 1.5-inch pitot tube using a magnehelic gauge and was corrected with measures of the applied vacuum and vapor temperature. After each change in applied vacuum, the flow was allowed to equilibrate for approximately 10 minutes before the measurements were taken.

Table 3-3. Flow Data Collected during the Step Extraction Rate Test in VEL-03

Wellhead Vacuum (inH_2O)	Cumulative Flow (scfm)
25.0	57.7
20.0	49.4
16.5	38.9
12.5	28.0
9.3	20.4

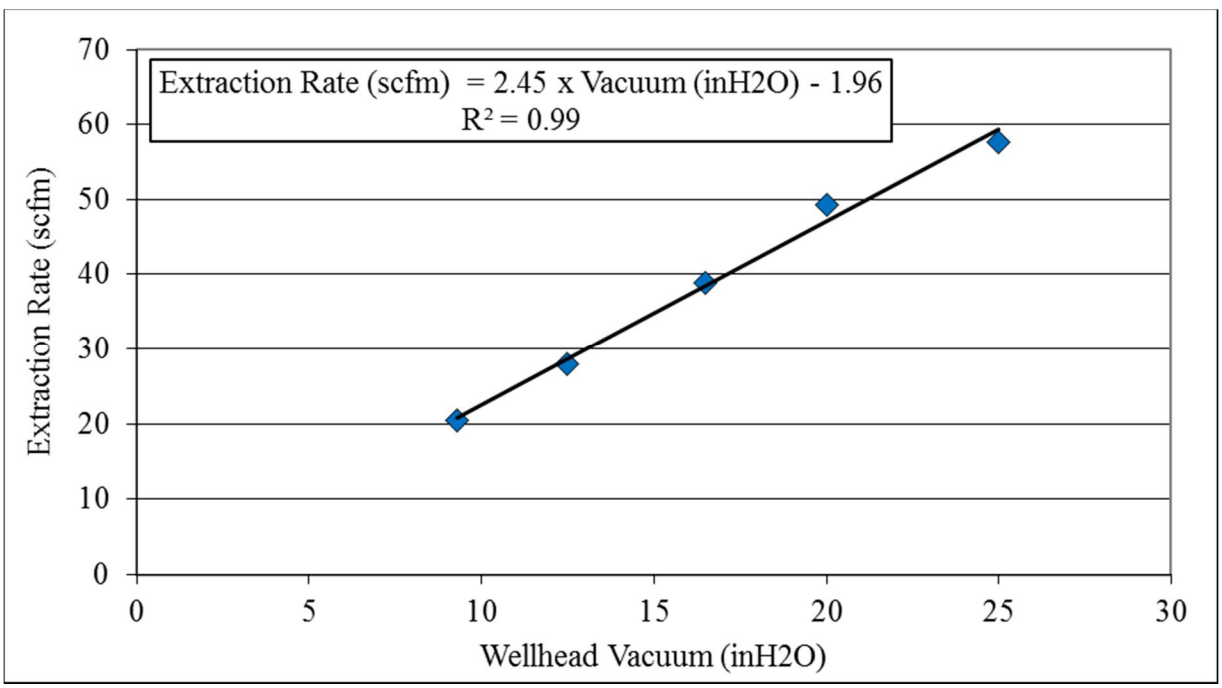


Figure 3-1. Extraction Rate in VEL-03 as a Function of Applied Vacuum

Extended Extraction Test in VEL-03

Vapor extraction continued in VEL-03 after completing the initial PneuLog and after about one hour to prepare for the multi-day extraction. The extraction test started on the afternoon of 28-Jan-14 and ended after 76 hours in the evening on 31-Jan-14 as indicated in Table 3-1. The extraction ranged from 53 to 57 scfm with an applied wellhead vacuum of 25 to 27 inH_2O. The total soil vapor volume extracted during the testing was calculated to be about 207,410 cubic feet. Table 3-1 also indicates the time and duration of PneuLog equipment removal and three power interruptions for extraction. In general, the system was monitored three times a day (every 7 to 9 hours) and included vapor sample collection, measures of the extraction rate, and measures of vacuum in monitoring wells. Continuous flow and vacuum monitoring was performed with a datalogger at well VEL-03 and in the four monitoring screens of VML-02. The automated monitoring is described and in presented in Section 4.

The vapor concentrations in samples collected from extraction well VEL-03 during the test are plotted in Figure 3-2 as a function of elapsed time from the start of the step extraction testing (see Table 3-1). Periods without extraction are indicated by the solid black line. The concentration trends show a relatively steady and linear decay in concentration over this period. The immediate decay and initial values close to the maxima detected in VML-02 indicate that VEL-03 is located near or within the source of the highest vapor concentrations.

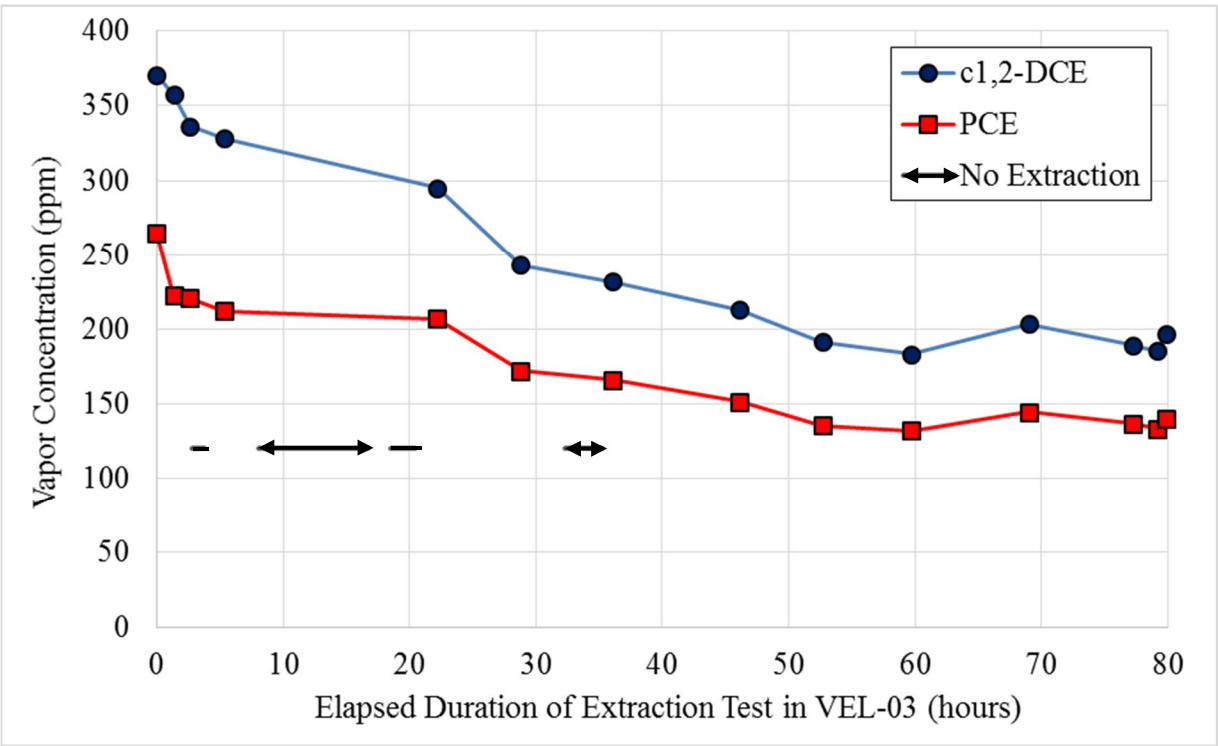


Figure 3-2. Vapor Concentration History in the Extracted Vapors from VEL-03 (Time)

To eliminate periods without extraction, the concentration data are plotted as a function of the cumulative volume of soil vapor extracted in Figure 3-3. This plot demonstrates a linear decay from the initial concentration followed by a trend approaching an asymptotic value. Slight upward deviations in concentration appeared in the samples collected shortly after the 18.5-hour shutdown (extracted vapor volume = 34,300 ft^3) and during steady extraction at an elapsed test time of 69 hours (173,000 ft^3).

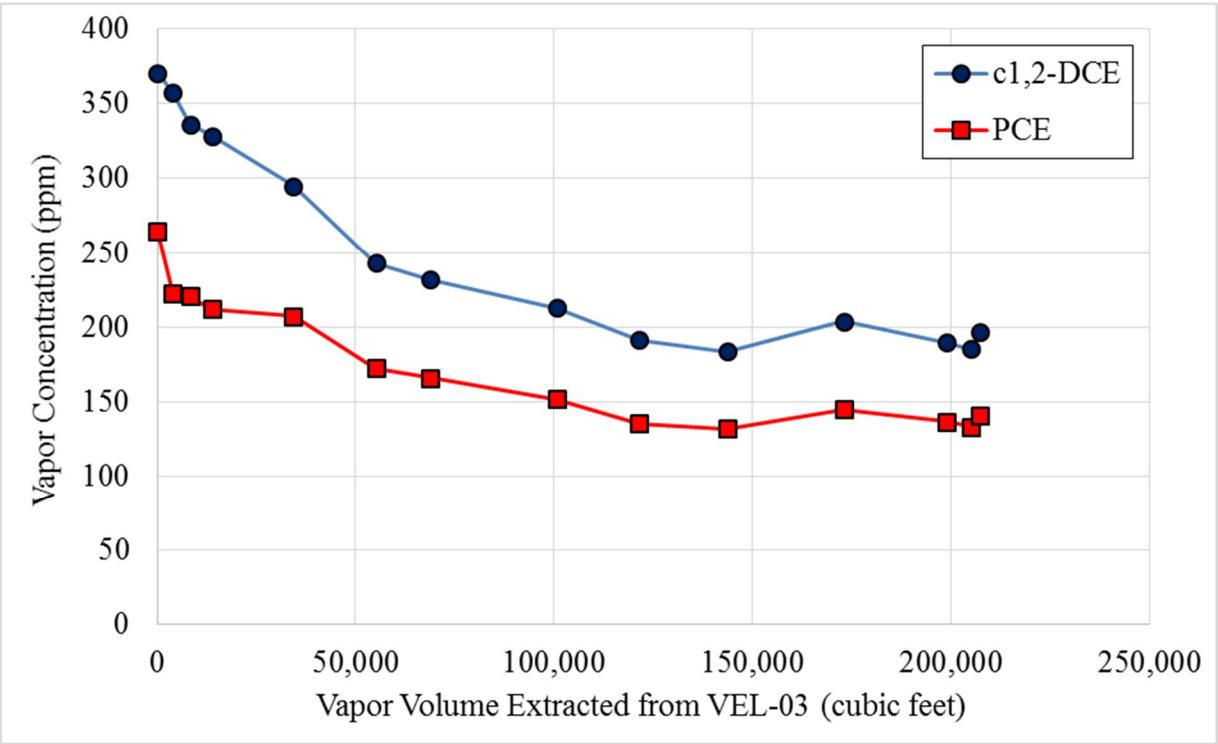


Figure 3-3. Vapor Concentration History in the Extracted Vapors from VEL-03 (Volume)

The initial linear decay in concentration as a function of the extracted volume of soil vapor provides a rough estimate for the total volume of contaminated soil. During this early extraction period, the impact of mass transfer constraints and retardation from partitioning to other phases are minimal as the flushing time is rapid compared to the time for re-equilibration. This estimate is described in detail in Appendix F of Army Corp of Engineer's Soil Vapor Extraction and Bioventing Engineer's Manual (EM 1110-1-4001, June 2002). The early measures of concentration are plotted in Figure 3-4. A linear fit to these early data provides the calculation for the vapor pore volume. Extrapolating the trend to a vapor concentration of zero yields the following vapor volumes of contamination:

PCE: Vapor Pore Volume = (224 ppm) / (0.00076 ppm/ft^3) = 295,000 ft^3
c12DCE: Vapor Pore Volume = (358 ppm) / (0.0019 ppm/ft^3) = 188,000 ft^3

Further, assume the soil total porosity is 0.40 and the water saturation is 0.25 (i.e., water occupies 25% of the pore space). The soil vapor porosity is then approximately 0.30. Therefore, the contaminated soil volume is roughly 3.3 times the contaminated soil vapor volume, or about,

PCE: Contaminated Soil Volume = 983,000 ft^3 ~ 36,400 yd^3
c12DCE: Contaminated Soil Volume = 628,000 ft^3 ~ 23,300 yd^3

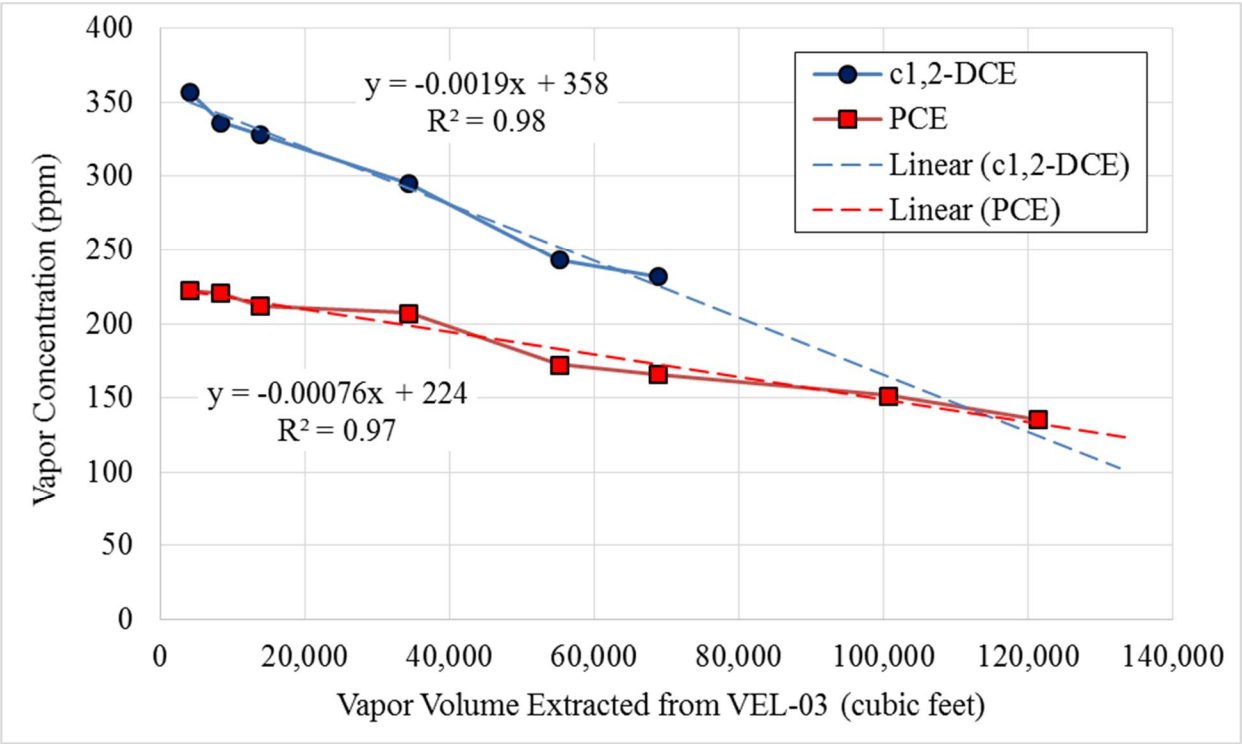


Figure 3-4. Linear Correlation to Early Extraction Data at VEL-03

These order-of-magnitude estimates for the contaminated soil volume are also consistent with the baseline vapor concentrations measured at VML-01. The PCE vapor concentrations at VML-01 were higher than c1,2-DCE suggesting a larger area of contamination for PCE and also PCE vapor concentrations were more than an order-of-magnitude lower at VML-01 than concentrations in the source area.

The vapor concentrations in VML-02 and VML-01 were measured throughout the extraction in VEL-03 to assess the radius of influence of the extraction. The vapor concentrations measured in VML-02 are plotted as a function of time in Figure 3-5. VML-02 is located approximately 22 feet west of VEL-03. Concentration decays during the extraction were observed at all depths in VML-02 with two exceptions. c1,2-DCE did not change at a depth of 130 feet and PCE did not change significantly at a depth of 170 feet. Therefore, the radius of influence exceeds 22 feet.

The concentration responses to the extraction were observed in VML-02 after approximately 30 hours of the test. This time coincided with a cumulative extracted vapor volume of about 60,000 ft^3. As described previously, multiplying this volume by 3.3 yields a total extraction-swept soil volume of 200,000 ft^3. Assuming a lower vadose zone thickness of 90 feet (~110 to 200 feet

below ground surface) and dividing the soil volume by this thickness yields an area of about 2,200 ft^2 equivalent to a circle of radius 27 feet. This radius compares well with the distance of 22 feet between locations.

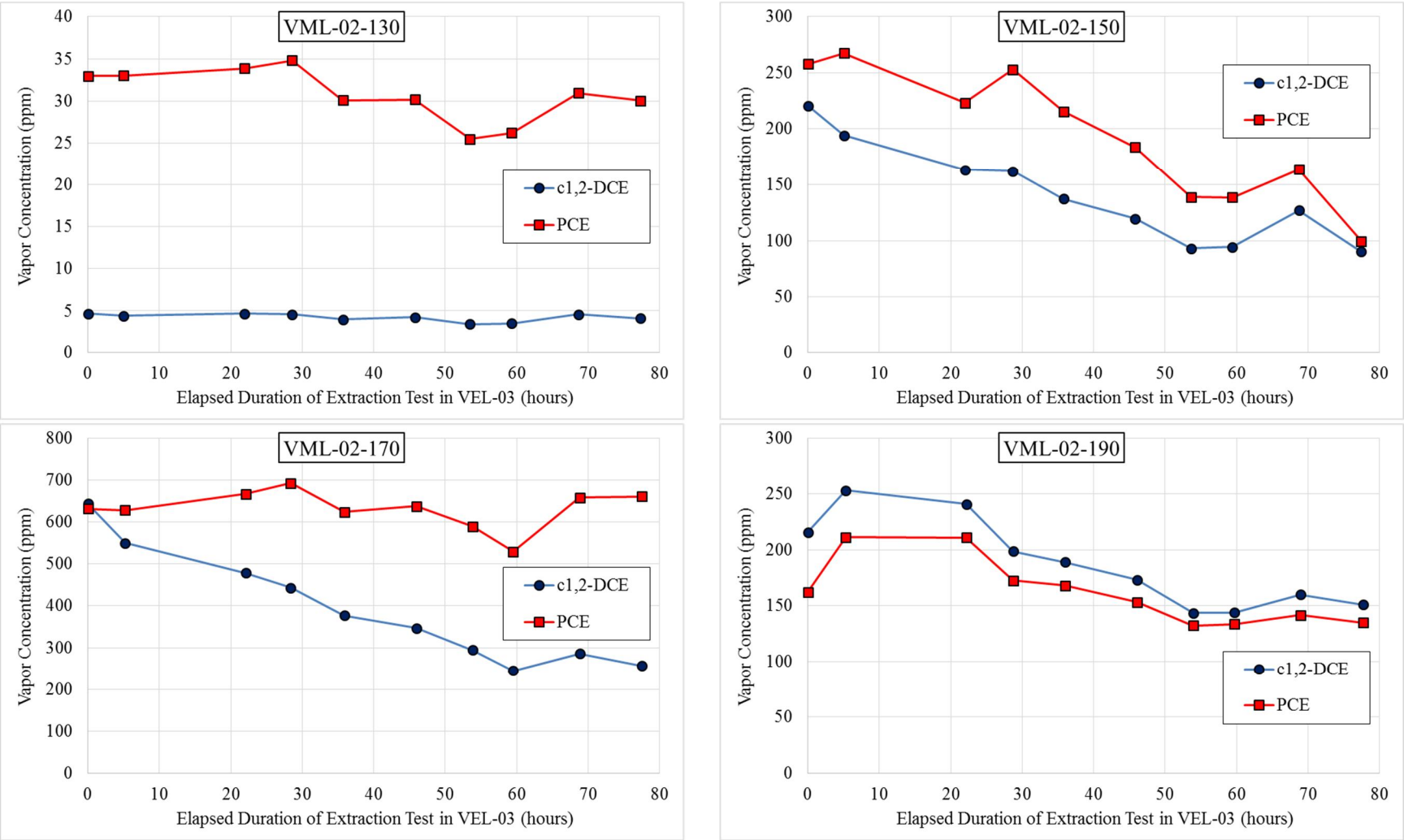


Figure 3-5. Vapor Concentration History in VML-02 during the Extended Extraction Test

Notable exceptions to the trend of decaying PCE concentration were observed in VML-02-130 and VML-02-170. In the shallow soils above the top of the VEL-03 screen (160 feet deep), at some distance from VEL-03, a longer period of extraction may be required to observe the influence of the well. However, the PCE vapor concentration at this shallow depth was much less than found in the deeper soils. The higher PCE vapor concentration found at the deeper depth of 170 feet coincides with the highest PCE concentration estimated from the PneuLog profiles of VEL-03. The PCE vapor concentrations measured in VEL-02 at the beginning and end of the extraction test are plotted as a function of depth in Figure 3-6. This figure also includes the PCE soil vapor concentration profiles estimated from the PneuLog data. The data correlate very well and suggest the soil interval from roughly 160 to 170 feet harbors the majority of the residual PCE in the LVZ.

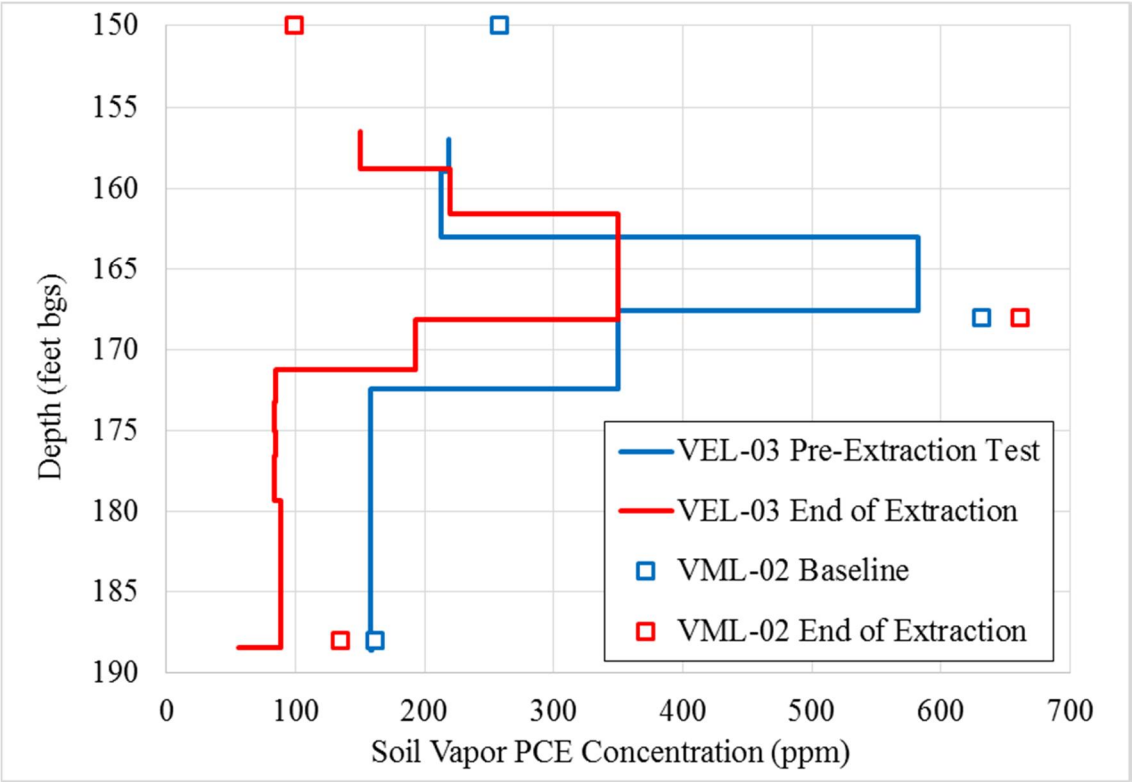


Figure 3-6. Comparison of PCE Vapor Concentrations in the VEL-03 PneuLogs and VML-02 during the Extended Extraction Test

The vapor concentrations measured in VML-01 during the extraction test are plotted as a function of time in Figure 3-7. VML-01 is located approximately 120 feet north of VEL-03. In general the concentrations in these locations were relatively unchanged during extraction; however, the PCE vapor concentration at depths of 150 and 190 feet increased. The highest PCE vapor concentration was detected at 170 feet, as in VML-02, and the concentrations in the soils above and below this interval appeared to be increasing toward this value during the extraction. A plausible explanation for these increases is vapor mixing (i.e., dispersion) resulting from the flow of vapors through permeable intervals that disturb diffusion profiles. However, a longer period of extraction and observation is required to assess the relationship between contaminated

groundwater and the increasing vapor concentrations observed at VML-01-190. A radius of influence to 120 feet is evident in the changing PCE concentrations.

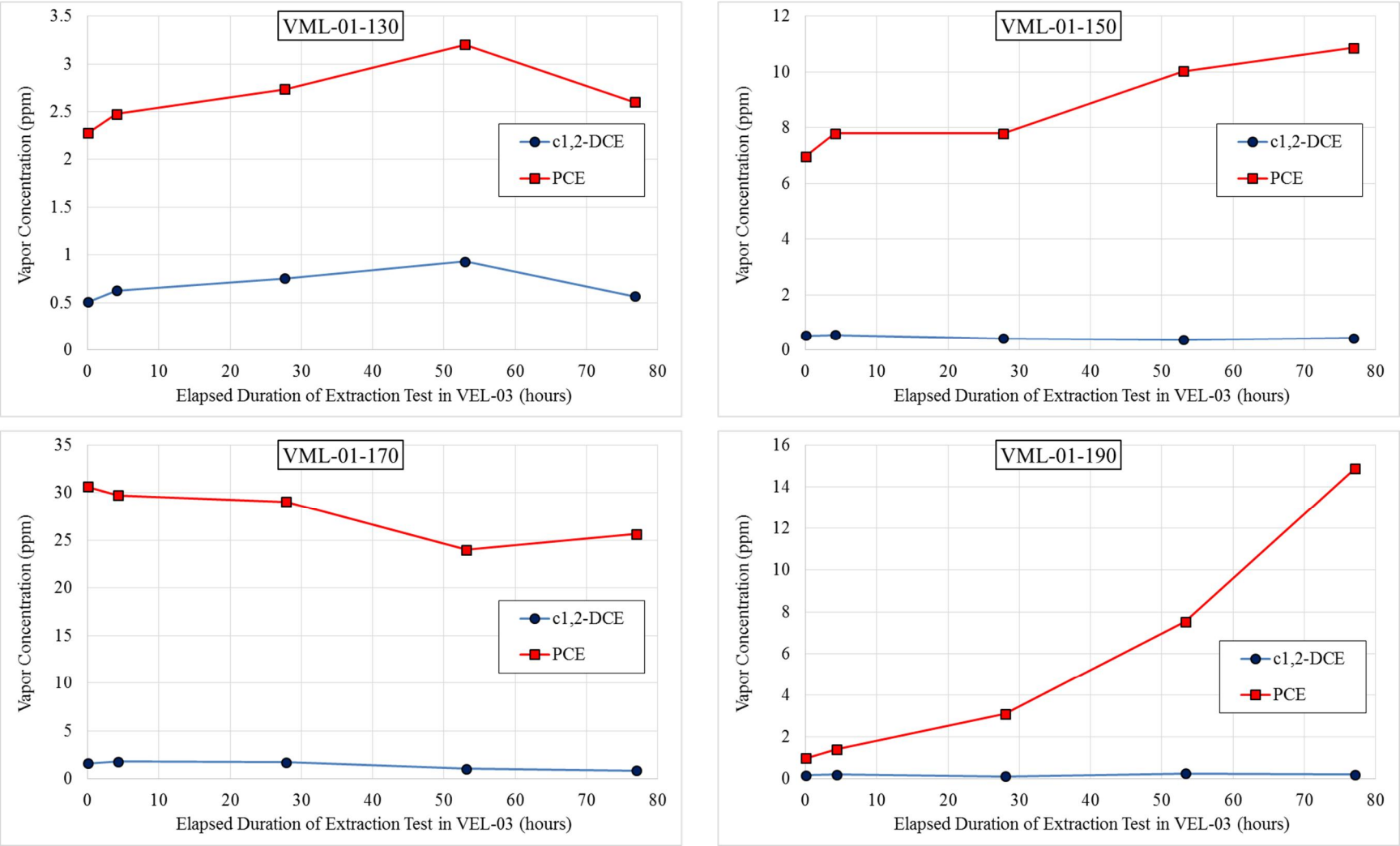


Figure 3-7. Vapor Concentration History in VML-01 during the Extended Extraction Test

Vapor samples were also collected and analyzed from well PER-14A. However, a great deal of variability was observed in the results based on the method and duration of purging. The results are provided in Table 3-4 without further discussion.

Table 3-4. Vapor Concentrations from Samples Collected in PER-14A

Event (elapsed days)	Purge Rate (scfm)	Purge Duration (minutes)	c1,2-DCE (ppmV)	PCE (ppmV)
Baseline (0)	6	9	60	15
PneuLog (0)	6	58	416	99
Rebound (4)	6	8.5	0.82	1.0
Rebound (4)	6	29	26	12
Rebound (13)	0.35	145	0.03	0.21
Rebound (31)	0.35	145	0.32	0.67

To evaluate any rebound in vapor concentrations that decayed (or increased) during the extraction test, vapor samples were collected and analyzed one day, 13 days, and 31 days after the extraction was terminated. The results of the analyses are plotted in Figures 3-8, Figure 3-9 and 3-10 for VEL-03, VML-02 and VML-01, respectively. The rebound observed in VEL-03 was relatively slow and is evaluated further in Section 5. At VML-02 the rebound concentrations approached baseline values except at a depth of 150 feet where the concentration persisted at a lesser concentration.

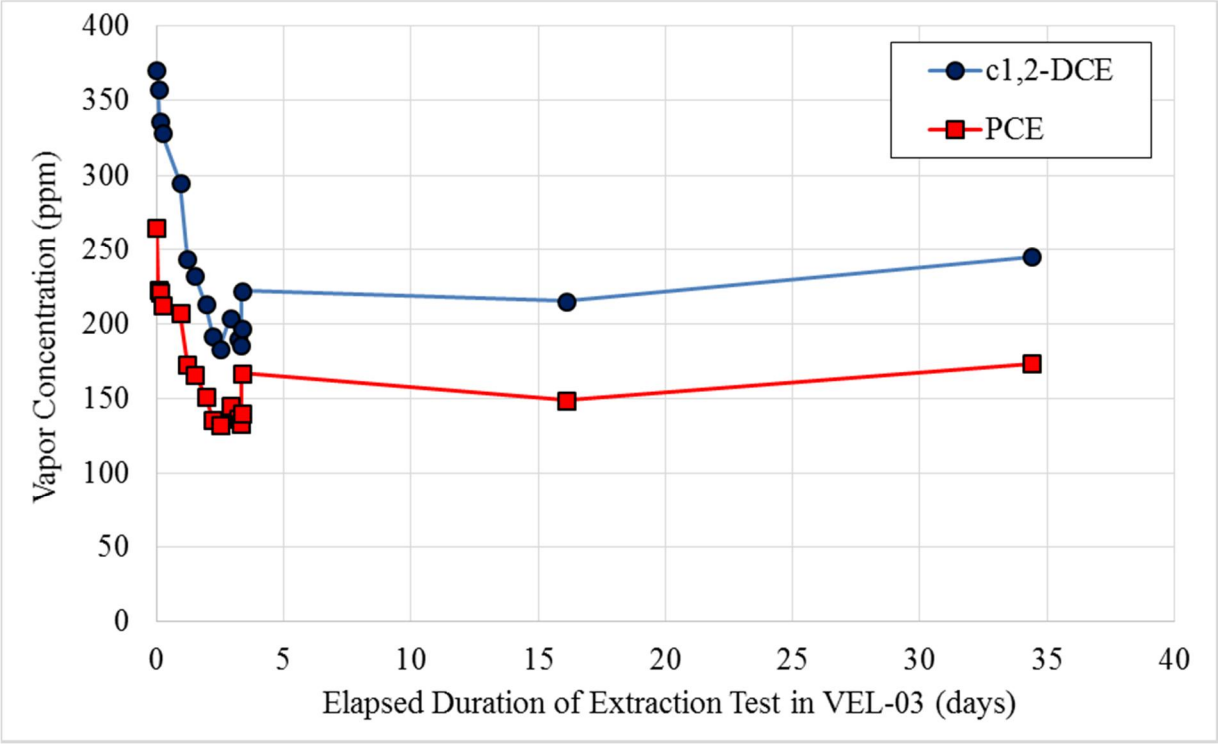


Figure 3-8. Vapor Concentration Rebound in VEL-03 after the Extended Extraction Test

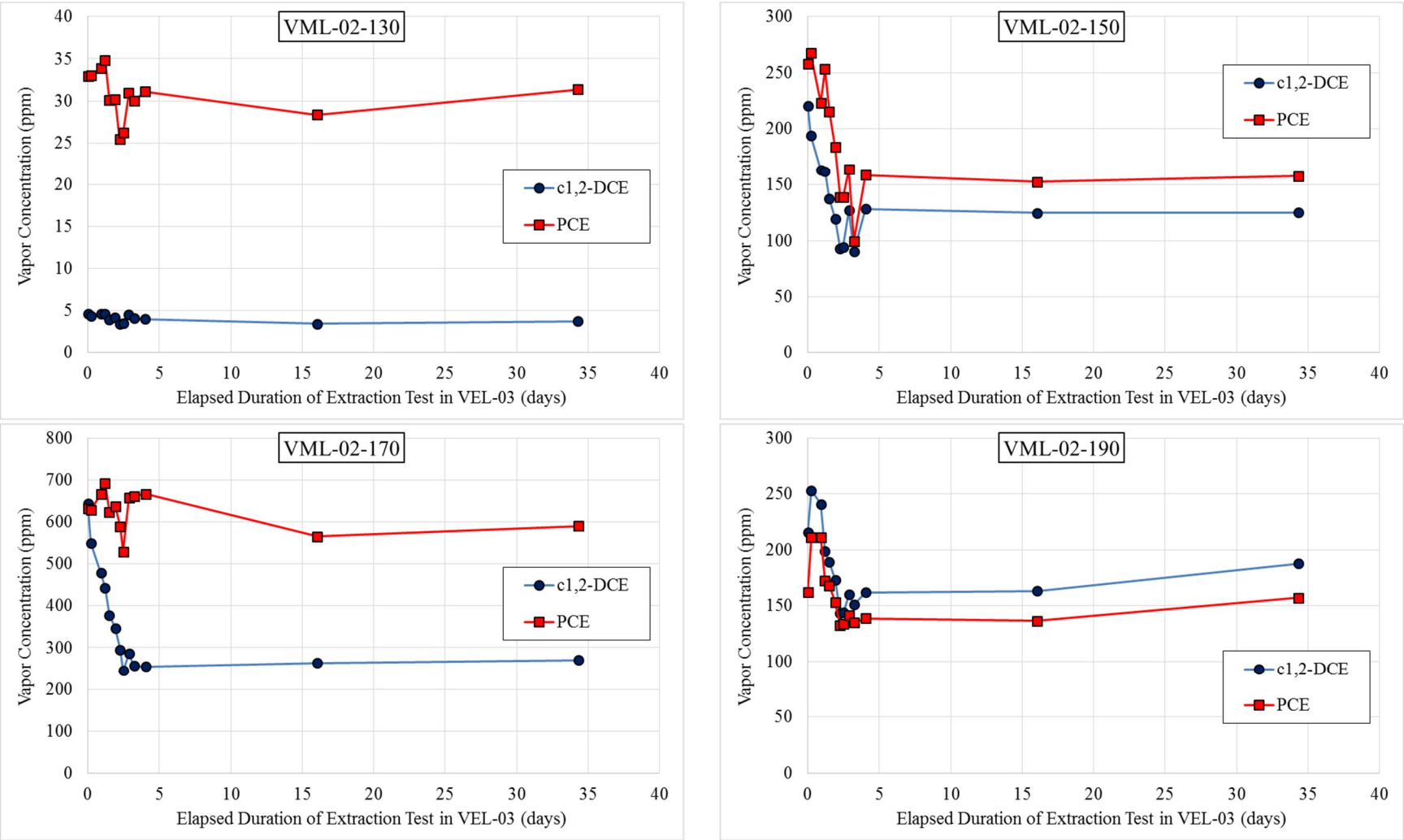


Figure 3-9. Vapor Concentration Rebound in VML-02 after the Extended Extraction Test

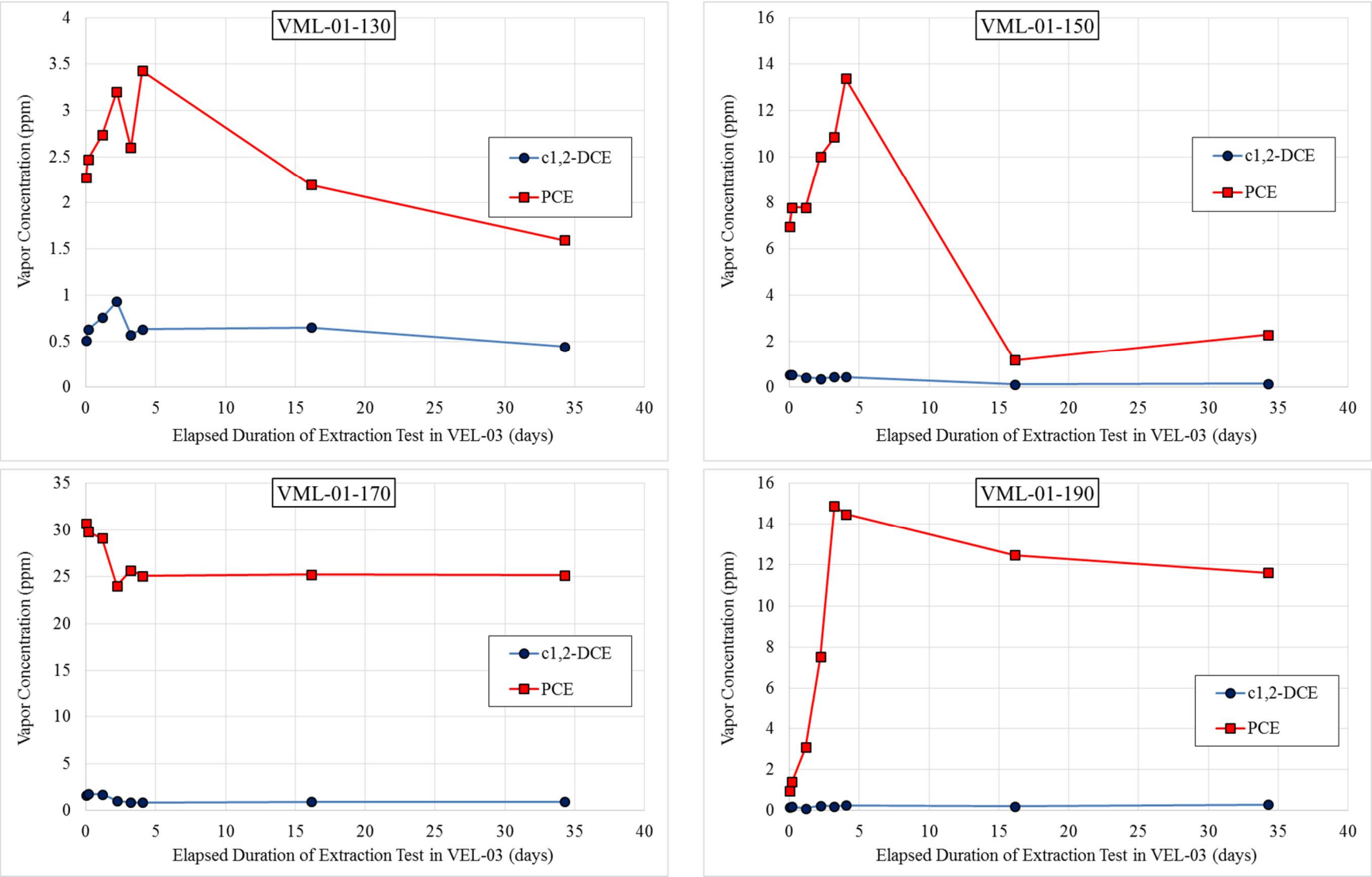


Figure 3-10. Vapor Concentration Rebound in VML-01 after the Extended Extraction Test

At VML-01 depths of 130 and 150 feet the PCE vapor concentrations increased during the extraction at VEL-03; however, during the rebound period concentrations decayed below the baseline values. At a depth of 170 feet, where the highest PCE concentration was detected at VML-01, the vapor concentration was reduced during extraction and persisted at this slightly lower concentration during the rebound period. At a depth of 190 feet, the PCE vapor concentration increased dramatically during extraction and then persisted at the elevated concentration during the rebound period. The concentration responses at 170 and 190 feet suggest the vapors undergo very little movement during ambient conditions. A longer period of extraction is required to assess the behavior at VML-01.

The cumulative masses of contaminants extracted during the test were calculated from the measured extraction rates and vapor concentrations. Results are plotted in Figure 3-11. Approximately 12 pounds of PCE and 10 pounds of c1,2-DCE were extracted during the test. The stable mass extraction rates of PCE and c1,2-DCE were about 4.5 and 3.7 pounds per day, respectively.

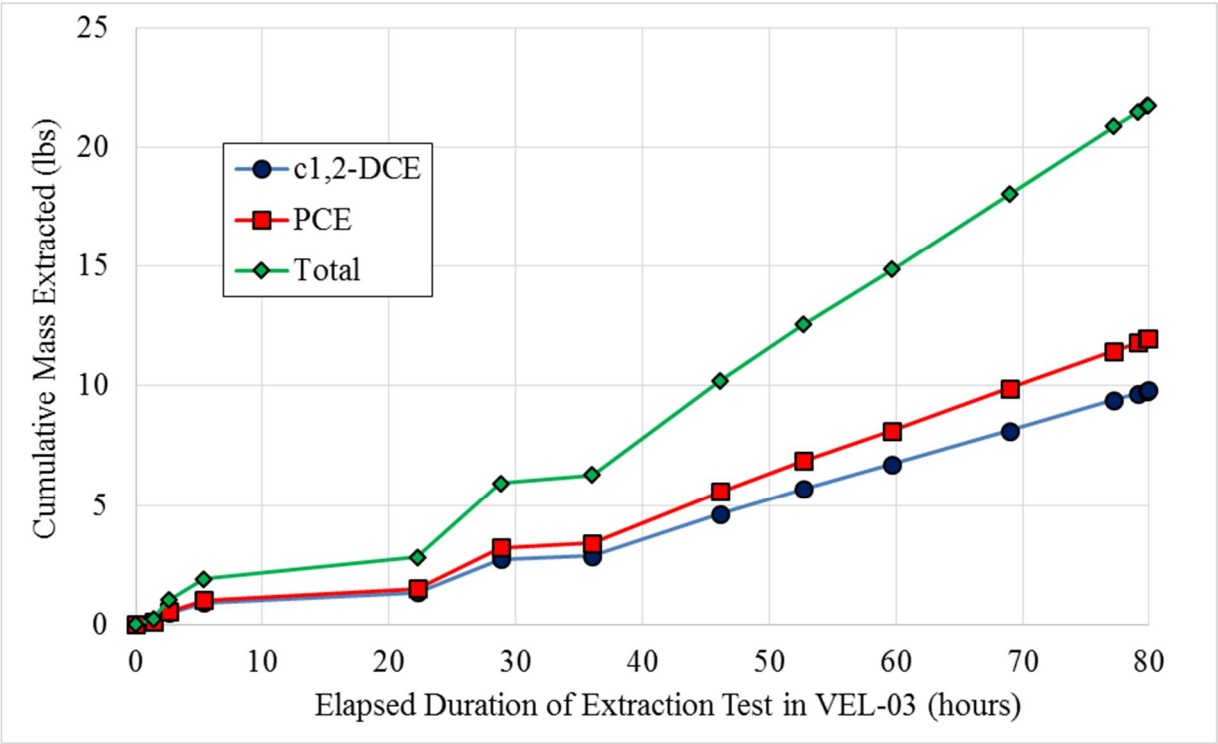


Figure 3-11. Cumulative Mass in the Extracted Vapors from VEL-03

4. MONITORING WELL VACUUM READINGS

During the extraction test in VEL-03 (screened from 160 to 190 feet), an automated datalogger was employed to measure the extraction rate and applied vacuum at VEL-03 as well as the subsurface vacuum responses at VML-02, located about 22 feet away. The automated vacuum and flow monitoring was supplemented with manual readings collected during each of the three daily vapor sampling events using calibrated magnehelic gauges. The datalogger captured the exact times of the power outages and restarts described previously. The logged vacuum data are plotted in Figure 4-1 for the first day of extraction as data beyond this period were steady with only slight responses to changes in barometric pressure (the variation of the barometric pressure during the test was small at 2 inH_2O). Periods without data represent the first two power interruptions. The extraction rate at VEL-03 was relatively steady during extraction at an average rate of 52.7 scfm.

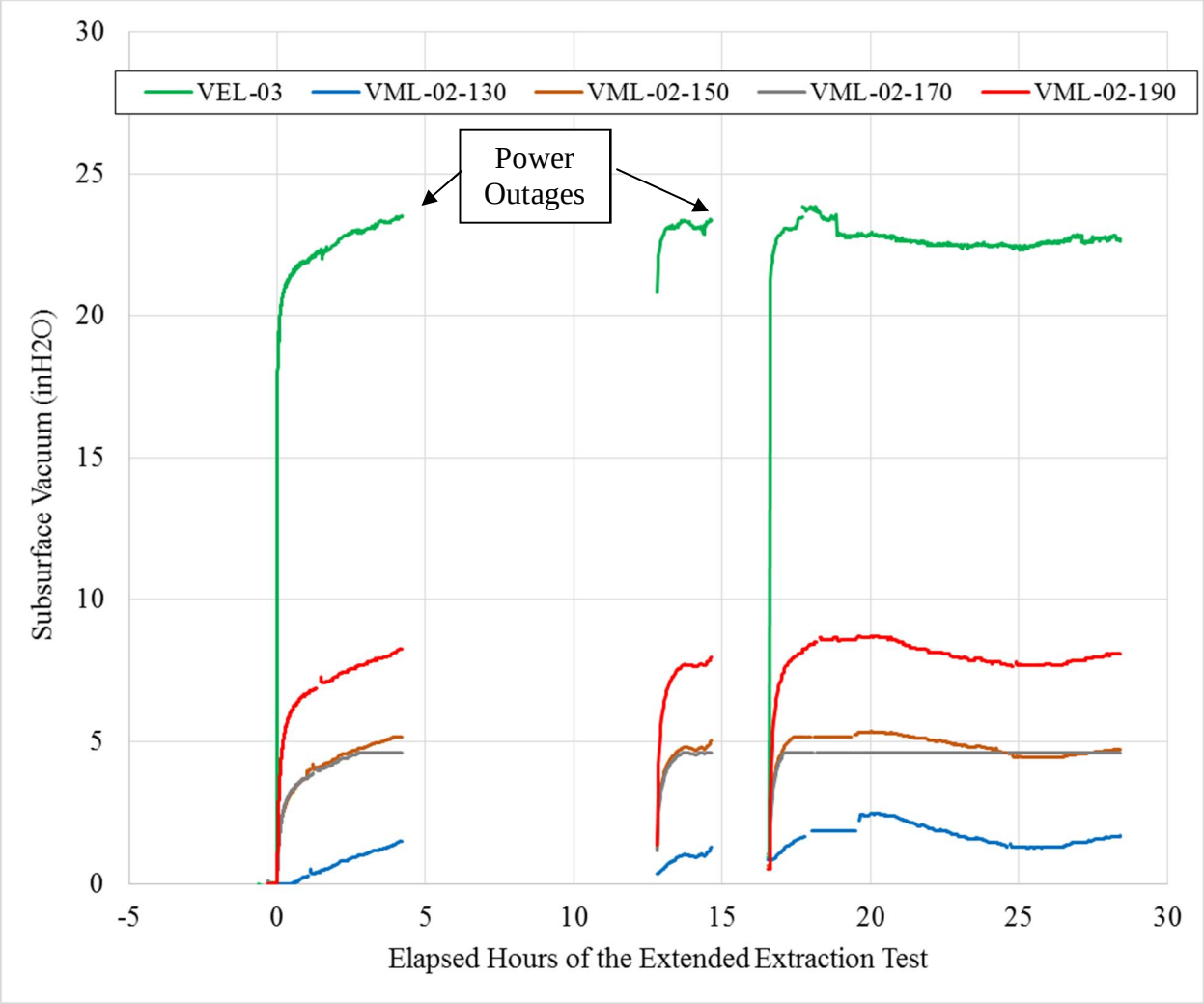


Figure 4-1. Subsurface Vacuum Responses during the Extended Extraction Test

During the start of the extraction test, the vacuums at VML-02 responded rapidly and were increasing toward an equilibrium when the first power outage occurred. After the second power interruption the vacuums attained equilibrium. The vacuum at VML-02-170 exceeded the range of the gauge (4.9 inH_2O); however, it responded almost identically to VML-02-150 as verified by manual readings. Gauges were rearranged from hours 18 to 19 to better capture the responses and account for the small variations observed in the plots.

The highest vacuum response at VML-02 was observed at a depth of 190 feet (8 inH_2O) and represented about 35% of the applied vacuum at VEL-03 (22.5 inH_2O). The equilibrium subsurface vacuums recorded at depths of 150 and 170 feet were about 5 inH2O exceeding 20% of the applied vacuum. The least vacuum at VML-02 was recorded at a depth of 130 feet located 30 feet above the top of the extraction screen. The higher vacuum at 190 feet compared to the shallower depths is the result of three-dimensional flow in the subsurface and resulting pressure losses. The surface is at zero vacuum and the subsurface vacuum is expected to increase with depth to the top of the extraction screen where the vacuum is a maximum. Further from the well, at a depth of 190 feet, the flow must be predominantly horizontal because of the water table whereas the flow is increasingly more vertical at shallower depths. These flow dynamics yield the vacuum profile observed at VML-02.

The applied vacuum at VEL-03 and the deeper vacuums at VML-02 are plotted versus distance on a logarithmic scale in Figure 4-2. A typical rule-of-thumb for radius of influence based on vacuum response is 1% of the applied vacuum based on a logarithmic scale. Using the fits to data shown in Figure 4-2, the vacuum radii of influence are 186 feet and 66 feet at depths of 190 feet and 170 feet, respectively. These distances are consistent with the concentration responses observed in VML-01.

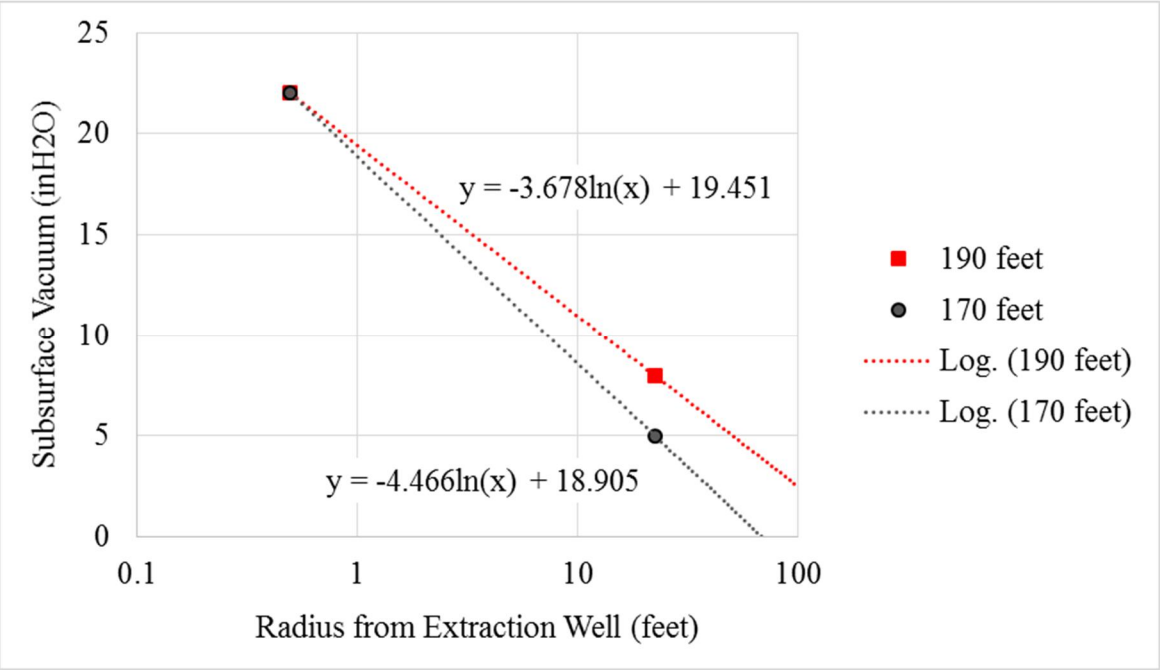


Figure 4-2. Subsurface Vacuum Responses as a Function of Distance and Depth

Monitoring of subsurface vacuums continued after the termination of the extraction test and returned to equilibrium rapidly. On the day following the termination, the extraction monitoring located at VEL-03 was moved to well PER-14A for the first rebound vapor sampling event. After the collection of all other vapor samples, the extraction blower was moved to PER-14A to perform the purging and then allow for an extended extraction period. During the extraction on PER-14A, the applied vacuum at PER-14A and the vacuum responses at VML-02 were recorded and at plotted in Figure 4-3. Time zero is the start of extraction on PER-14A. The final extraction rate was approximately 6 scfm with an applied vacuum of 45 in H2O. As shown, no response was observed at VML-02 during over 30 minutes of extraction. Conversely, the earlier purging of well VEL-03 had nearly an immediate response at VML-02 as noted in the plot. These results indicate, consistent with the PneuLog profile for PER-14A, that the soils surrounding the screen of PER-14A were either of low permeability (i.e., fine-grained or clay) or had a very high moisture content.

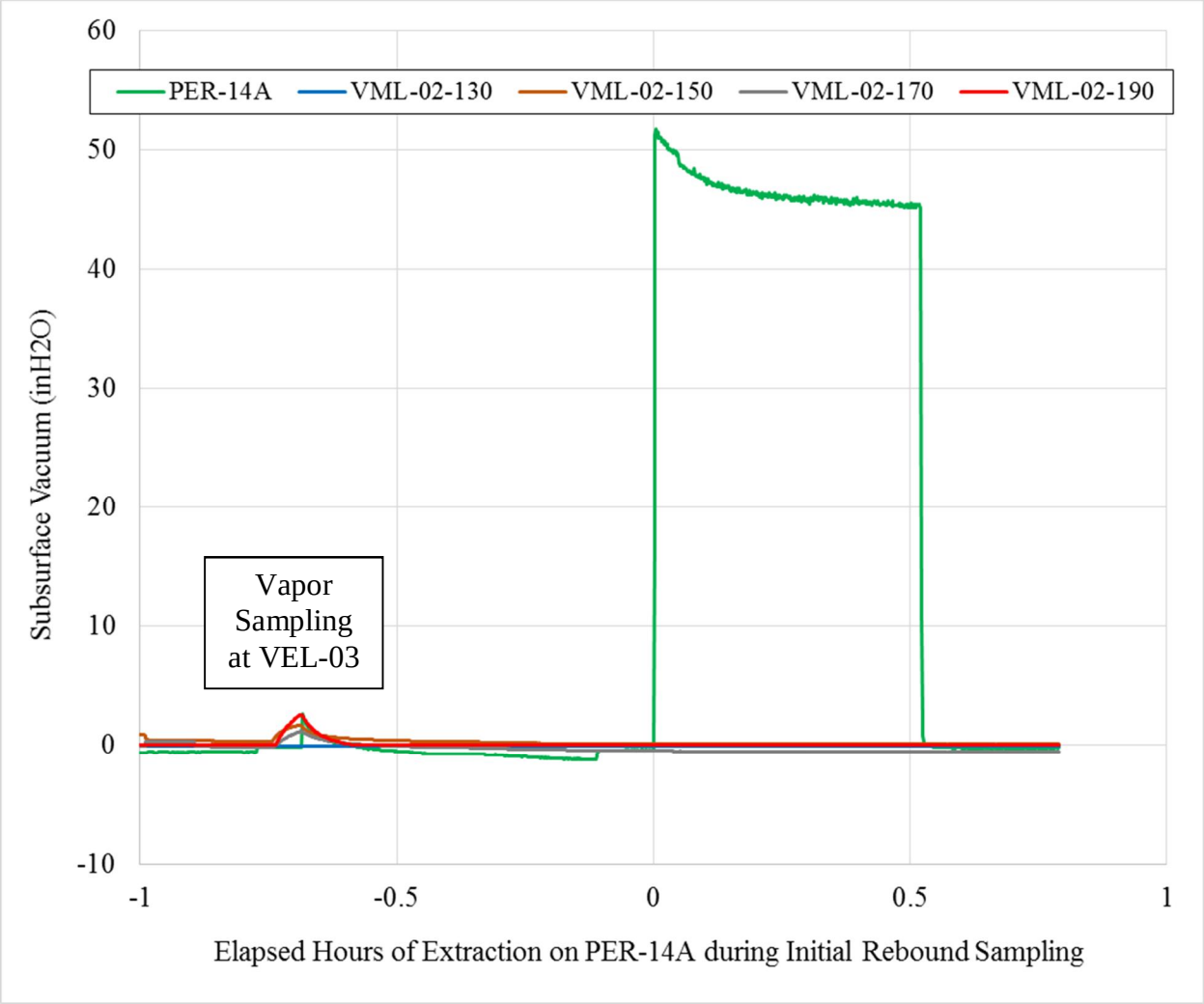


Figure 4-3. Subsurface Vacuum Responses during the Purging of PER-14A

5. SVE MODELING

The extended extraction test was described in Section 3. For SVE modeling, the data considered include soil vapor samples collected and analyzed from the manifold and also from monitoring wells. A detailed log of the system operating time and flow rates is provided in Table 3-1. The vapor concentration data along with the flow history were used to calibrate the two-region model of SVE developed by Praxis Environmental Technologies and published as Appendix F of the US Army Corps of Engineers SVE and Bioventing Engineers Manual. This model was then used to provide an order-of-magnitude estimate of the contaminant mass at the site, quantify mass transfer constraints, and evaluate possible future extraction strategies for the site. The two-region (mobile-immobile) soil model describing SVE and the underlying assumptions are presented in Attachment C of this report. The following parameters are assumed measured or otherwise available and employed as input data by the model:

- h (m), vertical thickness of the contaminated zone
- T (K), soil temperature
- H (kPa m^3 / mol), Henry's constant
- $K_{d,m}$ (L/kg), the distribution coefficient in mobile region
- $K_{d,i}$ (L/kg), distribution coefficient in the immobile region
- γ_m (1/day), degradation constant in mobile region
- γ_i (1/day), degradation constant in immobile region
- D_c (m^2/day), pure component free air diffusion coefficient
- φ_m, porosity of mobile region
- φ_i, porosity of immobile region
- ρ_m (g/cm^3), solid density of soil grains in mobile region
- ρ_i (g/cm^3), solid density of soil grains in immobile region
- S_m, water saturation in the mobile zone
- S_i, water saturation in the immobile zone
- Q (scfm), total soil vapor extraction rate, allowed to be a step-wise transient

The model is calibrated by varying the following parameters until finding the best match (minimum error) with field measures of extraction rate, extracted vapor concentration and cumulative mass removed:

- $C_{0,m}$ (mg/m^3), initial vapor concentration in the mobile zone
- $C_{0,i}$ (mg/m^3), initial vapor concentration in the immobile zone
- r_c (m), equivalent radius of contamination (i.e., volume of contaminated soil)
- f, fraction of the contaminated volume that is characterized as mobile
- L_i (m), half-thickness of immobile lenses (i.e., characteristic diffusion path length)

The mass transfer constraints for contaminant removal are generally lumped into a bulk mass transfer coefficient, α. When molecular diffusion alone from fine-grained soils (immobile soils) provides the constraint, the bulk mass transfer coefficient, α, is roughly related to diffusion by:

$$\alpha \approx \frac{D_c\, \phi_i^{4/3} \left(1 - S_i\right)^{10/3} \pi^2}{R_i\, L_i^2}$$

Fit of Two Region Model to Field Data

The measured vapor concentrations of PCE and cis-1,2-DCE in the influent manifold during the SVE pilot test are plotted in Figure 3-8 and generally decay with time. During the extended extraction test, the extracted concentration (i.e., mobile zone concentration) decreased by roughly 50% in only 65 hours of vapor extraction at about 53 scfm. The extraction history was divided into 16 segments of constant extraction or dormancy (rebound) to account for the step extraction testing and power outages. As indicated in Figure 3-8, vapor samples were collected from VEL-03 at 13 and 31 days after the extraction test ended to assess the rebound in the concentrations. The rebound provides data for assessing the bulk mass transfer coefficient defined above.

The SVE model was fit to the PCE data presented in Figure 3-8 and the result is plotted in Figure 5-1. The data and model are plotted on a logarithmic scale to better illustrate the fit. In the general the initial concentration decay represents a sweeping of the vapors from the mobile soils and can be related to the volume of contaminated soil as described in Section 3. The rebound in concentration that follows the sweep of contaminant vapors from mobile soils is then related to the volume and mass transfer characteristics of the immobile soils (i.e., source zone) that will define the duration of extraction to attain cleanup goals. A best fit of the model parameters to the concentration and flow data was achieved using a downhill simplex optimization routine that converged quickly to the fit shown in Figure 5-1. The specified soil properties and the resulting best-fit parameters including the representative soil volume, initial contaminant concentrations, and mass transfer coefficient parameters are provided in Table 5-1.

The fraction of the soil characterized as mobile is 0.33 and was determined from the PneuLog profiles summarized in Figure 2-10. Mobile soil is defined as an interval yielding appreciable vapor flow and an effective vapor permeability of at least 0.1 scfm/ft/inH_2O. The total depth of intervals in Figure 2-10 meeting these criteria is about 10 feet, or about 33% of the 30-foot screen interval. Degradation of PCE to cis-1,2-DCE during the testing was considered negligible and is neglected in subsequent modeling. Average initial PCE vapor concentrations in both zones were calibrated to be 225 ppmv based on the Tedlar bag samples and the model fit. The volume of the contaminated soil was estimated previously to be 36,400 cubic yards. This volume corresponds to a contaminated soil cylinder in the lower vadose zone with a thickness of 90 feet (200 – 110 ft below ground surface) and a radius of roughly 59 feet. For the assumed soil properties and initial PCE vapor concentrations, the representative contaminated volume yields an initial PCE mass estimate of 63 pounds. Recall from Section 3 that approximately 12 pounds of PCE were extracted during the testing and therefore about 50 lbs of PCE remains in the lower vadose zone source area.

After completing the fit to the PCE data, the model was matched to the cis-1,2-DCE data. The only parameters changed for this modeling were the chemical properties (i.e., Henry's constant, octanol-water partition coefficient, and vapor diffusion coefficient in air) and the initial vapor concentration (330 ppmv). As indicated in Figure 5-2, very good agreement was achieved with

the same contaminated soil volume of 36,400 cubic yards. These conditions yield an initial cis-1,2-DCE mass estimate of 61 pounds. Recall from Section 3 that approximately 10 pounds of cis-1,2-DCE were extracted during the testing and therefore about 50 lbs of cis-1,2-DCE remains in the lower vadose zone source area.

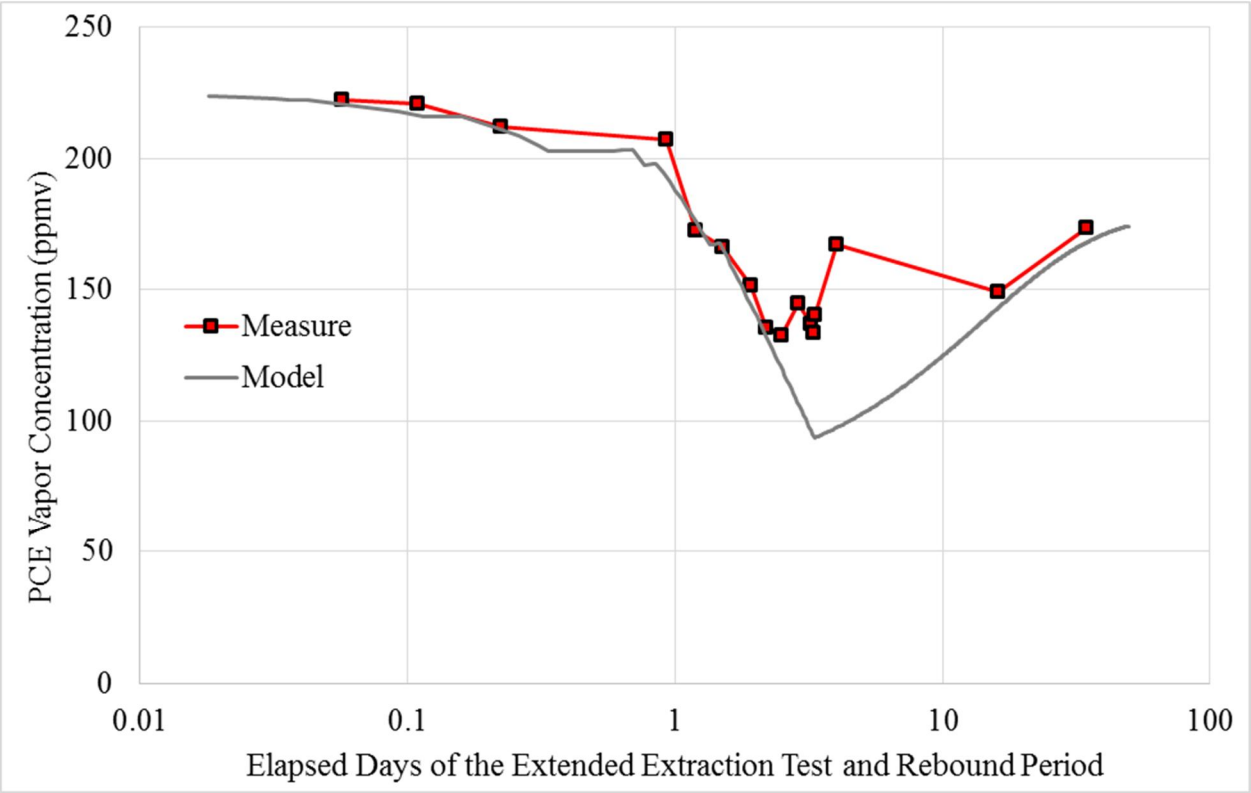


Figure 5-1. Model Fit to PCE Concentrations in Extracted Soil Vapors

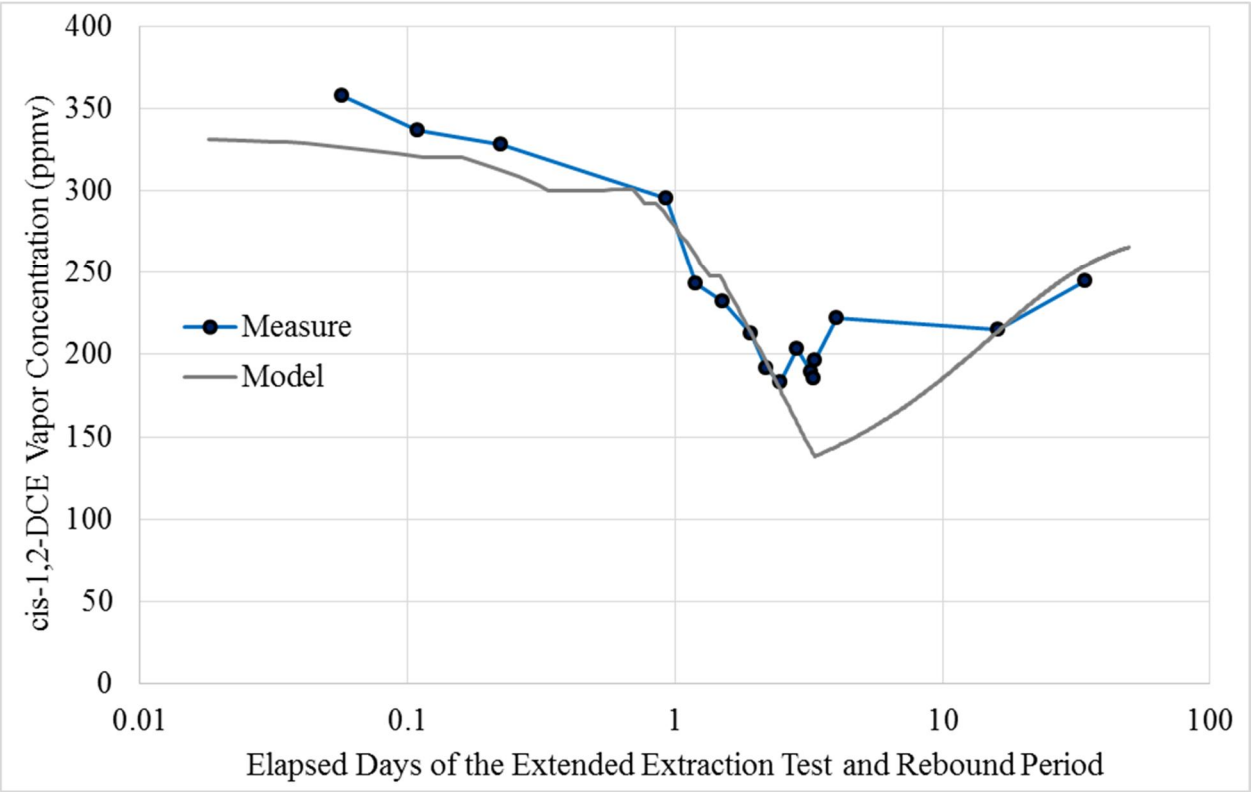


Figure 5-2. Model Fit to cis-1,2-DCE Concentrations in Extracted Soil Vapors

Table 5-1. Parameters for Two-Region Modeling of Extraction during the SVE Pilot Test

Property	Units[a]	PCE	c12DCE
Measured or Assumed Soil Properties			
Thickness of the vadose zone	ft	100	100
Total Porosity, mobile	nd	0.40	0.40
Total Porosity, immobile	nd	0.40	0.40
Water Saturation, mobile (vol/vol)	%	25	25
Water Saturation, immobile (vol/vol)	%	40	40
K_d, mobile	L/kg	0.18	0.009
K_d, immobile	L/kg	0.18	0.009
Temperature	ºC	20	20
Contaminant Properties			
Henry's Constant	nd	1.08	0.32
Octanol-Water Partition	L/kg	600	30
Diffusion Coefficient in Air	m^2/day	0.68	0.82
Model Best-Fit Parameters			
Initial Vapor Concentration, mobile	ppmv	225	330
Initial Vapor Concentration, immobile	ppmv	225	330
Effective Radius of Contaminated Soil	ft	59	59
Effective Volume of Contaminated Soil	yd^3	36,400	36,400
Effective Half-Thickness of Immobile Soil Lenses	ft	1.5	1.5
Fraction of Soil Characterized as Mobile	nd	0.33	0.33
Fraction of Soil Characterized as Immobile	nd	0.67	0.67

[a] nd = dimensionless

The effective half-thickness, or diffusion path length, for mass transfer was estimated to be about 1.5 feet. This suggests the fine-grained, immobile soils had a characteristic thickness of about 3 feet. This length is similar to those observed in the PneuLog profiles. The bulk mass transfer coefficient for PCE was calculated to be 0.0634 day^{-1} and yields a characteristic re-equilibration time of about 16 days. For cis-1,2-DCE, the bulk mass transfer coefficient was also calculated to be 0.0634 day^{-1}. The values are nearly identical because PCE has a lower air diffusion coefficient but also a lower vapor retardation coefficient resulting from PCE's higher Henry's constant.

The bulk mass transfer coefficient and other calibrated model parameters can be used to calculate a theoretical maximum mass extraction rate or mass loading of PCE from the vadose zone to groundwater. The maximum theoretical mass migration rate from immobile source soils to mobile soils is calculated as follows:

$$\text{Maximum Mass Migration Rate} = \alpha * C_{im} * \text{Immobile Fraction} * \text{Total Soil Volume}$$

For values from the model fit, this rate is:

$$\text{Maximum Mass Migration Rate} = (0.0634\ day^{-1}) * (225\ ppmv) * (6.9\ mg/m3/ppmv) * (1\text{-}0.33) * (36{,}400\ yd^3) * (0.765\ m^3 / yd^3)$$

$$\text{Maximum Mass Migration Rate} = 1.8\ kg/day = 4\ pounds/day$$

This maximum migration rate assumes instantaneous extraction or entry into groundwater and as such over-predicts the long-term value. At the end of the SVE pilot testing, the PCE mass extraction rate was 4.5 pounds per day, close to the long-term theoretical maximum that will decay as the concentration in the immobile zone decays.

Another important mass transfer related parameter for SVE operations is the vapor pore volume exchange rate. This parameter is calculated from the extraction rate, the contaminated soil volume, and the water saturation. Assuming an extraction rate of 52.7 scfm and that flow occurs only in the mobile soil, the SVE pilot test exchange rate was:

$$\text{Exchange Rate} = \text{Volume} * \text{Mobile Fraction} * \text{Porosity} * (1 - S_m) / \text{Extraction Rate}$$

$$\text{Exchange Rate} = 36{,}400\ yd^3 * (27\ ft^3/yd^3) * 0.33 * 0.40 * (1\text{-}0.25) / (52.7\ ft^3/min) / (1440\ min/day) = 1.3\ days$$

An exchange rate of 1.3 days is much faster than the characteristic mass transfer time of 16 days. In standard practice, the immobile zone is included in the soil vapor volume and total volume yields an exchange rate of about 3.4 days that is still much faster than mass transfer. Hence, the extraction rate of 52.7 scfm was adequate to create and maintain a relatively low vapor concentration in the mobile zone soils compared to the vapor concentration in the immobile zone soils and provided a large driving concentration gradient for mass transfer by diffusion during the SVE pilot test and the subsequent rebound period. Hence, this extraction rate is adequate should SVE be implemented at the site in the lower vadose zone.

Evaluation of Two Region Model Input Parameters

In this section, other site data such as concentrations in the soil vapor monitoring wells and the extent of contaminated vapors are compared to model determined parameters to provide a reality check on the model results.

Initial Vapor Concentrations: The fitted initial vapor concentrations of 225 ppmv and 330 ppmv for PCE and cis-1,2-DCE are consistent with the early measured values extracted from VEL-03. Initial values measured at VML-02 are both higher and lower than those initially extracted from VEL-03 as indicated in Figure 3-8 and the PneuLog profiles of Figure 2-5. Volume-averaged values of 225 ppmv and 330 ppmv for PCE and cis-1,2-DCE, respectively, are justified.

Effective Radius (Volume) of Contaminated Soil: The characteristic volume of contaminated soil was calculated to be 36,400 yd^3. The lower vadose zone thickness was assumed to be 90 feet extending from the bottom of the perched water aquitard (~110 feet bgs) to the water table (~200 feet bgs). Hence, the effective area is 10,900 ft^2. This area represents a circle with a diameter of roughly 60 ft. This rough circle is overlaid on the site map in Figure 5-3. This calculated effective area is consistent with the known release area. The area is also consistent with the order-of-magnitude lower PCE and cis-1,2-DCE vapor concentrations measured at VML-01 as shown in Figure 3-10.

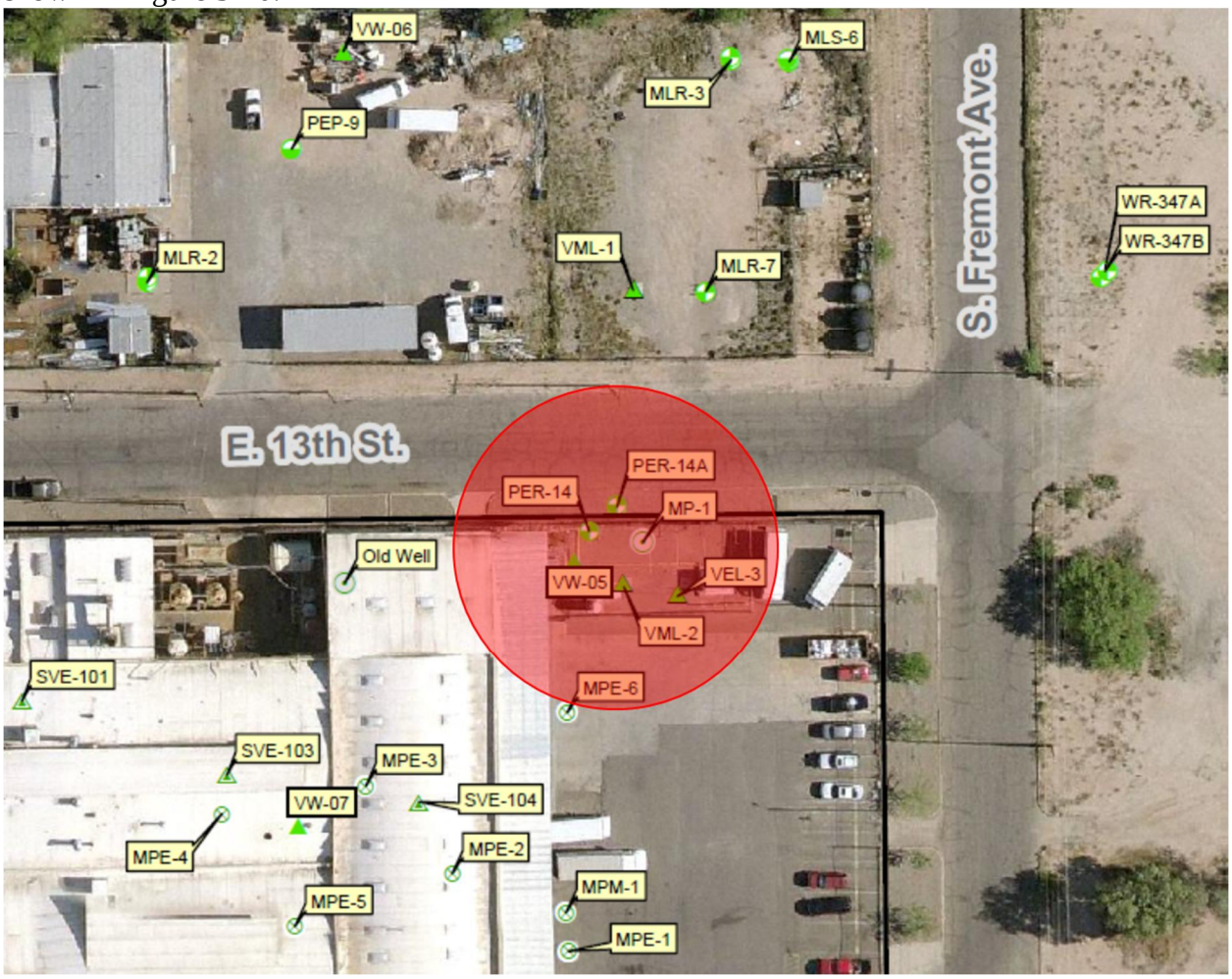


Figure 5-3. Estimated Effective Source Area

Effective Half-Thickness of Immobile Soil Lenses: The effective half-thickness, or diffusion path length, for mass transfer was estimated to be 1.5 feet from the model fit. This suggests the fine-grained, immobile soils had a characteristic thickness of about 3 feet. These lengths are similar to values observed in the PneuLog profiles. Each soil layer identified in the permeability profiles from the PneuLogs of VEL-03 was characterized as either mobile (permeability > 0.1 scfm/ft/inH_2O) or immobile (permeability < 0.1 scfm/ft/inH_2O). The thickness of the immobile layers varied from 1 foot to 20 feet as shown in the permeability profiles of Figure 2-10. The average depth interval is on the order of ten feet and yields an associated half-length for diffusion of roughly 5 feet on the same order as the model fit of 3 feet.

Fraction of Soil Characterized as Mobile: The fraction of the soil characterized as mobile was determined similarly to the diffusion length. Each soil layer identified in the permeability profiles from the PneuLogs was characterized as either mobile (permeability > 0.1 scfm/ft/inH_2O) or immobile (permeability < 0.1 scfm/ft/inH_2O). The depth intervals of mobile soils were summed as were the depth intervals of immobile soils. The mobile soils totaled about 10 feet out of the total of 30 feet logged yielding a mobile fraction of 0.33 and an immobile fraction of 0.67.

Forecast for Future SVE Operations

Forecasts for future SVE performance can be made with the calibrated SVE model. The scenario considered was restarting SVE six months after the end of the pilot testing at a continuous rate of 52.7 scfm and continuing for another 18 months. The model forecasts are illustrated in Figures 5-4 and 5-5 for PCE and cis-1,2-DCE, respectively. These plots include estimates for the vapor concentration in the immobile, or source, contaminated soil volume as well as the mass remaining in the soil. The vapor concentration in the source soils determines the duration of operation. A stringent operational goal is represented by a PCE vapor concentration of 0.78 ppmv corresponding to an equilibrium pore water concentration of 5 ppb (MCL for PCE). Continuing SVE at 52.7 scfm for an additional 9 months is expected to lower the PCE vapor concentration in the source soil to less than 1 ppm and thereby effectively meet a stringent vadose zone goal. This operational goal is illustrated in Figure 5-4 where the dashed line falls below 1 ppm. The mass remaining in the lower vadose zone is plotted as the gray line and on the linear scale on the right-hand side of the graph. As indicated, achieving such low PCE vapor concentrations requires extracting almost all of the mass and would be verified by performing a rebound test to assess the maximum vapor concentration observed under equilibrium conditions. In practice observing this low concentration is not likely because the underlying groundwater is contaminated and, at some juncture, will off-gas PCE vapors.

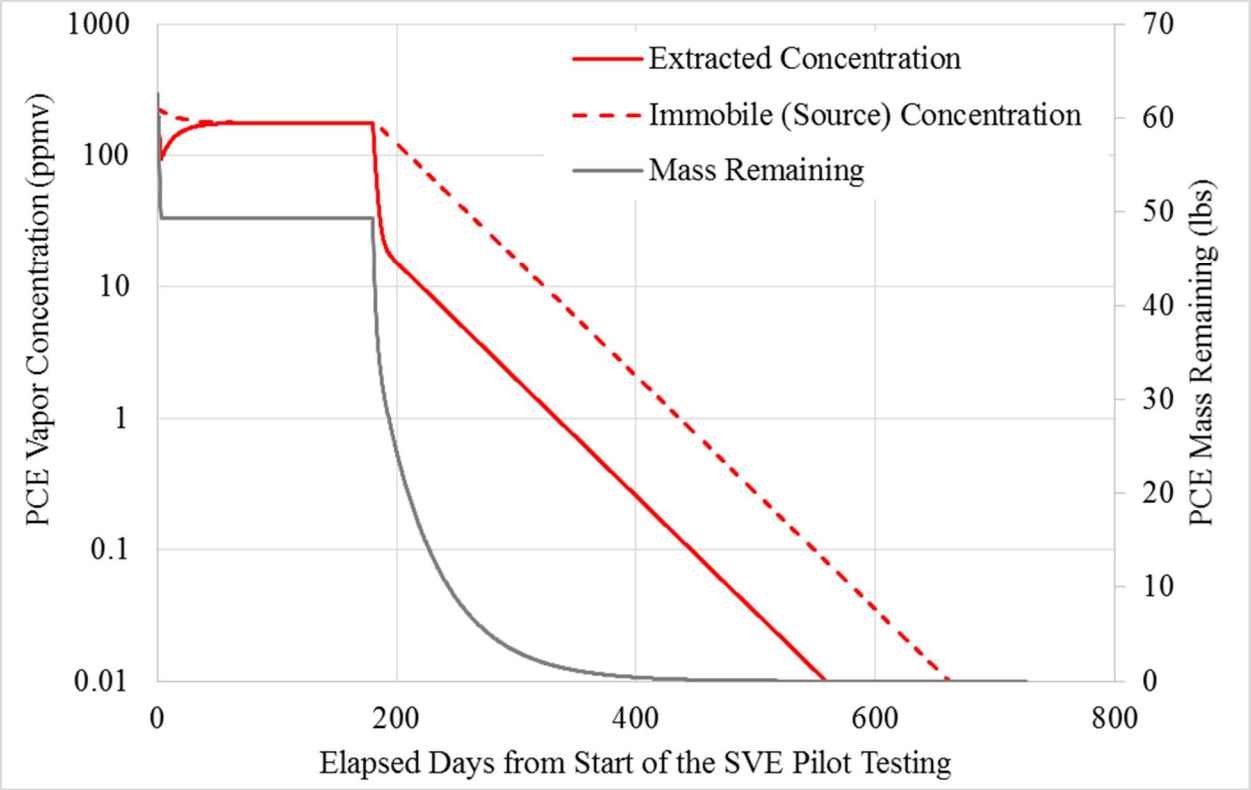


Figure 5-4. Forecasts of PCE Concentrations and Remaining Mass during Additional SVE

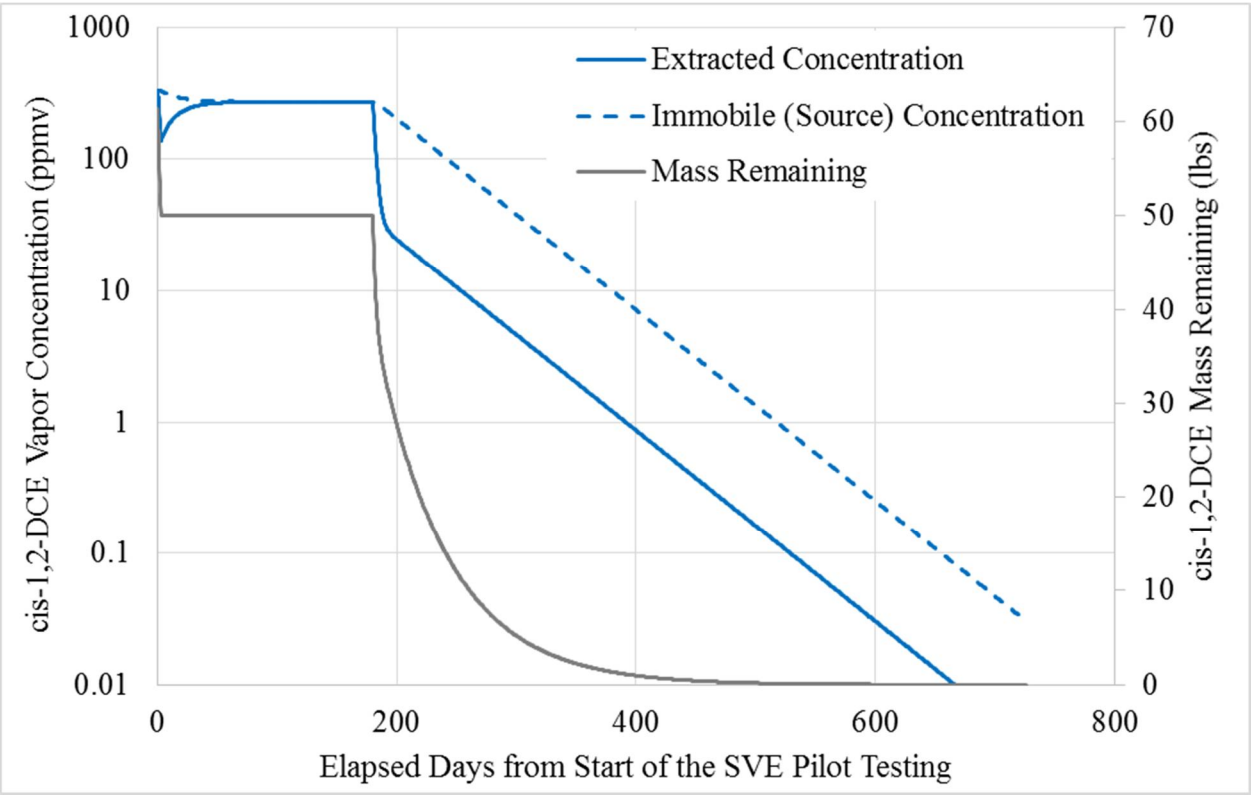


Figure 5-5. Forecasts of c1,2-DCE Concentrations and Remaining Mass during Additional SVE

6. RECOMMENDATIONS

Based on the PneuLog profiles, extended extraction test data, and modeling to interpret the observed subsurface vapor concentrations and masses extracted, our recommendation is to operate a small blower extracting from VEL-03 for 9 months. Extracted vapors could be routed through the existing activated carbon treatment system. As described in this report, this action has the potential to remove the majority of residual contaminant mass currently in the LVZ. The masses of PCE and c1,2-DCE in the source area were estimated to be on the order of 50 pounds each and the extended extraction test removed over 15% of each in only three days. The primary reservoir of the residual mass was identified as the soil interval from about 160 to 170 feet below ground.

The simple SVE action would also be expected to have a significant effect on groundwater concentrations. The increase in PCE concentration at VML-01-190 during extraction shows that contaminant vapors distant from the source area, and impacting groundwater, can be pulled to the vapor extraction well. The contaminant vapors are apparently trapped under the aquitard confining the LVZ and remain available to enter groundwater.

Appendix A
PneuLog Standard Operating Procedure

STANDARD OPERATING PROCEDURE - PneuLog®

1. INTRODUCTION

This project will utilize a procedure combining site characterization and the collection of soil vapor extraction (SVE) data in vadose zone soils containing volatile organic compounds (VOCs). The procedure developed by PRAXIS Environmental Technologies, Inc. uses pneumatic well logging, known as PneuLog®, to measure the vertical air permeability and chemical concentration profiles in wells screened for SVE. The field procedures associated with PneuLog® are described in this attachment. All field activities will adhere to the procedures and specifications contained in the project Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) prepared as separate documents.

Pneumatic well logging is used to develop a detailed conceptual site model to aid in the design, optimization, or closure of SVE systems. The following data are collected in addition to lithologic logging and conventional sample analyses to build the conceptual site model:

- Flow and vacuum data from extraction wells,
- Vertical vapor concentration data from extraction wells, and
- Vertical air production profiles from extraction wells.

This attachment describes the PneuLog® technology and the collection of the data listed above.

2. TECHNOLOGY DESCRIPTION

This project will employ an expedited approach to vadose zone characterization with simultaneous collection of data for optimized SVE design and operation. For both vadose zone characterization and remedial design, Praxis has developed, field-tested and commercialized a pneumatic well logging process. Known as PneuLog®, the well logging is performed by simultaneously measuring the cumulative air flow and chemical vapor concentrations along the depth of an extraction well screen during active SVE. To make these measurements, a flow sensor is moved through the well during vapor extraction and soil gas samples are collected and analyzed continuously. Performing these measurements at a representative number of wells can yield a three-dimensional picture of the extent of chemicals in soils at a site as well as the soil permeability distribution. These measurements, in conjunction with traditional measurements, yield a thorough site evaluation.

The equipment for the pneumatic logging is illustrated in Figure 1. The Pneulog® instrumentation is attached to a cable, which passes through alignment pulleys and a vacuum-tight fitting at the wellhead. The instrumentation is raised or lowered by a motorized reel around which the cable is wound. The logging proceeds at roughly eight feet per minute along the screen in the SVE well. Sensors in the pulley assembly indicate the depth of the measurement. Electrical leads connect the flow sensor to a data acquisition system located on the motorized reel. A vapor sampling tube connects the sample port on the instrument to a vacuum pump, also on the reel. The sampling pump draws a continuous stream of air through the sampling tube to

the surface where it is analyzed for VOCs and other compounds of interest (e.g., oxygen and carbon dioxide). A photoionization detector (PID) is used to provide a continuous reading of total VOC concentration. Canister samples can be collected for off-site gas chromatographic and mass spectrometer analyses to determine compound-specific concentrations at discrete depths and to calibrate the PID readings. Supplemental vapor samples can be collected and analyzed on-site with a field gas chromatograph.

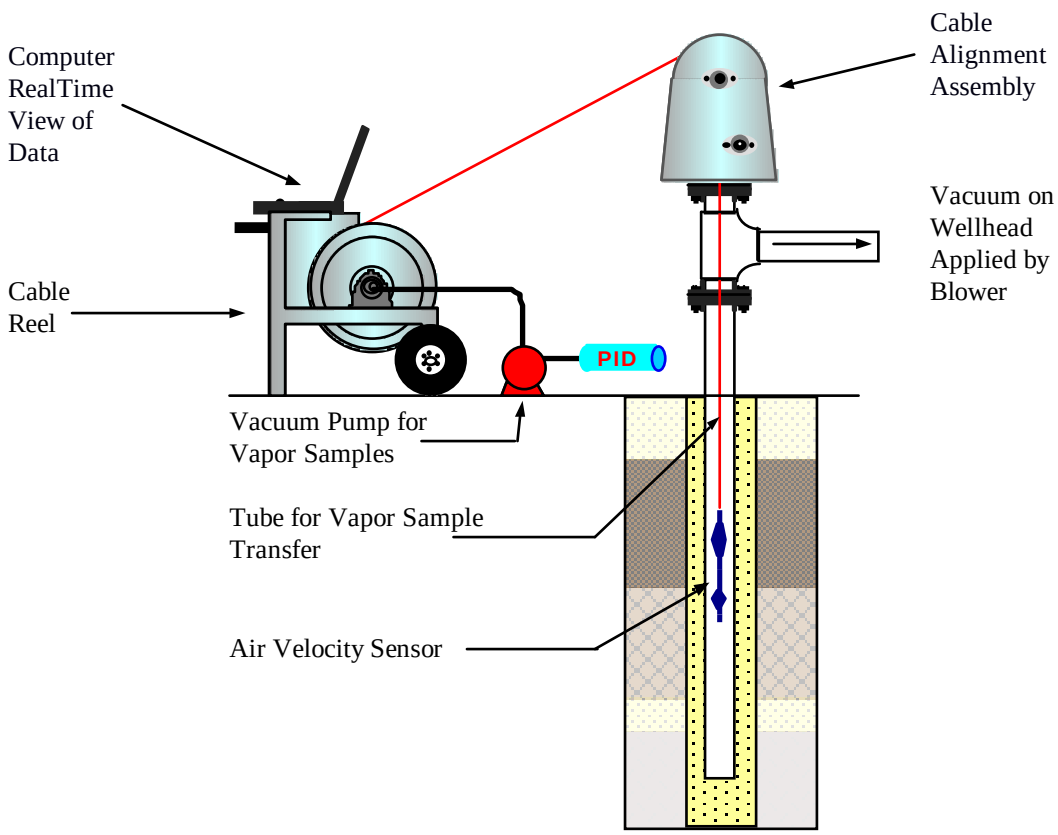


Figure 1. Schematic of Pneumatic Well Logging Equipment

The airflow from each soil layer is related to the cumulative airflow by a simple mass balance. To determine the airflow from a given soil layer, the cumulative airflow measured below the soil layer is subtracted from the cumulative airflow measured above the soil layer. The soil permeability of the interval is then determined from Darcy's law. The data and the analyses appear similar to output from borehole flowmeter testing in water wells (Molz et al., 1989). A typical cumulative airflow measurement from PneuLog® is provided in Figure 2a. In this example, the well is screened from 12 to 32 feet below the ground surface (bgs). The screen interval is indicated by the green (dark) and yellow (light) blocks together. As shown, the airflow from the bottom half of the well is practically zero. The airflow increases steadily from 0 to 28 standard cubic feet per minute (scfm) between 23 and 16.5 feet bgs as the instrument is raised through the screen. The steady flow increase indicates this soil interval has a relatively

uniform permeability to air. From 16.5 to 15 feet, only 2.5 scfm of soil gas are added. 15 scfm are then added in the next 1.5-foot interval up to 13.5 feet. The top 1.5 feet of the screen adds only one scfm to the total.

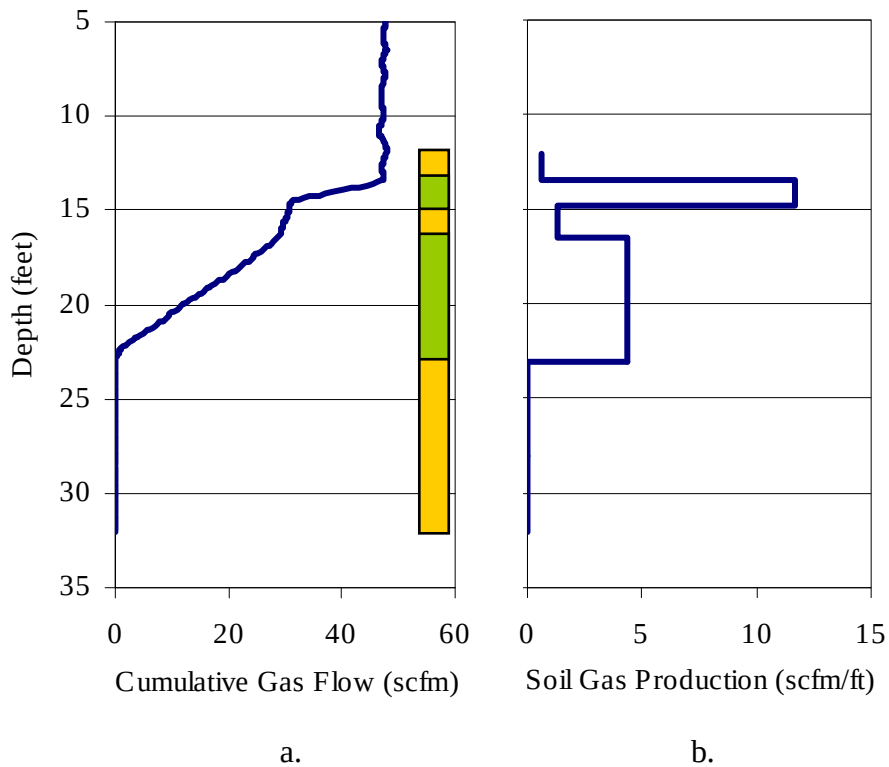


Figure 2. Example Pneumatic Well Logging Results for Soil Permeability to Air

Figure 2b presents an interpretation of the cumulative flow measurements as soil gas production. An effective air permeability profile can be generated using the soil gas production profile with multi-dimensional analytical or numerical airflow models. The permeability of an interval is proportional to the change in flow across the interval, its thickness, its depth below the surface and the well vacuum according to Darcy's law. Figure 2b reveals roughly five soil strata along the screen. The stratum intersected by the bottom half of the screen has a relatively low permeability since no measurable soil gas was produced. The geologist characterized the soils of this interval as silts. The soil intervals from 16.5 to 23 feet and 13.5 to 15 feet have air productions indicative of coarse sands. These two sand intervals are separated by a 1.5-foot-thick silt interval. The soil at the top of the screen would also be characterized as silt. This characterization of the physical properties is superior to a geological log and a typical air permeability test. The PneuLog® results were qualitatively consistent with the geological log; however, the geological log provided little indication of air permeability. Without the pneumatic

logging data, the permeability determined by typical testing would be averaged over the screen interval and dominant features of the subsurface flow during SVE would not be quantified.

The characterizations of zones containing chemicals and soil gas concentrations result from the measurement of VOC concentrations along the well screen. An example concentration log, which was collected simultaneously with the previously discussed air flow log, is presented in Figure 3a. This concentration profile was obtained from a continuous PID reading which was calibrated to trichloroethylene (TCE) concentrations with on-site and off-site gas chromatographic analyses of vapor samples from discrete depths and the wellhead. The measured vapor concentration is lowest near the bottom of the screen and increases slightly up to a depth of about 28 feet. As the instrumentation is raised higher in the well, the concentration increases sharply to a maximum and remains relatively steady into the soil gas production interval starting at 23 feet. The concentration then decreases steadily from 22 to 15 feet bgs. Between 15 feet and the top of the screen, the concentration increases very slightly.

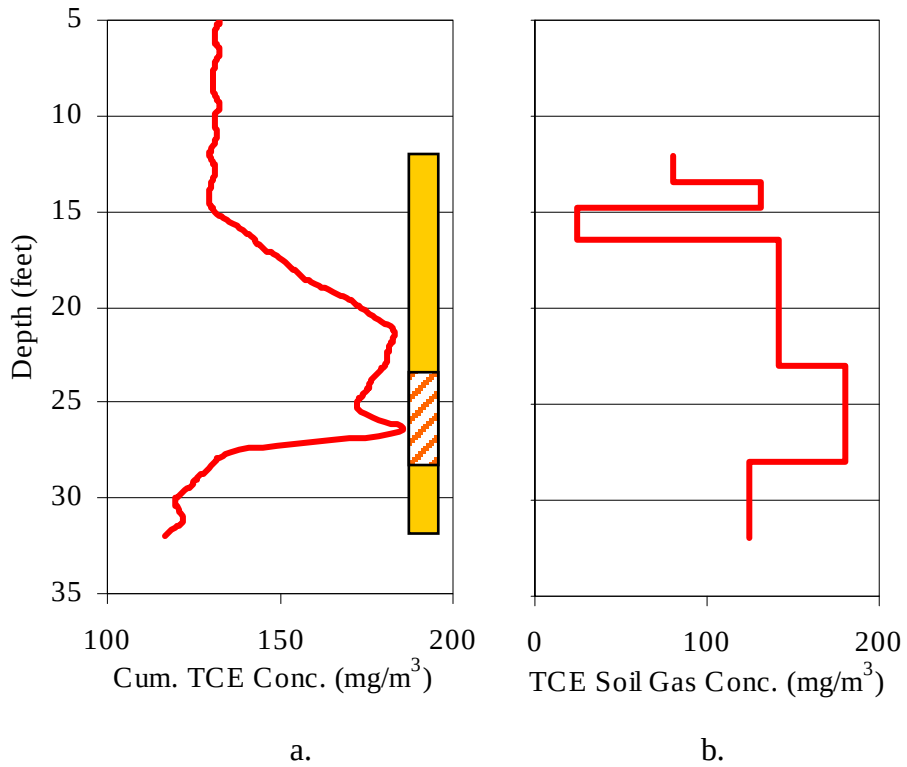


Figure 3. Sample Pneumatic Well Logging Results

The observed increases and decreases in concentration can be combined with the depth-specific air production in a mass balance to estimate depth-specific soil gas concentrations. The PneuLog® device simultaneously measures the flow rate and concentration versus depth. The change in the product of these two variables over a specified depth interval divided by the flow change is equal to the chemical vapor concentration in the soils of that depth interval.

Application of this relationship to the data shown in Figures 2a and 3a yields the chemical vapor concentration profile presented in Figure 3b. The highest concentration occurs in the low permeability material underlying the deep sand interval. This high concentration indicates the low permeability interval creates a mass transfer constraint to SVE. Compounds must migrate slowly out of this interval into the flow interval above. The silt interval at 15 feet does not appear to be a barrier to chemical migration between the sands.

As illustrated by this example, pneumatic logging provides a more thorough and appropriate site characterization than traditional methods alone. Repeating the process in a representative number of wells can generate a three-dimensional description of the physical and chemical subsurface by correlating between locations. The technique also provides data to more effectively design and optimize an SVE system. Soil strata near or below cleanup goals are quickly identified and the extraction flow rate can be lowered or terminated from these layers. The operation can then be focused on strata remaining above cleanup goals. This optimization could lead to cost savings by accelerating cleanup and lowering operation & maintenance costs.

3. FIELD TASKS AND PROCEDURES

This section describes the field activities and procedures to collect data for site characterization and SVE design using PneuLog®. The activities adhere to the procedures and specifications contained in the project Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) prepared as separate documents. Site evaluation includes measurements of flow and vacuum in extraction and monitoring wells during pneumatic logging. Concentrations during the tests are monitored with a PID and two samples from each screen interval are collected and analyzed for VOCs. During the testing, vacuum responses are monitored in other available screens to aid in the calculation of permeabilities at the site. Vacuum responses depend on the soil properties and well spacing and may not be measurable in all monitored screen intervals.

The PneuLog® technique was described in detail in Section 2. During the pneumatic logging, a small flow of air is extracted through the Teflon® tubing attached to the flow instrument in the well. The total organic compound concentration in this air flow will be measured with a calibrated photoionization detector (PID) to yield the chemical concentration in soil gases extracted along the well screen depth. The pneumatic log will then be repeated and the instrument will be paused at a depth of major change in flow or concentration, generally at the maximum concentration. At this discrete depth, a sample of the soil gas may be collected in a canister or Tedlar® bag. A second canister or Tedlar® sample will be collected at the top of the well. Canisters will be packaged and shipped to a state-certified, off-site laboratory for analysis by GC/MS. The flow data from the pneumatic well log will immediately be analyzed to yield an air production profile along the well screen and the concentration log will be analyzed to indicate the intervals with the highest chemical concentrations. In wells with lower concentrations, a meaningful maximum concentration along the screen may not be identified. In these screens, a vapor sample will be collected from the bottom of the screen.

Any point or non-point discharge to air generally requires review and permission from the local air board. This includes any process that volatilizes materials from the ground (e.g., soil vapor extraction) or uses volatilization as a means of disposal for unwanted materials or constituents. The SVE aspect of this fieldwork will require the extraction of vaporous chemicals from the subsurface. The SVE discharge from each well will be treated with existing vapor abatement equipment on each site.

4. VAPOR SAMPLING AND ANALYSES

This section summarizes the procedures for collecting and analyzing vapor samples during the field tests. The equipment that will be used to collect vapor samples is also described. The sample locations, frequencies, and procedures presented are subject to change based on site-specific conditions.

Vapor concentrations will be monitored continuously during extraction periods with a calibrated PID as described in Section 3. Vapor samples will be collected in Summa® canisters for off-site analysis via method TO-14 (VOCs) or TO-15 (VOCs), and/or method TO-3 (total volatile petroleum hydrocarbons) at a state-certified laboratory or in Tedlar bags for on-site analyses of VOCs using a modified EPA Method 18. Approximately 2 samples will be collected during the pneumatic log of each screen in each well location. Samples will be collected through the pneumatic logging instrumentation and will provide depth-specific concentrations from inside the extraction wells. One sample will be collected from above the screen interval and one sample from the depth in the screen yielding the highest concentration or the bottom.

Depth-specific samples will be drawn by a small, oilless diaphragm pump through a Teflon® tube attached to the flow instrumentation for pneumatic logging. The vapor sample will be monitored by a PID on the surface and collected near the discharge of the Teflon® tube in a stainless steel SUMMA® canister or Tedlar® bag. The majority of samples collected in Tedlar bags will be analyzed on-site with a portable GC. Canisters will also be used to directly collect vapor samples at the wellhead to validate on-site analyses. The canisters will be submitted for offsite chemical analysis. Samples will be collected following the guidance offered in EPA's *"Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*," EPA 4-84-041-April 1984. The specific methods to be used are TO-14, "Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using SUMMA Passivated Canister Sampling and Gas Chromatography Analysis" or TO-15 and/or TO-3 for total volatile petroleum hydrocarbons. The canisters will be used and samples collected in the vacuum mode. The vacuum in the clean canister (near 30 inches Hg) will be sufficient to pull the sample out of the gas line. A slow flow rate into the canister will be controlled manually by slightly cracking open its valve. The rate is checked by monitoring the canister vacuum gauge and comparing the value to the elapsed time and the wellhead vacuum. The final canister vacuum will be approximately equal to the vacuum in the vapor extraction line. The final vacuum will be recorded on the chain-of-custody and then measured at the laboratory after shipment and before analysis. The two recorded vacuums will be approximately equal if the canister has not leaked. Each canister will be cleaned in the laboratory before delivery.

The purpose of a field quality control program is to provide a measure of data quality. QA samples to be collected include field duplicates, equipment blanks, trip blanks, ambient condition blanks, and material for matrix spike/matrix spike duplicate (MS/MSD) analyses. Collection of the QA samples during the project is described in the project Work Plan. A summary of the quality control sampling for vapor sampling during PneuLog® is provided in Table 1. The sample handling, preservation and shipment procedures are described in the Work Plan along with sample custody and decontamination procedures.

TABLE 1
QUALITY CONTROL SAMPLES

Sample Matrix Analysis	Analysis Level	Number of Samples						
		Primary	Duplicate	Ambient Blank	Trip Blank	Equipment Blank	Matrix Spike /MSD	Total
Soil Vapor								
VOCs (Offsite TO-14)	III	TBD[1]	1 per 10	0	0	0	0	TBD[1]
VOCs (Offsite TO-15)	III	TBD[1]	1 per 10	0	0	0	0	TBD[1]
VOCs (Onsite TO-18)	I	2 per well	1 per 10	1 per 10	0	1 per 10	0	13 per 5 wells
TVPH (Offsite TO-3)	III	TBD[1]	1 per 10	0	0	0	0	TBD[1]

[1] TBD = To Be Determined

5. DATA MANAGEMENT

The data to be collected during PneuLog® include:

- Soil vapor concentrations,
- Extraction air flowrates,
- Wellhead vacuums,
- Vertical air flow profiles, and
- Vertical concentration profiles.

These data can be used to define the vertical and horizontal extent of chemicals at the various sites if a sufficient number of representative wells are logged. The data will also yield the disposition of the chemicals (e.g., found primarily in low permeability soil, found near the groundwater, suspected non-aqueous phase liquid present, etc.). The pneumatic logging data, combined with historical data can provide information on optimal SVE system operation and possibly the optimal locations for new SVE wells.

A general chronicle of field activities and personnel on site will be recorded daily. The following information shall be recorded for all field activities: (1) location, (2) date and time, and (3) identity of people performing activity. The information shall be recorded in a field notebook or on data logging sheets. These records shall be archived in an easily accessible form and made available to the Air Force upon request.

The collection of soil vapor samples will be documented in a field notebook or on appropriate data logging sheets. These records shall be archived in an easily accessible form and made available to the Air Force or its contractors upon request. The following additional information shall be recorded for all sampling activities: (1) sample type and sampling method, (2) the identity of each sample including location and depth(s), where applicable, from which it was collected, (3) the date and time of collection, (4) the amount of each sample or sample container volume, (5) sample description (e.g., color, odor, clarity), and (6) identification of conditions that might affect the representativeness of a sample (e.g., refueling operations, damaged casing).

Field measurements will be recorded on data sheets specific to each measurement (e.g., air flow rates and wellhead vacuums). For each field instrument the following shall also be recorded: (1) the numerical value and units of each measurement, and (2) calibration results

6. HEALTH AND SAFETY

The health and safety plan for the fieldwork is prepared separately and is adhered to during all field activities.

7. MANAGEMENT AND STAFFING

Key staff from PRAXIS assigned to the project are shown in Table 2 with their responsibilities. Team members include:

Ms. Mary Scarpetti is the President of PRAXIS. She is responsible for the administrative, contractual and fiscal aspects of all PRAXIS projects. All significant changes in scope or cost must have her approval. Ms. Scarpetti received her law degree from the University of San Francisco in 1990 and is a member of the California Bar Association. Ms. Scarpetti has seven years of experience in the operations and financing of small firms and, in particular, government contracting and accounting. She worked in the securities industry prior to law school.

Dr. Lloyd "Bo" Stewart is the Principal Engineer for the pneumatic well logging and a Vice President of PRAXIS. Dr. Stewart has ten years of experience overseeing the development and implementation of innovative technologies for the remediation and characterization of hazardous waste sites. Dr. Stewart also develops and implements computer models for risk assessments and cleanup actions. Remedial technologies under development at Praxis include steam injection combined with vacuum extraction, dual-phase extraction, and hydraulic fracturing. Dr. Stewart received his Ph.D. in Mechanical Engineering from the University of California Berkeley in 1989.

Mr. Mike Chendorain in the Soil Hydrologist for the subsurface investigation, data analysis, and modeling. Mr. Chendorain received an MS in Soil and Environmental Sciences from the University of California at Riverside. He received a BS in Environmental Sciences from Virginia Institute of Technology. He has three years of experience in modeling the fate and transport of chemicals in the subsurface. While working on his MS, he also worked as a teaching assistant and as a research assistant.

Table 2
PRAXIS Project Team Members

Responsibility	Team Member
Program Manager / Contracts	Mary Scarpetti
Project Manager / Principal Engineer	Bo Stewart
Subsurface Modeling/Data Analysis	Mike Chendorain
Equipment Installation & Maintenance	Steven Scarpetti

8. REFERENCES

Molz, F.J., R. H. Morin, A. E. Hess, J. G. Melville, and O. Guven, 1989, "The Impeller Meter for Measuring Aquifer Permeability Variations: Evaluation and Comparison with Other Tests," *Water Resources Research*, Vol. 25, No. 7, pp. 1677-1683.

Appendix B
Gas Chromatography Results

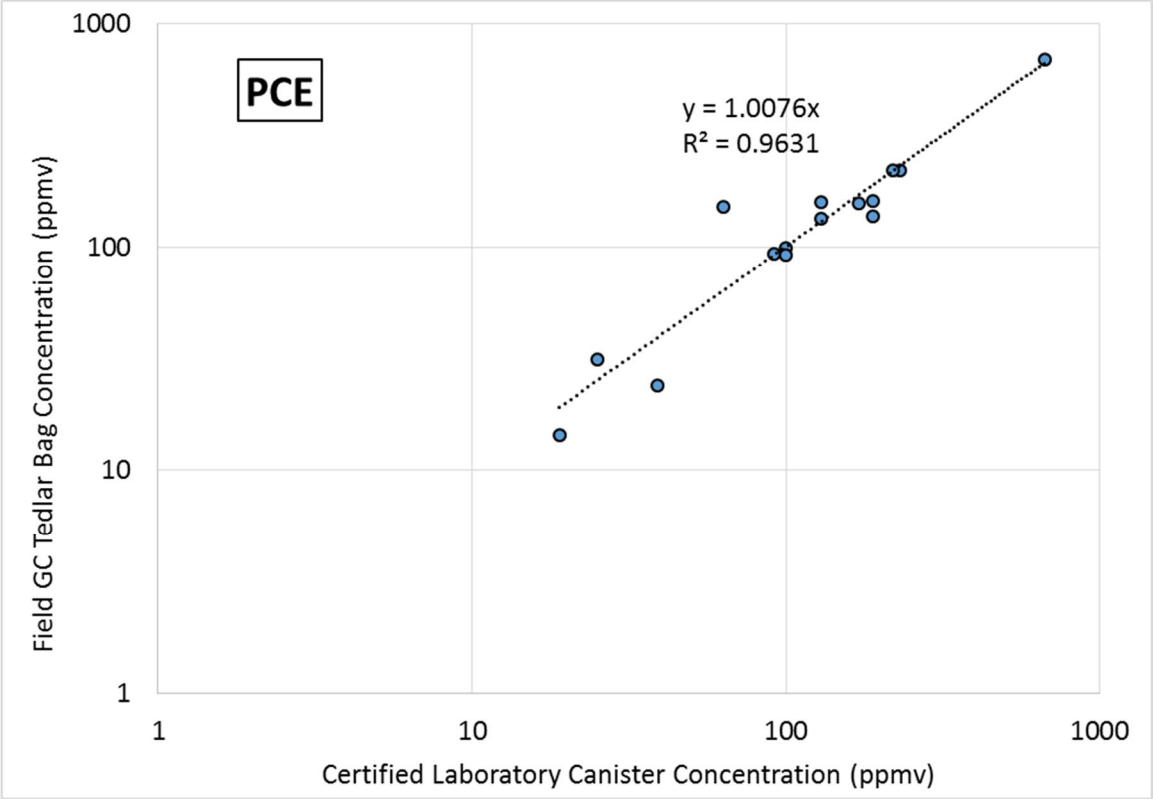
Date Collected	Time Collected	Sampler	Well	Depth	Tedlar Bag #	Vapor Concentrations in ppmV						Summa
						1,1DCE	t1,2DCE	c1,2DCE	TCE	PCE	Total	
1/27/2014	11:15	LDS	VML-01-130	0	401	nd	nd	0.509	0.065	2.277	2.851	
1/27/2014	11:24	LDS	VML-01-150	0	402	nd	nd	0.527	0.472	6.970	7.969	
1/27/2014	11:31	LDS	VML-01-170	0	403	nd	nd	1.617	2.961	30.665	35.243	
1/27/2014	11:53	LDS	VML-01-190	0	404	nd	nd	0.169	0.087	0.973	1.229	
1/27/2014	11:59	LDS	Equip Blank	atm	405	nd	nd	nd	nd	0.029	0.029	
1/27/2014	12:16	LDS	VML-02-130	0	406	0.287	nd	4.673	2.146	32.979	40.084	
1/27/2014	12:23	LDS	VML-02-150	0	407	2.354	0.107	220.810	30.806	257.889	511.966	
1/27/2014	12:30	LDS	VML-02-170	0	408	4.288	0.274	643.320	98.268	631.216	1377.366	
1/27/2014	12:42	LDS	VML-02-190	0	409	2.177	0.124	215.796	19.946	162.258	400.301	
1/27/2014	12:42	LDS	VML-02-190D	0	410	2.119	0.126	214.909	19.864	161.686	398.704	
1/27/2014	13:21	LDS	VEL-03	0	411	3.316	0.147	370.584	35.620	264.665	674.332	
1/27/2014	13:48	LDS	PER-14A	0	412	0.506	nd	59.618	2.930	14.964	78.018	
1/27/2014	15:58	LDS	PER-14A	175.06	413	3.436	0.161	416.429	19.627	99.450	539.102	Summa
1/27/2014	16:12	LDS	PER-14A	182.15	414	2.554	0.143	280.509	16.280	104.899	404.385	
1/27/2014	16:16	LDS	PER-14A	186.96	415	2.242	0.141	262.698	15.437	100.879	381.397	
1/27/2014	16:21	LDS	PER-14A	192.02	416	2.625	0.126	306.726	15.979	91.846	417.301	Summa
1/27/2014	17:04	LDS	PER-14A	196.83	417	2.203	0.118	253.401	14.628	93.541	363.891	Summa
1/27/2014	17:04	LDS	PER-14A	196.83	418	2.270	0.135	256.326	14.832	96.665	370.228	
1/27/2014	17:21	LDS	Equip Blank	atm	419	nd	nd	0.303	0.026	0.363	0.693	
1/28/2014	12:16	LDS	VEL-03	135.1	420	3.045	0.156	357.400	30.797	222.384	613.782	Summa
1/28/2014	12:57	LDS	VEL-03	191.18	421	1.392	0.066	144.532	16.987	159.318	322.294	Summa
1/28/2014	13:03	LDS	VEL-03	185.35	422	1.814	0.109	179.257	17.375	157.750	356.306	
1/28/2014	13:06	LDS	VEL-03	180.04	423	2.229	0.118	236.852	19.010	157.828	416.037	
1/28/2014	13:11	LDS	VEL-03	175.99	424	2.594	0.136	333.424	21.255	157.504	514.914	Summa
1/28/2014	13:23	LDS	VEL-03	170.92	425	3.008	0.153	374.033	25.634	184.483	587.311	
1/28/2014	13:26	LDS	VEL-03	165.1	426	2.998	0.156	358.953	30.289	223.255	615.652	
1/28/2014	13:31	LDS	VEL-03	154.97	427	2.773	0.121	336.416	28.974	220.619	588.903	Summa
1/28/2014	13:31	LDS	VEL-03	154.97	428	2.760	0.135	335.778	28.949	219.410	587.033	
1/28/2014	14:20	LDS	Equip Blank	atm	429	nd	nd	0.320	0.047	0.900	1.267	
1/28/2014	14:56	LDS	VML-01-130	0	430	nd	nd	0.627	0.081	2.475	3.183	
1/28/2014	15:02	LDS	VML-01-150	0	431	0.042	nd	0.556	0.491	7.795	8.884	
1/28/2014	15:10	LDS	VML-01-170	0	432	nd	nd	1.784	2.793	29.749	34.327	
1/28/2014	15:17	LDS	VML-01-190	0	433	nd	nd	0.198	0.116	1.417	1.732	
1/28/2014	15:52	LDS	VML-02-130	0	434	0.268	nd	4.432	2.034	32.987	39.722	

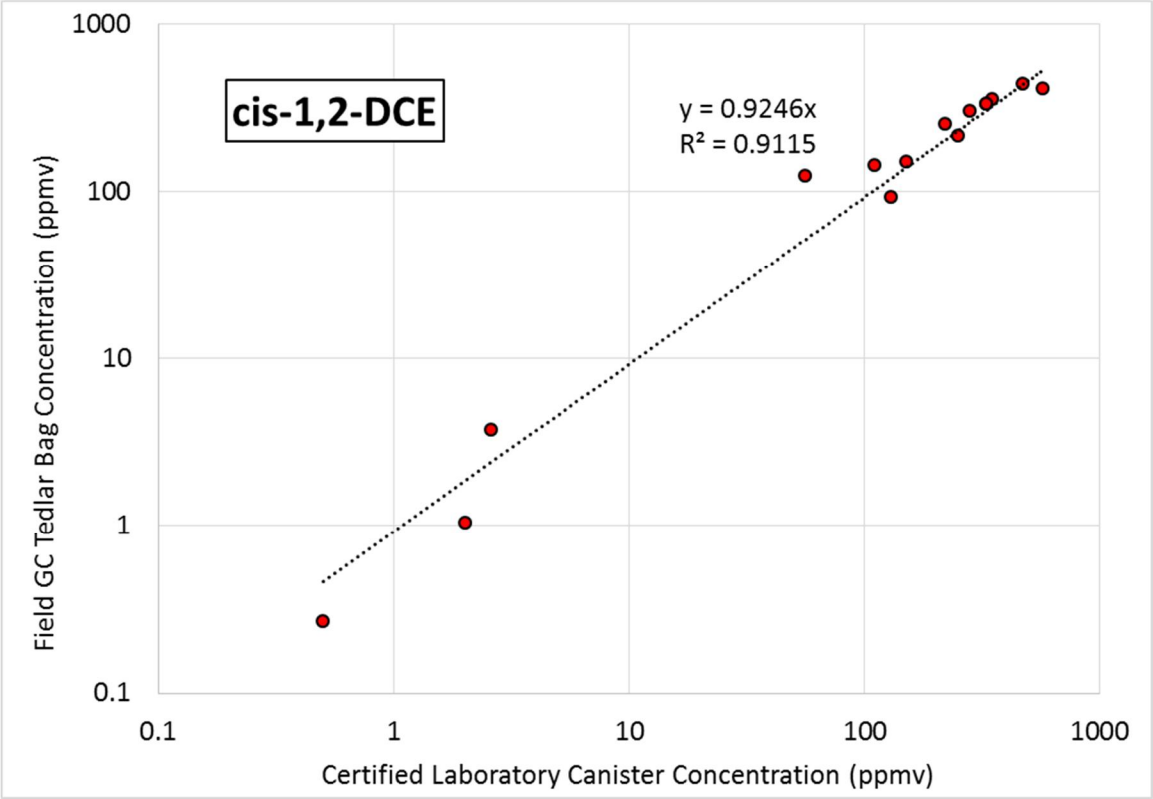
Date Collected	Time Collected	Sampler	Well	Depth	Tedlar Bag #	Vapor Concentrations in ppmV						Summa
						1,1DCE	t1,2DCE	c1,2DCE	TCE	PCE	Total	
1/28/2014	15:57	LDS	VML-02-150	0	435	1.809	0.110	194.380	28.143	267.463	491.905	
1/28/2014	16:05	LDS	VML-02-170	0	436	3.370	0.241	549.790	90.686	627.735	1271.822	
1/28/2014	16:12	LDS	VML-02-190	0	437	2.276	0.159	253.233	24.376	211.422	491.466	
1/28/2014	16:12	LDS	VML-02-190D	0	438	2.343	0.159	249.593	23.757	202.991	478.844	
1/28/2014	16:16	LDS	VEL-03	0	439	2.612	0.132	328.350	28.190	212.100	571.383	
1/29/2014	8:46	LDS	VML-02-130	0	291	0.297	nd	4.677	2.152	33.862	40.989	
1/29/2014	8:52	LDS	VML-02-150	0	292	1.449	0.100	163.474	23.411	223.445	411.878	
1/29/2014	8:58	LDS	VML-02-170	0	293	2.468	0.215	478.520	84.478	666.503	1232.183	
1/29/2014	9:04	LDS	VML-02-190	0	294	1.994	0.136	240.952	23.428	211.160	477.670	
1/29/2014	9:06	LDS	VEL-03	0	295	2.244	0.113	295.153	26.438	207.199	531.148	
1/29/2014	9:08	LDS	Equip Blank	atm	296	nd	nd	0.553	0.087	1.449	2.089	
1/29/2014	14:25	LDS	Equip Blank	atm	297	nd	nd	0.335	0.056	0.822	1.213	
1/29/2014	14:35	LDS	VML-01-130	0	298	nd	nd	0.757	0.092	2.735	3.584	
1/29/2014	14:41	LDS	VML-01-150	0	299	nd	nd	0.434	0.379	7.792	8.605	
1/29/2014	14:47	LDS	VML-01-170	0	300	nd	nd	1.730	2.568	29.082	33.380	
1/29/2014	14:54	LDS	VML-01-190	0	301	nd	nd	0.113	0.205	3.089	3.407	
1/29/2014	15:27	LDS	VML-02-130	0	302	0.248	nd	4.610	2.106	34.829	41.793	
1/29/2014	15:33	LDS	VML-02-150	0	303	1.243	0.101	161.962	24.254	253.164	440.724	
1/29/2014	15:16	LDS	VML-02-170	0	304	2.190	0.202	442.872	80.958	692.894	1219.115	Summa
1/29/2014	15:39	LDS	VML-02-190	0	305	1.640	0.106	198.823	19.485	172.640	392.693	
1/29/2014	15:41	LDS	VEL-03	0	306	1.773	0.090	243.110	21.797	172.387	439.157	
1/29/2014	15:41	LDS	VEL-03D	0	307	1.937	0.075	255.689	23.035	182.706	463.442	
1/29/2014	15:45	LDS	Equip Blank	atm	308	nd	nd	0.059	nd	0.126	0.186	
1/29/2014	22:36	LDS	VML-02-130	0	309	0.237	nd	3.992	1.865	30.087	36.181	
1/29/2014	22:41	LDS	VML-02-150	0	310	1.037	0.075	137.318	20.794	215.658	374.882	
1/29/2014	22:47	LDS	VML-02-170	0	311	1.786	0.176	377.444	70.410	623.957	1073.772	
1/29/2014	22:54	LDS	VML-02-190	0	312	1.627	0.113	189.169	19.412	167.995	378.317	
1/29/2014	22:56	LDS	VEL-03	0	313	1.663	0.072	231.926	21.058	166.184	420.904	
1/30/2014	8:38	LDS	VML-02-130	0	314	0.209	nd	4.253	1.843	30.190	36.494	
1/30/2014	8:43	LDS	VML-02-150	0	315	0.808	0.057	119.642	17.285	183.803	321.595	
1/30/2014	8:50	LDS	VML-02-170	0	316	1.319	0.156	347.217	66.797	637.515	1053.004	
1/30/2014	8:57	LDS	VML-02-190	0	317	1.418	0.120	173.429	19.439	153.301	347.707	
1/30/2014	9:02	LDS	VEL-03	0	318	1.556	0.069	213.033	19.235	151.675	385.568	
1/30/2014	9:02	LDS	VEL-03D	0	319	1.486	0.074	212.303	19.164	149.963	382.990	

Date Collected	Time Collected	Sampler	Well	Depth	Tedlar Bag #	Vapor Concentrations in ppmV						Summa
						1,1DCE	t1,2DCE	c1,2DCE	TCE	PCE	Total	
1/30/2014	9:10	LDS	Equip Blank	atm	320	nd	nd	0.108	0.025	0.617	0.750	
1/30/2014	15:50	LDS	VML-01-130	0	321	nd	nd	0.932	0.143	3.203	4.278	
1/30/2014	15:55	LDS	VML-01-150	0	322	nd	nd	0.372	0.480	10.021	10.872	
1/30/2014	16:05	LDS	VML-01-170	0	323	nd	nd	1.055	1.944	24.000	26.999	Summa
1/30/2014	16:14	LDS	VML-01-190	0	324	nd	nd	0.251	0.439	7.525	8.216	
1/30/2014	16:23	LDS	VML-02-130	0	325	0.182	nd	3.427	1.556	25.486	30.651	
1/30/2014	16:31	LDS	VML-02-150	0	326	0.623	0.055	93.154	13.111	138.741	245.684	Summa
1/30/2014	16:44	LDS	VML-02-170	0	327	1.001	0.141	294.882	59.108	589.691	944.822	
1/30/2014	16:50	LDS	VML-02-190	0	328	1.533	0.112	143.705	17.942	132.345	295.636	
1/30/2014	15:35	LDS	VEL-03	0	329	1.400	0.067	191.571	17.499	135.631	346.168	
1/30/2014	15:35	LDS	VEL-03D	0	330	1.478	0.074	194.861	16.847	116.562	329.821	
1/30/2014	15:40	LDS	Equip Blank	atm	331	nd	nd	0.225	0.039	0.849	1.113	
1/30/2014	22:11	LDS	VML-02-130	0	332	0.203	nd	3.517	1.568	26.200	31.489	
1/30/2014	22:17	LDS	VML-02-150	0	333	0.693	0.043	94.324	13.072	138.681	246.813	
1/30/2014	22:23	LDS	VML-02-170	0	334	0.761	0.129	244.946	51.267	529.397	826.499	
1/30/2014	22:34	LDS	VML-02-190	0	335	1.298	0.101	144.110	19.477	133.575	298.562	
1/30/2014	22:36	LDS	VEL-03	0	336	1.382	0.052	183.469	16.849	132.253	334.004	
1/31/2014	7:32	LDS	VML-02-130	0	337	0.229	nd	4.574	1.893	30.943	37.639	
1/31/2014	7:38	LDS	VML-02-150	0	338	0.594	0.058	126.948	16.603	163.579	307.782	
1/31/2014	7:44	LDS	VML-02-170	0	339	0.704	0.161	285.864	63.150	657.795	1007.673	
1/31/2014	7:51	LDS	VML-02-190	0	340	1.382	0.165	160.145	26.676	141.588	329.956	
1/31/2014	7:53	LDS	VEL-03	0	341	1.509	0.075	203.751	18.695	144.865	368.896	
1/31/2014	15:42	LDS	VML-01-130	0	342	nd	nd	0.569	0.059	2.598	3.227	
1/31/2014	15:47	LDS	VML-01-150	0	343	nd	nd	0.440	0.498	10.860	11.798	
1/31/2014	15:54	LDS	VML-01-170	0	344	nd	nd	0.872	2.042	25.652	28.567	
1/31/2014	16:01	LDS	VML-01-190	0	345	nd	nd	0.213	0.775	14.887	15.875	
1/31/2014	16:15	LDS	VML-02-130	0	346	0.216	0.017	4.132	1.804	30.047	36.216	
1/31/2014	16:21	LDS	VML-02-150	0	347	0.422	0.058	90.083	11.195	99.443	201.202	
1/31/2014	16:27	LDS	VML-02-170	0	348	0.467	0.156	256.493	60.883	661.124	979.122	
1/31/2014	16:38	LDS	VML-02-190	0	349	1.358	0.192	150.916	29.517	135.051	317.035	Summa
1/31/2014	16:06	LDS	VEL-03	0	350	1.204	0.061	189.587	17.692	136.816	345.360	
1/31/2014	16:06	LDS	VEL-03D	0	231	1.241	0.061	198.431	18.510	142.778	361.021	
1/31/2014	16:10	LDS	Equip Blank	atm	232	nd	nd	0.144	nd	0.559	0.703	
1/31/2014	17:39	LDS	VEL-03	188.17	233	0.355	0.032	35.685	5.273	56.130	97.475	

Date Collected	Time Collected	Sampler	Well	Depth	Tedlar Bag #	Vapor Concentrations in ppmV						Summa
						1,1DCE	t1,2DCE	c1,2DCE	TCE	PCE	Total	
1/31/2014	17:39	LDS	VEL-03D	188.17	234	0.386	0.029	38.479	5.736	61.080	105.709	
1/31/2014	17:44	LDS	VEL-03	182.1	235	0.766	0.058	85.222	9.914	88.711	184.672	
1/31/2014	17:47	LDS	VEL-03	177.03	236	0.576	0.060	81.499	9.633	83.598	175.366	
1/31/2014	17:50	LDS	VEL-03	172.98	237	0.600	0.051	78.556	10.560	84.288	174.054	
1/31/2014	17:53	LDS	VEL-03	168.17	238	0.706	0.054	104.790	11.144	92.010	208.704	
1/31/2014	17:57	LDS	VEL-03	162.6	239	1.428	0.063	208.674	17.746	121.522	349.433	
1/31/2014	18:01	LDS	VEL-03	151.97	240	1.233	0.058	185.497	17.386	133.371	337.545	
1/31/2014	18:18	LDS	Equip Blank	atm	241	nd	nd	0.040	nd	0.449	0.489	
1/31/2014	18:45	LDS	VEL-03	0	242	1.134	0.064	196.554	18.395	140.527	356.674	
2/1/2014	11:26	LDS	VML-02-130	0	243	0.235	nd	4.030	1.876	31.120	37.260	
2/1/2014	11:31	LDS	VML-02-150	0	244	0.508	0.086	128.324	16.543	158.619	304.080	
2/1/2014	11:37	LDS	VML-02-170	0	245	0.399	0.153	254.742	61.681	666.242	983.217	
2/1/2014	11:44	LDS	VML-02-190	0	246	1.254	0.208	162.014	30.573	138.736	332.786	
2/1/2014	11:48	LDS	VEL-03	0	247	1.598	0.077	221.922	21.335	166.981	411.911	
2/1/2014	11:48	LDS	VEL-03 dup	0	248	1.405	0.074	216.889	20.780	161.303	400.451	
2/1/2014	11:57	LDS	VML-01-130	0	249	nd	nd	0.633	0.096	3.430	4.159	
2/1/2014	12:02	LDS	VML-01-150	0	250	nd	nd	0.449	0.651	13.383	14.483	
2/1/2014	12:08	LDS	VML-01-170	0	251	nd	nd	0.880	2.012	25.070	27.963	
2/1/2014	12:18	LDS	VML-01-190	0	252	nd	nd	0.269	0.703	14.475	15.448	Summa
2/1/2014	12:38	LDS	PER-14A	0	253	nd	nd	0.824	0.082	1.047	1.953	
2/1/2014	13:01	LDS	PER-14A	0	254	0.156	nd	25.669	2.809	12.487	41.122	
2/1/2014	13:08	LDS	Equip Blank	atm	255	nd	nd	0.087	0.028	0.432	0.547	
2/13/2014	11:11	EL	PER-14A	0		nd	nd	0.027	nd	0.210	0.237	
2/13/2014	13:38	EL	VEL-03	0		1.400	0.078	215.093	18.937	148.894	384.402	
2/13/2014	14:00	EL	VML-01-130	0		nd	nd	0.650	0.065	2.196	2.911	
2/13/2014	14:06	EL	VML-01-150	0		nd	nd	0.122	0.065	1.177	1.364	
2/13/2014	14:06	EL	VML-01-150D	0		nd	nd	0.114	0.068	1.200	1.383	
2/13/2014	14:13	EL	VML-01-170	0		nd	nd	0.946	2.147	25.223	28.315	
2/13/2014	14:21	EL	VML-01-190	0		nd	nd	0.213	0.686	12.479	13.379	
2/13/2014	11:38	EL	VML-02-130	0		0.240	nd	3.481	1.773	28.349	33.842	
2/13/2014	11:50	EL	VML-02-150	0		0.597	0.080	124.798	15.950	152.520	293.944	Summa
2/13/2014	12:02	EL	VML-02-170	0		0.626	0.178	263.413	60.668	564.969	889.854	
2/13/2014	12:10	EL	VML-02-190	0		1.322	0.161	163.365	23.959	136.621	325.427	
2/13/2014	11:17	EL	Equip Blank	atm		nd	nd	nd	nd	0.157	0.157	

Date Collected	Time Collected	Sampler	Well	Depth	Tedlar Bag #	Vapor Concentrations in ppmV						Summa
						1,1DCE	t1,2DCE	c1,2DCE	TCE	PCE	Total	
3/3/2014	17:13	EL	VML-01-130	0		nd	nd	0.442	0.037	1.595	2.073	
3/3/2014	17:19	EL	VML-01-150	0		nd	nd	0.151	0.154	2.283	2.587	
3/3/2014	17:26	EL	VML-01-170	0		nd	nd	0.946	2.262	25.137	28.345	
3/3/2014	17:33	EL	VML-01-190	0		nd	nd	0.303	0.703	11.615	12.621	
3/3/2014	17:59	EL	VML-02-130	0		0.242	nd	3.774	1.991	31.346	37.353	
3/3/2014		EL	VML-02-150	0		0.600	0.081	125.020	16.456	157.575	299.732	
3/3/2014	18:23	EL	VML-02-170	0		0.891	0.202	269.937	65.246	589.788	926.065	
3/3/2014	18:31	EL	VML-02-190	0		1.348	0.144	187.630	25.182	156.999	371.303	
3/3/2014	17:05	EL	PER-14A	0		nd	nd	0.323	0.036	0.666	1.024	
3/3/2014	20:02	EL	VEL-03	0		1.517	0.089	244.941	22.771	173.571	442.889	
3/3/2014	17:59	EL	VML-02-130D	0		0.235	nd	4.027	1.970	30.749	36.982	
3/3/2014	18:36	EL	Equip Blank	atm		nd	nd	0.094	0.025	0.555	0.674	


PCE
y = 1.0076x
R² = 0.9631
Field GC Tedlar Bag Concentration (ppmv)
Certified Laboratory Canister Concentration (ppmv)
1000
100
10
1
1
10
100
1000


cis-1,2-DCE
y = 0.9246x
R² = 0.9115
Field GC Tedlar Bag Concentration (ppmv)
Certified Laboratory Canister Concentration (ppmv)
1000
100
10
1
0.1
0.1
1
10
100
1000

Appendix C
Two-Region SVE Model

DESCRIPTION OF TWO-REGION SVE MODEL

Background

Historical vapor concentration data along with the extraction flow history provide a long-term, consistent data set describing the performance of an SVE system. This appendix describes a two-region model of SVE independently developed and applied by Praxis Environmental Technologies over the last decade (Stewart, 1999) to evaluate SVE performance using historical data and then to forecast future performance. The model is based on a simple mass balance within a contaminated volume. An estimate for this volume results from a fit of historical extraction data. In addition, the model can be used to estimate the residual mass at a site, quantify mass transfer constraints, and evaluate various extraction strategies. The model conceptualizes the soils of a site as either mobile (vapors flow during SVE) or immobile (vapors are stagnant during SVE). For example, a sand interval may be designated mobile while an adjacent clay is termed immobile. As described in the discussion to follow, all of the mobile soil properties and concentrations are averaged (i.e., lumped) together, all of the immobile soil properties and concentrations are averaged together, and an averaged characteristic mass transfer coefficient is assumed for the transfer of contaminant between the two soil types. Generally, multiple soil layers of various soil types exist at a site. The two-region model approach lumps all the soils into either mobile or immobile zones. The conceptual model is illustrated in Figure 1. The removal of contaminants in the mobile zone is realized instantaneously throughout the volume. The mechanisms of removal include pumping and biodegradation.

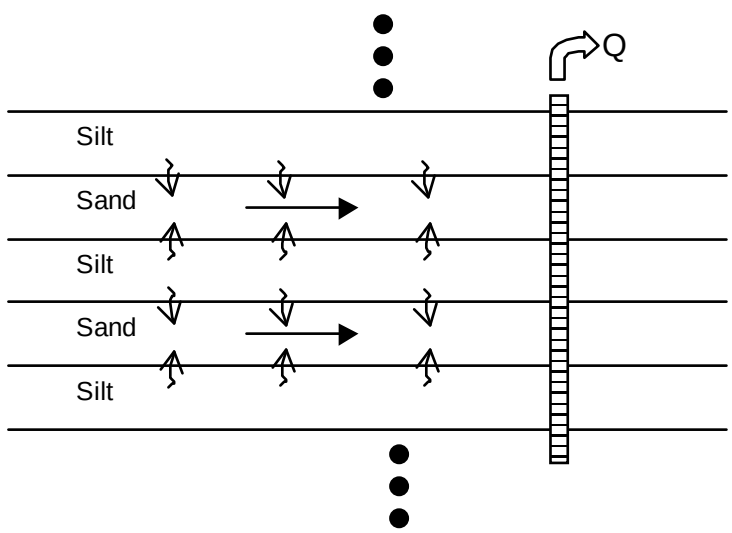


Figure 1. Conceptual Domain for SVE Modeling

Similar models have been developed in the academic literature for predicting contaminant behavior in column studies (e.g., Brusseau, 1994) but are used infrequently in SVE field practice except for trend analysis without quantification of in situ parameters. This type of model has

been used widely to evaluate disequilibrium on the pore scale (Griffioen et al., 1998). The mathematical foundations and underlying assumptions can be found in numerous texts (e.g., Lochak and Meunier, 1988). As described below, during SVE the model can be related to the soil properties, contaminant properties, contaminated volume, extraction history and mass transfer between the mobile and immobile soils on the field scale rather than the pore scale. The basic simplifying assumptions in the model are (1) soils are categorized as permeable to air flow (mobile) or not (immobile) and (2) the flushing rate of the mobile zone by clean air is rapid enough to justify averaging the contaminant concentration over the entire contaminated volume. When these assumptions are valid, the two-region approach can yield results as accurate as sophisticated numerical models. This equivalence in accuracy is achieved because the data available regarding a site is usually limited and is not sufficient to take advantage of the complexity of numerical models. This lack of data results in large uncertainties. The two-region model is much simpler to implement and therefore more cost effective to employ. Also, parametric studies with the two-region model are straightforward and rapid.

Contaminant Partitioning

In the simplest view, contaminants within the soil are partitioned among three phases if a nonaqueous phase liquid (NAPL) is not present: adsorbed to the solid matrix, dissolved in the pore water, and volatilized in the soil gas. A contaminant exists as a separate NAPL only if the total mass exceeds the solubility limits of the contaminant in the other three phases. The thermodynamic equilibrium relationships describing the partitioning among the three phases are:

$$\text{Air-Water:} \quad C_v = \frac{C_w H'}{\overline{R}T} = C_w H \tag{1}$$

$$\text{Water-Soil:} \quad C_s = C_w K_d \tag{2}$$

where C_v is the mass of contaminant per unit volume of the soil gas, C_w is the mass of contaminant per unit mass of pore water, and C_s is the mass of contaminant adsorbed to a unit mass of the solid matrix. Partitioning between the vapor and solid phases is generally small and is neglected here. The other parameters in (1) and (2) are:

H' = Henry's law constant between water and air ($\frac{\text{kPa m}^3}{\text{mol}}$)

K_d = distribution coefficient between water and solid ($\frac{\text{L}}{\text{kg}}$)

$\overline{R}$ = ideal gas constant ($0.008314 \frac{\text{kPa m}^3}{\text{mol K}}$)

T = absolute temperature of the system (K)

$H = \frac{H'}{\overline{R}T}$ = dimensionless Henry's constant at system temperature

H' is a laboratory measured property for each contaminant and is available in many reference texts. The use of Henry's law partitioning is based on the assumption that the compounds of concern are sparingly soluble in the water. This approach is not valid for compounds miscible with water. The distribution coefficient for each contaminant in each soil type can be estimated by the following empirical relationship:

$$K_d = 0.6\, f_{oc}\, K_{ow} \tag{3}$$

where:

f_{oc} = fraction of organic carbon in the soil solids
K_{ow} = octanol-water partition coefficient of the contaminant (available in reference texts)

The total contaminant mass in a specified soil volume is equal to the sum of the mass adsorbed, the mass dissolved in pore water, and the mass volatilized:

$$m_j = \left[(1-\phi_j)\rho_{s.j}C_{s,j} + \phi_j S_j C_{w,j} + \phi_j(1-S_j)C_{v,j}\right] f_j V$$

$$m_j = C_{w,j}\left[(1-\phi_j)\rho_{s.j}K_{d,j} + \phi_j S_j + \phi_j(1-S_j)H\right] f_j V$$

$$m_j = C_{v,j}\phi_j(1-S_j) f_j V\left[1 + \frac{(1-\phi_j)\rho_{s.j}K_{d,j} + \phi_j S_j}{H\phi_j(1-S_j)}\right] = C_{v,j}R_j\phi_j(1-S_j) f_j V \tag{4}$$

where j refers to either the mobile (m) or immobile (i) region in the treatment zone. The parameters are defined by:

m_j = total mass of contaminant in region j
V = total volume of soil (mobile + immobile)
f_j = fraction of the treatment volume occupied by region j ($f_m + f_i = 1$)
ϕ_j = porosity of the soil in region j
S_j = water saturation in region j
$\rho_{s,j}$ = density of the solid matrix in region j
R_j = vapor phase retardation factor = $1 + \dfrac{(1-\phi_j)\rho_{s.j}K_{d,j} + \phi_j S_j}{H\phi_j(1-S_j)}$

R_j is the vapor phase retardation factor for contaminant transport and is analogous to the well-known retardation factor for contaminant transport in the liquid phase.

Two-Region SVE Model Formulation

Removal of contaminants from the vadose zone during SVE occurs by major two mechanisms. The first is by extracting the soil gases from the mobile regions and the second is degradation of the contaminants. In the derivation below, the treatment zone is assumed to consist of a mobile (m) region and an immobile (i) region. As the concentration is reduced in the mobile region, contaminants diffuse from the immobile region into the mobile region. From a simple mass balance, the change in mass in the mobile region by these three mechanisms is described by:

$$\frac{dm_m}{dt} = -C_{v,m}Q - C_{v,m}\frac{\gamma_m S_m \phi_m}{H} f_m V - \frac{dm_i}{dt} \tag{5}$$

In the immobile region, no advection occurs and the change in mass consists of degradation and transfer with the mobile zone. These processes are described mathematically as:

$$\frac{dm_i}{dt} = -C_{v,i}\frac{\gamma_i S_i \phi_i}{H} f_i V + \alpha F \phi_i (1 - S_i) f_i V (C_{v,m} - C_{v,i}) \tag{6}$$

where:

Q = volumetric extraction rate of soil gases
t = time
γ_j = degradation decay constant in region j
α = first order mass transfer coefficient between regions m and i
F = flow configuration factor (interfacial area multiplied by contact time)

The first term in equation (5) represents the removal by pumping and the second term accounts for in situ degradation. The degradation is assumed to occur in the aqueous phase only. The third term accounts for mass transfer from the immobile regions into the mobile regions. The first term in equation (6) represents degradation in the pore water of the immobile region. The second term couples the diffusion from the immobile region to the contaminant concentration in the mobile region. The diffusion occurs only in the vapor phase in the model, although equation (6) can be formulated to include liquid diffusion if the water saturation is high in the immobile region. The retardation in the immobile region is included in the mass transfer coefficient. The mass transfer term also includes a flow configuration factor. This factor accounts for well and screen placement in relation to the contaminated volume. The mass transfer is highly dependent on the extraction well configuration because the flow over the interfacial area between the mobile and immobile zones depends on the flow configuration. For example, a well placed on the periphery of a contaminated volume would extract a great deal of dilution air versus a well placed in the center of the volume. If multiple wells operate simultaneously, stagnation zones between extraction wells are expected to have a very low effective mass transfer because vapors emanating from the immobile zone are not effectively swept away hindering further transfer. For example, two extraction wells within a source area remove less mass than either operated alone at the same total extraction rate because of the limited mass transfer in the stagnation zone created between them. In general, at a multi-well site, the flow factor must be determined empirically by operating under various extraction scenarios. For a single extraction well the

factor is effectively one since it appears as a multiplier to the mass transfer coefficient and no variation in the location of extraction is possible.

Estimates for the degradation decay constant in each region are calculated from:

$$\gamma_j = \frac{\ln(2)}{t_{1/2}} \tag{7}$$

where $t_{1/2}$ represents the biodegradation half-life of a compound in the soil. From a consideration of linear diffusion in an immobile region, the mass transfer coefficient can be initially estimated with:

$$\alpha = \frac{D(1-S_i)^{10/3} f_i^{4/3}}{R_i a^2} \tag{8}$$

where D is the vapor phase diffusion coefficient of the contaminant in air and a is the half-length over which diffusion occurs (half the thickness of the average immobile region if linear).

Equations (5) and (6) represent two, coupled first order ordinary differential equations for the mass in the mobile and immobile regions. If the extraction rate Q is constant, all coefficients in (5) and (6) are constant and the solution is straightforward to obtain given an initial concentration in each region. Solving the equations in terms of the vapor concentrations by utilizing equation (4) and designating the initial average vapor contaminant concentration in each region as $C_{v,mo}$ and $C_{v,io}$ at some initial time t_0 yields:

$$C_{v,m} = \Theta_1 e^{r_1(t-t_0)} + \Theta_2 e^{r_2(t-t_0)} \tag{9}$$

$$C_{v,i} = \Theta_1 \omega_1 e^{r_1(t-t_0)} + \Theta_2 \omega_2 e^{r_2(t-t_0)} \tag{10}$$

where:

$$\Theta_1 = \frac{C_{v,io} - \omega_2 C_{v,mo}}{\omega_1 - \omega_2}$$

$$\Theta_2 = \frac{C_{v,io} - \omega_1 C_{v,mo}}{\omega_1 - \omega_2}$$

$$\omega_1 = \frac{R_m r_1 + \Theta + \alpha F \Phi}{\Phi(\Gamma_i + \alpha F)}$$

$$\omega_2 = \frac{R_m r_2 + \Theta + \alpha F \Phi}{\Phi(\Gamma_i + \alpha F)}$$

$$\Theta = \frac{Q}{\phi_m (1 - S_m) f_m V} + \Gamma_m$$

$$\Phi = \frac{\phi_i (1 - S_i) f_i}{\phi_m (1 - S_m) f_m}$$

$$\Gamma_j = \frac{\gamma_j S_j}{H(1 - S_j)}$$

$$r_1 = \frac{-b + \sqrt{b^2 - 4R_m R_i \Theta(\alpha F + \Gamma_i)}}{2R_m R_i}$$

$$r_2 = \frac{-b - \sqrt{b^2 - 4R_m R_i \Theta(\alpha F + \Gamma_i)}}{2R_m R_i}$$

$$b = R_m(\alpha F + \Gamma_i) + R_i(\Theta + \Phi \alpha F)$$

Equations (9) and (10) are simple to use for calculating contaminant extraction rates, cleanup times, etc. The mobile zone concentration is equal to the extracted concentration by definition. The equations are simple to use for a parametric study of the input variables or for history-matching. History-matching yields a calibration of the input parameters which then generates estimates for the residual mass and cleanup times. The solution slightly under predicts early extraction rates (because of averaging the initial contaminant distribution) but can be very accurate over longer periods when mass transfer constraints (i.e., diffusion) dominates. This mass transfer determines the ultimate cleanup time.

Additional Discussion

In most practical cases, a variable extraction rate is employed because of the diffusion limitations. Equations (5) and (6) can be readily solved for the variable extraction rate, though not in the simple form of equations (9) and (10). If the time variation of Q is a smooth function, equations (5) and (6) can be solved using a straightforward numerical ODE solver. However, if the variation of Q can be described by a series of step functions as is the usual case, then an analytical solution may be obtained. The steady flow solution is used to describe the extraction rate during each period and when a step change occurs, the ending concentrations are used as the initial condition for the next extraction period. As an example consider a three step variation in Q describing an initial period of extraction, shutting off the extraction, followed by a resumption in the extraction at a different rate:

$$Q = Q_1 \quad \text{for } 0 < t \leq t_1$$
$$Q = 0 \quad \text{for } t_1 < t \leq t_2$$
$$Q = Q_2 \quad \text{for } t > t_2$$

This situation commonly occurs in practice and represents a rebound test.

Additional complexities can be included in the model if warranted by additional data. For instance, if a NAPL is identified or partitioning calculations suggest its presence, a second mass transfer constraint can be added to account for the mass transfer during NAPL evaporation. Similarly, off gassing from groundwater can be included if volatilization of contaminants from groundwater is significant.

In the early days of SVE, sites were often described solely by the initial convective exponential decay ignoring a determination of the longer transient associated with the diffusive component. Neglecting the contribution of the immobile zone resulted in vastly underestimating the time to reach a specified cleanup goal and the total mass of contaminant at the site.

For most sites, the two-region model is first run using measured soil properties (e.g., moisture content, porosity, etc.), contaminant properties, and the extraction history. Parameters which are varied to obtain a best fit to the extraction concentration history are usually:

- Total Volume of Contaminated Soil;
- Fractions of the Contaminated Volume Classified as either Mobile or Immobile;
- Initial Concentration in the Immobile Soil; and
- Mass Transfer Coefficient between Mobile and Immobile Zones.

The results of the history matching are then the four parameters listed above and the total mass in the soil which is calculated from these parameters.

References

Brusseau, M.L., "Evaluation of Simple Methods for Estimating Contaminant Removal by Flushing," *Ground Water*, Vol. 34, No. 1, pp. 19-22, 1996.

Griffioen, J.W., D.A. Barry, and J.-Y. Parlange, "Interpretation of two-region model parameters," *Water Resources Research*, Vol. 34, No. 3, pp. 373-384, 1998.

Lochak, P. and C. Meunier, Multiphase Averaging for Classical Systems With Applications to Adiabatic Theorems, Springer-Verlag, 349 pp., 1988.

Stewart, L.D., "Analytical modeling of contaminant vapor extraction from heterogeneous soils," Manuscript prepared for submission to *Water Resources Research*, 1999.

Attachment B

Manual Field Measurements

Lower Vadose Zone SVE Pilot Test Technical Memorandum

PARK EUCLID WQARF SITE

Measurement Info			Vacuum Measurement (+/-) (Inches W.C.) [2]											Vapor Concentrations by Photoionization Detector (ppm)										
Type	Date	Time[1]	VEL-3	VML-02 [3]				PER-14A	VML-01				WR-347B	VEL-3	VML-02 [3]				PER-14A	VML-01				WR-347B
				130	150	170	190		130	150	170	190			130	150	170	190		130	150	170	190	
Baseline	1/27/14	11:30																			103.6	1.9	3.4	
	1/27/14	12:15													53.9	606.5	1375.9	484.6						
	1/27/14	13:49																	19.5					
	1/27/14	14:00	2.14	2.10	2.07	2.08	2.08		2.11	2.06	2.04	2.06	1.17											
Step-Down	1/28/14	8:30							0.00	0.00	0.03	0.00	0.06							16.2	13.0	157.8	5.6	0.0
	1/28/14	10:54	25																					
	1/28/14	11:20	20																					
	1/28/14	11:35	16.5						0.06	0.49	0.70	1.06	-0.20							9.4	0.3	0.9	2.5	0.3
	1/28/14	11:40	12.5																					
	1/28/14	11:46	9.3																					
	1/28/14	11:55	25																					
SVE Test	1/28/14	12:18												1213.9										
	1/28/14	13:32												1252.3										
	1/28/14	14:30							-0.40	-0.37	-0.35	-0.16	-0.11							14.6	1.2	189.1	3.0	0.0
	1/28/14	15:50							-0.29	0.23	0.45	1.05	-0.13	1262.3						16.1	0.0	0.5	0.0	0.0
	1/28/14	16:45							-0.05	0.51	0.74	1.34	-0.05	1288.0						16.1	0.0	0.0	0.0	0.0
	1/29/14	9:00							1.36	1.96	2.19	2.76	0.34	1273.6						0.2	0.1	0.0	0.0	0.2
	1/29/14	14:30							0.84	1.37	1.56	2.30	0.28	1214.4						0.0	0.0	0.0	0.0	0.0
	1/29/14	22:30							0.16	0.44	0.56	0.68	0.07							0.7	0.0	0.7	0.0	0.0
	1/30/14	9:45							1.15	1.66	1.87	2.56	0.36	674.4						0.4	0.3	0.4	0.2	0.4
	1/30/14	15:30							-0.36	0.15	0.33	1.09	-0.20	656.3						1.8	0.6	0.5	0.3	0.4
	1/30/14	22:05							0.25	0.76	0.95	1.66	0.00	619.6						2.2	0.5	0.5	0.3	0.0
	1/31/14	7:30						0.28	0.37	0.87	1.05	1.79	0.05	712.4					4.3	0.2	0.1	0.2	0.1	0.4
	1/31/14	15:30						0.08	-0.05	0.42	0.48	1.42	-0.08	643.5					2.8	1.9	0.2	0.2	0.1	0.0
Post Test	2/1/14	11:20						0.00	-0.42	-0.44	-0.42	-0.43	0.00											

[1] The time listed is an approximate time representing when the vacuum/pressure reading for the pilot test were measured at the set of wells in the study.

[2] Negative vacuum measurementss denote a positive pressure.

[3] Data was collected using a datalogger (not manually) at VEL-03 and the VML-02 cluster.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Tel: (916)373-5600

TestAmerica Job ID: 320-5954-1
Client Project/Site: Park-Euclid WQARF Site

For:
URS Corporation
8181 East Tufts Ave.
Denver, Colorado 80237

Attn: Mr. Robert Boudra

Authorized for release by:
2/18/2014 1:13:10 PM

Laura Turpen, Project Manager II
(916)373-5600
laura.turpen@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Cover Page 1
Table of Contents 2
Definitions/Glossary 3
Case Narrative 4
Detection Summary 5
Client Sample Results 9
Surrogate Summary 54
QC Sample Results 55
QC Association Summary 76
Lab Chronicle 77
Certification Summary 80
Method Summary 81
Sample Summary 82
Chain of Custody 83
Field Data Sheets 85
Receipt Checklists 99
Clean Canister Certification 100
Pre-Ship Certification 100
Clean Canister Data 102

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 320-5954-1

Laboratory: TestAmerica Sacramento

Narrative

Receipt
The samples were received on 2/4/2014 9:15 AM; the samples arrived in good condition.

Air - GC/MS VOA
Method(s) TO-15: The following sample was diluted due to the abundance of non-target analytes: ambient-VPT-012714 (320-5954-1).
Elevated reporting limits (RLs) are provided.

No other analytical or quality issues were noted.

VOA Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Detection Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Client Sample ID: ambient-VPT-012714 — Lab Sample ID: 320-5954-1

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Acetone	330		250		ppb v/v	49.8		TO-15	Total/NA
Cyclohexane	29		20		ppb v/v	49.8		TO-15	Total/NA
Ethyl acetate	300		15		ppb v/v	49.8		TO-15	Total/NA
Toluene	150		20		ppb v/v	49.8		TO-15	Total/NA
m,p-Xylene	73		40		ppb v/v	49.8		TO-15	Total/NA
o-Xylene	25		20		ppb v/v	49.8		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Acetone	780		590		ug/m3	49.8		TO-15	Total/NA
Cyclohexane	100		69		ug/m3	49.8		TO-15	Total/NA
Ethyl acetate	1100		54		ug/m3	49.8		TO-15	Total/NA
Toluene	550		75		ug/m3	49.8		TO-15	Total/NA
m,p-Xylene	310		170		ug/m3	49.8		TO-15	Total/NA
o-Xylene	110		86		ug/m3	49.8		TO-15	Total/NA

Client Sample ID: VML-02-190-VPT-012714 — Lab Sample ID: 320-5954-2

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	250000		2000		ppb v/v	5020		TO-15	Total/NA
Tetrachloroethene	190000		2000		ppb v/v	5020		TO-15	Total/NA
Trichloroethene	24000		2000		ppb v/v	5020		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1000000		8000		ug/m3	5020		TO-15	Total/NA
Tetrachloroethene	1300000		14000		ug/m3	5020		TO-15	Total/NA
Trichloroethene	130000		11000		ug/m3	5020		TO-15	Total/NA

Client Sample ID: PER-14A-178-VPT-012714 — Lab Sample ID: 320-5954-3

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	100000		2000		ppb v/v	5060		TO-15	Total/NA
Trichloroethene	18000		2000		ppb v/v	5060		TO-15	Total/NA
cis-1,2-Dichloroethene - DL	570000		5000		ppb v/v	12600		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	700000		14000		ug/m3	5060		TO-15	Total/NA
Trichloroethene	98000		11000		ug/m3	5060		TO-15	Total/NA
cis-1,2-Dichloroethene - DL	2300000		20000		ug/m3	12600		TO-15	Total/NA

Client Sample ID: PER-14A-192-VPT-012714 — Lab Sample ID: 320-5954-4

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	280000		2000		ppb v/v	5120		TO-15	Total/NA
Tetrachloroethene	100000		2000		ppb v/v	5120		TO-15	Total/NA
Trichloroethene	16000		2000		ppb v/v	5120		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1100000		8100		ug/m3	5120		TO-15	Total/NA
Tetrachloroethene	700000		14000		ug/m3	5120		TO-15	Total/NA
Trichloroethene	83000		11000		ug/m3	5120		TO-15	Total/NA

Client Sample ID: PER-14A-197-VPT-012714 — Lab Sample ID: 320-5954-5

This Detection Summary does not include radiochemical test results.

Client Sample ID: PER-14A-197-VPT-012714 (Continued) — Lab Sample ID: 320-5954-5

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	220000		2100	ppb v/v	5160		TO-15	Total/NA
Tetrachloroethene	92000		2100	ppb v/v	5160		TO-15	Total/NA
Trichloroethene	13000		2100	ppb v/v	5160		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	850000		8200	ug/m3	5160		TO-15	Total/NA
Tetrachloroethene	630000		14000	ug/m3	5160		TO-15	Total/NA
Trichloroethene	70000		11000	ug/m3	5160		TO-15	Total/NA

Client Sample ID: STEPTEST-VPT-012814 — Lab Sample ID: 320-5954-6

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	350000		3000	ppb v/v	7560		TO-15	Total/NA
Tetrachloroethene	230000		3000	ppb v/v	7560		TO-15	Total/NA
Toluene	3800		3000	ppb v/v	7560		TO-15	Total/NA
Trichloroethene	29000		3000	ppb v/v	7560		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1400000		12000	ug/m3	7560		TO-15	Total/NA
Tetrachloroethene	1600000		21000	ug/m3	7560		TO-15	Total/NA
Toluene	14000		11000	ug/m3	7560		TO-15	Total/NA
Trichloroethene	160000		16000	ug/m3	7560		TO-15	Total/NA

Client Sample ID: VEL-3-190-VPT-012814 — Lab Sample ID: 320-5954-7

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	110000		1600	ppb v/v	4000		TO-15	Total/NA
Tetrachloroethene	130000		1600	ppb v/v	4000		TO-15	Total/NA
Trichloroethene	13000		1600	ppb v/v	4000		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	440000		6300	ug/m3	4000		TO-15	Total/NA
Tetrachloroethene	890000		11000	ug/m3	4000		TO-15	Total/NA
Trichloroethene	69000		8600	ug/m3	4000		TO-15	Total/NA

Client Sample ID: VEL-3-175-VPT-012814 — Lab Sample ID: 320-5954-8

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	330000		2400	ppb v/v	6000		TO-15	Total/NA
Tetrachloroethene	170000		2400	ppb v/v	6000		TO-15	Total/NA
Trichloroethene	22000		2400	ppb v/v	6000		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1300000		9500	ug/m3	6000		TO-15	Total/NA
Tetrachloroethene	1200000		16000	ug/m3	6000		TO-15	Total/NA
Trichloroethene	120000		13000	ug/m3	6000		TO-15	Total/NA

Client Sample ID: VEL-3-160-VPT-012814 — Lab Sample ID: 320-5954-9

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	330000		2400	ppb v/v	6080		TO-15	Total/NA
Tetrachloroethene	220000		2400	ppb v/v	6080		TO-15	Total/NA
Trichloroethene	28000		2400	ppb v/v	6080		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: VEL-3-160-VPT-012814 (Continued) — Lab Sample ID: 320-5954-9

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1300000		9600		ug/m3	6080		TO-15	Total/NA
Tetrachloroethene	1500000		16000		ug/m3	6080		TO-15	Total/NA
Trichloroethene	150000		13000		ug/m3	6080		TO-15	Total/NA

Client Sample ID: VML-02-SVE170-VPT-012914 — Lab Sample ID: 320-5954-10

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	470000		5200		ppb v/v	12900		TO-15	Total/NA
Tetrachloroethene	670000		5200		ppb v/v	12900		TO-15	Total/NA
Trichloroethene	83000		5200		ppb v/v	12900		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1800000		20000		ug/m3	12900		TO-15	Total/NA
Tetrachloroethene	4500000		35000		ug/m3	12900		TO-15	Total/NA
Trichloroethene	450000		28000		ug/m3	12900		TO-15	Total/NA

Client Sample ID: VML-01-SVE170-VPT-013014 — Lab Sample ID: 320-5954-11

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	2000		330		ppb v/v	832		TO-15	Total/NA
Tetrachloroethene	39000		330		ppb v/v	832		TO-15	Total/NA
Toluene	830		330		ppb v/v	832		TO-15	Total/NA
Trichloroethene	3300		330		ppb v/v	832		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	7900		1300		ug/m3	832		TO-15	Total/NA
Tetrachloroethene	260000		2300		ug/m3	832		TO-15	Total/NA
Toluene	3100		1300		ug/m3	832		TO-15	Total/NA
Trichloroethene	18000		1800		ug/m3	832		TO-15	Total/NA

Client Sample ID: VML-02-SVE150-VPT-013014 — Lab Sample ID: 320-5954-12

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	130000		2000		ppb v/v	5000		TO-15	Total/NA
Tetrachloroethene	190000		2000		ppb v/v	5000		TO-15	Total/NA
Trichloroethene	18000		2000		ppb v/v	5000		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	530000		7900		ug/m3	5000		TO-15	Total/NA
Tetrachloroethene	1300000		14000		ug/m3	5000		TO-15	Total/NA
Trichloroethene	96000		11000		ug/m3	5000		TO-15	Total/NA

Client Sample ID: VML-02-SVE190-013114 — Lab Sample ID: 320-5954-13

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	150000		2000		ppb v/v	5000		TO-15	Total/NA
Tetrachloroethene	130000		2000		ppb v/v	5000		TO-15	Total/NA
Trichloroethene	29000		2000		ppb v/v	5000		TO-15	Total/NA
Vinyl chloride	4300		2000		ppb v/v	5000		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	590000		7900		ug/m3	5000		TO-15	Total/NA
Tetrachloroethene	860000		14000		ug/m3	5000		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: VML-02-SVE190-013114 (Continued) — Lab Sample ID: 320-5954-13

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Trichloroethene	150000		11000		ug/m3	5000		TO-15	Total/NA
Vinyl chloride	11000		5100		ug/m3	5000		TO-15	Total/NA

Client Sample ID: VML-01-RB190-VPT-020114 — Lab Sample ID: 320-5954-14

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Acetone	2400		2100		ppb v/v	418		TO-15	Total/NA
Cyclohexane	180		170		ppb v/v	418		TO-15	Total/NA
cis-1,2-Dichloroethene	500		170		ppb v/v	418		TO-15	Total/NA
Tetrachloroethene	19000		170		ppb v/v	418		TO-15	Total/NA
Toluene	1300		170		ppb v/v	418		TO-15	Total/NA
Trichloroethene	1100		170		ppb v/v	418		TO-15	Total/NA
m,p-Xylene	590		330		ppb v/v	418		TO-15	Total/NA
o-Xylene	180		170		ppb v/v	418		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Acetone	5800		5000		ug/m3	418		TO-15	Total/NA
Cyclohexane	630		580		ug/m3	418		TO-15	Total/NA
cis-1,2-Dichloroethene	2000		660		ug/m3	418		TO-15	Total/NA
Tetrachloroethene	130000		1100		ug/m3	418		TO-15	Total/NA
Toluene	4900		630		ug/m3	418		TO-15	Total/NA
Trichloroethene	6000		900		ug/m3	418		TO-15	Total/NA
m,p-Xylene	2600		1500		ug/m3	418		TO-15	Total/NA
o-Xylene	760		730		ug/m3	418		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Client Sample ID: ambient-VPT-012714

Lab Sample ID: 320-5954-1

Date Collected: 01/27/14 10:31
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**330**		250		ppb v/v			02/15/14 22:02	49.8
Allyl chloride	ND		40		ppb v/v			02/15/14 22:02	49.8
Benzene	ND		20		ppb v/v			02/15/14 22:02	49.8
Benzyl chloride	ND		40		ppb v/v			02/15/14 22:02	49.8
Bromodichloromethane	ND		15		ppb v/v			02/15/14 22:02	49.8
Bromoform	ND		20		ppb v/v			02/15/14 22:02	49.8
Bromomethane	ND		40		ppb v/v			02/15/14 22:02	49.8
1,3-Butadiene	ND		40		ppb v/v			02/15/14 22:02	49.8
2-Butanone (MEK)	ND		40		ppb v/v			02/15/14 22:02	49.8
n-Butylbenzene	ND		20		ppb v/v			02/15/14 22:02	49.8
sec-Butylbenzene	ND		20		ppb v/v			02/15/14 22:02	49.8
tert-Butylbenzene	ND		40		ppb v/v			02/15/14 22:02	49.8
Carbon disulfide	ND		40		ppb v/v			02/15/14 22:02	49.8
Carbon tetrachloride	ND		40		ppb v/v			02/15/14 22:02	49.8
Chlorobenzene	ND		15		ppb v/v			02/15/14 22:02	49.8
Chloroethane	ND		40		ppb v/v			02/15/14 22:02	49.8
Chloroform	ND		15		ppb v/v			02/15/14 22:02	49.8
Chloromethane	ND		40		ppb v/v			02/15/14 22:02	49.8
Cyclohexane	**29**		20		ppb v/v			02/15/14 22:02	49.8
Dibromochloromethane	ND		20		ppb v/v			02/15/14 22:02	49.8
1,2-Dibromoethane (EDB)	ND		40		ppb v/v			02/15/14 22:02	49.8
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		20		ppb v/v			02/15/14 22:02	49.8
1,2-Dichlorobenzene	ND		20		ppb v/v			02/15/14 22:02	49.8
1,3-Dichlorobenzene	ND		20		ppb v/v			02/15/14 22:02	49.8
1,4-Dichlorobenzene	ND		20		ppb v/v			02/15/14 22:02	49.8
Dichlorodifluoromethane	ND		20		ppb v/v			02/15/14 22:02	49.8
1,1-Dichloroethane	ND		15		ppb v/v			02/15/14 22:02	49.8
1,2-Dichloroethane	ND		40		ppb v/v			02/15/14 22:02	49.8
1,1-Dichloroethene	ND		40		ppb v/v			02/15/14 22:02	49.8
cis-1,2-Dichloroethene	ND		20		ppb v/v			02/15/14 22:02	49.8
trans-1,2-Dichloroethene	ND		20		ppb v/v			02/15/14 22:02	49.8
1,2-Dichloropropane	ND		20		ppb v/v			02/15/14 22:02	49.8
cis-1,3-Dichloropropene	ND		20		ppb v/v			02/15/14 22:02	49.8
trans-1,3-Dichloropropene	ND		20		ppb v/v			02/15/14 22:02	49.8
Ethyl acetate	**300**		15		ppb v/v			02/15/14 22:02	49.8
Ethylbenzene	ND		20		ppb v/v			02/15/14 22:02	49.8
4-Ethyltoluene	ND		20		ppb v/v			02/15/14 22:02	49.8
n-Heptane	ND		40		ppb v/v			02/15/14 22:02	49.8
Hexachlorobutadiene	ND		100		ppb v/v			02/15/14 22:02	49.8
n-Hexane	ND		40		ppb v/v			02/15/14 22:02	49.8
2-Hexanone	ND		20		ppb v/v			02/15/14 22:02	49.8
Isopropylbenzene	ND		40		ppb v/v			02/15/14 22:02	49.8
Methyl-t-Butyl Ether (MTBE)	ND		40		ppb v/v			02/15/14 22:02	49.8
4-Methyl-2-pentanone (MIBK)	ND		20		ppb v/v			02/15/14 22:02	49.8
Methylene chloride	ND		20		ppb v/v			02/15/14 22:02	49.8
Naphthalene	ND		40		ppb v/v			02/15/14 22:02	49.8
n-Octane	ND		20		ppb v/v			02/15/14 22:02	49.8
Propene	ND		20		ppb v/v			02/15/14 22:02	49.8

Client Sample ID: ambient-VPT-012714

Lab Sample ID: 320-5954-1

Date Collected: 01/27/14 10:31

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
n-Propylbenzene	ND		20	ppb v/v			02/15/14 22:02	49.8
Styrene	ND		20	ppb v/v			02/15/14 22:02	49.8
1,1,2,2-Tetrachloroethane	ND		20	ppb v/v			02/15/14 22:02	49.8
Tetrachloroethene	ND		20	ppb v/v			02/15/14 22:02	49.8
Tetrahydrofuran	ND		40	ppb v/v			02/15/14 22:02	49.8
Toluene	**150**		20	ppb v/v			02/15/14 22:02	49.8
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		20	ppb v/v			02/15/14 22:02	49.8
1,2,4-Trichlorobenzene	ND		100	ppb v/v			02/15/14 22:02	49.8
1,1,1-Trichloroethane	ND		15	ppb v/v			02/15/14 22:02	49.8
1,1,2-Trichloroethane	ND		20	ppb v/v			02/15/14 22:02	49.8
Trichloroethene	ND		20	ppb v/v			02/15/14 22:02	49.8
Trichlorofluoromethane	ND		20	ppb v/v			02/15/14 22:02	49.8
1,2,4-Trimethylbenzene	ND		40	ppb v/v			02/15/14 22:02	49.8
1,3,5-Trimethylbenzene	ND		20	ppb v/v			02/15/14 22:02	49.8
2,2,4-Trimethylpentane	ND		20	ppb v/v			02/15/14 22:02	49.8
Vinyl acetate	ND		40	ppb v/v			02/15/14 22:02	49.8
Vinyl bromide	ND		40	ppb v/v			02/15/14 22:02	49.8
Vinyl chloride	ND		20	ppb v/v			02/15/14 22:02	49.8
m,p-Xylene	**73**		40	ppb v/v			02/15/14 22:02	49.8
o-Xylene	**25**		20	ppb v/v			02/15/14 22:02	49.8
2-Propanol	ND		100	ppb v/v			02/15/14 22:02	49.8
n-Nonane	ND		40	ppb v/v			02/15/14 22:02	49.8

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**780**		590	ug/m3			02/15/14 22:02	49.8
Allyl chloride	ND		120	ug/m3			02/15/14 22:02	49.8
Benzene	ND		64	ug/m3			02/15/14 22:02	49.8
Benzyl chloride	ND		210	ug/m3			02/15/14 22:02	49.8
Bromodichloromethane	ND		100	ug/m3			02/15/14 22:02	49.8
Bromoform	ND		210	ug/m3			02/15/14 22:02	49.8
Bromomethane	ND		150	ug/m3			02/15/14 22:02	49.8
1,3-Butadiene	ND		88	ug/m3			02/15/14 22:02	49.8
2-Butanone (MEK)	ND		120	ug/m3			02/15/14 22:02	49.8
n-Butylbenzene	ND		110	ug/m3			02/15/14 22:02	49.8
sec-Butylbenzene	ND		110	ug/m3			02/15/14 22:02	49.8
tert-Butylbenzene	ND		220	ug/m3			02/15/14 22:02	49.8
Carbon disulfide	ND		120	ug/m3			02/15/14 22:02	49.8
Carbon tetrachloride	ND		250	ug/m3			02/15/14 22:02	49.8
Chlorobenzene	ND		69	ug/m3			02/15/14 22:02	49.8
Chloroethane	ND		110	ug/m3			02/15/14 22:02	49.8
Chloroform	ND		73	ug/m3			02/15/14 22:02	49.8
Chloromethane	ND		82	ug/m3			02/15/14 22:02	49.8
Cyclohexane	**100**		69	ug/m3			02/15/14 22:02	49.8
Dibromochloromethane	ND		170	ug/m3			02/15/14 22:02	49.8
1,2-Dibromoethane (EDB)	ND		310	ug/m3			02/15/14 22:02	49.8
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		140	ug/m3			02/15/14 22:02	49.8
1,2-Dichlorobenzene	ND		120	ug/m3			02/15/14 22:02	49.8
1,3-Dichlorobenzene	ND		120	ug/m3			02/15/14 22:02	49.8
1,4-Dichlorobenzene	ND		120	ug/m3			02/15/14 22:02	49.8

Client Sample ID: ambient-VPT-012714

Lab Sample ID: 320-5954-1

Date Collected: 01/27/14 10:31

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Dichlorodifluoromethane	ND		99		ug/m3			02/15/14 22:02	49.8
1,1-Dichloroethane	ND		60		ug/m3			02/15/14 22:02	49.8
1,2-Dichloroethane	ND		160		ug/m3			02/15/14 22:02	49.8
1,1-Dichloroethene	ND		160		ug/m3			02/15/14 22:02	49.8
cis-1,2-Dichloroethene	ND		79		ug/m3			02/15/14 22:02	49.8
trans-1,2-Dichloroethene	ND		79		ug/m3			02/15/14 22:02	49.8
1,2-Dichloropropane	ND		92		ug/m3			02/15/14 22:02	49.8
cis-1,3-Dichloropropene	ND		90		ug/m3			02/15/14 22:02	49.8
trans-1,3-Dichloropropene	ND		90		ug/m3			02/15/14 22:02	49.8
Ethyl acetate	**1100**		54		ug/m3			02/15/14 22:02	49.8
Ethylbenzene	ND		86		ug/m3			02/15/14 22:02	49.8
4-Ethyltoluene	ND		98		ug/m3			02/15/14 22:02	49.8
n-Heptane	ND		160		ug/m3			02/15/14 22:02	49.8
Hexachlorobutadiene	ND		1100		ug/m3			02/15/14 22:02	49.8
n-Hexane	ND		140		ug/m3			02/15/14 22:02	49.8
2-Hexanone	ND		82		ug/m3			02/15/14 22:02	49.8
Isopropylbenzene	ND		200		ug/m3			02/15/14 22:02	49.8
Methyl-t-Butyl Ether (MTBE)	ND		140		ug/m3			02/15/14 22:02	49.8
4-Methyl-2-pentanone (MIBK)	ND		82		ug/m3			02/15/14 22:02	49.8
Methylene chloride	ND		69		ug/m3			02/15/14 22:02	49.8
Naphthalene	ND		210		ug/m3			02/15/14 22:02	49.8
n-Octane	ND		93		ug/m3			02/15/14 22:02	49.8
Propene	ND		34		ug/m3			02/15/14 22:02	49.8
n-Propylbenzene	ND		98		ug/m3			02/15/14 22:02	49.8
Styrene	ND		85		ug/m3			02/15/14 22:02	49.8
1,1,2,2-Tetrachloroethane	ND		140		ug/m3			02/15/14 22:02	49.8
Tetrachloroethene	ND		140		ug/m3			02/15/14 22:02	49.8
Tetrahydrofuran	ND		120		ug/m3			02/15/14 22:02	49.8
Toluene	**550**		75		ug/m3			02/15/14 22:02	49.8
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		150		ug/m3			02/15/14 22:02	49.8
1,2,4-Trichlorobenzene	ND		740		ug/m3			02/15/14 22:02	49.8
1,1,1-Trichloroethane	ND		82		ug/m3			02/15/14 22:02	49.8
1,1,2-Trichloroethane	ND		110		ug/m3			02/15/14 22:02	49.8
Trichloroethene	ND		110		ug/m3			02/15/14 22:02	49.8
Trichlorofluoromethane	ND		110		ug/m3			02/15/14 22:02	49.8
1,2,4-Trimethylbenzene	ND		200		ug/m3			02/15/14 22:02	49.8
1,3,5-Trimethylbenzene	ND		98		ug/m3			02/15/14 22:02	49.8
2,2,4-Trimethylpentane	ND		93		ug/m3			02/15/14 22:02	49.8
Vinyl acetate	ND		140		ug/m3			02/15/14 22:02	49.8
Vinyl bromide	ND		170		ug/m3			02/15/14 22:02	49.8
Vinyl chloride	ND		51		ug/m3			02/15/14 22:02	49.8
m,p-Xylene	**310**		170		ug/m3			02/15/14 22:02	49.8
o-Xylene	**110**		86		ug/m3			02/15/14 22:02	49.8
2-Propanol	ND		240		ug/m3			02/15/14 22:02	49.8
n-Nonane	ND		210		ug/m3			02/15/14 22:02	49.8

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*107*		*70 - 130*		*02/15/14 22:02*	*49.8*
1,2-Dichloroethane-d4 (Surr)	*98*		*70 - 130*		*02/15/14 22:02*	*49.8*

Client Sample ID: ambient-VPT-012714

Lab Sample ID: 320-5954-1

Date Collected: 01/27/14 10:31
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Toluene-d8 (Surr)	106		70 - 130		02/15/14 22:02	49.8

Client Sample ID: VML-02-190-VPT-012714

Lab Sample ID: 320-5954-2

Date Collected: 01/27/14 12:53
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		25000	ppb v/v			02/15/14 22:51	5020
Allyl chloride	ND		4000	ppb v/v			02/15/14 22:51	5020
Benzene	ND		2000	ppb v/v			02/15/14 22:51	5020
Benzyl chloride	ND		4000	ppb v/v			02/15/14 22:51	5020
Bromodichloromethane	ND		1500	ppb v/v			02/15/14 22:51	5020
Bromoform	ND		2000	ppb v/v			02/15/14 22:51	5020
Bromomethane	ND		4000	ppb v/v			02/15/14 22:51	5020
1,3-Butadiene	ND		4000	ppb v/v			02/15/14 22:51	5020
2-Butanone (MEK)	ND		4000	ppb v/v			02/15/14 22:51	5020
n-Butylbenzene	ND		2000	ppb v/v			02/15/14 22:51	5020
sec-Butylbenzene	ND		2000	ppb v/v			02/15/14 22:51	5020
tert-Butylbenzene	ND		4000	ppb v/v			02/15/14 22:51	5020
Carbon disulfide	ND		4000	ppb v/v			02/15/14 22:51	5020
Carbon tetrachloride	ND		4000	ppb v/v			02/15/14 22:51	5020
Chlorobenzene	ND		1500	ppb v/v			02/15/14 22:51	5020
Chloroethane	ND		4000	ppb v/v			02/15/14 22:51	5020
Chloroform	ND		1500	ppb v/v			02/15/14 22:51	5020
Chloromethane	ND		4000	ppb v/v			02/15/14 22:51	5020
Cyclohexane	ND		2000	ppb v/v			02/15/14 22:51	5020
Dibromochloromethane	ND		2000	ppb v/v			02/15/14 22:51	5020
1,2-Dibromoethane (EDB)	ND		4000	ppb v/v			02/15/14 22:51	5020
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2000	ppb v/v			02/15/14 22:51	5020
1,2-Dichlorobenzene	ND		2000	ppb v/v			02/15/14 22:51	5020
1,3-Dichlorobenzene	ND		2000	ppb v/v			02/15/14 22:51	5020
1,4-Dichlorobenzene	ND		2000	ppb v/v			02/15/14 22:51	5020
Dichlorodifluoromethane	ND		2000	ppb v/v			02/15/14 22:51	5020
1,1-Dichloroethane	ND		1500	ppb v/v			02/15/14 22:51	5020
1,2-Dichloroethane	ND		4000	ppb v/v			02/15/14 22:51	5020
1,1-Dichloroethene	ND		4000	ppb v/v			02/15/14 22:51	5020
cis-1,2-Dichloroethene	**250000**		2000	ppb v/v			02/15/14 22:51	5020
trans-1,2-Dichloroethene	ND		2000	ppb v/v			02/15/14 22:51	5020
1,2-Dichloropropane	ND		2000	ppb v/v			02/15/14 22:51	5020
cis-1,3-Dichloropropene	ND		2000	ppb v/v			02/15/14 22:51	5020
trans-1,3-Dichloropropene	ND		2000	ppb v/v			02/15/14 22:51	5020
Ethyl acetate	ND		1500	ppb v/v			02/15/14 22:51	5020
Ethylbenzene	ND		2000	ppb v/v			02/15/14 22:51	5020
4-Ethyltoluene	ND		2000	ppb v/v			02/15/14 22:51	5020
n-Heptane	ND		4000	ppb v/v			02/15/14 22:51	5020
Hexachlorobutadiene	ND		10000	ppb v/v			02/15/14 22:51	5020

Client Sample ID: VML-02-190-VPT-012714 **Lab Sample ID: 320-5954-2**

Date Collected: 01/27/14 12:53 **Matrix: Air**

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
n-Hexane	ND		4000		ppb v/v			02/15/14 22:51	5020
2-Hexanone	ND		2000		ppb v/v			02/15/14 22:51	5020
Isopropylbenzene	ND		4000		ppb v/v			02/15/14 22:51	5020
Methyl-t-Butyl Ether (MTBE)	ND		4000		ppb v/v			02/15/14 22:51	5020
4-Methyl-2-pentanone (MIBK)	ND		2000		ppb v/v			02/15/14 22:51	5020
Methylene chloride	ND		2000		ppb v/v			02/15/14 22:51	5020
Naphthalene	ND		4000		ppb v/v			02/15/14 22:51	5020
n-Octane	ND		2000		ppb v/v			02/15/14 22:51	5020
Propene	ND		2000		ppb v/v			02/15/14 22:51	5020
n-Propylbenzene	ND		2000		ppb v/v			02/15/14 22:51	5020
Styrene	ND		2000		ppb v/v			02/15/14 22:51	5020
1,1,2,2-Tetrachloroethane	ND		2000		ppb v/v			02/15/14 22:51	5020
Tetrachloroethene	**190000**		2000		ppb v/v			02/15/14 22:51	5020
Tetrahydrofuran	ND		4000		ppb v/v			02/15/14 22:51	5020
Toluene	ND		2000		ppb v/v			02/15/14 22:51	5020
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2000		ppb v/v			02/15/14 22:51	5020
1,2,4-Trichlorobenzene	ND		10000		ppb v/v			02/15/14 22:51	5020
1,1,1-Trichloroethane	ND		1500		ppb v/v			02/15/14 22:51	5020
1,1,2-Trichloroethane	ND		2000		ppb v/v			02/15/14 22:51	5020
Trichloroethene	**24000**		2000		ppb v/v			02/15/14 22:51	5020
Trichlorofluoromethane	ND		2000		ppb v/v			02/15/14 22:51	5020
1,2,4-Trimethylbenzene	ND		4000		ppb v/v			02/15/14 22:51	5020
1,3,5-Trimethylbenzene	ND		2000		ppb v/v			02/15/14 22:51	5020
2,2,4-Trimethylpentane	ND		2000		ppb v/v			02/15/14 22:51	5020
Vinyl acetate	ND		4000		ppb v/v			02/15/14 22:51	5020
Vinyl bromide	ND		4000		ppb v/v			02/15/14 22:51	5020
Vinyl chloride	ND		2000		ppb v/v			02/15/14 22:51	5020
m,p-Xylene	ND		4000		ppb v/v			02/15/14 22:51	5020
o-Xylene	ND		2000		ppb v/v			02/15/14 22:51	5020
2-Propanol	ND		10000		ppb v/v			02/15/14 22:51	5020
n-Nonane	ND		4000		ppb v/v			02/15/14 22:51	5020

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		60000		ug/m3			02/15/14 22:51	5020
Allyl chloride	ND		13000		ug/m3			02/15/14 22:51	5020
Benzene	ND		6400		ug/m3			02/15/14 22:51	5020
Benzyl chloride	ND		21000		ug/m3			02/15/14 22:51	5020
Bromodichloromethane	ND		10000		ug/m3			02/15/14 22:51	5020
Bromoform	ND		21000		ug/m3			02/15/14 22:51	5020
Bromomethane	ND		16000		ug/m3			02/15/14 22:51	5020
1,3-Butadiene	ND		8900		ug/m3			02/15/14 22:51	5020
2-Butanone (MEK)	ND		12000		ug/m3			02/15/14 22:51	5020
n-Butylbenzene	ND		11000		ug/m3			02/15/14 22:51	5020
sec-Butylbenzene	ND		11000		ug/m3			02/15/14 22:51	5020
tert-Butylbenzene	ND		22000		ug/m3			02/15/14 22:51	5020
Carbon disulfide	ND		13000		ug/m3			02/15/14 22:51	5020
Carbon tetrachloride	ND		25000		ug/m3			02/15/14 22:51	5020
Chlorobenzene	ND		6900		ug/m3			02/15/14 22:51	5020
Chloroethane	ND		11000		ug/m3			02/15/14 22:51	5020

Client Sample ID: VML-02-190-VPT-012714 **Lab Sample ID: 320-5954-2**

Date Collected: 01/27/14 12:53 **Matrix: Air**

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Chloroform	ND		7400		ug/m3			02/15/14 22:51	5020
Chloromethane	ND		8300		ug/m3			02/15/14 22:51	5020
Cyclohexane	ND		6900		ug/m3			02/15/14 22:51	5020
Dibromochloromethane	ND		17000		ug/m3			02/15/14 22:51	5020
1,2-Dibromoethane (EDB)	ND		31000		ug/m3			02/15/14 22:51	5020
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		14000		ug/m3			02/15/14 22:51	5020
1,2-Dichlorobenzene	ND		12000		ug/m3			02/15/14 22:51	5020
1,3-Dichlorobenzene	ND		12000		ug/m3			02/15/14 22:51	5020
1,4-Dichlorobenzene	ND		12000		ug/m3			02/15/14 22:51	5020
Dichlorodifluoromethane	ND		9900		ug/m3			02/15/14 22:51	5020
1,1-Dichloroethane	ND		6100		ug/m3			02/15/14 22:51	5020
1,2-Dichloroethane	ND		16000		ug/m3			02/15/14 22:51	5020
1,1-Dichloroethene	ND		16000		ug/m3			02/15/14 22:51	5020
cis-1,2-Dichloroethene	**1000000**		8000		ug/m3			02/15/14 22:51	5020
trans-1,2-Dichloroethene	ND		8000		ug/m3			02/15/14 22:51	5020
1,2-Dichloropropane	ND		9300		ug/m3			02/15/14 22:51	5020
cis-1,3-Dichloropropene	ND		9100		ug/m3			02/15/14 22:51	5020
trans-1,3-Dichloropropene	ND		9100		ug/m3			02/15/14 22:51	5020
Ethyl acetate	ND		5400		ug/m3			02/15/14 22:51	5020
Ethylbenzene	ND		8700		ug/m3			02/15/14 22:51	5020
4-Ethyltoluene	ND		9900		ug/m3			02/15/14 22:51	5020
n-Heptane	ND		16000		ug/m3			02/15/14 22:51	5020
Hexachlorobutadiene	ND		110000		ug/m3			02/15/14 22:51	5020
n-Hexane	ND		14000		ug/m3			02/15/14 22:51	5020
2-Hexanone	ND		8200		ug/m3			02/15/14 22:51	5020
Isopropylbenzene	ND		20000		ug/m3			02/15/14 22:51	5020
Methyl-t-Butyl Ether (MTBE)	ND		14000		ug/m3			02/15/14 22:51	5020
4-Methyl-2-pentanone (MIBK)	ND		8200		ug/m3			02/15/14 22:51	5020
Methylene chloride	ND		7000		ug/m3			02/15/14 22:51	5020
Naphthalene	ND		21000		ug/m3			02/15/14 22:51	5020
n-Octane	ND		9400		ug/m3			02/15/14 22:51	5020
Propene	ND		3500		ug/m3			02/15/14 22:51	5020
n-Propylbenzene	ND		9900		ug/m3			02/15/14 22:51	5020
Styrene	ND		8600		ug/m3			02/15/14 22:51	5020
1,1,2,2-Tetrachloroethane	ND		14000		ug/m3			02/15/14 22:51	5020
Tetrachloroethene	**1300000**		14000		ug/m3			02/15/14 22:51	5020
Tetrahydrofuran	ND		12000		ug/m3			02/15/14 22:51	5020
Toluene	ND		7600		ug/m3			02/15/14 22:51	5020
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		15000		ug/m3			02/15/14 22:51	5020
1,2,4-Trichlorobenzene	ND		75000		ug/m3			02/15/14 22:51	5020
1,1,1-Trichloroethane	ND		8200		ug/m3			02/15/14 22:51	5020
1,1,2-Trichloroethane	ND		11000		ug/m3			02/15/14 22:51	5020
Trichloroethene	**130000**		11000		ug/m3			02/15/14 22:51	5020
Trichlorofluoromethane	ND		11000		ug/m3			02/15/14 22:51	5020
1,2,4-Trimethylbenzene	ND		20000		ug/m3			02/15/14 22:51	5020
1,3,5-Trimethylbenzene	ND		9900		ug/m3			02/15/14 22:51	5020
2,2,4-Trimethylpentane	ND		9400		ug/m3			02/15/14 22:51	5020
Vinyl acetate	ND		14000		ug/m3			02/15/14 22:51	5020

Client Sample ID: VML-02-190-VPT-012714

Lab Sample ID: 320-5954-2

Date Collected: 01/27/14 12:53
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Vinyl bromide	ND		18000		ug/m3			02/15/14 22:51	5020
Vinyl chloride	ND		5100		ug/m3			02/15/14 22:51	5020
m,p-Xylene	ND		17000		ug/m3			02/15/14 22:51	5020
o-Xylene	ND		8700		ug/m3			02/15/14 22:51	5020
2-Propanol	ND		25000		ug/m3			02/15/14 22:51	5020
n-Nonane	ND		21000		ug/m3			02/15/14 22:51	5020

Surrogate	*%Recovery*	*Qualifier*	*Limits*		*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*104*		*70 - 130*			*02/15/14 22:51*	*5020*
1,2-Dichloroethane-d4 (Surr)	*99*		*70 - 130*			*02/15/14 22:51*	*5020*
Toluene-d8 (Surr)	*104*		*70 - 130*			*02/15/14 22:51*	*5020*

Client Sample ID: PER-14A-178-VPT-012714

Lab Sample ID: 320-5954-3

Date Collected: 01/27/14 16:10
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		25000		ppb v/v			02/15/14 23:40	5060
Allyl chloride	ND		4000		ppb v/v			02/15/14 23:40	5060
Benzene	ND		2000		ppb v/v			02/15/14 23:40	5060
Benzyl chloride	ND		4000		ppb v/v			02/15/14 23:40	5060
Bromodichloromethane	ND		1500		ppb v/v			02/15/14 23:40	5060
Bromoform	ND		2000		ppb v/v			02/15/14 23:40	5060
Bromomethane	ND		4000		ppb v/v			02/15/14 23:40	5060
1,3-Butadiene	ND		4000		ppb v/v			02/15/14 23:40	5060
2-Butanone (MEK)	ND		4000		ppb v/v			02/15/14 23:40	5060
n-Butylbenzene	ND		2000		ppb v/v			02/15/14 23:40	5060
sec-Butylbenzene	ND		2000		ppb v/v			02/15/14 23:40	5060
tert-Butylbenzene	ND		4000		ppb v/v			02/15/14 23:40	5060
Carbon disulfide	ND		4000		ppb v/v			02/15/14 23:40	5060
Carbon tetrachloride	ND		4000		ppb v/v			02/15/14 23:40	5060
Chlorobenzene	ND		1500		ppb v/v			02/15/14 23:40	5060
Chloroethane	ND		4000		ppb v/v			02/15/14 23:40	5060
Chloroform	ND		1500		ppb v/v			02/15/14 23:40	5060
Chloromethane	ND		4000		ppb v/v			02/15/14 23:40	5060
Cyclohexane	ND		2000		ppb v/v			02/15/14 23:40	5060
Dibromochloromethane	ND		2000		ppb v/v			02/15/14 23:40	5060
1,2-Dibromoethane (EDB)	ND		4000		ppb v/v			02/15/14 23:40	5060
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2000		ppb v/v			02/15/14 23:40	5060
1,2-Dichlorobenzene	ND		2000		ppb v/v			02/15/14 23:40	5060
1,3-Dichlorobenzene	ND		2000		ppb v/v			02/15/14 23:40	5060
1,4-Dichlorobenzene	ND		2000		ppb v/v			02/15/14 23:40	5060
Dichlorodifluoromethane	ND		2000		ppb v/v			02/15/14 23:40	5060
1,1-Dichloroethane	ND		1500		ppb v/v			02/15/14 23:40	5060
1,2-Dichloroethane	ND		4000		ppb v/v			02/15/14 23:40	5060
1,1-Dichloroethene	ND		4000		ppb v/v			02/15/14 23:40	5060
trans-1,2-Dichloroethene	ND		2000		ppb v/v			02/15/14 23:40	5060

Client Sample ID: PER-14A-178-VPT-012714 **Lab Sample ID: 320-5954-3**

Date Collected: 01/27/14 16:10 **Matrix: Air**

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichloropropane	ND		2000	ppb v/v			02/15/14 23:40	5060
cis-1,3-Dichloropropene	ND		2000	ppb v/v			02/15/14 23:40	5060
trans-1,3-Dichloropropene	ND		2000	ppb v/v			02/15/14 23:40	5060
Ethyl acetate	ND		1500	ppb v/v			02/15/14 23:40	5060
Ethylbenzene	ND		2000	ppb v/v			02/15/14 23:40	5060
4-Ethyltoluene	ND		2000	ppb v/v			02/15/14 23:40	5060
n-Heptane	ND		4000	ppb v/v			02/15/14 23:40	5060
Hexachlorobutadiene	ND		10000	ppb v/v			02/15/14 23:40	5060
n-Hexane	ND		4000	ppb v/v			02/15/14 23:40	5060
2-Hexanone	ND		2000	ppb v/v			02/15/14 23:40	5060
Isopropylbenzene	ND		4000	ppb v/v			02/15/14 23:40	5060
Methyl-t-Butyl Ether (MTBE)	ND		4000	ppb v/v			02/15/14 23:40	5060
4-Methyl-2-pentanone (MIBK)	ND		2000	ppb v/v			02/15/14 23:40	5060
Methylene chloride	ND		2000	ppb v/v			02/15/14 23:40	5060
Naphthalene	ND		4000	ppb v/v			02/15/14 23:40	5060
n-Octane	ND		2000	ppb v/v			02/15/14 23:40	5060
Propene	ND		2000	ppb v/v			02/15/14 23:40	5060
n-Propylbenzene	ND		2000	ppb v/v			02/15/14 23:40	5060
Styrene	ND		2000	ppb v/v			02/15/14 23:40	5060
1,1,2,2-Tetrachloroethane	ND		2000	ppb v/v			02/15/14 23:40	5060
Tetrachloroethene	**100000**		2000	ppb v/v			02/15/14 23:40	5060
Tetrahydrofuran	ND		4000	ppb v/v			02/15/14 23:40	5060
Toluene	ND		2000	ppb v/v			02/15/14 23:40	5060
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2000	ppb v/v			02/15/14 23:40	5060
1,2,4-Trichlorobenzene	ND		10000	ppb v/v			02/15/14 23:40	5060
1,1,1-Trichloroethane	ND		1500	ppb v/v			02/15/14 23:40	5060
1,1,2-Trichloroethane	ND		2000	ppb v/v			02/15/14 23:40	5060
Trichloroethene	**18000**		2000	ppb v/v			02/15/14 23:40	5060
Trichlorofluoromethane	ND		2000	ppb v/v			02/15/14 23:40	5060
1,2,4-Trimethylbenzene	ND		4000	ppb v/v			02/15/14 23:40	5060
1,3,5-Trimethylbenzene	ND		2000	ppb v/v			02/15/14 23:40	5060
2,2,4-Trimethylpentane	ND		2000	ppb v/v			02/15/14 23:40	5060
Vinyl acetate	ND		4000	ppb v/v			02/15/14 23:40	5060
Vinyl bromide	ND		4000	ppb v/v			02/15/14 23:40	5060
Vinyl chloride	ND		2000	ppb v/v			02/15/14 23:40	5060
m,p-Xylene	ND		4000	ppb v/v			02/15/14 23:40	5060
o-Xylene	ND		2000	ppb v/v			02/15/14 23:40	5060
2-Propanol	ND		10000	ppb v/v			02/15/14 23:40	5060
n-Nonane	ND		4000	ppb v/v			02/15/14 23:40	5060

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		60000	ug/m3			02/15/14 23:40	5060
Allyl chloride	ND		13000	ug/m3			02/15/14 23:40	5060
Benzene	ND		6500	ug/m3			02/15/14 23:40	5060
Benzyl chloride	ND		21000	ug/m3			02/15/14 23:40	5060
Bromodichloromethane	ND		10000	ug/m3			02/15/14 23:40	5060
Bromoform	ND		21000	ug/m3			02/15/14 23:40	5060
Bromomethane	ND		16000	ug/m3			02/15/14 23:40	5060
1,3-Butadiene	ND		9000	ug/m3			02/15/14 23:40	5060

Client Sample ID: PER-14A-178-VPT-012714

Lab Sample ID: 320-5954-3

Date Collected: 01/27/14 16:10
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
2-Butanone (MEK)	ND		12000		ug/m3			02/15/14 23:40	5060
n-Butylbenzene	ND		11000		ug/m3			02/15/14 23:40	5060
sec-Butylbenzene	ND		11000		ug/m3			02/15/14 23:40	5060
tert-Butylbenzene	ND		22000		ug/m3			02/15/14 23:40	5060
Carbon disulfide	ND		13000		ug/m3			02/15/14 23:40	5060
Carbon tetrachloride	ND		25000		ug/m3			02/15/14 23:40	5060
Chlorobenzene	ND		7000		ug/m3			02/15/14 23:40	5060
Chloroethane	ND		11000		ug/m3			02/15/14 23:40	5060
Chloroform	ND		7400		ug/m3			02/15/14 23:40	5060
Chloromethane	ND		8400		ug/m3			02/15/14 23:40	5060
Cyclohexane	ND		7000		ug/m3			02/15/14 23:40	5060
Dibromochloromethane	ND		17000		ug/m3			02/15/14 23:40	5060
1,2-Dibromoethane (EDB)	ND		31000		ug/m3			02/15/14 23:40	5060
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		14000		ug/m3			02/15/14 23:40	5060
1,2-Dichlorobenzene	ND		12000		ug/m3			02/15/14 23:40	5060
1,3-Dichlorobenzene	ND		12000		ug/m3			02/15/14 23:40	5060
1,4-Dichlorobenzene	ND		12000		ug/m3			02/15/14 23:40	5060
Dichlorodifluoromethane	ND		10000		ug/m3			02/15/14 23:40	5060
1,1-Dichloroethane	ND		6100		ug/m3			02/15/14 23:40	5060
1,2-Dichloroethane	ND		16000		ug/m3			02/15/14 23:40	5060
1,1-Dichloroethene	ND		16000		ug/m3			02/15/14 23:40	5060
trans-1,2-Dichloroethene	ND		8000		ug/m3			02/15/14 23:40	5060
1,2-Dichloropropane	ND		9400		ug/m3			02/15/14 23:40	5060
cis-1,3-Dichloropropene	ND		9200		ug/m3			02/15/14 23:40	5060
trans-1,3-Dichloropropene	ND		9200		ug/m3			02/15/14 23:40	5060
Ethyl acetate	ND		5500		ug/m3			02/15/14 23:40	5060
Ethylbenzene	ND		8800		ug/m3			02/15/14 23:40	5060
4-Ethyltoluene	ND		10000		ug/m3			02/15/14 23:40	5060
n-Heptane	ND		17000		ug/m3			02/15/14 23:40	5060
Hexachlorobutadiene	ND		110000		ug/m3			02/15/14 23:40	5060
n-Hexane	ND		14000		ug/m3			02/15/14 23:40	5060
2-Hexanone	ND		8300		ug/m3			02/15/14 23:40	5060
Isopropylbenzene	ND		20000		ug/m3			02/15/14 23:40	5060
Methyl-t-Butyl Ether (MTBE)	ND		15000		ug/m3			02/15/14 23:40	5060
4-Methyl-2-pentanone (MIBK)	ND		8300		ug/m3			02/15/14 23:40	5060
Methylene chloride	ND		7000		ug/m3			02/15/14 23:40	5060
Naphthalene	ND		21000		ug/m3			02/15/14 23:40	5060
n-Octane	ND		9500		ug/m3			02/15/14 23:40	5060
Propene	ND		3500		ug/m3			02/15/14 23:40	5060
n-Propylbenzene	ND		9900		ug/m3			02/15/14 23:40	5060
Styrene	ND		8600		ug/m3			02/15/14 23:40	5060
1,1,2,2-Tetrachloroethane	ND		14000		ug/m3			02/15/14 23:40	5060
Tetrachloroethene	**700000**		14000		ug/m3			02/15/14 23:40	5060
Tetrahydrofuran	ND		12000		ug/m3			02/15/14 23:40	5060
Toluene	ND		7600		ug/m3			02/15/14 23:40	5060
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		16000		ug/m3			02/15/14 23:40	5060
1,2,4-Trichlorobenzene	ND		75000		ug/m3			02/15/14 23:40	5060
1,1,1-Trichloroethane	ND		8300		ug/m3			02/15/14 23:40	5060

Client Sample ID: PER-14A-178-VPT-012714

Lab Sample ID: 320-5954-3

Date Collected: 01/27/14 16:10
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,2-Trichloroethane	ND		11000	ug/m3			02/15/14 23:40	5060
Trichloroethene	**98000**		11000	ug/m3			02/15/14 23:40	5060
Trichlorofluoromethane	ND		11000	ug/m3			02/15/14 23:40	5060
1,2,4-Trimethylbenzene	ND		20000	ug/m3			02/15/14 23:40	5060
1,3,5-Trimethylbenzene	ND		10000	ug/m3			02/15/14 23:40	5060
2,2,4-Trimethylpentane	ND		9500	ug/m3			02/15/14 23:40	5060
Vinyl acetate	ND		14000	ug/m3			02/15/14 23:40	5060
Vinyl bromide	ND		18000	ug/m3			02/15/14 23:40	5060
Vinyl chloride	ND		5200	ug/m3			02/15/14 23:40	5060
m,p-Xylene	ND		18000	ug/m3			02/15/14 23:40	5060
o-Xylene	ND		8800	ug/m3			02/15/14 23:40	5060
2-Propanol	ND		25000	ug/m3			02/15/14 23:40	5060
n-Nonane	ND		21000	ug/m3			02/15/14 23:40	5060

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*104*		*70 - 130*		*02/15/14 23:40*	*5060*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*		*02/15/14 23:40*	*5060*
Toluene-d8 (Surr)	*104*		*70 - 130*		*02/15/14 23:40*	*5060*

Method: TO-15 - Volatile Organic Compounds in Ambient Air - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**570000**		5000	ppb v/v			02/17/14 17:53	12600

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**2300000**		20000	ug/m3			02/17/14 17:53	12600

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*104*		*70 - 130*		*02/17/14 17:53*	*12600*
1,2-Dichloroethane-d4 (Surr)	*99*		*70 - 130*		*02/17/14 17:53*	*12600*
Toluene-d8 (Surr)	*103*		*70 - 130*		*02/17/14 17:53*	*12600*

Client Sample ID: PER-14A-192-VPT-012714

Lab Sample ID: 320-5954-4

Date Collected: 01/27/14 16:30
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		26000	ppb v/v			02/16/14 00:29	5120
Allyl chloride	ND		4100	ppb v/v			02/16/14 00:29	5120
Benzene	ND		2000	ppb v/v			02/16/14 00:29	5120
Benzyl chloride	ND		4100	ppb v/v			02/16/14 00:29	5120
Bromodichloromethane	ND		1500	ppb v/v			02/16/14 00:29	5120
Bromoform	ND		2000	ppb v/v			02/16/14 00:29	5120
Bromomethane	ND		4100	ppb v/v			02/16/14 00:29	5120
1,3-Butadiene	ND		4100	ppb v/v			02/16/14 00:29	5120
2-Butanone (MEK)	ND		4100	ppb v/v			02/16/14 00:29	5120
n-Butylbenzene	ND		2000	ppb v/v			02/16/14 00:29	5120
sec-Butylbenzene	ND		2000	ppb v/v			02/16/14 00:29	5120
tert-Butylbenzene	ND		4100	ppb v/v			02/16/14 00:29	5120

Client Sample ID: PER-14A-192-VPT-012714 **Lab Sample ID: 320-5954-4**

Date Collected: 01/27/14 16:30 **Matrix: Air**

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon disulfide	ND		4100	ppb v/v			02/16/14 00:29	5120
Carbon tetrachloride	ND		4100	ppb v/v			02/16/14 00:29	5120
Chlorobenzene	ND		1500	ppb v/v			02/16/14 00:29	5120
Chloroethane	ND		4100	ppb v/v			02/16/14 00:29	5120
Chloroform	ND		1500	ppb v/v			02/16/14 00:29	5120
Chloromethane	ND		4100	ppb v/v			02/16/14 00:29	5120
Cyclohexane	ND		2000	ppb v/v			02/16/14 00:29	5120
Dibromochloromethane	ND		2000	ppb v/v			02/16/14 00:29	5120
1,2-Dibromoethane (EDB)	ND		4100	ppb v/v			02/16/14 00:29	5120
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2000	ppb v/v			02/16/14 00:29	5120
1,2-Dichlorobenzene	ND		2000	ppb v/v			02/16/14 00:29	5120
1,3-Dichlorobenzene	ND		2000	ppb v/v			02/16/14 00:29	5120
1,4-Dichlorobenzene	ND		2000	ppb v/v			02/16/14 00:29	5120
Dichlorodifluoromethane	ND		2000	ppb v/v			02/16/14 00:29	5120
1,1-Dichloroethane	ND		1500	ppb v/v			02/16/14 00:29	5120
1,2-Dichloroethane	ND		4100	ppb v/v			02/16/14 00:29	5120
1,1-Dichloroethene	ND		4100	ppb v/v			02/16/14 00:29	5120
cis-1,2-Dichloroethene	**280000**		2000	ppb v/v			02/16/14 00:29	5120
trans-1,2-Dichloroethene	ND		2000	ppb v/v			02/16/14 00:29	5120
1,2-Dichloropropane	ND		2000	ppb v/v			02/16/14 00:29	5120
cis-1,3-Dichloropropene	ND		2000	ppb v/v			02/16/14 00:29	5120
trans-1,3-Dichloropropene	ND		2000	ppb v/v			02/16/14 00:29	5120
Ethyl acetate	ND		1500	ppb v/v			02/16/14 00:29	5120
Ethylbenzene	ND		2000	ppb v/v			02/16/14 00:29	5120
4-Ethyltoluene	ND		2000	ppb v/v			02/16/14 00:29	5120
n-Heptane	ND		4100	ppb v/v			02/16/14 00:29	5120
Hexachlorobutadiene	ND		10000	ppb v/v			02/16/14 00:29	5120
n-Hexane	ND		4100	ppb v/v			02/16/14 00:29	5120
2-Hexanone	ND		2000	ppb v/v			02/16/14 00:29	5120
Isopropylbenzene	ND		4100	ppb v/v			02/16/14 00:29	5120
Methyl-t-Butyl Ether (MTBE)	ND		4100	ppb v/v			02/16/14 00:29	5120
4-Methyl-2-pentanone (MIBK)	ND		2000	ppb v/v			02/16/14 00:29	5120
Methylene chloride	ND		2000	ppb v/v			02/16/14 00:29	5120
Naphthalene	ND		4100	ppb v/v			02/16/14 00:29	5120
n-Octane	ND		2000	ppb v/v			02/16/14 00:29	5120
Propene	ND		2000	ppb v/v			02/16/14 00:29	5120
n-Propylbenzene	ND		2000	ppb v/v			02/16/14 00:29	5120
Styrene	ND		2000	ppb v/v			02/16/14 00:29	5120
1,1,2,2-Tetrachloroethane	ND		2000	ppb v/v			02/16/14 00:29	5120
Tetrachloroethene	**100000**		2000	ppb v/v			02/16/14 00:29	5120
Tetrahydrofuran	ND		4100	ppb v/v			02/16/14 00:29	5120
Toluene	ND		2000	ppb v/v			02/16/14 00:29	5120
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2000	ppb v/v			02/16/14 00:29	5120
1,2,4-Trichlorobenzene	ND		10000	ppb v/v			02/16/14 00:29	5120
1,1,1-Trichloroethane	ND		1500	ppb v/v			02/16/14 00:29	5120
1,1,2-Trichloroethane	ND		2000	ppb v/v			02/16/14 00:29	5120
Trichloroethene	**16000**		2000	ppb v/v			02/16/14 00:29	5120
Trichlorofluoromethane	ND		2000	ppb v/v			02/16/14 00:29	5120

Client Sample ID: PER-14A-192-VPT-012714

Lab Sample ID: 320-5954-4

Date Collected: 01/27/14 16:30

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2,4-Trimethylbenzene	ND		4100	ppb v/v			02/16/14 00:29	5120
1,3,5-Trimethylbenzene	ND		2000	ppb v/v			02/16/14 00:29	5120
2,2,4-Trimethylpentane	ND		2000	ppb v/v			02/16/14 00:29	5120
Vinyl acetate	ND		4100	ppb v/v			02/16/14 00:29	5120
Vinyl bromide	ND		4100	ppb v/v			02/16/14 00:29	5120
Vinyl chloride	ND		2000	ppb v/v			02/16/14 00:29	5120
m,p-Xylene	ND		4100	ppb v/v			02/16/14 00:29	5120
o-Xylene	ND		2000	ppb v/v			02/16/14 00:29	5120
2-Propanol	ND		10000	ppb v/v			02/16/14 00:29	5120
n-Nonane	ND		4100	ppb v/v			02/16/14 00:29	5120

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		61000	ug/m3			02/16/14 00:29	5120
Allyl chloride	ND		13000	ug/m3			02/16/14 00:29	5120
Benzene	ND		6500	ug/m3			02/16/14 00:29	5120
Benzyl chloride	ND		21000	ug/m3			02/16/14 00:29	5120
Bromodichloromethane	ND		10000	ug/m3			02/16/14 00:29	5120
Bromoform	ND		21000	ug/m3			02/16/14 00:29	5120
Bromomethane	ND		16000	ug/m3			02/16/14 00:29	5120
1,3-Butadiene	ND		9100	ug/m3			02/16/14 00:29	5120
2-Butanone (MEK)	ND		12000	ug/m3			02/16/14 00:29	5120
n-Butylbenzene	ND		11000	ug/m3			02/16/14 00:29	5120
sec-Butylbenzene	ND		11000	ug/m3			02/16/14 00:29	5120
tert-Butylbenzene	ND		22000	ug/m3			02/16/14 00:29	5120
Carbon disulfide	ND		13000	ug/m3			02/16/14 00:29	5120
Carbon tetrachloride	ND		26000	ug/m3			02/16/14 00:29	5120
Chlorobenzene	ND		7100	ug/m3			02/16/14 00:29	5120
Chloroethane	ND		11000	ug/m3			02/16/14 00:29	5120
Chloroform	ND		7500	ug/m3			02/16/14 00:29	5120
Chloromethane	ND		8500	ug/m3			02/16/14 00:29	5120
Cyclohexane	ND		7000	ug/m3			02/16/14 00:29	5120
Dibromochloromethane	ND		17000	ug/m3			02/16/14 00:29	5120
1,2-Dibromoethane (EDB)	ND		31000	ug/m3			02/16/14 00:29	5120
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		14000	ug/m3			02/16/14 00:29	5120
1,2-Dichlorobenzene	ND		12000	ug/m3			02/16/14 00:29	5120
1,3-Dichlorobenzene	ND		12000	ug/m3			02/16/14 00:29	5120
1,4-Dichlorobenzene	ND		12000	ug/m3			02/16/14 00:29	5120
Dichlorodifluoromethane	ND		10000	ug/m3			02/16/14 00:29	5120
1,1-Dichloroethane	ND		6200	ug/m3			02/16/14 00:29	5120
1,2-Dichloroethane	ND		17000	ug/m3			02/16/14 00:29	5120
1,1-Dichloroethene	ND		16000	ug/m3			02/16/14 00:29	5120
cis-1,2-Dichloroethene	**1100000**		8100	ug/m3			02/16/14 00:29	5120
trans-1,2-Dichloroethene	ND		8100	ug/m3			02/16/14 00:29	5120
1,2-Dichloropropane	ND		9500	ug/m3			02/16/14 00:29	5120
cis-1,3-Dichloropropene	ND		9300	ug/m3			02/16/14 00:29	5120
trans-1,3-Dichloropropene	ND		9300	ug/m3			02/16/14 00:29	5120
Ethyl acetate	ND		5500	ug/m3			02/16/14 00:29	5120
Ethylbenzene	ND		8900	ug/m3			02/16/14 00:29	5120
4-Ethyltoluene	ND		10000	ug/m3			02/16/14 00:29	5120

Client Sample ID: PER-14A-192-VPT-012714

Lab Sample ID: 320-5954-4

Date Collected: 01/27/14 16:30
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
n-Heptane	ND		17000	ug/m3			02/16/14 00:29	5120
Hexachlorobutadiene	ND		110000	ug/m3			02/16/14 00:29	5120
n-Hexane	ND		14000	ug/m3			02/16/14 00:29	5120
2-Hexanone	ND		8400	ug/m3			02/16/14 00:29	5120
Isopropylbenzene	ND		20000	ug/m3			02/16/14 00:29	5120
Methyl-t-Butyl Ether (MTBE)	ND		15000	ug/m3			02/16/14 00:29	5120
4-Methyl-2-pentanone (MIBK)	ND		8400	ug/m3			02/16/14 00:29	5120
Methylene chloride	ND		7100	ug/m3			02/16/14 00:29	5120
Naphthalene	ND		21000	ug/m3			02/16/14 00:29	5120
n-Octane	ND		9600	ug/m3			02/16/14 00:29	5120
Propene	ND		3500	ug/m3			02/16/14 00:29	5120
n-Propylbenzene	ND		10000	ug/m3			02/16/14 00:29	5120
Styrene	ND		8700	ug/m3			02/16/14 00:29	5120
1,1,2,2-Tetrachloroethane	ND		14000	ug/m3			02/16/14 00:29	5120
Tetrachloroethene	**700000**		14000	ug/m3			02/16/14 00:29	5120
Tetrahydrofuran	ND		12000	ug/m3			02/16/14 00:29	5120
Toluene	ND		7700	ug/m3			02/16/14 00:29	5120
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		16000	ug/m3			02/16/14 00:29	5120
1,2,4-Trichlorobenzene	ND		76000	ug/m3			02/16/14 00:29	5120
1,1,1-Trichloroethane	ND		8400	ug/m3			02/16/14 00:29	5120
1,1,2-Trichloroethane	ND		11000	ug/m3			02/16/14 00:29	5120
Trichloroethene	**83000**		11000	ug/m3			02/16/14 00:29	5120
Trichlorofluoromethane	ND		12000	ug/m3			02/16/14 00:29	5120
1,2,4-Trimethylbenzene	ND		20000	ug/m3			02/16/14 00:29	5120
1,3,5-Trimethylbenzene	ND		10000	ug/m3			02/16/14 00:29	5120
2,2,4-Trimethylpentane	ND		9600	ug/m3			02/16/14 00:29	5120
Vinyl acetate	ND		14000	ug/m3			02/16/14 00:29	5120
Vinyl bromide	ND		18000	ug/m3			02/16/14 00:29	5120
Vinyl chloride	ND		5200	ug/m3			02/16/14 00:29	5120
m,p-Xylene	ND		18000	ug/m3			02/16/14 00:29	5120
o-Xylene	ND		8900	ug/m3			02/16/14 00:29	5120
2-Propanol	ND		25000	ug/m3			02/16/14 00:29	5120
n-Nonane	ND		21000	ug/m3			02/16/14 00:29	5120

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*106*		*70 - 130*		*02/16/14 00:29*	*5120*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*		*02/16/14 00:29*	*5120*
Toluene-d8 (Surr)	*104*		*70 - 130*		*02/16/14 00:29*	*5120*

Client Sample ID: PER-14A-197-VPT-012714

Lab Sample ID: 320-5954-5

Date Collected: 01/27/14 17:13
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		26000	ppb v/v			02/16/14 01:18	5160
Allyl chloride	ND		4100	ppb v/v			02/16/14 01:18	5160
Benzene	ND		2100	ppb v/v			02/16/14 01:18	5160

Client Sample ID: PER-14A-197-VPT-012714

Lab Sample ID: 320-5954-5

Date Collected: 01/27/14 17:13

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Benzyl chloride	ND		4100	ppb v/v			02/16/14 01:18	5160
Bromodichloromethane	ND		1500	ppb v/v			02/16/14 01:18	5160
Bromoform	ND		2100	ppb v/v			02/16/14 01:18	5160
Bromomethane	ND		4100	ppb v/v			02/16/14 01:18	5160
1,3-Butadiene	ND		4100	ppb v/v			02/16/14 01:18	5160
2-Butanone (MEK)	ND		4100	ppb v/v			02/16/14 01:18	5160
n-Butylbenzene	ND		2100	ppb v/v			02/16/14 01:18	5160
sec-Butylbenzene	ND		2100	ppb v/v			02/16/14 01:18	5160
tert-Butylbenzene	ND		4100	ppb v/v			02/16/14 01:18	5160
Carbon disulfide	ND		4100	ppb v/v			02/16/14 01:18	5160
Carbon tetrachloride	ND		4100	ppb v/v			02/16/14 01:18	5160
Chlorobenzene	ND		1500	ppb v/v			02/16/14 01:18	5160
Chloroethane	ND		4100	ppb v/v			02/16/14 01:18	5160
Chloroform	ND		1500	ppb v/v			02/16/14 01:18	5160
Chloromethane	ND		4100	ppb v/v			02/16/14 01:18	5160
Cyclohexane	ND		2100	ppb v/v			02/16/14 01:18	5160
Dibromochloromethane	ND		2100	ppb v/v			02/16/14 01:18	5160
1,2-Dibromoethane (EDB)	ND		4100	ppb v/v			02/16/14 01:18	5160
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2100	ppb v/v			02/16/14 01:18	5160
1,2-Dichlorobenzene	ND		2100	ppb v/v			02/16/14 01:18	5160
1,3-Dichlorobenzene	ND		2100	ppb v/v			02/16/14 01:18	5160
1,4-Dichlorobenzene	ND		2100	ppb v/v			02/16/14 01:18	5160
Dichlorodifluoromethane	ND		2100	ppb v/v			02/16/14 01:18	5160
1,1-Dichloroethane	ND		1500	ppb v/v			02/16/14 01:18	5160
1,2-Dichloroethane	ND		4100	ppb v/v			02/16/14 01:18	5160
1,1-Dichloroethene	ND		4100	ppb v/v			02/16/14 01:18	5160
cis-1,2-Dichloroethene	**220000**		2100	ppb v/v			02/16/14 01:18	5160
trans-1,2-Dichloroethene	ND		2100	ppb v/v			02/16/14 01:18	5160
1,2-Dichloropropane	ND		2100	ppb v/v			02/16/14 01:18	5160
cis-1,3-Dichloropropene	ND		2100	ppb v/v			02/16/14 01:18	5160
trans-1,3-Dichloropropene	ND		2100	ppb v/v			02/16/14 01:18	5160
Ethyl acetate	ND		1500	ppb v/v			02/16/14 01:18	5160
Ethylbenzene	ND		2100	ppb v/v			02/16/14 01:18	5160
4-Ethyltoluene	ND		2100	ppb v/v			02/16/14 01:18	5160
n-Heptane	ND		4100	ppb v/v			02/16/14 01:18	5160
Hexachlorobutadiene	ND		10000	ppb v/v			02/16/14 01:18	5160
n-Hexane	ND		4100	ppb v/v			02/16/14 01:18	5160
2-Hexanone	ND		2100	ppb v/v			02/16/14 01:18	5160
Isopropylbenzene	ND		4100	ppb v/v			02/16/14 01:18	5160
Methyl-t-Butyl Ether (MTBE)	ND		4100	ppb v/v			02/16/14 01:18	5160
4-Methyl-2-pentanone (MIBK)	ND		2100	ppb v/v			02/16/14 01:18	5160
Methylene chloride	ND		2100	ppb v/v			02/16/14 01:18	5160
Naphthalene	ND		4100	ppb v/v			02/16/14 01:18	5160
n-Octane	ND		2100	ppb v/v			02/16/14 01:18	5160
Propene	ND		2100	ppb v/v			02/16/14 01:18	5160
n-Propylbenzene	ND		2100	ppb v/v			02/16/14 01:18	5160
Styrene	ND		2100	ppb v/v			02/16/14 01:18	5160
1,1,2,2-Tetrachloroethane	ND		2100	ppb v/v			02/16/14 01:18	5160

Client Sample ID: PER-14A-197-VPT-012714 **Lab Sample ID: 320-5954-5**

Date Collected: 01/27/14 17:13 **Matrix: Air**

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	**92000**		2100	ppb v/v			02/16/14 01:18	5160
Tetrahydrofuran	ND		4100	ppb v/v			02/16/14 01:18	5160
Toluene	ND		2100	ppb v/v			02/16/14 01:18	5160
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2100	ppb v/v			02/16/14 01:18	5160
1,2,4-Trichlorobenzene	ND		10000	ppb v/v			02/16/14 01:18	5160
1,1,1-Trichloroethane	ND		1500	ppb v/v			02/16/14 01:18	5160
1,1,2-Trichloroethane	ND		2100	ppb v/v			02/16/14 01:18	5160
Trichloroethene	**13000**		2100	ppb v/v			02/16/14 01:18	5160
Trichlorofluoromethane	ND		2100	ppb v/v			02/16/14 01:18	5160
1,2,4-Trimethylbenzene	ND		4100	ppb v/v			02/16/14 01:18	5160
1,3,5-Trimethylbenzene	ND		2100	ppb v/v			02/16/14 01:18	5160
2,2,4-Trimethylpentane	ND		2100	ppb v/v			02/16/14 01:18	5160
Vinyl acetate	ND		4100	ppb v/v			02/16/14 01:18	5160
Vinyl bromide	ND		4100	ppb v/v			02/16/14 01:18	5160
Vinyl chloride	ND		2100	ppb v/v			02/16/14 01:18	5160
m,p-Xylene	ND		4100	ppb v/v			02/16/14 01:18	5160
o-Xylene	ND		2100	ppb v/v			02/16/14 01:18	5160
2-Propanol	ND		10000	ppb v/v			02/16/14 01:18	5160
n-Nonane	ND		4100	ppb v/v			02/16/14 01:18	5160

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		61000	ug/m3			02/16/14 01:18	5160
Allyl chloride	ND		13000	ug/m3			02/16/14 01:18	5160
Benzene	ND		6600	ug/m3			02/16/14 01:18	5160
Benzyl chloride	ND		21000	ug/m3			02/16/14 01:18	5160
Bromodichloromethane	ND		10000	ug/m3			02/16/14 01:18	5160
Bromoform	ND		21000	ug/m3			02/16/14 01:18	5160
Bromomethane	ND		16000	ug/m3			02/16/14 01:18	5160
1,3-Butadiene	ND		9100	ug/m3			02/16/14 01:18	5160
2-Butanone (MEK)	ND		12000	ug/m3			02/16/14 01:18	5160
n-Butylbenzene	ND		11000	ug/m3			02/16/14 01:18	5160
sec-Butylbenzene	ND		11000	ug/m3			02/16/14 01:18	5160
tert-Butylbenzene	ND		23000	ug/m3			02/16/14 01:18	5160
Carbon disulfide	ND		13000	ug/m3			02/16/14 01:18	5160
Carbon tetrachloride	ND		26000	ug/m3			02/16/14 01:18	5160
Chlorobenzene	ND		7100	ug/m3			02/16/14 01:18	5160
Chloroethane	ND		11000	ug/m3			02/16/14 01:18	5160
Chloroform	ND		7600	ug/m3			02/16/14 01:18	5160
Chloromethane	ND		8500	ug/m3			02/16/14 01:18	5160
Cyclohexane	ND		7100	ug/m3			02/16/14 01:18	5160
Dibromochloromethane	ND		18000	ug/m3			02/16/14 01:18	5160
1,2-Dibromoethane (EDB)	ND		32000	ug/m3			02/16/14 01:18	5160
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		14000	ug/m3			02/16/14 01:18	5160
1,2-Dichlorobenzene	ND		12000	ug/m3			02/16/14 01:18	5160
1,3-Dichlorobenzene	ND		12000	ug/m3			02/16/14 01:18	5160
1,4-Dichlorobenzene	ND		12000	ug/m3			02/16/14 01:18	5160
Dichlorodifluoromethane	ND		10000	ug/m3			02/16/14 01:18	5160
1,1-Dichloroethane	ND		6300	ug/m3			02/16/14 01:18	5160
1,2-Dichloroethane	ND		17000	ug/m3			02/16/14 01:18	5160

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Client Sample ID: PER-14A-197-VPT-012714
Date Collected: 01/27/14 17:13
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Lab Sample ID: 320-5954-5
Matrix: Air

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,1-Dichloroethene	ND		16000	ug/m3			02/16/14 01:18	5160
cis-1,2-Dichloroethene	**850000**		8200	ug/m3			02/16/14 01:18	5160
trans-1,2-Dichloroethene	ND		8200	ug/m3			02/16/14 01:18	5160
1,2-Dichloropropane	ND		9500	ug/m3			02/16/14 01:18	5160
cis-1,3-Dichloropropene	ND		9400	ug/m3			02/16/14 01:18	5160
trans-1,3-Dichloropropene	ND		9400	ug/m3			02/16/14 01:18	5160
Ethyl acetate	ND		5600	ug/m3			02/16/14 01:18	5160
Ethylbenzene	ND		9000	ug/m3			02/16/14 01:18	5160
4-Ethyltoluene	ND		10000	ug/m3			02/16/14 01:18	5160
n-Heptane	ND		17000	ug/m3			02/16/14 01:18	5160
Hexachlorobutadiene	ND		110000	ug/m3			02/16/14 01:18	5160
n-Hexane	ND		15000	ug/m3			02/16/14 01:18	5160
2-Hexanone	ND		8500	ug/m3			02/16/14 01:18	5160
Isopropylbenzene	ND		20000	ug/m3			02/16/14 01:18	5160
Methyl-t-Butyl Ether (MTBE)	ND		15000	ug/m3			02/16/14 01:18	5160
4-Methyl-2-pentanone (MIBK)	ND		8500	ug/m3			02/16/14 01:18	5160
Methylene chloride	ND		7200	ug/m3			02/16/14 01:18	5160
Naphthalene	ND		22000	ug/m3			02/16/14 01:18	5160
n-Octane	ND		9600	ug/m3			02/16/14 01:18	5160
Propene	ND		3600	ug/m3			02/16/14 01:18	5160
n-Propylbenzene	ND		10000	ug/m3			02/16/14 01:18	5160
Styrene	ND		8800	ug/m3			02/16/14 01:18	5160
1,1,2,2-Tetrachloroethane	ND		14000	ug/m3			02/16/14 01:18	5160
Tetrachloroethene	**630000**		14000	ug/m3			02/16/14 01:18	5160
Tetrahydrofuran	ND		12000	ug/m3			02/16/14 01:18	5160
Toluene	ND		7800	ug/m3			02/16/14 01:18	5160
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		16000	ug/m3			02/16/14 01:18	5160
1,2,4-Trichlorobenzene	ND		77000	ug/m3			02/16/14 01:18	5160
1,1,1-Trichloroethane	ND		8400	ug/m3			02/16/14 01:18	5160
1,1,2-Trichloroethane	ND		11000	ug/m3			02/16/14 01:18	5160
Trichloroethene	**70000**		11000	ug/m3			02/16/14 01:18	5160
Trichlorofluoromethane	ND		12000	ug/m3			02/16/14 01:18	5160
1,2,4-Trimethylbenzene	ND		20000	ug/m3			02/16/14 01:18	5160
1,3,5-Trimethylbenzene	ND		10000	ug/m3			02/16/14 01:18	5160
2,2,4-Trimethylpentane	ND		9600	ug/m3			02/16/14 01:18	5160
Vinyl acetate	ND		15000	ug/m3			02/16/14 01:18	5160
Vinyl bromide	ND		18000	ug/m3			02/16/14 01:18	5160
Vinyl chloride	ND		5300	ug/m3			02/16/14 01:18	5160
m,p-Xylene	ND		18000	ug/m3			02/16/14 01:18	5160
o-Xylene	ND		9000	ug/m3			02/16/14 01:18	5160
2-Propanol	ND		25000	ug/m3			02/16/14 01:18	5160
n-Nonane	ND		22000	ug/m3			02/16/14 01:18	5160

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*103*		*70 - 130*		*02/16/14 01:18*	*5160*
1,2-Dichloroethane-d4 (Surr)	*101*		*70 - 130*		*02/16/14 01:18*	*5160*
Toluene-d8 (Surr)	*104*		*70 - 130*		*02/16/14 01:18*	*5160*

Client Sample Results

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Client Sample ID: STEPTEST-VPT-012814

Lab Sample ID: 320-5954-6

Date Collected: 01/28/14 12:25
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		38000		ppb v/v			02/16/14 02:07	7560
Allyl chloride	ND		6000		ppb v/v			02/16/14 02:07	7560
Benzene	ND		3000		ppb v/v			02/16/14 02:07	7560
Benzyl chloride	ND		6000		ppb v/v			02/16/14 02:07	7560
Bromodichloromethane	ND		2300		ppb v/v			02/16/14 02:07	7560
Bromoform	ND		3000		ppb v/v			02/16/14 02:07	7560
Bromomethane	ND		6000		ppb v/v			02/16/14 02:07	7560
1,3-Butadiene	ND		6000		ppb v/v			02/16/14 02:07	7560
2-Butanone (MEK)	ND		6000		ppb v/v			02/16/14 02:07	7560
n-Butylbenzene	ND		3000		ppb v/v			02/16/14 02:07	7560
sec-Butylbenzene	ND		3000		ppb v/v			02/16/14 02:07	7560
tert-Butylbenzene	ND		6000		ppb v/v			02/16/14 02:07	7560
Carbon disulfide	ND		6000		ppb v/v			02/16/14 02:07	7560
Carbon tetrachloride	ND		6000		ppb v/v			02/16/14 02:07	7560
Chlorobenzene	ND		2300		ppb v/v			02/16/14 02:07	7560
Chloroethane	ND		6000		ppb v/v			02/16/14 02:07	7560
Chloroform	ND		2300		ppb v/v			02/16/14 02:07	7560
Chloromethane	ND		6000		ppb v/v			02/16/14 02:07	7560
Cyclohexane	ND		3000		ppb v/v			02/16/14 02:07	7560
Dibromochloromethane	ND		3000		ppb v/v			02/16/14 02:07	7560
1,2-Dibromoethane (EDB)	ND		6000		ppb v/v			02/16/14 02:07	7560
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		3000		ppb v/v			02/16/14 02:07	7560
1,2-Dichlorobenzene	ND		3000		ppb v/v			02/16/14 02:07	7560
1,3-Dichlorobenzene	ND		3000		ppb v/v			02/16/14 02:07	7560
1,4-Dichlorobenzene	ND		3000		ppb v/v			02/16/14 02:07	7560
Dichlorodifluoromethane	ND		3000		ppb v/v			02/16/14 02:07	7560
1,1-Dichloroethane	ND		2300		ppb v/v			02/16/14 02:07	7560
1,2-Dichloroethane	ND		6000		ppb v/v			02/16/14 02:07	7560
1,1-Dichloroethene	ND		6000		ppb v/v			02/16/14 02:07	7560
cis-1,2-Dichloroethene	**350000**		3000		ppb v/v			02/16/14 02:07	7560
trans-1,2-Dichloroethene	ND		3000		ppb v/v			02/16/14 02:07	7560
1,2-Dichloropropane	ND		3000		ppb v/v			02/16/14 02:07	7560
cis-1,3-Dichloropropene	ND		3000		ppb v/v			02/16/14 02:07	7560
trans-1,3-Dichloropropene	ND		3000		ppb v/v			02/16/14 02:07	7560
Ethyl acetate	ND		2300		ppb v/v			02/16/14 02:07	7560
Ethylbenzene	ND		3000		ppb v/v			02/16/14 02:07	7560
4-Ethyltoluene	ND		3000		ppb v/v			02/16/14 02:07	7560
n-Heptane	ND		6000		ppb v/v			02/16/14 02:07	7560
Hexachlorobutadiene	ND		15000		ppb v/v			02/16/14 02:07	7560
n-Hexane	ND		6000		ppb v/v			02/16/14 02:07	7560
2-Hexanone	ND		3000		ppb v/v			02/16/14 02:07	7560
Isopropylbenzene	ND		6000		ppb v/v			02/16/14 02:07	7560
Methyl-t-Butyl Ether (MTBE)	ND		6000		ppb v/v			02/16/14 02:07	7560
4-Methyl-2-pentanone (MIBK)	ND		3000		ppb v/v			02/16/14 02:07	7560
Methylene chloride	ND		3000		ppb v/v			02/16/14 02:07	7560
Naphthalene	ND		6000		ppb v/v			02/16/14 02:07	7560
n-Octane	ND		3000		ppb v/v			02/16/14 02:07	7560
Propene	ND		3000		ppb v/v			02/16/14 02:07	7560

Client Sample ID: STEPTEST-VPT-012814

Lab Sample ID: 320-5954-6

Date Collected: 01/28/14 12:25

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
n-Propylbenzene	ND		3000	ppb v/v			02/16/14 02:07	7560
Styrene	ND		3000	ppb v/v			02/16/14 02:07	7560
1,1,2,2-Tetrachloroethane	ND		3000	ppb v/v			02/16/14 02:07	7560
Tetrachloroethene	**230000**		3000	ppb v/v			02/16/14 02:07	7560
Tetrahydrofuran	ND		6000	ppb v/v			02/16/14 02:07	7560
Toluene	**3800**		3000	ppb v/v			02/16/14 02:07	7560
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		3000	ppb v/v			02/16/14 02:07	7560
1,2,4-Trichlorobenzene	ND		15000	ppb v/v			02/16/14 02:07	7560
1,1,1-Trichloroethane	ND		2300	ppb v/v			02/16/14 02:07	7560
1,1,2-Trichloroethane	ND		3000	ppb v/v			02/16/14 02:07	7560
Trichloroethene	**29000**		3000	ppb v/v			02/16/14 02:07	7560
Trichlorofluoromethane	ND		3000	ppb v/v			02/16/14 02:07	7560
1,2,4-Trimethylbenzene	ND		6000	ppb v/v			02/16/14 02:07	7560
1,3,5-Trimethylbenzene	ND		3000	ppb v/v			02/16/14 02:07	7560
2,2,4-Trimethylpentane	ND		3000	ppb v/v			02/16/14 02:07	7560
Vinyl acetate	ND		6000	ppb v/v			02/16/14 02:07	7560
Vinyl bromide	ND		6000	ppb v/v			02/16/14 02:07	7560
Vinyl chloride	ND		3000	ppb v/v			02/16/14 02:07	7560
m,p-Xylene	ND		6000	ppb v/v			02/16/14 02:07	7560
o-Xylene	ND		3000	ppb v/v			02/16/14 02:07	7560
2-Propanol	ND		15000	ppb v/v			02/16/14 02:07	7560
n-Nonane	ND		6000	ppb v/v			02/16/14 02:07	7560

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		90000	ug/m3			02/16/14 02:07	7560
Allyl chloride	ND		19000	ug/m3			02/16/14 02:07	7560
Benzene	ND		9700	ug/m3			02/16/14 02:07	7560
Benzyl chloride	ND		31000	ug/m3			02/16/14 02:07	7560
Bromodichloromethane	ND		15000	ug/m3			02/16/14 02:07	7560
Bromoform	ND		31000	ug/m3			02/16/14 02:07	7560
Bromomethane	ND		23000	ug/m3			02/16/14 02:07	7560
1,3-Butadiene	ND		13000	ug/m3			02/16/14 02:07	7560
2-Butanone (MEK)	ND		18000	ug/m3			02/16/14 02:07	7560
n-Butylbenzene	ND		17000	ug/m3			02/16/14 02:07	7560
sec-Butylbenzene	ND		17000	ug/m3			02/16/14 02:07	7560
tert-Butylbenzene	ND		33000	ug/m3			02/16/14 02:07	7560
Carbon disulfide	ND		19000	ug/m3			02/16/14 02:07	7560
Carbon tetrachloride	ND		38000	ug/m3			02/16/14 02:07	7560
Chlorobenzene	ND		10000	ug/m3			02/16/14 02:07	7560
Chloroethane	ND		16000	ug/m3			02/16/14 02:07	7560
Chloroform	ND		11000	ug/m3			02/16/14 02:07	7560
Chloromethane	ND		12000	ug/m3			02/16/14 02:07	7560
Cyclohexane	ND		10000	ug/m3			02/16/14 02:07	7560
Dibromochloromethane	ND		26000	ug/m3			02/16/14 02:07	7560
1,2-Dibromoethane (EDB)	ND		46000	ug/m3			02/16/14 02:07	7560
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		21000	ug/m3			02/16/14 02:07	7560
1,2-Dichlorobenzene	ND		18000	ug/m3			02/16/14 02:07	7560
1,3-Dichlorobenzene	ND		18000	ug/m3			02/16/14 02:07	7560
1,4-Dichlorobenzene	ND		18000	ug/m3			02/16/14 02:07	7560

Client Sample ID: STEPTEST-VPT-012814
Date Collected: 01/28/14 12:25
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Lab Sample ID: 320-5954-6
Matrix: Air

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Dichlorodifluoromethane	ND		15000	ug/m3			02/16/14 02:07	7560
1,1-Dichloroethane	ND		9200	ug/m3			02/16/14 02:07	7560
1,2-Dichloroethane	ND		24000	ug/m3			02/16/14 02:07	7560
1,1-Dichloroethene	ND		24000	ug/m3			02/16/14 02:07	7560
cis-1,2-Dichloroethene	**1400000**		12000	ug/m3			02/16/14 02:07	7560
trans-1,2-Dichloroethene	ND		12000	ug/m3			02/16/14 02:07	7560
1,2-Dichloropropane	ND		14000	ug/m3			02/16/14 02:07	7560
cis-1,3-Dichloropropene	ND		14000	ug/m3			02/16/14 02:07	7560
trans-1,3-Dichloropropene	ND		14000	ug/m3			02/16/14 02:07	7560
Ethyl acetate	ND		8200	ug/m3			02/16/14 02:07	7560
Ethylbenzene	ND		13000	ug/m3			02/16/14 02:07	7560
4-Ethyltoluene	ND		15000	ug/m3			02/16/14 02:07	7560
n-Heptane	ND		25000	ug/m3			02/16/14 02:07	7560
Hexachlorobutadiene	ND		160000	ug/m3			02/16/14 02:07	7560
n-Hexane	ND		21000	ug/m3			02/16/14 02:07	7560
2-Hexanone	ND		12000	ug/m3			02/16/14 02:07	7560
Isopropylbenzene	ND		30000	ug/m3			02/16/14 02:07	7560
Methyl-t-Butyl Ether (MTBE)	ND		22000	ug/m3			02/16/14 02:07	7560
4-Methyl-2-pentanone (MIBK)	ND		12000	ug/m3			02/16/14 02:07	7560
Methylene chloride	ND		11000	ug/m3			02/16/14 02:07	7560
Naphthalene	ND		32000	ug/m3			02/16/14 02:07	7560
n-Octane	ND		14000	ug/m3			02/16/14 02:07	7560
Propene	ND		5200	ug/m3			02/16/14 02:07	7560
n-Propylbenzene	ND		15000	ug/m3			02/16/14 02:07	7560
Styrene	ND		13000	ug/m3			02/16/14 02:07	7560
1,1,2,2-Tetrachloroethane	ND		21000	ug/m3			02/16/14 02:07	7560
Tetrachloroethene	**1600000**		21000	ug/m3			02/16/14 02:07	7560
Tetrahydrofuran	ND		18000	ug/m3			02/16/14 02:07	7560
Toluene	**14000**		11000	ug/m3			02/16/14 02:07	7560
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		23000	ug/m3			02/16/14 02:07	7560
1,2,4-Trichlorobenzene	ND		110000	ug/m3			02/16/14 02:07	7560
1,1,1-Trichloroethane	ND		12000	ug/m3			02/16/14 02:07	7560
1,1,2-Trichloroethane	ND		17000	ug/m3			02/16/14 02:07	7560
Trichloroethene	**160000**		16000	ug/m3			02/16/14 02:07	7560
Trichlorofluoromethane	ND		17000	ug/m3			02/16/14 02:07	7560
1,2,4-Trimethylbenzene	ND		30000	ug/m3			02/16/14 02:07	7560
1,3,5-Trimethylbenzene	ND		15000	ug/m3			02/16/14 02:07	7560
2,2,4-Trimethylpentane	ND		14000	ug/m3			02/16/14 02:07	7560
Vinyl acetate	ND		21000	ug/m3			02/16/14 02:07	7560
Vinyl bromide	ND		26000	ug/m3			02/16/14 02:07	7560
Vinyl chloride	ND		7700	ug/m3			02/16/14 02:07	7560
m,p-Xylene	ND		26000	ug/m3			02/16/14 02:07	7560
o-Xylene	ND		13000	ug/m3			02/16/14 02:07	7560
2-Propanol	ND		37000	ug/m3			02/16/14 02:07	7560
n-Nonane	ND		32000	ug/m3			02/16/14 02:07	7560

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*106*		*70 - 130*		*02/16/14 02:07*	*7560*
1,2-Dichloroethane-d4 (Surr)	*98*		*70 - 130*		*02/16/14 02:07*	*7560*

Client Sample ID: STEPTEST-VPT-012814

Lab Sample ID: 320-5954-6

Date Collected: 01/28/14 12:25
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Toluene-d8 (Surr)	103		70 - 130		02/16/14 02:07	7560

Client Sample ID: VEL-3-190-VPT-012814

Lab Sample ID: 320-5954-7

Date Collected: 01/28/14 13:01
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		20000	ppb v/v			02/16/14 02:55	4000
Allyl chloride	ND		3200	ppb v/v			02/16/14 02:55	4000
Benzene	ND		1600	ppb v/v			02/16/14 02:55	4000
Benzyl chloride	ND		3200	ppb v/v			02/16/14 02:55	4000
Bromodichloromethane	ND		1200	ppb v/v			02/16/14 02:55	4000
Bromoform	ND		1600	ppb v/v			02/16/14 02:55	4000
Bromomethane	ND		3200	ppb v/v			02/16/14 02:55	4000
1,3-Butadiene	ND		3200	ppb v/v			02/16/14 02:55	4000
2-Butanone (MEK)	ND		3200	ppb v/v			02/16/14 02:55	4000
n-Butylbenzene	ND		1600	ppb v/v			02/16/14 02:55	4000
sec-Butylbenzene	ND		1600	ppb v/v			02/16/14 02:55	4000
tert-Butylbenzene	ND		3200	ppb v/v			02/16/14 02:55	4000
Carbon disulfide	ND		3200	ppb v/v			02/16/14 02:55	4000
Carbon tetrachloride	ND		3200	ppb v/v			02/16/14 02:55	4000
Chlorobenzene	ND		1200	ppb v/v			02/16/14 02:55	4000
Chloroethane	ND		3200	ppb v/v			02/16/14 02:55	4000
Chloroform	ND		1200	ppb v/v			02/16/14 02:55	4000
Chloromethane	ND		3200	ppb v/v			02/16/14 02:55	4000
Cyclohexane	ND		1600	ppb v/v			02/16/14 02:55	4000
Dibromochloromethane	ND		1600	ppb v/v			02/16/14 02:55	4000
1,2-Dibromoethane (EDB)	ND		3200	ppb v/v			02/16/14 02:55	4000
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		1600	ppb v/v			02/16/14 02:55	4000
1,2-Dichlorobenzene	ND		1600	ppb v/v			02/16/14 02:55	4000
1,3-Dichlorobenzene	ND		1600	ppb v/v			02/16/14 02:55	4000
1,4-Dichlorobenzene	ND		1600	ppb v/v			02/16/14 02:55	4000
Dichlorodifluoromethane	ND		1600	ppb v/v			02/16/14 02:55	4000
1,1-Dichloroethane	ND		1200	ppb v/v			02/16/14 02:55	4000
1,2-Dichloroethane	ND		3200	ppb v/v			02/16/14 02:55	4000
1,1-Dichloroethene	ND		3200	ppb v/v			02/16/14 02:55	4000
cis-1,2-Dichloroethene	**110000**		1600	ppb v/v			02/16/14 02:55	4000
trans-1,2-Dichloroethene	ND		1600	ppb v/v			02/16/14 02:55	4000
1,2-Dichloropropane	ND		1600	ppb v/v			02/16/14 02:55	4000
cis-1,3-Dichloropropene	ND		1600	ppb v/v			02/16/14 02:55	4000
trans-1,3-Dichloropropene	ND		1600	ppb v/v			02/16/14 02:55	4000
Ethyl acetate	ND		1200	ppb v/v			02/16/14 02:55	4000
Ethylbenzene	ND		1600	ppb v/v			02/16/14 02:55	4000
4-Ethyltoluene	ND		1600	ppb v/v			02/16/14 02:55	4000
n-Heptane	ND		3200	ppb v/v			02/16/14 02:55	4000
Hexachlorobutadiene	ND		8000	ppb v/v			02/16/14 02:55	4000

Client Sample ID: VEL-3-190-VPT-012814

Lab Sample ID: 320-5954-7

Date Collected: 01/28/14 13:01

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
n-Hexane	ND		3200		ppb v/v			02/16/14 02:55	4000
2-Hexanone	ND		1600		ppb v/v			02/16/14 02:55	4000
Isopropylbenzene	ND		3200		ppb v/v			02/16/14 02:55	4000
Methyl-t-Butyl Ether (MTBE)	ND		3200		ppb v/v			02/16/14 02:55	4000
4-Methyl-2-pentanone (MIBK)	ND		1600		ppb v/v			02/16/14 02:55	4000
Methylene chloride	ND		1600		ppb v/v			02/16/14 02:55	4000
Naphthalene	ND		3200		ppb v/v			02/16/14 02:55	4000
n-Octane	ND		1600		ppb v/v			02/16/14 02:55	4000
Propene	ND		1600		ppb v/v			02/16/14 02:55	4000
n-Propylbenzene	ND		1600		ppb v/v			02/16/14 02:55	4000
Styrene	ND		1600		ppb v/v			02/16/14 02:55	4000
1,1,2,2-Tetrachloroethane	ND		1600		ppb v/v			02/16/14 02:55	4000
Tetrachloroethene	**130000**		1600		ppb v/v			02/16/14 02:55	4000
Tetrahydrofuran	ND		3200		ppb v/v			02/16/14 02:55	4000
Toluene	ND		1600		ppb v/v			02/16/14 02:55	4000
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1600		ppb v/v			02/16/14 02:55	4000
1,2,4-Trichlorobenzene	ND		8000		ppb v/v			02/16/14 02:55	4000
1,1,1-Trichloroethane	ND		1200		ppb v/v			02/16/14 02:55	4000
1,1,2-Trichloroethane	ND		1600		ppb v/v			02/16/14 02:55	4000
Trichloroethene	**13000**		1600		ppb v/v			02/16/14 02:55	4000
Trichlorofluoromethane	ND		1600		ppb v/v			02/16/14 02:55	4000
1,2,4-Trimethylbenzene	ND		3200		ppb v/v			02/16/14 02:55	4000
1,3,5-Trimethylbenzene	ND		1600		ppb v/v			02/16/14 02:55	4000
2,2,4-Trimethylpentane	ND		1600		ppb v/v			02/16/14 02:55	4000
Vinyl acetate	ND		3200		ppb v/v			02/16/14 02:55	4000
Vinyl bromide	ND		3200		ppb v/v			02/16/14 02:55	4000
Vinyl chloride	ND		1600		ppb v/v			02/16/14 02:55	4000
m,p-Xylene	ND		3200		ppb v/v			02/16/14 02:55	4000
o-Xylene	ND		1600		ppb v/v			02/16/14 02:55	4000
2-Propanol	ND		8000		ppb v/v			02/16/14 02:55	4000
n-Nonane	ND		3200		ppb v/v			02/16/14 02:55	4000

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		48000		ug/m3			02/16/14 02:55	4000
Allyl chloride	ND		10000		ug/m3			02/16/14 02:55	4000
Benzene	ND		5100		ug/m3			02/16/14 02:55	4000
Benzyl chloride	ND		17000		ug/m3			02/16/14 02:55	4000
Bromodichloromethane	ND		8000		ug/m3			02/16/14 02:55	4000
Bromoform	ND		17000		ug/m3			02/16/14 02:55	4000
Bromomethane	ND		12000		ug/m3			02/16/14 02:55	4000
1,3-Butadiene	ND		7100		ug/m3			02/16/14 02:55	4000
2-Butanone (MEK)	ND		9400		ug/m3			02/16/14 02:55	4000
n-Butylbenzene	ND		8800		ug/m3			02/16/14 02:55	4000
sec-Butylbenzene	ND		8800		ug/m3			02/16/14 02:55	4000
tert-Butylbenzene	ND		18000		ug/m3			02/16/14 02:55	4000
Carbon disulfide	ND		10000		ug/m3			02/16/14 02:55	4000
Carbon tetrachloride	ND		20000		ug/m3			02/16/14 02:55	4000
Chlorobenzene	ND		5500		ug/m3			02/16/14 02:55	4000
Chloroethane	ND		8400		ug/m3			02/16/14 02:55	4000

Client Sample ID: VEL-3-190-VPT-012814

Lab Sample ID: 320-5954-7

Date Collected: 01/28/14 13:01

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Chloroform	ND		5900		ug/m3			02/16/14 02:55	4000
Chloromethane	ND		6600		ug/m3			02/16/14 02:55	4000
Cyclohexane	ND		5500		ug/m3			02/16/14 02:55	4000
Dibromochloromethane	ND		14000		ug/m3			02/16/14 02:55	4000
1,2-Dibromoethane (EDB)	ND		25000		ug/m3			02/16/14 02:55	4000
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		11000		ug/m3			02/16/14 02:55	4000
1,2-Dichlorobenzene	ND		9600		ug/m3			02/16/14 02:55	4000
1,3-Dichlorobenzene	ND		9600		ug/m3			02/16/14 02:55	4000
1,4-Dichlorobenzene	ND		9600		ug/m3			02/16/14 02:55	4000
Dichlorodifluoromethane	ND		7900		ug/m3			02/16/14 02:55	4000
1,1-Dichloroethane	ND		4900		ug/m3			02/16/14 02:55	4000
1,2-Dichloroethane	ND		13000		ug/m3			02/16/14 02:55	4000
1,1-Dichloroethene	ND		13000		ug/m3			02/16/14 02:55	4000
cis-1,2-Dichloroethene	**440000**		6300		ug/m3			02/16/14 02:55	4000
trans-1,2-Dichloroethene	ND		6300		ug/m3			02/16/14 02:55	4000
1,2-Dichloropropane	ND		7400		ug/m3			02/16/14 02:55	4000
cis-1,3-Dichloropropene	ND		7300		ug/m3			02/16/14 02:55	4000
trans-1,3-Dichloropropene	ND		7300		ug/m3			02/16/14 02:55	4000
Ethyl acetate	ND		4300		ug/m3			02/16/14 02:55	4000
Ethylbenzene	ND		6900		ug/m3			02/16/14 02:55	4000
4-Ethyltoluene	ND		7900		ug/m3			02/16/14 02:55	4000
n-Heptane	ND		13000		ug/m3			02/16/14 02:55	4000
Hexachlorobutadiene	ND		85000		ug/m3			02/16/14 02:55	4000
n-Hexane	ND		11000		ug/m3			02/16/14 02:55	4000
2-Hexanone	ND		6600		ug/m3			02/16/14 02:55	4000
Isopropylbenzene	ND		16000		ug/m3			02/16/14 02:55	4000
Methyl-t-Butyl Ether (MTBE)	ND		12000		ug/m3			02/16/14 02:55	4000
4-Methyl-2-pentanone (MIBK)	ND		6600		ug/m3			02/16/14 02:55	4000
Methylene chloride	ND		5600		ug/m3			02/16/14 02:55	4000
Naphthalene	ND		17000		ug/m3			02/16/14 02:55	4000
n-Octane	ND		7500		ug/m3			02/16/14 02:55	4000
Propene	ND		2800		ug/m3			02/16/14 02:55	4000
n-Propylbenzene	ND		7900		ug/m3			02/16/14 02:55	4000
Styrene	ND		6800		ug/m3			02/16/14 02:55	4000
1,1,2,2-Tetrachloroethane	ND		11000		ug/m3			02/16/14 02:55	4000
Tetrachloroethene	**890000**		11000		ug/m3			02/16/14 02:55	4000
Tetrahydrofuran	ND		9400		ug/m3			02/16/14 02:55	4000
Toluene	ND		6000		ug/m3			02/16/14 02:55	4000
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		12000		ug/m3			02/16/14 02:55	4000
1,2,4-Trichlorobenzene	ND		59000		ug/m3			02/16/14 02:55	4000
1,1,1-Trichloroethane	ND		6500		ug/m3			02/16/14 02:55	4000
1,1,2-Trichloroethane	ND		8700		ug/m3			02/16/14 02:55	4000
Trichloroethene	**69000**		8600		ug/m3			02/16/14 02:55	4000
Trichlorofluoromethane	ND		9000		ug/m3			02/16/14 02:55	4000
1,2,4-Trimethylbenzene	ND		16000		ug/m3			02/16/14 02:55	4000
1,3,5-Trimethylbenzene	ND		7900		ug/m3			02/16/14 02:55	4000
2,2,4-Trimethylpentane	ND		7500		ug/m3			02/16/14 02:55	4000
Vinyl acetate	ND		11000		ug/m3			02/16/14 02:55	4000

Client Sample ID: VEL-3-190-VPT-012814

Lab Sample ID: 320-5954-7

Date Collected: 01/28/14 13:01
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Vinyl bromide	ND		14000	ug/m3			02/16/14 02:55	4000
Vinyl chloride	ND		4100	ug/m3			02/16/14 02:55	4000
m,p-Xylene	ND		14000	ug/m3			02/16/14 02:55	4000
o-Xylene	ND		6900	ug/m3			02/16/14 02:55	4000
2-Propanol	ND		20000	ug/m3			02/16/14 02:55	4000
n-Nonane	ND		17000	ug/m3			02/16/14 02:55	4000

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*103*		*70 - 130*		*02/16/14 02:55*	*4000*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*		*02/16/14 02:55*	*4000*
Toluene-d8 (Surr)	*103*		*70 - 130*		*02/16/14 02:55*	*4000*

Client Sample ID: VEL-3-175-VPT-012814

Lab Sample ID: 320-5954-8

Date Collected: 01/28/14 13:20
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		30000	ppb v/v			02/16/14 03:44	6000
Allyl chloride	ND		4800	ppb v/v			02/16/14 03:44	6000
Benzene	ND		2400	ppb v/v			02/16/14 03:44	6000
Benzyl chloride	ND		4800	ppb v/v			02/16/14 03:44	6000
Bromodichloromethane	ND		1800	ppb v/v			02/16/14 03:44	6000
Bromoform	ND		2400	ppb v/v			02/16/14 03:44	6000
Bromomethane	ND		4800	ppb v/v			02/16/14 03:44	6000
1,3-Butadiene	ND		4800	ppb v/v			02/16/14 03:44	6000
2-Butanone (MEK)	ND		4800	ppb v/v			02/16/14 03:44	6000
n-Butylbenzene	ND		2400	ppb v/v			02/16/14 03:44	6000
sec-Butylbenzene	ND		2400	ppb v/v			02/16/14 03:44	6000
tert-Butylbenzene	ND		4800	ppb v/v			02/16/14 03:44	6000
Carbon disulfide	ND		4800	ppb v/v			02/16/14 03:44	6000
Carbon tetrachloride	ND		4800	ppb v/v			02/16/14 03:44	6000
Chlorobenzene	ND		1800	ppb v/v			02/16/14 03:44	6000
Chloroethane	ND		4800	ppb v/v			02/16/14 03:44	6000
Chloroform	ND		1800	ppb v/v			02/16/14 03:44	6000
Chloromethane	ND		4800	ppb v/v			02/16/14 03:44	6000
Cyclohexane	ND		2400	ppb v/v			02/16/14 03:44	6000
Dibromochloromethane	ND		2400	ppb v/v			02/16/14 03:44	6000
1,2-Dibromoethane (EDB)	ND		4800	ppb v/v			02/16/14 03:44	6000
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2400	ppb v/v			02/16/14 03:44	6000
1,2-Dichlorobenzene	ND		2400	ppb v/v			02/16/14 03:44	6000
1,3-Dichlorobenzene	ND		2400	ppb v/v			02/16/14 03:44	6000
1,4-Dichlorobenzene	ND		2400	ppb v/v			02/16/14 03:44	6000
Dichlorodifluoromethane	ND		2400	ppb v/v			02/16/14 03:44	6000
1,1-Dichloroethane	ND		1800	ppb v/v			02/16/14 03:44	6000
1,2-Dichloroethane	ND		4800	ppb v/v			02/16/14 03:44	6000
1,1-Dichloroethene	ND		4800	ppb v/v			02/16/14 03:44	6000
cis-1,2-Dichloroethene	**330000**		2400	ppb v/v			02/16/14 03:44	6000

Client Sample ID: VEL-3-175-VPT-012814

Lab Sample ID: 320-5954-8

Date Collected: 01/28/14 13:20

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,2-Dichloroethene	ND		2400	ppb v/v			02/16/14 03:44	6000
1,2-Dichloropropane	ND		2400	ppb v/v			02/16/14 03:44	6000
cis-1,3-Dichloropropene	ND		2400	ppb v/v			02/16/14 03:44	6000
trans-1,3-Dichloropropene	ND		2400	ppb v/v			02/16/14 03:44	6000
Ethyl acetate	ND		1800	ppb v/v			02/16/14 03:44	6000
Ethylbenzene	ND		2400	ppb v/v			02/16/14 03:44	6000
4-Ethyltoluene	ND		2400	ppb v/v			02/16/14 03:44	6000
n-Heptane	ND		4800	ppb v/v			02/16/14 03:44	6000
Hexachlorobutadiene	ND		12000	ppb v/v			02/16/14 03:44	6000
n-Hexane	ND		4800	ppb v/v			02/16/14 03:44	6000
2-Hexanone	ND		2400	ppb v/v			02/16/14 03:44	6000
Isopropylbenzene	ND		4800	ppb v/v			02/16/14 03:44	6000
Methyl-t-Butyl Ether (MTBE)	ND		4800	ppb v/v			02/16/14 03:44	6000
4-Methyl-2-pentanone (MIBK)	ND		2400	ppb v/v			02/16/14 03:44	6000
Methylene chloride	ND		2400	ppb v/v			02/16/14 03:44	6000
Naphthalene	ND		4800	ppb v/v			02/16/14 03:44	6000
n-Octane	ND		2400	ppb v/v			02/16/14 03:44	6000
Propene	ND		2400	ppb v/v			02/16/14 03:44	6000
n-Propylbenzene	ND		2400	ppb v/v			02/16/14 03:44	6000
Styrene	ND		2400	ppb v/v			02/16/14 03:44	6000
1,1,2,2-Tetrachloroethane	ND		2400	ppb v/v			02/16/14 03:44	6000
Tetrachloroethene	**170000**		2400	ppb v/v			02/16/14 03:44	6000
Tetrahydrofuran	ND		4800	ppb v/v			02/16/14 03:44	6000
Toluene	ND		2400	ppb v/v			02/16/14 03:44	6000
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2400	ppb v/v			02/16/14 03:44	6000
1,2,4-Trichlorobenzene	ND		12000	ppb v/v			02/16/14 03:44	6000
1,1,1-Trichloroethane	ND		1800	ppb v/v			02/16/14 03:44	6000
1,1,2-Trichloroethane	ND		2400	ppb v/v			02/16/14 03:44	6000
Trichloroethene	**22000**		2400	ppb v/v			02/16/14 03:44	6000
Trichlorofluoromethane	ND		2400	ppb v/v			02/16/14 03:44	6000
1,2,4-Trimethylbenzene	ND		4800	ppb v/v			02/16/14 03:44	6000
1,3,5-Trimethylbenzene	ND		2400	ppb v/v			02/16/14 03:44	6000
2,2,4-Trimethylpentane	ND		2400	ppb v/v			02/16/14 03:44	6000
Vinyl acetate	ND		4800	ppb v/v			02/16/14 03:44	6000
Vinyl bromide	ND		4800	ppb v/v			02/16/14 03:44	6000
Vinyl chloride	ND		2400	ppb v/v			02/16/14 03:44	6000
m,p-Xylene	ND		4800	ppb v/v			02/16/14 03:44	6000
o-Xylene	ND		2400	ppb v/v			02/16/14 03:44	6000
2-Propanol	ND		12000	ppb v/v			02/16/14 03:44	6000
n-Nonane	ND		4800	ppb v/v			02/16/14 03:44	6000

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		71000	ug/m3			02/16/14 03:44	6000
Allyl chloride	ND		15000	ug/m3			02/16/14 03:44	6000
Benzene	ND		7700	ug/m3			02/16/14 03:44	6000
Benzyl chloride	ND		25000	ug/m3			02/16/14 03:44	6000
Bromodichloromethane	ND		12000	ug/m3			02/16/14 03:44	6000
Bromoform	ND		25000	ug/m3			02/16/14 03:44	6000
Bromomethane	ND		19000	ug/m3			02/16/14 03:44	6000

Client Sample ID: VEL-3-175-VPT-012814

Lab Sample ID: 320-5954-8

Date Collected: 01/28/14 13:20

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,3-Butadiene	ND		11000		ug/m3			02/16/14 03:44	6000
2-Butanone (MEK)	ND		14000		ug/m3			02/16/14 03:44	6000
n-Butylbenzene	ND		13000		ug/m3			02/16/14 03:44	6000
sec-Butylbenzene	ND		13000		ug/m3			02/16/14 03:44	6000
tert-Butylbenzene	ND		26000		ug/m3			02/16/14 03:44	6000
Carbon disulfide	ND		15000		ug/m3			02/16/14 03:44	6000
Carbon tetrachloride	ND		30000		ug/m3			02/16/14 03:44	6000
Chlorobenzene	ND		8300		ug/m3			02/16/14 03:44	6000
Chloroethane	ND		13000		ug/m3			02/16/14 03:44	6000
Chloroform	ND		8800		ug/m3			02/16/14 03:44	6000
Chloromethane	ND		9900		ug/m3			02/16/14 03:44	6000
Cyclohexane	ND		8300		ug/m3			02/16/14 03:44	6000
Dibromochloromethane	ND		20000		ug/m3			02/16/14 03:44	6000
1,2-Dibromoethane (EDB)	ND		37000		ug/m3			02/16/14 03:44	6000
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		17000		ug/m3			02/16/14 03:44	6000
1,2-Dichlorobenzene	ND		14000		ug/m3			02/16/14 03:44	6000
1,3-Dichlorobenzene	ND		14000		ug/m3			02/16/14 03:44	6000
1,4-Dichlorobenzene	ND		14000		ug/m3			02/16/14 03:44	6000
Dichlorodifluoromethane	ND		12000		ug/m3			02/16/14 03:44	6000
1,1-Dichloroethane	ND		7300		ug/m3			02/16/14 03:44	6000
1,2-Dichloroethane	ND		19000		ug/m3			02/16/14 03:44	6000
1,1-Dichloroethene	ND		19000		ug/m3			02/16/14 03:44	6000
cis-1,2-Dichloroethene	**1300000**		9500		ug/m3			02/16/14 03:44	6000
trans-1,2-Dichloroethene	ND		9500		ug/m3			02/16/14 03:44	6000
1,2-Dichloropropane	ND		11000		ug/m3			02/16/14 03:44	6000
cis-1,3-Dichloropropene	ND		11000		ug/m3			02/16/14 03:44	6000
trans-1,3-Dichloropropene	ND		11000		ug/m3			02/16/14 03:44	6000
Ethyl acetate	ND		6500		ug/m3			02/16/14 03:44	6000
Ethylbenzene	ND		10000		ug/m3			02/16/14 03:44	6000
4-Ethyltoluene	ND		12000		ug/m3			02/16/14 03:44	6000
n-Heptane	ND		20000		ug/m3			02/16/14 03:44	6000
Hexachlorobutadiene	ND		130000		ug/m3			02/16/14 03:44	6000
n-Hexane	ND		17000		ug/m3			02/16/14 03:44	6000
2-Hexanone	ND		9800		ug/m3			02/16/14 03:44	6000
Isopropylbenzene	ND		24000		ug/m3			02/16/14 03:44	6000
Methyl-t-Butyl Ether (MTBE)	ND		17000		ug/m3			02/16/14 03:44	6000
4-Methyl-2-pentanone (MIBK)	ND		9800		ug/m3			02/16/14 03:44	6000
Methylene chloride	ND		8300		ug/m3			02/16/14 03:44	6000
Naphthalene	ND		25000		ug/m3			02/16/14 03:44	6000
n-Octane	ND		11000		ug/m3			02/16/14 03:44	6000
Propene	ND		4100		ug/m3			02/16/14 03:44	6000
n-Propylbenzene	ND		12000		ug/m3			02/16/14 03:44	6000
Styrene	ND		10000		ug/m3			02/16/14 03:44	6000
1,1,2,2-Tetrachloroethane	ND		16000		ug/m3			02/16/14 03:44	6000
Tetrachloroethene	**1200000**		16000		ug/m3			02/16/14 03:44	6000
Tetrahydrofuran	ND		14000		ug/m3			02/16/14 03:44	6000
Toluene	ND		9000		ug/m3			02/16/14 03:44	6000
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		18000		ug/m3			02/16/14 03:44	6000

Client Sample ID: VEL-3-175-VPT-012814

Lab Sample ID: 320-5954-8

Date Collected: 01/28/14 13:20
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2,4-Trichlorobenzene	ND		89000	ug/m3			02/16/14 03:44	6000
1,1,1-Trichloroethane	ND		9800	ug/m3			02/16/14 03:44	6000
1,1,2-Trichloroethane	ND		13000	ug/m3			02/16/14 03:44	6000
Trichloroethene	**120000**		13000	ug/m3			02/16/14 03:44	6000
Trichlorofluoromethane	ND		13000	ug/m3			02/16/14 03:44	6000
1,2,4-Trimethylbenzene	ND		24000	ug/m3			02/16/14 03:44	6000
1,3,5-Trimethylbenzene	ND		12000	ug/m3			02/16/14 03:44	6000
2,2,4-Trimethylpentane	ND		11000	ug/m3			02/16/14 03:44	6000
Vinyl acetate	ND		17000	ug/m3			02/16/14 03:44	6000
Vinyl bromide	ND		21000	ug/m3			02/16/14 03:44	6000
Vinyl chloride	ND		6100	ug/m3			02/16/14 03:44	6000
m,p-Xylene	ND		21000	ug/m3			02/16/14 03:44	6000
o-Xylene	ND		10000	ug/m3			02/16/14 03:44	6000
2-Propanol	ND		29000	ug/m3			02/16/14 03:44	6000
n-Nonane	ND		25000	ug/m3			02/16/14 03:44	6000

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*104*		*70 - 130*		*02/16/14 03:44*	*6000*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*		*02/16/14 03:44*	*6000*
Toluene-d8 (Surr)	*102*		*70 - 130*		*02/16/14 03:44*	*6000*

Client Sample ID: VEL-3-160-VPT-012814

Lab Sample ID: 320-5954-9

Date Collected: 01/28/14 13:41
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		30000	ppb v/v			02/16/14 08:30	6080
Allyl chloride	ND		4900	ppb v/v			02/16/14 08:30	6080
Benzene	ND		2400	ppb v/v			02/16/14 08:30	6080
Benzyl chloride	ND		4900	ppb v/v			02/16/14 08:30	6080
Bromodichloromethane	ND		1800	ppb v/v			02/16/14 08:30	6080
Bromoform	ND		2400	ppb v/v			02/16/14 08:30	6080
Bromomethane	ND		4900	ppb v/v			02/16/14 08:30	6080
1,3-Butadiene	ND		4900	ppb v/v			02/16/14 08:30	6080
2-Butanone (MEK)	ND		4900	ppb v/v			02/16/14 08:30	6080
n-Butylbenzene	ND		2400	ppb v/v			02/16/14 08:30	6080
sec-Butylbenzene	ND		2400	ppb v/v			02/16/14 08:30	6080
tert-Butylbenzene	ND		4900	ppb v/v			02/16/14 08:30	6080
Carbon disulfide	ND		4900	ppb v/v			02/16/14 08:30	6080
Carbon tetrachloride	ND		4900	ppb v/v			02/16/14 08:30	6080
Chlorobenzene	ND		1800	ppb v/v			02/16/14 08:30	6080
Chloroethane	ND		4900	ppb v/v			02/16/14 08:30	6080
Chloroform	ND		1800	ppb v/v			02/16/14 08:30	6080
Chloromethane	ND		4900	ppb v/v			02/16/14 08:30	6080
Cyclohexane	ND		2400	ppb v/v			02/16/14 08:30	6080
Dibromochloromethane	ND		2400	ppb v/v			02/16/14 08:30	6080
1,2-Dibromoethane (EDB)	ND		4900	ppb v/v			02/16/14 08:30	6080

Client Sample ID: VEL-3-160-VPT-012814

Lab Sample ID: 320-5954-9

Date Collected: 01/28/14 13:41
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2400		ppb v/v			02/16/14 08:30	6080
1,2-Dichlorobenzene	ND		2400		ppb v/v			02/16/14 08:30	6080
1,3-Dichlorobenzene	ND		2400		ppb v/v			02/16/14 08:30	6080
1,4-Dichlorobenzene	ND		2400		ppb v/v			02/16/14 08:30	6080
Dichlorodifluoromethane	ND		2400		ppb v/v			02/16/14 08:30	6080
1,1-Dichloroethane	ND		1800		ppb v/v			02/16/14 08:30	6080
1,2-Dichloroethane	ND		4900		ppb v/v			02/16/14 08:30	6080
1,1-Dichloroethene	ND		4900		ppb v/v			02/16/14 08:30	6080
cis-1,2-Dichloroethene	**330000**		2400		ppb v/v			02/16/14 08:30	6080
trans-1,2-Dichloroethene	ND		2400		ppb v/v			02/16/14 08:30	6080
1,2-Dichloropropane	ND		2400		ppb v/v			02/16/14 08:30	6080
cis-1,3-Dichloropropene	ND		2400		ppb v/v			02/16/14 08:30	6080
trans-1,3-Dichloropropene	ND		2400		ppb v/v			02/16/14 08:30	6080
Ethyl acetate	ND		1800		ppb v/v			02/16/14 08:30	6080
Ethylbenzene	ND		2400		ppb v/v			02/16/14 08:30	6080
4-Ethyltoluene	ND		2400		ppb v/v			02/16/14 08:30	6080
n-Heptane	ND		4900		ppb v/v			02/16/14 08:30	6080
Hexachlorobutadiene	ND		12000		ppb v/v			02/16/14 08:30	6080
n-Hexane	ND		4900		ppb v/v			02/16/14 08:30	6080
2-Hexanone	ND		2400		ppb v/v			02/16/14 08:30	6080
Isopropylbenzene	ND		4900		ppb v/v			02/16/14 08:30	6080
Methyl-t-Butyl Ether (MTBE)	ND		4900		ppb v/v			02/16/14 08:30	6080
4-Methyl-2-pentanone (MIBK)	ND		2400		ppb v/v			02/16/14 08:30	6080
Methylene chloride	ND		2400		ppb v/v			02/16/14 08:30	6080
Naphthalene	ND		4900		ppb v/v			02/16/14 08:30	6080
n-Octane	ND		2400		ppb v/v			02/16/14 08:30	6080
Propene	ND		2400		ppb v/v			02/16/14 08:30	6080
n-Propylbenzene	ND		2400		ppb v/v			02/16/14 08:30	6080
Styrene	ND		2400		ppb v/v			02/16/14 08:30	6080
1,1,2,2-Tetrachloroethane	ND		2400		ppb v/v			02/16/14 08:30	6080
Tetrachloroethene	**220000**		2400		ppb v/v			02/16/14 08:30	6080
Tetrahydrofuran	ND		4900		ppb v/v			02/16/14 08:30	6080
Toluene	ND		2400		ppb v/v			02/16/14 08:30	6080
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2400		ppb v/v			02/16/14 08:30	6080
1,2,4-Trichlorobenzene	ND		12000		ppb v/v			02/16/14 08:30	6080
1,1,1-Trichloroethane	ND		1800		ppb v/v			02/16/14 08:30	6080
1,1,2-Trichloroethane	ND		2400		ppb v/v			02/16/14 08:30	6080
Trichloroethene	**28000**		2400		ppb v/v			02/16/14 08:30	6080
Trichlorofluoromethane	ND		2400		ppb v/v			02/16/14 08:30	6080
1,2,4-Trimethylbenzene	ND		4900		ppb v/v			02/16/14 08:30	6080
1,3,5-Trimethylbenzene	ND		2400		ppb v/v			02/16/14 08:30	6080
2,2,4-Trimethylpentane	ND		2400		ppb v/v			02/16/14 08:30	6080
Vinyl acetate	ND		4900		ppb v/v			02/16/14 08:30	6080
Vinyl bromide	ND		4900		ppb v/v			02/16/14 08:30	6080
Vinyl chloride	ND		2400		ppb v/v			02/16/14 08:30	6080
m,p-Xylene	ND		4900		ppb v/v			02/16/14 08:30	6080
o-Xylene	ND		2400		ppb v/v			02/16/14 08:30	6080
2-Propanol	ND		12000		ppb v/v			02/16/14 08:30	6080

Client Sample ID: VEL-3-160-VPT-012814

Lab Sample ID: 320-5954-9

Date Collected: 01/28/14 13:41
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
n-Nonane	ND		4900	ppb v/v			02/16/14 08:30	6080

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		72000	ug/m3			02/16/14 08:30	6080
Allyl chloride	ND		15000	ug/m3			02/16/14 08:30	6080
Benzene	ND		7800	ug/m3			02/16/14 08:30	6080
Benzyl chloride	ND		25000	ug/m3			02/16/14 08:30	6080
Bromodichloromethane	ND		12000	ug/m3			02/16/14 08:30	6080
Bromoform	ND		25000	ug/m3			02/16/14 08:30	6080
Bromomethane	ND		19000	ug/m3			02/16/14 08:30	6080
1,3-Butadiene	ND		11000	ug/m3			02/16/14 08:30	6080
2-Butanone (MEK)	ND		14000	ug/m3			02/16/14 08:30	6080
n-Butylbenzene	ND		13000	ug/m3			02/16/14 08:30	6080
sec-Butylbenzene	ND		13000	ug/m3			02/16/14 08:30	6080
tert-Butylbenzene	ND		27000	ug/m3			02/16/14 08:30	6080
Carbon disulfide	ND		15000	ug/m3			02/16/14 08:30	6080
Carbon tetrachloride	ND		31000	ug/m3			02/16/14 08:30	6080
Chlorobenzene	ND		8400	ug/m3			02/16/14 08:30	6080
Chloroethane	ND		13000	ug/m3			02/16/14 08:30	6080
Chloroform	ND		8900	ug/m3			02/16/14 08:30	6080
Chloromethane	ND		10000	ug/m3			02/16/14 08:30	6080
Cyclohexane	ND		8400	ug/m3			02/16/14 08:30	6080
Dibromochloromethane	ND		21000	ug/m3			02/16/14 08:30	6080
1,2-Dibromoethane (EDB)	ND		37000	ug/m3			02/16/14 08:30	6080
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		17000	ug/m3			02/16/14 08:30	6080
1,2-Dichlorobenzene	ND		15000	ug/m3			02/16/14 08:30	6080
1,3-Dichlorobenzene	ND		15000	ug/m3			02/16/14 08:30	6080
1,4-Dichlorobenzene	ND		15000	ug/m3			02/16/14 08:30	6080
Dichlorodifluoromethane	ND		12000	ug/m3			02/16/14 08:30	6080
1,1-Dichloroethane	ND		7400	ug/m3			02/16/14 08:30	6080
1,2-Dichloroethane	ND		20000	ug/m3			02/16/14 08:30	6080
1,1-Dichloroethene	ND		19000	ug/m3			02/16/14 08:30	6080
cis-1,2-Dichloroethene	**1300000**		9600	ug/m3			02/16/14 08:30	6080
trans-1,2-Dichloroethene	ND		9600	ug/m3			02/16/14 08:30	6080
1,2-Dichloropropane	ND		11000	ug/m3			02/16/14 08:30	6080
cis-1,3-Dichloropropene	ND		11000	ug/m3			02/16/14 08:30	6080
trans-1,3-Dichloropropene	ND		11000	ug/m3			02/16/14 08:30	6080
Ethyl acetate	ND		6600	ug/m3			02/16/14 08:30	6080
Ethylbenzene	ND		11000	ug/m3			02/16/14 08:30	6080
4-Ethyltoluene	ND		12000	ug/m3			02/16/14 08:30	6080
n-Heptane	ND		20000	ug/m3			02/16/14 08:30	6080
Hexachlorobutadiene	ND		130000	ug/m3			02/16/14 08:30	6080
n-Hexane	ND		17000	ug/m3			02/16/14 08:30	6080
2-Hexanone	ND		10000	ug/m3			02/16/14 08:30	6080
Isopropylbenzene	ND		24000	ug/m3			02/16/14 08:30	6080
Methyl-t-Butyl Ether (MTBE)	ND		18000	ug/m3			02/16/14 08:30	6080
4-Methyl-2-pentanone (MIBK)	ND		10000	ug/m3			02/16/14 08:30	6080
Methylene chloride	ND		8400	ug/m3			02/16/14 08:30	6080
Naphthalene	ND		25000	ug/m3			02/16/14 08:30	6080

Client Sample ID: VEL-3-160-VPT-012814

Lab Sample ID: 320-5954-9

Date Collected: 01/28/14 13:41
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
n-Octane	ND		11000	ug/m3			02/16/14 08:30	6080
Propene	ND		4200	ug/m3			02/16/14 08:30	6080
n-Propylbenzene	ND		12000	ug/m3			02/16/14 08:30	6080
Styrene	ND		10000	ug/m3			02/16/14 08:30	6080
1,1,2,2-Tetrachloroethane	ND		17000	ug/m3			02/16/14 08:30	6080
Tetrachloroethene	**1500000**		16000	ug/m3			02/16/14 08:30	6080
Tetrahydrofuran	ND		14000	ug/m3			02/16/14 08:30	6080
Toluene	ND		9200	ug/m3			02/16/14 08:30	6080
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		19000	ug/m3			02/16/14 08:30	6080
1,2,4-Trichlorobenzene	ND		90000	ug/m3			02/16/14 08:30	6080
1,1,1-Trichloroethane	ND		10000	ug/m3			02/16/14 08:30	6080
1,1,2-Trichloroethane	ND		13000	ug/m3			02/16/14 08:30	6080
Trichloroethene	**150000**		13000	ug/m3			02/16/14 08:30	6080
Trichlorofluoromethane	ND		14000	ug/m3			02/16/14 08:30	6080
1,2,4-Trimethylbenzene	ND		24000	ug/m3			02/16/14 08:30	6080
1,3,5-Trimethylbenzene	ND		12000	ug/m3			02/16/14 08:30	6080
2,2,4-Trimethylpentane	ND		11000	ug/m3			02/16/14 08:30	6080
Vinyl acetate	ND		17000	ug/m3			02/16/14 08:30	6080
Vinyl bromide	ND		21000	ug/m3			02/16/14 08:30	6080
Vinyl chloride	ND		6200	ug/m3			02/16/14 08:30	6080
m,p-Xylene	ND		21000	ug/m3			02/16/14 08:30	6080
o-Xylene	ND		11000	ug/m3			02/16/14 08:30	6080
2-Propanol	ND		30000	ug/m3			02/16/14 08:30	6080
n-Nonane	ND		26000	ug/m3			02/16/14 08:30	6080

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*104*		*70 - 130*		*02/16/14 08:30*	*6080*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*		*02/16/14 08:30*	*6080*
Toluene-d8 (Surr)	*105*		*70 - 130*		*02/16/14 08:30*	*6080*

Client Sample ID: VML-02-SVE170-VPT-012914

Lab Sample ID: 320-5954-10

Date Collected: 01/29/14 15:22
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		65000	ppb v/v			02/16/14 09:19	12900
Allyl chloride	ND		10000	ppb v/v			02/16/14 09:19	12900
Benzene	ND		5200	ppb v/v			02/16/14 09:19	12900
Benzyl chloride	ND		10000	ppb v/v			02/16/14 09:19	12900
Bromodichloromethane	ND		3900	ppb v/v			02/16/14 09:19	12900
Bromoform	ND		5200	ppb v/v			02/16/14 09:19	12900
Bromomethane	ND		10000	ppb v/v			02/16/14 09:19	12900
1,3-Butadiene	ND		10000	ppb v/v			02/16/14 09:19	12900
2-Butanone (MEK)	ND		10000	ppb v/v			02/16/14 09:19	12900
n-Butylbenzene	ND		5200	ppb v/v			02/16/14 09:19	12900
sec-Butylbenzene	ND		5200	ppb v/v			02/16/14 09:19	12900
tert-Butylbenzene	ND		10000	ppb v/v			02/16/14 09:19	12900

Client Sample ID: VML-02-SVE170-VPT-012914 **Lab Sample ID: 320-5954-10**

Date Collected: 01/29/14 15:22 **Matrix: Air**

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon disulfide	ND		10000	ppb v/v			02/16/14 09:19	12900
Carbon tetrachloride	ND		10000	ppb v/v			02/16/14 09:19	12900
Chlorobenzene	ND		3900	ppb v/v			02/16/14 09:19	12900
Chloroethane	ND		10000	ppb v/v			02/16/14 09:19	12900
Chloroform	ND		3900	ppb v/v			02/16/14 09:19	12900
Chloromethane	ND		10000	ppb v/v			02/16/14 09:19	12900
Cyclohexane	ND		5200	ppb v/v			02/16/14 09:19	12900
Dibromochloromethane	ND		5200	ppb v/v			02/16/14 09:19	12900
1,2-Dibromoethane (EDB)	ND		10000	ppb v/v			02/16/14 09:19	12900
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		5200	ppb v/v			02/16/14 09:19	12900
1,2-Dichlorobenzene	ND		5200	ppb v/v			02/16/14 09:19	12900
1,3-Dichlorobenzene	ND		5200	ppb v/v			02/16/14 09:19	12900
1,4-Dichlorobenzene	ND		5200	ppb v/v			02/16/14 09:19	12900
Dichlorodifluoromethane	ND		5200	ppb v/v			02/16/14 09:19	12900
1,1-Dichloroethane	ND		3900	ppb v/v			02/16/14 09:19	12900
1,2-Dichloroethane	ND		10000	ppb v/v			02/16/14 09:19	12900
1,1-Dichloroethene	ND		10000	ppb v/v			02/16/14 09:19	12900
cis-1,2-Dichloroethene	**470000**		5200	ppb v/v			02/16/14 09:19	12900
trans-1,2-Dichloroethene	ND		5200	ppb v/v			02/16/14 09:19	12900
1,2-Dichloropropane	ND		5200	ppb v/v			02/16/14 09:19	12900
cis-1,3-Dichloropropene	ND		5200	ppb v/v			02/16/14 09:19	12900
trans-1,3-Dichloropropene	ND		5200	ppb v/v			02/16/14 09:19	12900
Ethyl acetate	ND		3900	ppb v/v			02/16/14 09:19	12900
Ethylbenzene	ND		5200	ppb v/v			02/16/14 09:19	12900
4-Ethyltoluene	ND		5200	ppb v/v			02/16/14 09:19	12900
n-Heptane	ND		10000	ppb v/v			02/16/14 09:19	12900
Hexachlorobutadiene	ND		26000	ppb v/v			02/16/14 09:19	12900
n-Hexane	ND		10000	ppb v/v			02/16/14 09:19	12900
2-Hexanone	ND		5200	ppb v/v			02/16/14 09:19	12900
Isopropylbenzene	ND		10000	ppb v/v			02/16/14 09:19	12900
Methyl-t-Butyl Ether (MTBE)	ND		10000	ppb v/v			02/16/14 09:19	12900
4-Methyl-2-pentanone (MIBK)	ND		5200	ppb v/v			02/16/14 09:19	12900
Methylene chloride	ND		5200	ppb v/v			02/16/14 09:19	12900
Naphthalene	ND		10000	ppb v/v			02/16/14 09:19	12900
n-Octane	ND		5200	ppb v/v			02/16/14 09:19	12900
Propene	ND		5200	ppb v/v			02/16/14 09:19	12900
n-Propylbenzene	ND		5200	ppb v/v			02/16/14 09:19	12900
Styrene	ND		5200	ppb v/v			02/16/14 09:19	12900
1,1,2,2-Tetrachloroethane	ND		5200	ppb v/v			02/16/14 09:19	12900
Tetrachloroethene	**670000**		5200	ppb v/v			02/16/14 09:19	12900
Tetrahydrofuran	ND		10000	ppb v/v			02/16/14 09:19	12900
Toluene	ND		5200	ppb v/v			02/16/14 09:19	12900
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		5200	ppb v/v			02/16/14 09:19	12900
1,2,4-Trichlorobenzene	ND		26000	ppb v/v			02/16/14 09:19	12900
1,1,1-Trichloroethane	ND		3900	ppb v/v			02/16/14 09:19	12900
1,1,2-Trichloroethane	ND		5200	ppb v/v			02/16/14 09:19	12900
Trichloroethene	**83000**		5200	ppb v/v			02/16/14 09:19	12900
Trichlorofluoromethane	ND		5200	ppb v/v			02/16/14 09:19	12900

Client Sample ID: VML-02-SVE170-VPT-012914

Lab Sample ID: 320-5954-10

Date Collected: 01/29/14 15:22
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2,4-Trimethylbenzene	ND		10000	ppb v/v			02/16/14 09:19	12900
1,3,5-Trimethylbenzene	ND		5200	ppb v/v			02/16/14 09:19	12900
2,2,4-Trimethylpentane	ND		5200	ppb v/v			02/16/14 09:19	12900
Vinyl acetate	ND		10000	ppb v/v			02/16/14 09:19	12900
Vinyl bromide	ND		10000	ppb v/v			02/16/14 09:19	12900
Vinyl chloride	ND		5200	ppb v/v			02/16/14 09:19	12900
m,p-Xylene	ND		10000	ppb v/v			02/16/14 09:19	12900
o-Xylene	ND		5200	ppb v/v			02/16/14 09:19	12900
2-Propanol	ND		26000	ppb v/v			02/16/14 09:19	12900
n-Nonane	ND		10000	ppb v/v			02/16/14 09:19	12900

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		150000	ug/m3			02/16/14 09:19	12900
Allyl chloride	ND		32000	ug/m3			02/16/14 09:19	12900
Benzene	ND		16000	ug/m3			02/16/14 09:19	12900
Benzyl chloride	ND		53000	ug/m3			02/16/14 09:19	12900
Bromodichloromethane	ND		26000	ug/m3			02/16/14 09:19	12900
Bromoform	ND		53000	ug/m3			02/16/14 09:19	12900
Bromomethane	ND		40000	ug/m3			02/16/14 09:19	12900
1,3-Butadiene	ND		23000	ug/m3			02/16/14 09:19	12900
2-Butanone (MEK)	ND		30000	ug/m3			02/16/14 09:19	12900
n-Butylbenzene	ND		28000	ug/m3			02/16/14 09:19	12900
sec-Butylbenzene	ND		28000	ug/m3			02/16/14 09:19	12900
tert-Butylbenzene	ND		57000	ug/m3			02/16/14 09:19	12900
Carbon disulfide	ND		32000	ug/m3			02/16/14 09:19	12900
Carbon tetrachloride	ND		65000	ug/m3			02/16/14 09:19	12900
Chlorobenzene	ND		18000	ug/m3			02/16/14 09:19	12900
Chloroethane	ND		27000	ug/m3			02/16/14 09:19	12900
Chloroform	ND		19000	ug/m3			02/16/14 09:19	12900
Chloromethane	ND		21000	ug/m3			02/16/14 09:19	12900
Cyclohexane	ND		18000	ug/m3			02/16/14 09:19	12900
Dibromochloromethane	ND		44000	ug/m3			02/16/14 09:19	12900
1,2-Dibromoethane (EDB)	ND		79000	ug/m3			02/16/14 09:19	12900
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		36000	ug/m3			02/16/14 09:19	12900
1,2-Dichlorobenzene	ND		31000	ug/m3			02/16/14 09:19	12900
1,3-Dichlorobenzene	ND		31000	ug/m3			02/16/14 09:19	12900
1,4-Dichlorobenzene	ND		31000	ug/m3			02/16/14 09:19	12900
Dichlorodifluoromethane	ND		26000	ug/m3			02/16/14 09:19	12900
1,1-Dichloroethane	ND		16000	ug/m3			02/16/14 09:19	12900
1,2-Dichloroethane	ND		42000	ug/m3			02/16/14 09:19	12900
1,1-Dichloroethene	ND		41000	ug/m3			02/16/14 09:19	12900
cis-1,2-Dichloroethene	**1800000**		20000	ug/m3			02/16/14 09:19	12900
trans-1,2-Dichloroethene	ND		20000	ug/m3			02/16/14 09:19	12900
1,2-Dichloropropane	ND		24000	ug/m3			02/16/14 09:19	12900
cis-1,3-Dichloropropene	ND		23000	ug/m3			02/16/14 09:19	12900
trans-1,3-Dichloropropene	ND		23000	ug/m3			02/16/14 09:19	12900
Ethyl acetate	ND		14000	ug/m3			02/16/14 09:19	12900
Ethylbenzene	ND		22000	ug/m3			02/16/14 09:19	12900
4-Ethyltoluene	ND		25000	ug/m3			02/16/14 09:19	12900

Client Sample ID: VML-02-SVE170-VPT-012914

Lab Sample ID: 320-5954-10

Date Collected: 01/29/14 15:22

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
n-Heptane	ND		42000	ug/m3			02/16/14 09:19	12900
Hexachlorobutadiene	ND		280000	ug/m3			02/16/14 09:19	12900
n-Hexane	ND		36000	ug/m3			02/16/14 09:19	12900
2-Hexanone	ND		21000	ug/m3			02/16/14 09:19	12900
Isopropylbenzene	ND		51000	ug/m3			02/16/14 09:19	12900
Methyl-t-Butyl Ether (MTBE)	ND		37000	ug/m3			02/16/14 09:19	12900
4-Methyl-2-pentanone (MIBK)	ND		21000	ug/m3			02/16/14 09:19	12900
Methylene chloride	ND		18000	ug/m3			02/16/14 09:19	12900
Naphthalene	ND		54000	ug/m3			02/16/14 09:19	12900
n-Octane	ND		24000	ug/m3			02/16/14 09:19	12900
Propene	ND		8900	ug/m3			02/16/14 09:19	12900
n-Propylbenzene	ND		25000	ug/m3			02/16/14 09:19	12900
Styrene	ND		22000	ug/m3			02/16/14 09:19	12900
1,1,2,2-Tetrachloroethane	ND		35000	ug/m3			02/16/14 09:19	12900
Tetrachloroethene	**4500000**		35000	ug/m3			02/16/14 09:19	12900
Tetrahydrofuran	ND		30000	ug/m3			02/16/14 09:19	12900
Toluene	ND		19000	ug/m3			02/16/14 09:19	12900
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		40000	ug/m3			02/16/14 09:19	12900
1,2,4-Trichlorobenzene	ND		190000	ug/m3			02/16/14 09:19	12900
1,1,1-Trichloroethane	ND		21000	ug/m3			02/16/14 09:19	12900
1,1,2-Trichloroethane	ND		28000	ug/m3			02/16/14 09:19	12900
Trichloroethene	**450000**		28000	ug/m3			02/16/14 09:19	12900
Trichlorofluoromethane	ND		29000	ug/m3			02/16/14 09:19	12900
1,2,4-Trimethylbenzene	ND		51000	ug/m3			02/16/14 09:19	12900
1,3,5-Trimethylbenzene	ND		25000	ug/m3			02/16/14 09:19	12900
2,2,4-Trimethylpentane	ND		24000	ug/m3			02/16/14 09:19	12900
Vinyl acetate	ND		36000	ug/m3			02/16/14 09:19	12900
Vinyl bromide	ND		45000	ug/m3			02/16/14 09:19	12900
Vinyl chloride	ND		13000	ug/m3			02/16/14 09:19	12900
m,p-Xylene	ND		45000	ug/m3			02/16/14 09:19	12900
o-Xylene	ND		22000	ug/m3			02/16/14 09:19	12900
2-Propanol	ND		63000	ug/m3			02/16/14 09:19	12900
n-Nonane	ND		54000	ug/m3			02/16/14 09:19	12900

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*103*		*70 - 130*		*02/16/14 09:19*	*12900*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*		*02/16/14 09:19*	*12900*
Toluene-d8 (Surr)	*103*		*70 - 130*		*02/16/14 09:19*	*12900*

Client Sample ID: VML-01-SVE170-VPT-013014

Lab Sample ID: 320-5954-11

Date Collected: 01/30/14 16:07

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		4200	ppb v/v			02/17/14 18:41	832
Allyl chloride	ND		670	ppb v/v			02/17/14 18:41	832
Benzene	ND		330	ppb v/v			02/17/14 18:41	832

Client Sample ID: VML-01-SVE170-VPT-013014

Lab Sample ID: 320-5954-11

Date Collected: 01/30/14 16:07
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Benzyl chloride	ND		670	ppb v/v			02/17/14 18:41	832
Bromodichloromethane	ND		250	ppb v/v			02/17/14 18:41	832
Bromoform	ND		330	ppb v/v			02/17/14 18:41	832
Bromomethane	ND		670	ppb v/v			02/17/14 18:41	832
1,3-Butadiene	ND		670	ppb v/v			02/17/14 18:41	832
2-Butanone (MEK)	ND		670	ppb v/v			02/17/14 18:41	832
n-Butylbenzene	ND		330	ppb v/v			02/17/14 18:41	832
sec-Butylbenzene	ND		330	ppb v/v			02/17/14 18:41	832
tert-Butylbenzene	ND		670	ppb v/v			02/17/14 18:41	832
Carbon disulfide	ND		670	ppb v/v			02/17/14 18:41	832
Carbon tetrachloride	ND		670	ppb v/v			02/17/14 18:41	832
Chlorobenzene	ND		250	ppb v/v			02/17/14 18:41	832
Chloroethane	ND		670	ppb v/v			02/17/14 18:41	832
Chloroform	ND		250	ppb v/v			02/17/14 18:41	832
Chloromethane	ND		670	ppb v/v			02/17/14 18:41	832
Cyclohexane	ND		330	ppb v/v			02/17/14 18:41	832
Dibromochloromethane	ND		330	ppb v/v			02/17/14 18:41	832
1,2-Dibromoethane (EDB)	ND		670	ppb v/v			02/17/14 18:41	832
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		330	ppb v/v			02/17/14 18:41	832
1,2-Dichlorobenzene	ND		330	ppb v/v			02/17/14 18:41	832
1,3-Dichlorobenzene	ND		330	ppb v/v			02/17/14 18:41	832
1,4-Dichlorobenzene	ND		330	ppb v/v			02/17/14 18:41	832
Dichlorodifluoromethane	ND		330	ppb v/v			02/17/14 18:41	832
1,1-Dichloroethane	ND		250	ppb v/v			02/17/14 18:41	832
1,2-Dichloroethane	ND		670	ppb v/v			02/17/14 18:41	832
1,1-Dichloroethene	ND		670	ppb v/v			02/17/14 18:41	832
cis-1,2-Dichloroethene	**2000**		330	ppb v/v			02/17/14 18:41	832
trans-1,2-Dichloroethene	ND		330	ppb v/v			02/17/14 18:41	832
1,2-Dichloropropane	ND		330	ppb v/v			02/17/14 18:41	832
cis-1,3-Dichloropropene	ND		330	ppb v/v			02/17/14 18:41	832
trans-1,3-Dichloropropene	ND		330	ppb v/v			02/17/14 18:41	832
Ethyl acetate	ND		250	ppb v/v			02/17/14 18:41	832
Ethylbenzene	ND		330	ppb v/v			02/17/14 18:41	832
4-Ethyltoluene	ND		330	ppb v/v			02/17/14 18:41	832
n-Heptane	ND		670	ppb v/v			02/17/14 18:41	832
Hexachlorobutadiene	ND		1700	ppb v/v			02/17/14 18:41	832
n-Hexane	ND		670	ppb v/v			02/17/14 18:41	832
2-Hexanone	ND		330	ppb v/v			02/17/14 18:41	832
Isopropylbenzene	ND		670	ppb v/v			02/17/14 18:41	832
Methyl-t-Butyl Ether (MTBE)	ND		670	ppb v/v			02/17/14 18:41	832
4-Methyl-2-pentanone (MIBK)	ND		330	ppb v/v			02/17/14 18:41	832
Methylene chloride	ND		330	ppb v/v			02/17/14 18:41	832
Naphthalene	ND		670	ppb v/v			02/17/14 18:41	832
n-Octane	ND		330	ppb v/v			02/17/14 18:41	832
Propene	ND		330	ppb v/v			02/17/14 18:41	832
n-Propylbenzene	ND		330	ppb v/v			02/17/14 18:41	832
Styrene	ND		330	ppb v/v			02/17/14 18:41	832
1,1,2,2-Tetrachloroethane	ND		330	ppb v/v			02/17/14 18:41	832

Client Sample ID: VML-01-SVE170-VPT-013014 **Lab Sample ID: 320-5954-11**

Date Collected: 01/30/14 16:07 **Matrix: Air**

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	**39000**		330	ppb v/v			02/17/14 18:41	832
Tetrahydrofuran	ND		670	ppb v/v			02/17/14 18:41	832
Toluene	**830**		330	ppb v/v			02/17/14 18:41	832
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		330	ppb v/v			02/17/14 18:41	832
1,2,4-Trichlorobenzene	ND		1700	ppb v/v			02/17/14 18:41	832
1,1,1-Trichloroethane	ND		250	ppb v/v			02/17/14 18:41	832
1,1,2-Trichloroethane	ND		330	ppb v/v			02/17/14 18:41	832
Trichloroethene	**3300**		330	ppb v/v			02/17/14 18:41	832
Trichlorofluoromethane	ND		330	ppb v/v			02/17/14 18:41	832
1,2,4-Trimethylbenzene	ND		670	ppb v/v			02/17/14 18:41	832
1,3,5-Trimethylbenzene	ND		330	ppb v/v			02/17/14 18:41	832
2,2,4-Trimethylpentane	ND		330	ppb v/v			02/17/14 18:41	832
Vinyl acetate	ND		670	ppb v/v			02/17/14 18:41	832
Vinyl bromide	ND		670	ppb v/v			02/17/14 18:41	832
Vinyl chloride	ND		330	ppb v/v			02/17/14 18:41	832
m,p-Xylene	ND		670	ppb v/v			02/17/14 18:41	832
o-Xylene	ND		330	ppb v/v			02/17/14 18:41	832
2-Propanol	ND		1700	ppb v/v			02/17/14 18:41	832
n-Nonane	ND		670	ppb v/v			02/17/14 18:41	832

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		9900	ug/m3			02/17/14 18:41	832
Allyl chloride	ND		2100	ug/m3			02/17/14 18:41	832
Benzene	ND		1100	ug/m3			02/17/14 18:41	832
Benzyl chloride	ND		3400	ug/m3			02/17/14 18:41	832
Bromodichloromethane	ND		1700	ug/m3			02/17/14 18:41	832
Bromoform	ND		3400	ug/m3			02/17/14 18:41	832
Bromomethane	ND		2600	ug/m3			02/17/14 18:41	832
1,3-Butadiene	ND		1500	ug/m3			02/17/14 18:41	832
2-Butanone (MEK)	ND		2000	ug/m3			02/17/14 18:41	832
n-Butylbenzene	ND		1800	ug/m3			02/17/14 18:41	832
sec-Butylbenzene	ND		1800	ug/m3			02/17/14 18:41	832
tert-Butylbenzene	ND		3700	ug/m3			02/17/14 18:41	832
Carbon disulfide	ND		2100	ug/m3			02/17/14 18:41	832
Carbon tetrachloride	ND		4200	ug/m3			02/17/14 18:41	832
Chlorobenzene	ND		1100	ug/m3			02/17/14 18:41	832
Chloroethane	ND		1800	ug/m3			02/17/14 18:41	832
Chloroform	ND		1200	ug/m3			02/17/14 18:41	832
Chloromethane	ND		1400	ug/m3			02/17/14 18:41	832
Cyclohexane	ND		1100	ug/m3			02/17/14 18:41	832
Dibromochloromethane	ND		2800	ug/m3			02/17/14 18:41	832
1,2-Dibromoethane (EDB)	ND		5100	ug/m3			02/17/14 18:41	832
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2300	ug/m3			02/17/14 18:41	832
1,2-Dichlorobenzene	ND		2000	ug/m3			02/17/14 18:41	832
1,3-Dichlorobenzene	ND		2000	ug/m3			02/17/14 18:41	832
1,4-Dichlorobenzene	ND		2000	ug/m3			02/17/14 18:41	832
Dichlorodifluoromethane	ND		1600	ug/m3			02/17/14 18:41	832
1,1-Dichloroethane	ND		1000	ug/m3			02/17/14 18:41	832
1,2-Dichloroethane	ND		2700	ug/m3			02/17/14 18:41	832

Client Sample ID: VML-01-SVE170-VPT-013014

Lab Sample ID: 320-5954-11

Date Collected: 01/30/14 16:07

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,1-Dichloroethene	ND		2600	ug/m3			02/17/14 18:41	832
cis-1,2-Dichloroethene	**7900**		1300	ug/m3			02/17/14 18:41	832
trans-1,2-Dichloroethene	ND		1300	ug/m3			02/17/14 18:41	832
1,2-Dichloropropane	ND		1500	ug/m3			02/17/14 18:41	832
cis-1,3-Dichloropropene	ND		1500	ug/m3			02/17/14 18:41	832
trans-1,3-Dichloropropene	ND		1500	ug/m3			02/17/14 18:41	832
Ethyl acetate	ND		900	ug/m3			02/17/14 18:41	832
Ethylbenzene	ND		1400	ug/m3			02/17/14 18:41	832
4-Ethyltoluene	ND		1600	ug/m3			02/17/14 18:41	832
n-Heptane	ND		2700	ug/m3			02/17/14 18:41	832
Hexachlorobutadiene	ND		18000	ug/m3			02/17/14 18:41	832
n-Hexane	ND		2300	ug/m3			02/17/14 18:41	832
2-Hexanone	ND		1400	ug/m3			02/17/14 18:41	832
Isopropylbenzene	ND		3300	ug/m3			02/17/14 18:41	832
Methyl-t-Butyl Ether (MTBE)	ND		2400	ug/m3			02/17/14 18:41	832
4-Methyl-2-pentanone (MIBK)	ND		1400	ug/m3			02/17/14 18:41	832
Methylene chloride	ND		1200	ug/m3			02/17/14 18:41	832
Naphthalene	ND		3500	ug/m3			02/17/14 18:41	832
n-Octane	ND		1600	ug/m3			02/17/14 18:41	832
Propene	ND		570	ug/m3			02/17/14 18:41	832
n-Propylbenzene	ND		1600	ug/m3			02/17/14 18:41	832
Styrene	ND		1400	ug/m3			02/17/14 18:41	832
1,1,2,2-Tetrachloroethane	ND		2300	ug/m3			02/17/14 18:41	832
Tetrachloroethene	**260000**		2300	ug/m3			02/17/14 18:41	832
Tetrahydrofuran	ND		2000	ug/m3			02/17/14 18:41	832
Toluene	**3100**		1300	ug/m3			02/17/14 18:41	832
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2600	ug/m3			02/17/14 18:41	832
1,2,4-Trichlorobenzene	ND		12000	ug/m3			02/17/14 18:41	832
1,1,1-Trichloroethane	ND		1400	ug/m3			02/17/14 18:41	832
1,1,2-Trichloroethane	ND		1800	ug/m3			02/17/14 18:41	832
Trichloroethene	**18000**		1800	ug/m3			02/17/14 18:41	832
Trichlorofluoromethane	ND		1900	ug/m3			02/17/14 18:41	832
1,2,4-Trimethylbenzene	ND		3300	ug/m3			02/17/14 18:41	832
1,3,5-Trimethylbenzene	ND		1600	ug/m3			02/17/14 18:41	832
2,2,4-Trimethylpentane	ND		1600	ug/m3			02/17/14 18:41	832
Vinyl acetate	ND		2300	ug/m3			02/17/14 18:41	832
Vinyl bromide	ND		2900	ug/m3			02/17/14 18:41	832
Vinyl chloride	ND		850	ug/m3			02/17/14 18:41	832
m,p-Xylene	ND		2900	ug/m3			02/17/14 18:41	832
o-Xylene	ND		1400	ug/m3			02/17/14 18:41	832
2-Propanol	ND		4100	ug/m3			02/17/14 18:41	832
n-Nonane	ND		3500	ug/m3			02/17/14 18:41	832

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*107*		*70 - 130*		*02/17/14 18:41*	*832*
1,2-Dichloroethane-d4 (Surr)	*98*		*70 - 130*		*02/17/14 18:41*	*832*
Toluene-d8 (Surr)	*103*		*70 - 130*		*02/17/14 18:41*	*832*

Client Sample Results

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Client Sample ID: VML-02-SVE150-VPT-013014

Lab Sample ID: 320-5954-12

Date Collected: 01/30/14 16:38
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		25000		ppb v/v			02/16/14 10:56	5000
Allyl chloride	ND		4000		ppb v/v			02/16/14 10:56	5000
Benzene	ND		2000		ppb v/v			02/16/14 10:56	5000
Benzyl chloride	ND		4000		ppb v/v			02/16/14 10:56	5000
Bromodichloromethane	ND		1500		ppb v/v			02/16/14 10:56	5000
Bromoform	ND		2000		ppb v/v			02/16/14 10:56	5000
Bromomethane	ND		4000		ppb v/v			02/16/14 10:56	5000
1,3-Butadiene	ND		4000		ppb v/v			02/16/14 10:56	5000
2-Butanone (MEK)	ND		4000		ppb v/v			02/16/14 10:56	5000
n-Butylbenzene	ND		2000		ppb v/v			02/16/14 10:56	5000
sec-Butylbenzene	ND		2000		ppb v/v			02/16/14 10:56	5000
tert-Butylbenzene	ND		4000		ppb v/v			02/16/14 10:56	5000
Carbon disulfide	ND		4000		ppb v/v			02/16/14 10:56	5000
Carbon tetrachloride	ND		4000		ppb v/v			02/16/14 10:56	5000
Chlorobenzene	ND		1500		ppb v/v			02/16/14 10:56	5000
Chloroethane	ND		4000		ppb v/v			02/16/14 10:56	5000
Chloroform	ND		1500		ppb v/v			02/16/14 10:56	5000
Chloromethane	ND		4000		ppb v/v			02/16/14 10:56	5000
Cyclohexane	ND		2000		ppb v/v			02/16/14 10:56	5000
Dibromochloromethane	ND		2000		ppb v/v			02/16/14 10:56	5000
1,2-Dibromoethane (EDB)	ND		4000		ppb v/v			02/16/14 10:56	5000
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2000		ppb v/v			02/16/14 10:56	5000
1,2-Dichlorobenzene	ND		2000		ppb v/v			02/16/14 10:56	5000
1,3-Dichlorobenzene	ND		2000		ppb v/v			02/16/14 10:56	5000
1,4-Dichlorobenzene	ND		2000		ppb v/v			02/16/14 10:56	5000
Dichlorodifluoromethane	ND		2000		ppb v/v			02/16/14 10:56	5000
1,1-Dichloroethane	ND		1500		ppb v/v			02/16/14 10:56	5000
1,2-Dichloroethane	ND		4000		ppb v/v			02/16/14 10:56	5000
1,1-Dichloroethene	ND		4000		ppb v/v			02/16/14 10:56	5000
cis-1,2-Dichloroethene	**130000**		2000		ppb v/v			02/16/14 10:56	5000
trans-1,2-Dichloroethene	ND		2000		ppb v/v			02/16/14 10:56	5000
1,2-Dichloropropane	ND		2000		ppb v/v			02/16/14 10:56	5000
cis-1,3-Dichloropropene	ND		2000		ppb v/v			02/16/14 10:56	5000
trans-1,3-Dichloropropene	ND		2000		ppb v/v			02/16/14 10:56	5000
Ethyl acetate	ND		1500		ppb v/v			02/16/14 10:56	5000
Ethylbenzene	ND		2000		ppb v/v			02/16/14 10:56	5000
4-Ethyltoluene	ND		2000		ppb v/v			02/16/14 10:56	5000
n-Heptane	ND		4000		ppb v/v			02/16/14 10:56	5000
Hexachlorobutadiene	ND		10000		ppb v/v			02/16/14 10:56	5000
n-Hexane	ND		4000		ppb v/v			02/16/14 10:56	5000
2-Hexanone	ND		2000		ppb v/v			02/16/14 10:56	5000
Isopropylbenzene	ND		4000		ppb v/v			02/16/14 10:56	5000
Methyl-t-Butyl Ether (MTBE)	ND		4000		ppb v/v			02/16/14 10:56	5000
4-Methyl-2-pentanone (MIBK)	ND		2000		ppb v/v			02/16/14 10:56	5000
Methylene chloride	ND		2000		ppb v/v			02/16/14 10:56	5000
Naphthalene	ND		4000		ppb v/v			02/16/14 10:56	5000
n-Octane	ND		2000		ppb v/v			02/16/14 10:56	5000
Propene	ND		2000		ppb v/v			02/16/14 10:56	5000

Client Sample ID: VML-02-SVE150-VPT-013014 **Lab Sample ID: 320-5954-12**

Date Collected: 01/30/14 16:38 **Matrix: Air**

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
n-Propylbenzene	ND		2000	ppb v/v			02/16/14 10:56	5000
Styrene	ND		2000	ppb v/v			02/16/14 10:56	5000
1,1,2,2-Tetrachloroethane	ND		2000	ppb v/v			02/16/14 10:56	5000
Tetrachloroethene	**190000**		2000	ppb v/v			02/16/14 10:56	5000
Tetrahydrofuran	ND		4000	ppb v/v			02/16/14 10:56	5000
Toluene	ND		2000	ppb v/v			02/16/14 10:56	5000
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2000	ppb v/v			02/16/14 10:56	5000
1,2,4-Trichlorobenzene	ND		10000	ppb v/v			02/16/14 10:56	5000
1,1,1-Trichloroethane	ND		1500	ppb v/v			02/16/14 10:56	5000
1,1,2-Trichloroethane	ND		2000	ppb v/v			02/16/14 10:56	5000
Trichloroethene	**18000**		2000	ppb v/v			02/16/14 10:56	5000
Trichlorofluoromethane	ND		2000	ppb v/v			02/16/14 10:56	5000
1,2,4-Trimethylbenzene	ND		4000	ppb v/v			02/16/14 10:56	5000
1,3,5-Trimethylbenzene	ND		2000	ppb v/v			02/16/14 10:56	5000
2,2,4-Trimethylpentane	ND		2000	ppb v/v			02/16/14 10:56	5000
Vinyl acetate	ND		4000	ppb v/v			02/16/14 10:56	5000
Vinyl bromide	ND		4000	ppb v/v			02/16/14 10:56	5000
Vinyl chloride	ND		2000	ppb v/v			02/16/14 10:56	5000
m,p-Xylene	ND		4000	ppb v/v			02/16/14 10:56	5000
o-Xylene	ND		2000	ppb v/v			02/16/14 10:56	5000
2-Propanol	ND		10000	ppb v/v			02/16/14 10:56	5000
n-Nonane	ND		4000	ppb v/v			02/16/14 10:56	5000

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		59000	ug/m3			02/16/14 10:56	5000
Allyl chloride	ND		13000	ug/m3			02/16/14 10:56	5000
Benzene	ND		6400	ug/m3			02/16/14 10:56	5000
Benzyl chloride	ND		21000	ug/m3			02/16/14 10:56	5000
Bromodichloromethane	ND		10000	ug/m3			02/16/14 10:56	5000
Bromoform	ND		21000	ug/m3			02/16/14 10:56	5000
Bromomethane	ND		16000	ug/m3			02/16/14 10:56	5000
1,3-Butadiene	ND		8800	ug/m3			02/16/14 10:56	5000
2-Butanone (MEK)	ND		12000	ug/m3			02/16/14 10:56	5000
n-Butylbenzene	ND		11000	ug/m3			02/16/14 10:56	5000
sec-Butylbenzene	ND		11000	ug/m3			02/16/14 10:56	5000
tert-Butylbenzene	ND		22000	ug/m3			02/16/14 10:56	5000
Carbon disulfide	ND		12000	ug/m3			02/16/14 10:56	5000
Carbon tetrachloride	ND		25000	ug/m3			02/16/14 10:56	5000
Chlorobenzene	ND		6900	ug/m3			02/16/14 10:56	5000
Chloroethane	ND		11000	ug/m3			02/16/14 10:56	5000
Chloroform	ND		7300	ug/m3			02/16/14 10:56	5000
Chloromethane	ND		8300	ug/m3			02/16/14 10:56	5000
Cyclohexane	ND		6900	ug/m3			02/16/14 10:56	5000
Dibromochloromethane	ND		17000	ug/m3			02/16/14 10:56	5000
1,2-Dibromoethane (EDB)	ND		31000	ug/m3			02/16/14 10:56	5000
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		14000	ug/m3			02/16/14 10:56	5000
1,2-Dichlorobenzene	ND		12000	ug/m3			02/16/14 10:56	5000
1,3-Dichlorobenzene	ND		12000	ug/m3			02/16/14 10:56	5000
1,4-Dichlorobenzene	ND		12000	ug/m3			02/16/14 10:56	5000

Client Sample ID: VML-02-SVE150-VPT-013014

Lab Sample ID: 320-5954-12

Date Collected: 01/30/14 16:38
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Dichlorodifluoromethane	ND		9900	ug/m3			02/16/14 10:56	5000
1,1-Dichloroethane	ND		6100	ug/m3			02/16/14 10:56	5000
1,2-Dichloroethane	ND		16000	ug/m3			02/16/14 10:56	5000
1,1-Dichloroethene	ND		16000	ug/m3			02/16/14 10:56	5000
cis-1,2-Dichloroethene	**530000**		7900	ug/m3			02/16/14 10:56	5000
trans-1,2-Dichloroethene	ND		7900	ug/m3			02/16/14 10:56	5000
1,2-Dichloropropane	ND		9200	ug/m3			02/16/14 10:56	5000
cis-1,3-Dichloropropene	ND		9100	ug/m3			02/16/14 10:56	5000
trans-1,3-Dichloropropene	ND		9100	ug/m3			02/16/14 10:56	5000
Ethyl acetate	ND		5400	ug/m3			02/16/14 10:56	5000
Ethylbenzene	ND		8700	ug/m3			02/16/14 10:56	5000
4-Ethyltoluene	ND		9800	ug/m3			02/16/14 10:56	5000
n-Heptane	ND		16000	ug/m3			02/16/14 10:56	5000
Hexachlorobutadiene	ND		110000	ug/m3			02/16/14 10:56	5000
n-Hexane	ND		14000	ug/m3			02/16/14 10:56	5000
2-Hexanone	ND		8200	ug/m3			02/16/14 10:56	5000
Isopropylbenzene	ND		20000	ug/m3			02/16/14 10:56	5000
Methyl-t-Butyl Ether (MTBE)	ND		14000	ug/m3			02/16/14 10:56	5000
4-Methyl-2-pentanone (MIBK)	ND		8200	ug/m3			02/16/14 10:56	5000
Methylene chloride	ND		6900	ug/m3			02/16/14 10:56	5000
Naphthalene	ND		21000	ug/m3			02/16/14 10:56	5000
n-Octane	ND		9300	ug/m3			02/16/14 10:56	5000
Propene	ND		3400	ug/m3			02/16/14 10:56	5000
n-Propylbenzene	ND		9800	ug/m3			02/16/14 10:56	5000
Styrene	ND		8500	ug/m3			02/16/14 10:56	5000
1,1,2,2-Tetrachloroethane	ND		14000	ug/m3			02/16/14 10:56	5000
Tetrachloroethene	**1300000**		14000	ug/m3			02/16/14 10:56	5000
Tetrahydrofuran	ND		12000	ug/m3			02/16/14 10:56	5000
Toluene	ND		7500	ug/m3			02/16/14 10:56	5000
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		15000	ug/m3			02/16/14 10:56	5000
1,2,4-Trichlorobenzene	ND		74000	ug/m3			02/16/14 10:56	5000
1,1,1-Trichloroethane	ND		8200	ug/m3			02/16/14 10:56	5000
1,1,2-Trichloroethane	ND		11000	ug/m3			02/16/14 10:56	5000
Trichloroethene	**96000**		11000	ug/m3			02/16/14 10:56	5000
Trichlorofluoromethane	ND		11000	ug/m3			02/16/14 10:56	5000
1,2,4-Trimethylbenzene	ND		20000	ug/m3			02/16/14 10:56	5000
1,3,5-Trimethylbenzene	ND		9800	ug/m3			02/16/14 10:56	5000
2,2,4-Trimethylpentane	ND		9300	ug/m3			02/16/14 10:56	5000
Vinyl acetate	ND		14000	ug/m3			02/16/14 10:56	5000
Vinyl bromide	ND		17000	ug/m3			02/16/14 10:56	5000
Vinyl chloride	ND		5100	ug/m3			02/16/14 10:56	5000
m,p-Xylene	ND		17000	ug/m3			02/16/14 10:56	5000
o-Xylene	ND		8700	ug/m3			02/16/14 10:56	5000
2-Propanol	ND		25000	ug/m3			02/16/14 10:56	5000
n-Nonane	ND		21000	ug/m3			02/16/14 10:56	5000

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*102*		*70 - 130*		*02/16/14 10:56*	*5000*
1,2-Dichloroethane-d4 (Surr)	*101*		*70 - 130*		*02/16/14 10:56*	*5000*

Client Sample ID: VML-02-SVE150-VPT-013014

Lab Sample ID: 320-5954-12

Date Collected: 01/30/14 16:38

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Toluene-d8 (Surr)	104		70 - 130		02/16/14 10:56	5000

Client Sample ID: VML-02-SVE190-013114

Lab Sample ID: 320-5954-13

Date Collected: 01/31/14 16:44

Matrix: Air

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		25000	ppb v/v			02/17/14 19:30	5000
Allyl chloride	ND		4000	ppb v/v			02/17/14 19:30	5000
Benzene	ND		2000	ppb v/v			02/17/14 19:30	5000
Benzyl chloride	ND		4000	ppb v/v			02/17/14 19:30	5000
Bromodichloromethane	ND		1500	ppb v/v			02/17/14 19:30	5000
Bromoform	ND		2000	ppb v/v			02/17/14 19:30	5000
Bromomethane	ND		4000	ppb v/v			02/17/14 19:30	5000
1,3-Butadiene	ND		4000	ppb v/v			02/17/14 19:30	5000
2-Butanone (MEK)	ND		4000	ppb v/v			02/17/14 19:30	5000
n-Butylbenzene	ND		2000	ppb v/v			02/17/14 19:30	5000
sec-Butylbenzene	ND		2000	ppb v/v			02/17/14 19:30	5000
tert-Butylbenzene	ND		4000	ppb v/v			02/17/14 19:30	5000
Carbon disulfide	ND		4000	ppb v/v			02/17/14 19:30	5000
Carbon tetrachloride	ND		4000	ppb v/v			02/17/14 19:30	5000
Chlorobenzene	ND		1500	ppb v/v			02/17/14 19:30	5000
Chloroethane	ND		4000	ppb v/v			02/17/14 19:30	5000
Chloroform	ND		1500	ppb v/v			02/17/14 19:30	5000
Chloromethane	ND		4000	ppb v/v			02/17/14 19:30	5000
Cyclohexane	ND		2000	ppb v/v			02/17/14 19:30	5000
Dibromochloromethane	ND		2000	ppb v/v			02/17/14 19:30	5000
1,2-Dibromoethane (EDB)	ND		4000	ppb v/v			02/17/14 19:30	5000
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2000	ppb v/v			02/17/14 19:30	5000
1,2-Dichlorobenzene	ND		2000	ppb v/v			02/17/14 19:30	5000
1,3-Dichlorobenzene	ND		2000	ppb v/v			02/17/14 19:30	5000
1,4-Dichlorobenzene	ND		2000	ppb v/v			02/17/14 19:30	5000
Dichlorodifluoromethane	ND		2000	ppb v/v			02/17/14 19:30	5000
1,1-Dichloroethane	ND		1500	ppb v/v			02/17/14 19:30	5000
1,2-Dichloroethane	ND		4000	ppb v/v			02/17/14 19:30	5000
1,1-Dichloroethene	ND		4000	ppb v/v			02/17/14 19:30	5000
cis-1,2-Dichloroethene	**150000**		2000	ppb v/v			02/17/14 19:30	5000
trans-1,2-Dichloroethene	ND		2000	ppb v/v			02/17/14 19:30	5000
1,2-Dichloropropane	ND		2000	ppb v/v			02/17/14 19:30	5000
cis-1,3-Dichloropropene	ND		2000	ppb v/v			02/17/14 19:30	5000
trans-1,3-Dichloropropene	ND		2000	ppb v/v			02/17/14 19:30	5000
Ethyl acetate	ND		1500	ppb v/v			02/17/14 19:30	5000
Ethylbenzene	ND		2000	ppb v/v			02/17/14 19:30	5000
4-Ethyltoluene	ND		2000	ppb v/v			02/17/14 19:30	5000
n-Heptane	ND		4000	ppb v/v			02/17/14 19:30	5000
Hexachlorobutadiene	ND		10000	ppb v/v			02/17/14 19:30	5000

Client Sample ID: VML-02-SVE190-013114

Lab Sample ID: 320-5954-13

Date Collected: 01/31/14 16:44
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
n-Hexane	ND		4000	ppb v/v			02/17/14 19:30	5000
2-Hexanone	ND		2000	ppb v/v			02/17/14 19:30	5000
Isopropylbenzene	ND		4000	ppb v/v			02/17/14 19:30	5000
Methyl-t-Butyl Ether (MTBE)	ND		4000	ppb v/v			02/17/14 19:30	5000
4-Methyl-2-pentanone (MIBK)	ND		2000	ppb v/v			02/17/14 19:30	5000
Methylene chloride	ND		2000	ppb v/v			02/17/14 19:30	5000
Naphthalene	ND		4000	ppb v/v			02/17/14 19:30	5000
n-Octane	ND		2000	ppb v/v			02/17/14 19:30	5000
Propene	ND		2000	ppb v/v			02/17/14 19:30	5000
n-Propylbenzene	ND		2000	ppb v/v			02/17/14 19:30	5000
Styrene	ND		2000	ppb v/v			02/17/14 19:30	5000
1,1,2,2-Tetrachloroethane	ND		2000	ppb v/v			02/17/14 19:30	5000
Tetrachloroethene	**130000**		2000	ppb v/v			02/17/14 19:30	5000
Tetrahydrofuran	ND		4000	ppb v/v			02/17/14 19:30	5000
Toluene	ND		2000	ppb v/v			02/17/14 19:30	5000
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2000	ppb v/v			02/17/14 19:30	5000
1,2,4-Trichlorobenzene	ND		10000	ppb v/v			02/17/14 19:30	5000
1,1,1-Trichloroethane	ND		1500	ppb v/v			02/17/14 19:30	5000
1,1,2-Trichloroethane	ND		2000	ppb v/v			02/17/14 19:30	5000
Trichloroethene	**29000**		2000	ppb v/v			02/17/14 19:30	5000
Trichlorofluoromethane	ND		2000	ppb v/v			02/17/14 19:30	5000
1,2,4-Trimethylbenzene	ND		4000	ppb v/v			02/17/14 19:30	5000
1,3,5-Trimethylbenzene	ND		2000	ppb v/v			02/17/14 19:30	5000
2,2,4-Trimethylpentane	ND		2000	ppb v/v			02/17/14 19:30	5000
Vinyl acetate	ND		4000	ppb v/v			02/17/14 19:30	5000
Vinyl bromide	ND		4000	ppb v/v			02/17/14 19:30	5000
Vinyl chloride	**4300**		2000	ppb v/v			02/17/14 19:30	5000
m,p-Xylene	ND		4000	ppb v/v			02/17/14 19:30	5000
o-Xylene	ND		2000	ppb v/v			02/17/14 19:30	5000
2-Propanol	ND		10000	ppb v/v			02/17/14 19:30	5000
n-Nonane	ND		4000	ppb v/v			02/17/14 19:30	5000

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		59000	ug/m3			02/17/14 19:30	5000
Allyl chloride	ND		13000	ug/m3			02/17/14 19:30	5000
Benzene	ND		6400	ug/m3			02/17/14 19:30	5000
Benzyl chloride	ND		21000	ug/m3			02/17/14 19:30	5000
Bromodichloromethane	ND		10000	ug/m3			02/17/14 19:30	5000
Bromoform	ND		21000	ug/m3			02/17/14 19:30	5000
Bromomethane	ND		16000	ug/m3			02/17/14 19:30	5000
1,3-Butadiene	ND		8800	ug/m3			02/17/14 19:30	5000
2-Butanone (MEK)	ND		12000	ug/m3			02/17/14 19:30	5000
n-Butylbenzene	ND		11000	ug/m3			02/17/14 19:30	5000
sec-Butylbenzene	ND		11000	ug/m3			02/17/14 19:30	5000
tert-Butylbenzene	ND		22000	ug/m3			02/17/14 19:30	5000
Carbon disulfide	ND		12000	ug/m3			02/17/14 19:30	5000
Carbon tetrachloride	ND		25000	ug/m3			02/17/14 19:30	5000
Chlorobenzene	ND		6900	ug/m3			02/17/14 19:30	5000
Chloroethane	ND		11000	ug/m3			02/17/14 19:30	5000

Client Sample ID: VML-02-SVE190-013114

Lab Sample ID: 320-5954-13

Date Collected: 01/31/14 16:44
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Chloroform	ND		7300		ug/m3			02/17/14 19:30	5000
Chloromethane	ND		8300		ug/m3			02/17/14 19:30	5000
Cyclohexane	ND		6900		ug/m3			02/17/14 19:30	5000
Dibromochloromethane	ND		17000		ug/m3			02/17/14 19:30	5000
1,2-Dibromoethane (EDB)	ND		31000		ug/m3			02/17/14 19:30	5000
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		14000		ug/m3			02/17/14 19:30	5000
1,2-Dichlorobenzene	ND		12000		ug/m3			02/17/14 19:30	5000
1,3-Dichlorobenzene	ND		12000		ug/m3			02/17/14 19:30	5000
1,4-Dichlorobenzene	ND		12000		ug/m3			02/17/14 19:30	5000
Dichlorodifluoromethane	ND		9900		ug/m3			02/17/14 19:30	5000
1,1-Dichloroethane	ND		6100		ug/m3			02/17/14 19:30	5000
1,2-Dichloroethane	ND		16000		ug/m3			02/17/14 19:30	5000
1,1-Dichloroethene	ND		16000		ug/m3			02/17/14 19:30	5000
cis-1,2-Dichloroethene	**590000**		7900		ug/m3			02/17/14 19:30	5000
trans-1,2-Dichloroethene	ND		7900		ug/m3			02/17/14 19:30	5000
1,2-Dichloropropane	ND		9200		ug/m3			02/17/14 19:30	5000
cis-1,3-Dichloropropene	ND		9100		ug/m3			02/17/14 19:30	5000
trans-1,3-Dichloropropene	ND		9100		ug/m3			02/17/14 19:30	5000
Ethyl acetate	ND		5400		ug/m3			02/17/14 19:30	5000
Ethylbenzene	ND		8700		ug/m3			02/17/14 19:30	5000
4-Ethyltoluene	ND		9800		ug/m3			02/17/14 19:30	5000
n-Heptane	ND		16000		ug/m3			02/17/14 19:30	5000
Hexachlorobutadiene	ND		110000		ug/m3			02/17/14 19:30	5000
n-Hexane	ND		14000		ug/m3			02/17/14 19:30	5000
2-Hexanone	ND		8200		ug/m3			02/17/14 19:30	5000
Isopropylbenzene	ND		20000		ug/m3			02/17/14 19:30	5000
Methyl-t-Butyl Ether (MTBE)	ND		14000		ug/m3			02/17/14 19:30	5000
4-Methyl-2-pentanone (MIBK)	ND		8200		ug/m3			02/17/14 19:30	5000
Methylene chloride	ND		6900		ug/m3			02/17/14 19:30	5000
Naphthalene	ND		21000		ug/m3			02/17/14 19:30	5000
n-Octane	ND		9300		ug/m3			02/17/14 19:30	5000
Propene	ND		3400		ug/m3			02/17/14 19:30	5000
n-Propylbenzene	ND		9800		ug/m3			02/17/14 19:30	5000
Styrene	ND		8500		ug/m3			02/17/14 19:30	5000
1,1,2,2-Tetrachloroethane	ND		14000		ug/m3			02/17/14 19:30	5000
Tetrachloroethene	**860000**		14000		ug/m3			02/17/14 19:30	5000
Tetrahydrofuran	ND		12000		ug/m3			02/17/14 19:30	5000
Toluene	ND		7500		ug/m3			02/17/14 19:30	5000
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		15000		ug/m3			02/17/14 19:30	5000
1,2,4-Trichlorobenzene	ND		74000		ug/m3			02/17/14 19:30	5000
1,1,1-Trichloroethane	ND		8200		ug/m3			02/17/14 19:30	5000
1,1,2-Trichloroethane	ND		11000		ug/m3			02/17/14 19:30	5000
Trichloroethene	**150000**		11000		ug/m3			02/17/14 19:30	5000
Trichlorofluoromethane	ND		11000		ug/m3			02/17/14 19:30	5000
1,2,4-Trimethylbenzene	ND		20000		ug/m3			02/17/14 19:30	5000
1,3,5-Trimethylbenzene	ND		9800		ug/m3			02/17/14 19:30	5000
2,2,4-Trimethylpentane	ND		9300		ug/m3			02/17/14 19:30	5000
Vinyl acetate	ND		14000		ug/m3			02/17/14 19:30	5000

Client Sample ID: VML-02-SVE190-013114

Lab Sample ID: 320-5954-13

Date Collected: 01/31/14 16:44
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Vinyl bromide	ND		17000	ug/m3			02/17/14 19:30	5000
Vinyl chloride	**11000**		5100	ug/m3			02/17/14 19:30	5000
m,p-Xylene	ND		17000	ug/m3			02/17/14 19:30	5000
o-Xylene	ND		8700	ug/m3			02/17/14 19:30	5000
2-Propanol	ND		25000	ug/m3			02/17/14 19:30	5000
n-Nonane	ND		21000	ug/m3			02/17/14 19:30	5000

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*		*02/17/14 19:30*	*5000*
1,2-Dichloroethane-d4 (Surr)	*98*		*70 - 130*		*02/17/14 19:30*	*5000*
Toluene-d8 (Surr)	*104*		*70 - 130*		*02/17/14 19:30*	*5000*

Client Sample ID: VML-01-RB190-VPT-020114

Lab Sample ID: 320-5954-14

Date Collected: 02/01/14 12:23
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**2400**		2100	ppb v/v			02/18/14 05:37	418
Allyl chloride	ND		330	ppb v/v			02/18/14 05:37	418
Benzene	ND		170	ppb v/v			02/18/14 05:37	418
Benzyl chloride	ND		330	ppb v/v			02/18/14 05:37	418
Bromodichloromethane	ND		130	ppb v/v			02/18/14 05:37	418
Bromoform	ND		170	ppb v/v			02/18/14 05:37	418
Bromomethane	ND		330	ppb v/v			02/18/14 05:37	418
1,3-Butadiene	ND		330	ppb v/v			02/18/14 05:37	418
2-Butanone (MEK)	ND		330	ppb v/v			02/18/14 05:37	418
n-Butylbenzene	ND		170	ppb v/v			02/18/14 05:37	418
sec-Butylbenzene	ND		170	ppb v/v			02/18/14 05:37	418
tert-Butylbenzene	ND		330	ppb v/v			02/18/14 05:37	418
Carbon disulfide	ND		330	ppb v/v			02/18/14 05:37	418
Carbon tetrachloride	ND		330	ppb v/v			02/18/14 05:37	418
Chlorobenzene	ND		130	ppb v/v			02/18/14 05:37	418
Chloroethane	ND		330	ppb v/v			02/18/14 05:37	418
Chloroform	ND		130	ppb v/v			02/18/14 05:37	418
Chloromethane	ND		330	ppb v/v			02/18/14 05:37	418
Cyclohexane	**180**		170	ppb v/v			02/18/14 05:37	418
Dibromochloromethane	ND		170	ppb v/v			02/18/14 05:37	418
1,2-Dibromoethane (EDB)	ND		330	ppb v/v			02/18/14 05:37	418
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		170	ppb v/v			02/18/14 05:37	418
1,2-Dichlorobenzene	ND		170	ppb v/v			02/18/14 05:37	418
1,3-Dichlorobenzene	ND		170	ppb v/v			02/18/14 05:37	418
1,4-Dichlorobenzene	ND		170	ppb v/v			02/18/14 05:37	418
Dichlorodifluoromethane	ND		170	ppb v/v			02/18/14 05:37	418
1,1-Dichloroethane	ND		130	ppb v/v			02/18/14 05:37	418
1,2-Dichloroethane	ND		330	ppb v/v			02/18/14 05:37	418
1,1-Dichloroethene	ND		330	ppb v/v			02/18/14 05:37	418
cis-1,2-Dichloroethene	**500**		170	ppb v/v			02/18/14 05:37	418

Client Sample ID: VML-01-RB190-VPT-020114

Lab Sample ID: 320-5954-14

Date Collected: 02/01/14 12:23
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,2-Dichloroethene	ND		170	ppb v/v			02/18/14 05:37	418
1,2-Dichloropropane	ND		170	ppb v/v			02/18/14 05:37	418
cis-1,3-Dichloropropene	ND		170	ppb v/v			02/18/14 05:37	418
trans-1,3-Dichloropropene	ND		170	ppb v/v			02/18/14 05:37	418
Ethyl acetate	ND		130	ppb v/v			02/18/14 05:37	418
Ethylbenzene	ND		170	ppb v/v			02/18/14 05:37	418
4-Ethyltoluene	ND		170	ppb v/v			02/18/14 05:37	418
n-Heptane	ND		330	ppb v/v			02/18/14 05:37	418
Hexachlorobutadiene	ND		840	ppb v/v			02/18/14 05:37	418
n-Hexane	ND		330	ppb v/v			02/18/14 05:37	418
2-Hexanone	ND		170	ppb v/v			02/18/14 05:37	418
Isopropylbenzene	ND		330	ppb v/v			02/18/14 05:37	418
Methyl-t-Butyl Ether (MTBE)	ND		330	ppb v/v			02/18/14 05:37	418
4-Methyl-2-pentanone (MIBK)	ND		170	ppb v/v			02/18/14 05:37	418
Methylene chloride	ND		170	ppb v/v			02/18/14 05:37	418
Naphthalene	ND		330	ppb v/v			02/18/14 05:37	418
n-Octane	ND		170	ppb v/v			02/18/14 05:37	418
Propene	ND		170	ppb v/v			02/18/14 05:37	418
n-Propylbenzene	ND		170	ppb v/v			02/18/14 05:37	418
Styrene	ND		170	ppb v/v			02/18/14 05:37	418
1,1,2,2-Tetrachloroethane	ND		170	ppb v/v			02/18/14 05:37	418
Tetrachloroethene	**19000**		170	ppb v/v			02/18/14 05:37	418
Tetrahydrofuran	ND		330	ppb v/v			02/18/14 05:37	418
Toluene	**1300**		170	ppb v/v			02/18/14 05:37	418
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		170	ppb v/v			02/18/14 05:37	418
1,2,4-Trichlorobenzene	ND		840	ppb v/v			02/18/14 05:37	418
1,1,1-Trichloroethane	ND		130	ppb v/v			02/18/14 05:37	418
1,1,2-Trichloroethane	ND		170	ppb v/v			02/18/14 05:37	418
Trichloroethene	**1100**		170	ppb v/v			02/18/14 05:37	418
Trichlorofluoromethane	ND		170	ppb v/v			02/18/14 05:37	418
1,2,4-Trimethylbenzene	ND		330	ppb v/v			02/18/14 05:37	418
1,3,5-Trimethylbenzene	ND		170	ppb v/v			02/18/14 05:37	418
2,2,4-Trimethylpentane	ND		170	ppb v/v			02/18/14 05:37	418
Vinyl acetate	ND		330	ppb v/v			02/18/14 05:37	418
Vinyl bromide	ND		330	ppb v/v			02/18/14 05:37	418
Vinyl chloride	ND		170	ppb v/v			02/18/14 05:37	418
m,p-Xylene	**590**		330	ppb v/v			02/18/14 05:37	418
o-Xylene	**180**		170	ppb v/v			02/18/14 05:37	418
2-Propanol	ND		840	ppb v/v			02/18/14 05:37	418
n-Nonane	ND		330	ppb v/v			02/18/14 05:37	418

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**5800**		5000	ug/m3			02/18/14 05:37	418
Allyl chloride	ND		1000	ug/m3			02/18/14 05:37	418
Benzene	ND		530	ug/m3			02/18/14 05:37	418
Benzyl chloride	ND		1700	ug/m3			02/18/14 05:37	418
Bromodichloromethane	ND		840	ug/m3			02/18/14 05:37	418
Bromoform	ND		1700	ug/m3			02/18/14 05:37	418
Bromomethane	ND		1300	ug/m3			02/18/14 05:37	418

Client Sample ID: VML-01-RB190-VPT-020114 **Lab Sample ID: 320-5954-14**

Date Collected: 02/01/14 12:23 **Matrix: Air**

Date Received: 02/04/14 09:15

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,3-Butadiene	ND		740		ug/m3			02/18/14 05:37	418
2-Butanone (MEK)	ND		990		ug/m3			02/18/14 05:37	418
n-Butylbenzene	ND		920		ug/m3			02/18/14 05:37	418
sec-Butylbenzene	ND		920		ug/m3			02/18/14 05:37	418
tert-Butylbenzene	ND		1800		ug/m3			02/18/14 05:37	418
Carbon disulfide	ND		1000		ug/m3			02/18/14 05:37	418
Carbon tetrachloride	ND		2100		ug/m3			02/18/14 05:37	418
Chlorobenzene	ND		580		ug/m3			02/18/14 05:37	418
Chloroethane	ND		880		ug/m3			02/18/14 05:37	418
Chloroform	ND		610		ug/m3			02/18/14 05:37	418
Chloromethane	ND		690		ug/m3			02/18/14 05:37	418
Cyclohexane	**630**		580		ug/m3			02/18/14 05:37	418
Dibromochloromethane	ND		1400		ug/m3			02/18/14 05:37	418
1,2-Dibromoethane (EDB)	ND		2600		ug/m3			02/18/14 05:37	418
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		1200		ug/m3			02/18/14 05:37	418
1,2-Dichlorobenzene	ND		1000		ug/m3			02/18/14 05:37	418
1,3-Dichlorobenzene	ND		1000		ug/m3			02/18/14 05:37	418
1,4-Dichlorobenzene	ND		1000		ug/m3			02/18/14 05:37	418
Dichlorodifluoromethane	ND		830		ug/m3			02/18/14 05:37	418
1,1-Dichloroethane	ND		510		ug/m3			02/18/14 05:37	418
1,2-Dichloroethane	ND		1400		ug/m3			02/18/14 05:37	418
1,1-Dichloroethene	ND		1300		ug/m3			02/18/14 05:37	418
cis-1,2-Dichloroethene	**2000**		660		ug/m3			02/18/14 05:37	418
trans-1,2-Dichloroethene	ND		660		ug/m3			02/18/14 05:37	418
1,2-Dichloropropane	ND		770		ug/m3			02/18/14 05:37	418
cis-1,3-Dichloropropene	ND		760		ug/m3			02/18/14 05:37	418
trans-1,3-Dichloropropene	ND		760		ug/m3			02/18/14 05:37	418
Ethyl acetate	ND		450		ug/m3			02/18/14 05:37	418
Ethylbenzene	ND		730		ug/m3			02/18/14 05:37	418
4-Ethyltoluene	ND		820		ug/m3			02/18/14 05:37	418
n-Heptane	ND		1400		ug/m3			02/18/14 05:37	418
Hexachlorobutadiene	ND		8900		ug/m3			02/18/14 05:37	418
n-Hexane	ND		1200		ug/m3			02/18/14 05:37	418
2-Hexanone	ND		690		ug/m3			02/18/14 05:37	418
Isopropylbenzene	ND		1600		ug/m3			02/18/14 05:37	418
Methyl-t-Butyl Ether (MTBE)	ND		1200		ug/m3			02/18/14 05:37	418
4-Methyl-2-pentanone (MIBK)	ND		680		ug/m3			02/18/14 05:37	418
Methylene chloride	ND		580		ug/m3			02/18/14 05:37	418
Naphthalene	ND		1800		ug/m3			02/18/14 05:37	418
n-Octane	ND		780		ug/m3			02/18/14 05:37	418
Propene	ND		290		ug/m3			02/18/14 05:37	418
n-Propylbenzene	ND		820		ug/m3			02/18/14 05:37	418
Styrene	ND		710		ug/m3			02/18/14 05:37	418
1,1,2,2-Tetrachloroethane	ND		1100		ug/m3			02/18/14 05:37	418
Tetrachloroethene	**130000**		1100		ug/m3			02/18/14 05:37	418
Tetrahydrofuran	ND		990		ug/m3			02/18/14 05:37	418
Toluene	**4900**		630		ug/m3			02/18/14 05:37	418
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1300		ug/m3			02/18/14 05:37	418

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Client Sample ID: VML-01-RB190-VPT-020114
Lab Sample ID: 320-5954-14
Date Collected: 02/01/14 12:23
Matrix: Air
Date Received: 02/04/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,2,4-Trichlorobenzene	ND		6200		ug/m3			02/18/14 05:37	418
1,1,1-Trichloroethane	ND		680		ug/m3			02/18/14 05:37	418
1,1,2-Trichloroethane	ND		910		ug/m3			02/18/14 05:37	418
Trichloroethene	**6000**		900		ug/m3			02/18/14 05:37	418
Trichlorofluoromethane	ND		940		ug/m3			02/18/14 05:37	418
1,2,4-Trimethylbenzene	ND		1600		ug/m3			02/18/14 05:37	418
1,3,5-Trimethylbenzene	ND		820		ug/m3			02/18/14 05:37	418
2,2,4-Trimethylpentane	ND		780		ug/m3			02/18/14 05:37	418
Vinyl acetate	ND		1200		ug/m3			02/18/14 05:37	418
Vinyl bromide	ND		1500		ug/m3			02/18/14 05:37	418
Vinyl chloride	ND		430		ug/m3			02/18/14 05:37	418
m,p-Xylene	**2600**		1500		ug/m3			02/18/14 05:37	418
o-Xylene	**760**		730		ug/m3			02/18/14 05:37	418
2-Propanol	ND		2100		ug/m3			02/18/14 05:37	418
n-Nonane	ND		1800		ug/m3			02/18/14 05:37	418

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*108*		*70 - 130*		*02/18/14 05:37*	*418*
1,2-Dichloroethane-d4 (Surr)	*101*		*70 - 130*		*02/18/14 05:37*	*418*
Toluene-d8 (Surr)	*106*		*70 - 130*		*02/18/14 05:37*	*418*

Surrogate Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Matrix: Air **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		BFB	12DCE	TOL
Lab Sample ID	Client Sample ID	(70-130)	(70-130)	(70-130)
320-5954-1	ambient-VPT-012714	107	98	106
320-5954-2	VML-02-190-VPT-012714	104	99	104
320-5954-3	PER-14A-178-VPT-012714	104	100	104
320-5954-3 - DL	PER-14A-178-VPT-012714	104	99	103
320-5954-4	PER-14A-192-VPT-012714	106	100	104
320-5954-5	PER-14A-197-VPT-012714	103	101	104
320-5954-6	STEPTEST-VPT-012814	106	98	103
320-5954-7	VEL-3-190-VPT-012814	103	100	103
320-5954-8	VEL-3-175-VPT-012814	104	100	102
320-5954-9	VEL-3-160-VPT-012814	104	100	105
320-5954-10	VML-02-SVE170-VPT-012914	103	100	103
320-5954-11	VML-01-SVE170-VPT-013014	107	98	103
320-5954-12	VML-02-SVE150-VPT-013014	102	101	104
320-5954-13	VML-02-SVE190-013114	105	98	104
320-5954-14	VML-01-RB190-VPT-020114	108	101	106
LCS 320-36393/4	Lab Control Sample	106	105	104
LCS 320-36393/6	Lab Control Sample	106	99	105
LCS 320-36446/5	Lab Control Sample	106	104	108
LCS 320-36446/7	Lab Control Sample	108	98	105
LCSD 320-36393/5	Lab Control Sample Dup	108	103	106
LCSD 320-36393/7	Lab Control Sample Dup	105	97	105
LCSD 320-36446/6	Lab Control Sample Dup	107	102	107
LCSD 320-36446/8	Lab Control Sample Dup	107	98	107
MB 320-36393/9	Method Blank	103	99	103
MB 320-36446/10	Method Blank	104	99	104

Surrogate Legend

BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)
TOL = Toluene-d8 (Surr)

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Lab Sample ID: MB 320-36393/9
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		5.0		ppb v/v			02/15/14 17:53	1
Allyl chloride	ND		0.80		ppb v/v			02/15/14 17:53	1
Benzene	ND		0.40		ppb v/v			02/15/14 17:53	1
Benzyl chloride	ND		0.80		ppb v/v			02/15/14 17:53	1
Bromodichloromethane	ND		0.30		ppb v/v			02/15/14 17:53	1
Bromoform	ND		0.40		ppb v/v			02/15/14 17:53	1
Bromomethane	ND		0.80		ppb v/v			02/15/14 17:53	1
1,3-Butadiene	ND		0.80		ppb v/v			02/15/14 17:53	1
2-Butanone (MEK)	ND		0.80		ppb v/v			02/15/14 17:53	1
n-Butylbenzene	ND		0.40		ppb v/v			02/15/14 17:53	1
sec-Butylbenzene	ND		0.40		ppb v/v			02/15/14 17:53	1
tert-Butylbenzene	ND		0.80		ppb v/v			02/15/14 17:53	1
Carbon disulfide	ND		0.80		ppb v/v			02/15/14 17:53	1
Carbon tetrachloride	ND		0.80		ppb v/v			02/15/14 17:53	1
Chlorobenzene	ND		0.30		ppb v/v			02/15/14 17:53	1
Chloroethane	ND		0.80		ppb v/v			02/15/14 17:53	1
Chloroform	ND		0.30		ppb v/v			02/15/14 17:53	1
Chloromethane	ND		0.80		ppb v/v			02/15/14 17:53	1
Cyclohexane	ND		0.40		ppb v/v			02/15/14 17:53	1
Dibromochloromethane	ND		0.40		ppb v/v			02/15/14 17:53	1
1,2-Dibromoethane (EDB)	ND		0.80		ppb v/v			02/15/14 17:53	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40		ppb v/v			02/15/14 17:53	1
1,2-Dichlorobenzene	ND		0.40		ppb v/v			02/15/14 17:53	1
1,3-Dichlorobenzene	ND		0.40		ppb v/v			02/15/14 17:53	1
1,4-Dichlorobenzene	ND		0.40		ppb v/v			02/15/14 17:53	1
Dichlorodifluoromethane	ND		0.40		ppb v/v			02/15/14 17:53	1
1,1-Dichloroethane	ND		0.30		ppb v/v			02/15/14 17:53	1
1,2-Dichloroethane	ND		0.80		ppb v/v			02/15/14 17:53	1
1,1-Dichloroethene	ND		0.80		ppb v/v			02/15/14 17:53	1
cis-1,2-Dichloroethene	ND		0.40		ppb v/v			02/15/14 17:53	1
trans-1,2-Dichloroethene	ND		0.40		ppb v/v			02/15/14 17:53	1
1,2-Dichloropropane	ND		0.40		ppb v/v			02/15/14 17:53	1
cis-1,3-Dichloropropene	ND		0.40		ppb v/v			02/15/14 17:53	1
trans-1,3-Dichloropropene	ND		0.40		ppb v/v			02/15/14 17:53	1
Ethyl acetate	ND		0.30		ppb v/v			02/15/14 17:53	1
Ethylbenzene	ND		0.40		ppb v/v			02/15/14 17:53	1
4-Ethyltoluene	ND		0.40		ppb v/v			02/15/14 17:53	1
n-Heptane	ND		0.80		ppb v/v			02/15/14 17:53	1
Hexachlorobutadiene	ND		2.0		ppb v/v			02/15/14 17:53	1
n-Hexane	ND		0.80		ppb v/v			02/15/14 17:53	1
2-Hexanone	ND		0.40		ppb v/v			02/15/14 17:53	1
Isopropylbenzene	ND		0.80		ppb v/v			02/15/14 17:53	1
Methyl-t-Butyl Ether (MTBE)	ND		0.80		ppb v/v			02/15/14 17:53	1
4-Methyl-2-pentanone (MIBK)	ND		0.40		ppb v/v			02/15/14 17:53	1
Methylene chloride	ND		0.40		ppb v/v			02/15/14 17:53	1
Naphthalene	ND		0.80		ppb v/v			02/15/14 17:53	1
n-Octane	ND		0.40		ppb v/v			02/15/14 17:53	1
Propene	ND		0.40		ppb v/v			02/15/14 17:53	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-36393/9
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
n-Propylbenzene	ND		0.40		ppb v/v			02/15/14 17:53	1
Styrene	ND		0.40		ppb v/v			02/15/14 17:53	1
1,1,2,2-Tetrachloroethane	ND		0.40		ppb v/v			02/15/14 17:53	1
Tetrachloroethene	ND		0.40		ppb v/v			02/15/14 17:53	1
Tetrahydrofuran	ND		0.80		ppb v/v			02/15/14 17:53	1
Toluene	ND		0.40		ppb v/v			02/15/14 17:53	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40		ppb v/v			02/15/14 17:53	1
1,2,4-Trichlorobenzene	ND		2.0		ppb v/v			02/15/14 17:53	1
1,1,1-Trichloroethane	ND		0.30		ppb v/v			02/15/14 17:53	1
1,1,2-Trichloroethane	ND		0.40		ppb v/v			02/15/14 17:53	1
Trichloroethene	ND		0.40		ppb v/v			02/15/14 17:53	1
Trichlorofluoromethane	ND		0.40		ppb v/v			02/15/14 17:53	1
1,2,4-Trimethylbenzene	ND		0.80		ppb v/v			02/15/14 17:53	1
1,3,5-Trimethylbenzene	ND		0.40		ppb v/v			02/15/14 17:53	1
2,2,4-Trimethylpentane	ND		0.40		ppb v/v			02/15/14 17:53	1
Vinyl acetate	ND		0.80		ppb v/v			02/15/14 17:53	1
Vinyl bromide	ND		0.80		ppb v/v			02/15/14 17:53	1
Vinyl chloride	ND		0.40		ppb v/v			02/15/14 17:53	1
m,p-Xylene	ND		0.80		ppb v/v			02/15/14 17:53	1
o-Xylene	ND		0.40		ppb v/v			02/15/14 17:53	1
2-Propanol	ND		2.0		ppb v/v			02/15/14 17:53	1
n-Nonane	ND		0.80		ppb v/v			02/15/14 17:53	1

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		12		ug/m3			02/15/14 17:53	1
Allyl chloride	ND		2.5		ug/m3			02/15/14 17:53	1
Benzene	ND		1.3		ug/m3			02/15/14 17:53	1
Benzyl chloride	ND		4.1		ug/m3			02/15/14 17:53	1
Bromodichloromethane	ND		2.0		ug/m3			02/15/14 17:53	1
Bromoform	ND		4.1		ug/m3			02/15/14 17:53	1
Bromomethane	ND		3.1		ug/m3			02/15/14 17:53	1
1,3-Butadiene	ND		1.8		ug/m3			02/15/14 17:53	1
2-Butanone (MEK)	ND		2.4		ug/m3			02/15/14 17:53	1
n-Butylbenzene	ND		2.2		ug/m3			02/15/14 17:53	1
sec-Butylbenzene	ND		2.2		ug/m3			02/15/14 17:53	1
tert-Butylbenzene	ND		4.4		ug/m3			02/15/14 17:53	1
Carbon disulfide	ND		2.5		ug/m3			02/15/14 17:53	1
Carbon tetrachloride	ND		5.0		ug/m3			02/15/14 17:53	1
Chlorobenzene	ND		1.4		ug/m3			02/15/14 17:53	1
Chloroethane	ND		2.1		ug/m3			02/15/14 17:53	1
Chloroform	ND		1.5		ug/m3			02/15/14 17:53	1
Chloromethane	ND		1.7		ug/m3			02/15/14 17:53	1
Cyclohexane	ND		1.4		ug/m3			02/15/14 17:53	1
Dibromochloromethane	ND		3.4		ug/m3			02/15/14 17:53	1
1,2-Dibromoethane (EDB)	ND		6.1		ug/m3			02/15/14 17:53	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2.8		ug/m3			02/15/14 17:53	1
1,2-Dichlorobenzene	ND		2.4		ug/m3			02/15/14 17:53	1
1,3-Dichlorobenzene	ND		2.4		ug/m3			02/15/14 17:53	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-36393/9
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,4-Dichlorobenzene	ND		2.4		ug/m3			02/15/14 17:53	1
Dichlorodifluoromethane	ND		2.0		ug/m3			02/15/14 17:53	1
1,1-Dichloroethane	ND		1.2		ug/m3			02/15/14 17:53	1
1,2-Dichloroethane	ND		3.2		ug/m3			02/15/14 17:53	1
1,1-Dichloroethene	ND		3.2		ug/m3			02/15/14 17:53	1
cis-1,2-Dichloroethene	ND		1.6		ug/m3			02/15/14 17:53	1
trans-1,2-Dichloroethene	ND		1.6		ug/m3			02/15/14 17:53	1
1,2-Dichloropropane	ND		1.8		ug/m3			02/15/14 17:53	1
cis-1,3-Dichloropropene	ND		1.8		ug/m3			02/15/14 17:53	1
trans-1,3-Dichloropropene	ND		1.8		ug/m3			02/15/14 17:53	1
Ethyl acetate	ND		1.1		ug/m3			02/15/14 17:53	1
Ethylbenzene	ND		1.7		ug/m3			02/15/14 17:53	1
4-Ethyltoluene	ND		2.0		ug/m3			02/15/14 17:53	1
n-Heptane	ND		3.3		ug/m3			02/15/14 17:53	1
Hexachlorobutadiene	ND		21		ug/m3			02/15/14 17:53	1
n-Hexane	ND		2.8		ug/m3			02/15/14 17:53	1
2-Hexanone	ND		1.6		ug/m3			02/15/14 17:53	1
Isopropylbenzene	ND		3.9		ug/m3			02/15/14 17:53	1
Methyl-t-Butyl Ether (MTBE)	ND		2.9		ug/m3			02/15/14 17:53	1
4-Methyl-2-pentanone (MIBK)	ND		1.6		ug/m3			02/15/14 17:53	1
Methylene chloride	ND		1.4		ug/m3			02/15/14 17:53	1
Naphthalene	ND		4.2		ug/m3			02/15/14 17:53	1
n-Octane	ND		1.9		ug/m3			02/15/14 17:53	1
Propene	ND		0.69		ug/m3			02/15/14 17:53	1
n-Propylbenzene	ND		2.0		ug/m3			02/15/14 17:53	1
Styrene	ND		1.7		ug/m3			02/15/14 17:53	1
1,1,2,2-Tetrachloroethane	ND		2.7		ug/m3			02/15/14 17:53	1
Tetrachloroethene	ND		2.7		ug/m3			02/15/14 17:53	1
Tetrahydrofuran	ND		2.4		ug/m3			02/15/14 17:53	1
Toluene	ND		1.5		ug/m3			02/15/14 17:53	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		3.1		ug/m3			02/15/14 17:53	1
1,2,4-Trichlorobenzene	ND		15		ug/m3			02/15/14 17:53	1
1,1,1-Trichloroethane	ND		1.6		ug/m3			02/15/14 17:53	1
1,1,2-Trichloroethane	ND		2.2		ug/m3			02/15/14 17:53	1
Trichloroethene	ND		2.1		ug/m3			02/15/14 17:53	1
Trichlorofluoromethane	ND		2.2		ug/m3			02/15/14 17:53	1
1,2,4-Trimethylbenzene	ND		3.9		ug/m3			02/15/14 17:53	1
1,3,5-Trimethylbenzene	ND		2.0		ug/m3			02/15/14 17:53	1
2,2,4-Trimethylpentane	ND		1.9		ug/m3			02/15/14 17:53	1
Vinyl acetate	ND		2.8		ug/m3			02/15/14 17:53	1
Vinyl bromide	ND		3.5		ug/m3			02/15/14 17:53	1
Vinyl chloride	ND		1.0		ug/m3			02/15/14 17:53	1
m,p-Xylene	ND		3.5		ug/m3			02/15/14 17:53	1
o-Xylene	ND		1.7		ug/m3			02/15/14 17:53	1
2-Propanol	ND		4.9		ug/m3			02/15/14 17:53	1
n-Nonane	ND		4.2		ug/m3			02/15/14 17:53	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-36393/9
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Method Blank
Prep Type: Total/NA

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	103		70 - 130		02/15/14 17:53	1
1,2-Dichloroethane-d4 (Surr)	99		70 - 130		02/15/14 17:53	1
Toluene-d8 (Surr)	103		70 - 130		02/15/14 17:53	1

Lab Sample ID: LCS 320-36393/4
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetone	21.0	16.9		ppb v/v		80	70 - 130
Allyl chloride	20.6	19.2		ppb v/v		93	70 - 130
Benzene	20.6	19.1		ppb v/v		93	70 - 130
Benzyl chloride	20.2	20.2		ppb v/v		100	70 - 130
Bromodichloromethane	20.2	20.5		ppb v/v		102	70 - 130
Bromoform	19.8	22.1		ppb v/v		112	70 - 130
Bromomethane	19.0	18.6		ppb v/v		98	70 - 130
1,3-Butadiene	20.8	16.9		ppb v/v		81	70 - 130
2-Butanone (MEK)	21.2	18.6		ppb v/v		88	70 - 130
n-Butylbenzene	20.0	18.8		ppb v/v		94	70 - 130
sec-Butylbenzene	19.8	19.2		ppb v/v		97	70 - 130
tert-Butylbenzene	20.0	18.5		ppb v/v		92	70 - 130
Carbon disulfide	20.6	16.7		ppb v/v		81	70 - 130
Carbon tetrachloride	20.4	21.4		ppb v/v		105	70 - 130
Chlorobenzene	20.6	20.8		ppb v/v		101	70 - 130
Chloroethane	19.2	18.9		ppb v/v		99	70 - 130
Chloroform	20.4	19.4		ppb v/v		95	70 - 130
Chloromethane	19.4	16.5		ppb v/v		85	70 - 130
Cyclohexane	20.8	19.9		ppb v/v		96	70 - 130
Dibromochloromethane	21.4	22.4		ppb v/v		105	70 - 130
1,2-Dibromoethane (EDB)	20.4	20.6		ppb v/v		101	70 - 130
1,2-Dichloro-1,1,2,2-tetrafluoroethane	19.6	17.5		ppb v/v		89	70 - 130
1,2-Dichlorobenzene	20.0	21.4		ppb v/v		107	70 - 130
1,3-Dichlorobenzene	20.2	22.8		ppb v/v		113	70 - 130
1,4-Dichlorobenzene	19.8	22.4		ppb v/v		113	70 - 130
Dichlorodifluoromethane	19.8	16.6		ppb v/v		84	70 - 130
1,1-Dichloroethane	20.6	18.3		ppb v/v		89	70 - 130
1,2-Dichloroethane	20.6	19.8		ppb v/v		96	70 - 130
1,1-Dichloroethene	21.6	16.7		ppb v/v		77	70 - 130
cis-1,2-Dichloroethene	20.8	17.9		ppb v/v		86	70 - 130
trans-1,2-Dichloroethene	20.4	18.5		ppb v/v		91	70 - 130
1,2-Dichloropropane	20.2	20.5		ppb v/v		102	70 - 130
cis-1,3-Dichloropropene	20.8	19.6		ppb v/v		94	70 - 130
trans-1,3-Dichloropropene	21.2	22.2		ppb v/v		105	70 - 130
Ethyl acetate	20.4	18.1		ppb v/v		89	70 - 130
Ethylbenzene	20.4	21.5		ppb v/v		105	70 - 130
4-Ethyltoluene	20.4	20.9		ppb v/v		102	70 - 130
n-Heptane	20.8	20.2		ppb v/v		97	70 - 130

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-36393/4
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Hexachlorobutadiene	20.2	21.8		ppb v/v		108	70 - 130
n-Hexane	21.4	19.4		ppb v/v		91	70 - 130
2-Hexanone	21.0	20.5		ppb v/v		97	70 - 130
Isopropylbenzene	19.0	19.9		ppb v/v		105	70 - 130
Methyl-t-Butyl Ether (MTBE)	20.6	19.7		ppb v/v		96	70 - 130
4-Methyl-2-pentanone (MIBK)	20.2	20.0		ppb v/v		99	70 - 130
Methylene chloride	20.6	18.1		ppb v/v		88	70 - 130
Naphthalene	21.0	17.1		ppb v/v		81	70 - 130
n-Octane	20.6	19.9		ppb v/v		97	70 - 130
Propene	19.4	15.5		ppb v/v		80	70 - 130
n-Propylbenzene	19.6	19.8		ppb v/v		101	70 - 130
Styrene	20.2	23.9		ppb v/v		118	70 - 130
1,1,2,2-Tetrachloroethane	20.2	20.9		ppb v/v		104	70 - 130
Tetrachloroethene	19.2	18.6		ppb v/v		97	70 - 130
Tetrahydrofuran	21.4	19.2		ppb v/v		90	70 - 130
Toluene	20.8	24.2		ppb v/v		116	70 - 130
1,1,2-Trichloro-1,2,2-trifluoroetha ne	21.0	17.5		ppb v/v		83	70 - 130
1,2,4-Trichlorobenzene	20.4	19.5		ppb v/v		96	70 - 130
1,1,1-Trichloroethane	20.2	18.7		ppb v/v		93	70 - 130
1,1,2-Trichloroethane	20.0	20.6		ppb v/v		103	70 - 130
Trichloroethene	20.2	20.9		ppb v/v		103	70 - 130
Trichlorofluoromethane	20.0	18.1		ppb v/v		91	70 - 130
1,2,4-Trimethylbenzene	20.0	19.3		ppb v/v		96	70 - 130
1,3,5-Trimethylbenzene	20.0	19.1		ppb v/v		96	70 - 130
2,2,4-Trimethylpentane	20.4	19.7		ppb v/v		97	70 - 130
Vinyl acetate	19.8	20.4		ppb v/v		103	70 - 130
Vinyl bromide	21.2	17.6		ppb v/v		83	70 - 130
Vinyl chloride	19.6	16.6		ppb v/v		85	70 - 130
m,p-Xylene	39.6	41.5		ppb v/v		105	70 - 130
o-Xylene	20.2	21.0		ppb v/v		104	70 - 130
n-Nonane	20.2	20.3		ppb v/v		100	70 - 130

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetone	50	40.1		ug/m3		80	70 - 130
Allyl chloride	64	60.2		ug/m3		93	70 - 130
Benzene	66	61.1		ug/m3		93	70 - 130
Benzyl chloride	100	105		ug/m3		100	70 - 130
Bromodichloromethane	140	138		ug/m3		102	70 - 130
Bromoform	200	229		ug/m3		112	70 - 130
Bromomethane	74	72.3		ug/m3		98	70 - 130
1,3-Butadiene	46	37.5		ug/m3		81	70 - 130
2-Butanone (MEK)	63	54.9		ug/m3		88	70 - 130
n-Butylbenzene	110	103		ug/m3		94	70 - 130
sec-Butylbenzene	110	105		ug/m3		97	70 - 130
tert-Butylbenzene	110	102		ug/m3		92	70 - 130
Carbon disulfide	64	52.0		ug/m3		81	70 - 130
Carbon tetrachloride	130	135		ug/m3		105	70 - 130

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-36393/4
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chlorobenzene	95	95.8		ug/m3		101	70 - 130
Chloroethane	51	49.9		ug/m3		99	70 - 130
Chloroform	100	94.9		ug/m3		95	70 - 130
Chloromethane	40	34.0		ug/m3		85	70 - 130
Cyclohexane	72	68.4		ug/m3		96	70 - 130
Dibromochloromethane	180	191		ug/m3		105	70 - 130
1,2-Dibromoethane (EDB)	160	158		ug/m3		101	70 - 130
1,2-Dichloro-1,1,2,2-tetrafluoroethane	140	122		ug/m3		89	70 - 130
1,2-Dichlorobenzene	120	129		ug/m3		107	70 - 130
1,3-Dichlorobenzene	120	137		ug/m3		113	70 - 130
1,4-Dichlorobenzene	120	134		ug/m3		113	70 - 130
Dichlorodifluoromethane	98	82.3		ug/m3		84	70 - 130
1,1-Dichloroethane	83	73.9		ug/m3		89	70 - 130
1,2-Dichloroethane	83	80.0		ug/m3		96	70 - 130
1,1-Dichloroethene	86	66.2		ug/m3		77	70 - 130
cis-1,2-Dichloroethene	82	71.0		ug/m3		86	70 - 130
trans-1,2-Dichloroethene	81	73.4		ug/m3		91	70 - 130
1,2-Dichloropropane	93	94.8		ug/m3		102	70 - 130
cis-1,3-Dichloropropene	94	89.0		ug/m3		94	70 - 130
trans-1,3-Dichloropropene	96	101		ug/m3		105	70 - 130
Ethyl acetate	74	65.3		ug/m3		89	70 - 130
Ethylbenzene	89	93.2		ug/m3		105	70 - 130
4-Ethyltoluene	100	103		ug/m3		102	70 - 130
n-Heptane	85	83.0		ug/m3		97	70 - 130
Hexachlorobutadiene	220	233		ug/m3		108	70 - 130
n-Hexane	75	68.4		ug/m3		91	70 - 130
2-Hexanone	86	83.9		ug/m3		97	70 - 130
Isopropylbenzene	93	97.8		ug/m3		105	70 - 130
Methyl-t-Butyl Ether (MTBE)	74	71.2		ug/m3		96	70 - 130
4-Methyl-2-pentanone (MIBK)	83	82.0		ug/m3		99	70 - 130
Methylene chloride	72	62.9		ug/m3		88	70 - 130
Naphthalene	110	89.7		ug/m3		81	70 - 130
n-Octane	96	93.1		ug/m3		97	70 - 130
Propene	33	26.7		ug/m3		80	70 - 130
n-Propylbenzene	96	97.4		ug/m3		101	70 - 130
Styrene	86	102		ug/m3		118	70 - 130
1,1,2,2-Tetrachloroethane	140	144		ug/m3		104	70 - 130
Tetrachloroethene	130	126		ug/m3		97	70 - 130
Tetrahydrofuran	63	56.7		ug/m3		90	70 - 130
Toluene	78	91.0		ug/m3		116	70 - 130
1,1,2-Trichloro-1,2,2-trifluoroethane	160	134		ug/m3		83	70 - 130
1,2,4-Trichlorobenzene	150	145		ug/m3		96	70 - 130
1,1,1-Trichloroethane	110	102		ug/m3		93	70 - 130
1,1,2-Trichloroethane	110	113		ug/m3		103	70 - 130
Trichloroethene	110	112		ug/m3		103	70 - 130
Trichlorofluoromethane	110	102		ug/m3		91	70 - 130
1,2,4-Trimethylbenzene	98	94.7		ug/m3		96	70 - 130

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-36393/4
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,3,5-Trimethylbenzene	98	94.0		ug/m3		96	70 - 130
2,2,4-Trimethylpentane	95	92.2		ug/m3		97	70 - 130
Vinyl acetate	70	71.9		ug/m3		103	70 - 130
Vinyl bromide	93	76.8		ug/m3		83	70 - 130
Vinyl chloride	50	42.3		ug/m3		85	70 - 130
m,p-Xylene	170	180		ug/m3		105	70 - 130
o-Xylene	88	91.1		ug/m3		104	70 - 130
n-Nonane	110	106		ug/m3		100	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*106*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*105*		*70 - 130*
Toluene-d8 (Surr)	*104*		*70 - 130*

Lab Sample ID: LCS 320-36393/6
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2-Propanol	20.4	18.9		ppb v/v		93	70 - 130

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2-Propanol	50	46.4		ug/m3		93	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*106*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*99*		*70 - 130*
Toluene-d8 (Surr)	*105*		*70 - 130*

Lab Sample ID: LCSD 320-36393/5
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetone	21.0	16.4		ppb v/v		78	70 - 130	3	25
Allyl chloride	20.6	18.9		ppb v/v		92	70 - 130	2	25
Benzene	20.6	19.3		ppb v/v		93	70 - 130	1	25
Benzyl chloride	20.2	20.6		ppb v/v		102	70 - 130	2	25
Bromodichloromethane	20.2	20.8		ppb v/v		103	70 - 130	1	25
Bromoform	19.8	22.5		ppb v/v		114	70 - 130	2	25
Bromomethane	19.0	18.6		ppb v/v		98	70 - 130	0	25
1,3-Butadiene	20.8	17.0		ppb v/v		82	70 - 130	0	25
2-Butanone (MEK)	21.2	19.3		ppb v/v		91	70 - 130	3	25
n-Butylbenzene	20.0	19.2		ppb v/v		96	70 - 130	2	25
sec-Butylbenzene	19.8	19.1		ppb v/v		97	70 - 130	0	25
tert-Butylbenzene	20.0	18.9		ppb v/v		94	70 - 130	2	25
Carbon disulfide	20.6	16.7		ppb v/v		81	70 - 130	0	25
Carbon tetrachloride	20.4	21.3		ppb v/v		104	70 - 130	0	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36393/5
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chlorobenzene	20.6	21.0		ppb v/v		102	70 - 130	1	25
Chloroethane	19.2	19.1		ppb v/v		99	70 - 130	1	25
Chloroform	20.4	19.3		ppb v/v		95	70 - 130	0	25
Chloromethane	19.4	16.7		ppb v/v		86	70 - 130	1	25
Cyclohexane	20.8	19.9		ppb v/v		96	70 - 130	0	25
Dibromochloromethane	21.4	22.4		ppb v/v		105	70 - 130	0	25
1,2-Dibromoethane (EDB)	20.4	20.9		ppb v/v		102	70 - 130	1	25
1,2-Dichloro-1,1,2,2-tetrafluoroethane	19.6	17.4		ppb v/v		89	70 - 130	1	25
1,2-Dichlorobenzene	20.0	21.6		ppb v/v		108	70 - 130	1	25
1,3-Dichlorobenzene	20.2	22.8		ppb v/v		113	70 - 130	0	25
1,4-Dichlorobenzene	19.8	22.7		ppb v/v		115	70 - 130	2	25
Dichlorodifluoromethane	19.8	16.8		ppb v/v		85	70 - 130	1	25
1,1-Dichloroethane	20.6	18.1		ppb v/v		88	70 - 130	1	25
1,2-Dichloroethane	20.6	20.0		ppb v/v		97	70 - 130	1	25
1,1-Dichloroethene	21.6	16.6		ppb v/v		77	70 - 130	1	25
cis-1,2-Dichloroethene	20.8	17.8		ppb v/v		86	70 - 130	0	25
trans-1,2-Dichloroethene	20.4	18.4		ppb v/v		90	70 - 130	1	25
1,2-Dichloropropane	20.2	20.7		ppb v/v		102	70 - 130	1	25
cis-1,3-Dichloropropene	20.8	20.0		ppb v/v		96	70 - 130	2	25
trans-1,3-Dichloropropene	21.2	22.0		ppb v/v		104	70 - 130	1	25
Ethyl acetate	20.4	18.1		ppb v/v		89	70 - 130	0	25
Ethylbenzene	20.4	21.2		ppb v/v		104	70 - 130	1	25
4-Ethyltoluene	20.4	20.5		ppb v/v		101	70 - 130	2	25
n-Heptane	20.8	20.5		ppb v/v		98	70 - 130	1	25
Hexachlorobutadiene	20.2	22.3		ppb v/v		110	70 - 130	2	25
n-Hexane	21.4	19.3		ppb v/v		90	70 - 130	1	25
2-Hexanone	21.0	21.1		ppb v/v		101	70 - 130	3	25
Isopropylbenzene	19.0	19.8		ppb v/v		104	70 - 130	0	25
Methyl-t-Butyl Ether (MTBE)	20.6	19.6		ppb v/v		95	70 - 130	1	25
4-Methyl-2-pentanone (MIBK)	20.2	20.7		ppb v/v		103	70 - 130	3	25
Methylene chloride	20.6	17.7		ppb v/v		86	70 - 130	2	25
Naphthalene	21.0	18.3		ppb v/v		87	70 - 130	6	25
n-Octane	20.6	19.4		ppb v/v		94	70 - 130	3	25
Propene	19.4	15.7		ppb v/v		81	70 - 130	2	25
n-Propylbenzene	19.6	19.7		ppb v/v		101	70 - 130	0	25
Styrene	20.2	24.0		ppb v/v		119	70 - 130	0	25
1,1,2,2-Tetrachloroethane	20.2	20.9		ppb v/v		104	70 - 130	0	25
Tetrachloroethene	19.2	18.7		ppb v/v		97	70 - 130	0	25
Tetrahydrofuran	21.4	19.3		ppb v/v		90	70 - 130	0	25
Toluene	20.8	23.6		ppb v/v		113	70 - 130	2	25
1,1,2-Trichloro-1,2,2-trifluoroethane	21.0	17.1		ppb v/v		81	70 - 130	2	25
1,2,4-Trichlorobenzene	20.4	20.2		ppb v/v		99	70 - 130	3	25
1,1,1-Trichloroethane	20.2	18.5		ppb v/v		92	70 - 130	1	25
1,1,2-Trichloroethane	20.0	20.7		ppb v/v		103	70 - 130	0	25
Trichloroethene	20.2	21.1		ppb v/v		104	70 - 130	1	25
Trichlorofluoromethane	20.0	18.3		ppb v/v		91	70 - 130	1	25
1,2,4-Trimethylbenzene	20.0	18.7		ppb v/v		94	70 - 130	3	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36393/5
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,3,5-Trimethylbenzene	20.0	19.2		ppb v/v		96	70 - 130	1	25
2,2,4-Trimethylpentane	20.4	19.9		ppb v/v		97	70 - 130	1	25
Vinyl acetate	19.8	20.1		ppb v/v		102	70 - 130	2	25
Vinyl bromide	21.2	17.7		ppb v/v		84	70 - 130	1	25
Vinyl chloride	19.6	16.8		ppb v/v		86	70 - 130	1	25
m,p-Xylene	39.6	41.2		ppb v/v		104	70 - 130	1	25
o-Xylene	20.2	21.0		ppb v/v		104	70 - 130	0	25
n-Nonane	20.2	20.2		ppb v/v		100	70 - 130	0	25

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetone	50	38.9		ug/m3		78	70 - 130	3	25
Allyl chloride	64	59.1		ug/m3		92	70 - 130	2	25
Benzene	66	61.5		ug/m3		93	70 - 130	1	25
Benzyl chloride	100	107		ug/m3		102	70 - 130	2	25
Bromodichloromethane	140	139		ug/m3		103	70 - 130	1	25
Bromoform	200	232		ug/m3		114	70 - 130	2	25
Bromomethane	74	72.4		ug/m3		98	70 - 130	0	25
1,3-Butadiene	46	37.5		ug/m3		82	70 - 130	0	25
2-Butanone (MEK)	63	56.8		ug/m3		91	70 - 130	3	25
n-Butylbenzene	110	105		ug/m3		96	70 - 130	2	25
sec-Butylbenzene	110	105		ug/m3		97	70 - 130	0	25
tert-Butylbenzene	110	104		ug/m3		94	70 - 130	2	25
Carbon disulfide	64	52.2		ug/m3		81	70 - 130	0	25
Carbon tetrachloride	130	134		ug/m3		104	70 - 130	0	25
Chlorobenzene	95	96.5		ug/m3		102	70 - 130	1	25
Chloroethane	51	50.3		ug/m3		99	70 - 130	1	25
Chloroform	100	94.4		ug/m3		95	70 - 130	0	25
Chloromethane	40	34.5		ug/m3		86	70 - 130	1	25
Cyclohexane	72	68.6		ug/m3		96	70 - 130	0	25
Dibromochloromethane	180	191		ug/m3		105	70 - 130	0	25
1,2-Dibromoethane (EDB)	160	161		ug/m3		102	70 - 130	1	25
1,2-Dichloro-1,1,2,2-tetrafluoroethane	140	121		ug/m3		89	70 - 130	1	25
1,2-Dichlorobenzene	120	130		ug/m3		108	70 - 130	1	25
1,3-Dichlorobenzene	120	137		ug/m3		113	70 - 130	0	25
1,4-Dichlorobenzene	120	137		ug/m3		115	70 - 130	2	25
Dichlorodifluoromethane	98	83.3		ug/m3		85	70 - 130	1	25
1,1-Dichloroethane	83	73.1		ug/m3		88	70 - 130	1	25
1,2-Dichloroethane	83	80.9		ug/m3		97	70 - 130	1	25
1,1-Dichloroethene	86	65.6		ug/m3		77	70 - 130	1	25
cis-1,2-Dichloroethene	82	70.8		ug/m3		86	70 - 130	0	25
trans-1,2-Dichloroethene	81	73.0		ug/m3		90	70 - 130	1	25
1,2-Dichloropropane	93	95.6		ug/m3		102	70 - 130	1	25
cis-1,3-Dichloropropene	94	90.6		ug/m3		96	70 - 130	2	25
trans-1,3-Dichloropropene	96	100		ug/m3		104	70 - 130	1	25
Ethyl acetate	74	65.3		ug/m3		89	70 - 130	0	25
Ethylbenzene	89	92.2		ug/m3		104	70 - 130	1	25
4-Ethyltoluene	100	101		ug/m3		101	70 - 130	2	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36393/5
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
n-Heptane			85	83.9		ug/m3		98	70 - 130	1	25
Hexachlorobutadiene			220	237		ug/m3		110	70 - 130	2	25
n-Hexane			75	68.0		ug/m3		90	70 - 130	1	25
2-Hexanone			86	86.6		ug/m3		101	70 - 130	3	25
Isopropylbenzene			93	97.3		ug/m3		104	70 - 130	0	25
Methyl-t-Butyl Ether (MTBE)			74	70.6		ug/m3		95	70 - 130	1	25
4-Methyl-2-pentanone (MIBK)			83	84.8		ug/m3		103	70 - 130	3	25
Methylene chloride			72	61.4		ug/m3		86	70 - 130	2	25
Naphthalene			110	95.7		ug/m3		87	70 - 130	6	25
n-Octane			96	90.4		ug/m3		94	70 - 130	3	25
Propene			33	27.1		ug/m3		81	70 - 130	2	25
n-Propylbenzene			96	97.0		ug/m3		101	70 - 130	0	25
Styrene			86	102		ug/m3		119	70 - 130	0	25
1,1,2,2-Tetrachloroethane			140	144		ug/m3		104	70 - 130	0	25
Tetrachloroethene			130	127		ug/m3		97	70 - 130	0	25
Tetrahydrofuran			63	56.8		ug/m3		90	70 - 130	0	25
Toluene			78	88.9		ug/m3		113	70 - 130	2	25
1,1,2-Trichloro-1,2,2-trifluoroetha ne			160	131		ug/m3		81	70 - 130	2	25
1,2,4-Trichlorobenzene			150	150		ug/m3		99	70 - 130	3	25
1,1,1-Trichloroethane			110	101		ug/m3		92	70 - 130	1	25
1,1,2-Trichloroethane			110	113		ug/m3		103	70 - 130	0	25
Trichloroethene			110	113		ug/m3		104	70 - 130	1	25
Trichlorofluoromethane			110	103		ug/m3		91	70 - 130	1	25
1,2,4-Trimethylbenzene			98	92.2		ug/m3		94	70 - 130	3	25
1,3,5-Trimethylbenzene			98	94.6		ug/m3		96	70 - 130	1	25
2,2,4-Trimethylpentane			95	92.9		ug/m3		97	70 - 130	1	25
Vinyl acetate			70	70.8		ug/m3		102	70 - 130	2	25
Vinyl bromide			93	77.5		ug/m3		84	70 - 130	1	25
Vinyl chloride			50	42.9		ug/m3		86	70 - 130	1	25
m,p-Xylene			170	179		ug/m3		104	70 - 130	1	25
o-Xylene			88	91.0		ug/m3		104	70 - 130	0	25
n-Nonane			110	106		ug/m3		100	70 - 130	0	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*108*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*103*		*70 - 130*
Toluene-d8 (Surr)	*106*		*70 - 130*

Lab Sample ID: LCSD 320-36393/7
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2-Propanol			20.4	17.5		ppb v/v		86	70 - 130	8	25

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2-Propanol			50	43.1		ug/m3		86	70 - 130	8	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36393/7
Matrix: Air
Analysis Batch: 36393

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*97*		*70 - 130*
Toluene-d8 (Surr)	*105*		*70 - 130*

Lab Sample ID: MB 320-36446/10
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		5.0		ppb v/v			02/17/14 16:15	1
Allyl chloride	ND		0.80		ppb v/v			02/17/14 16:15	1
Benzene	ND		0.40		ppb v/v			02/17/14 16:15	1
Benzyl chloride	ND		0.80		ppb v/v			02/17/14 16:15	1
Bromodichloromethane	ND		0.30		ppb v/v			02/17/14 16:15	1
Bromoform	ND		0.40		ppb v/v			02/17/14 16:15	1
Bromomethane	ND		0.80		ppb v/v			02/17/14 16:15	1
1,3-Butadiene	ND		0.80		ppb v/v			02/17/14 16:15	1
2-Butanone (MEK)	ND		0.80		ppb v/v			02/17/14 16:15	1
n-Butylbenzene	ND		0.40		ppb v/v			02/17/14 16:15	1
sec-Butylbenzene	ND		0.40		ppb v/v			02/17/14 16:15	1
tert-Butylbenzene	ND		0.80		ppb v/v			02/17/14 16:15	1
Carbon disulfide	ND		0.80		ppb v/v			02/17/14 16:15	1
Carbon tetrachloride	ND		0.80		ppb v/v			02/17/14 16:15	1
Chlorobenzene	ND		0.30		ppb v/v			02/17/14 16:15	1
Chloroethane	ND		0.80		ppb v/v			02/17/14 16:15	1
Chloroform	ND		0.30		ppb v/v			02/17/14 16:15	1
Chloromethane	ND		0.80		ppb v/v			02/17/14 16:15	1
Cyclohexane	ND		0.40		ppb v/v			02/17/14 16:15	1
Dibromochloromethane	ND		0.40		ppb v/v			02/17/14 16:15	1
1,2-Dibromoethane (EDB)	ND		0.80		ppb v/v			02/17/14 16:15	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40		ppb v/v			02/17/14 16:15	1
1,2-Dichlorobenzene	ND		0.40		ppb v/v			02/17/14 16:15	1
1,3-Dichlorobenzene	ND		0.40		ppb v/v			02/17/14 16:15	1
1,4-Dichlorobenzene	ND		0.40		ppb v/v			02/17/14 16:15	1
Dichlorodifluoromethane	ND		0.40		ppb v/v			02/17/14 16:15	1
1,1-Dichloroethane	ND		0.30		ppb v/v			02/17/14 16:15	1
1,2-Dichloroethane	ND		0.80		ppb v/v			02/17/14 16:15	1
1,1-Dichloroethene	ND		0.80		ppb v/v			02/17/14 16:15	1
cis-1,2-Dichloroethene	ND		0.40		ppb v/v			02/17/14 16:15	1
trans-1,2-Dichloroethene	ND		0.40		ppb v/v			02/17/14 16:15	1
1,2-Dichloropropane	ND		0.40		ppb v/v			02/17/14 16:15	1
cis-1,3-Dichloropropene	ND		0.40		ppb v/v			02/17/14 16:15	1
trans-1,3-Dichloropropene	ND		0.40		ppb v/v			02/17/14 16:15	1
Ethyl acetate	ND		0.30		ppb v/v			02/17/14 16:15	1
Ethylbenzene	ND		0.40		ppb v/v			02/17/14 16:15	1
4-Ethyltoluene	ND		0.40		ppb v/v			02/17/14 16:15	1
n-Heptane	ND		0.80		ppb v/v			02/17/14 16:15	1
Hexachlorobutadiene	ND		2.0		ppb v/v			02/17/14 16:15	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-36446/10
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
n-Hexane	ND		0.80		ppb v/v			02/17/14 16:15	1
2-Hexanone	ND		0.40		ppb v/v			02/17/14 16:15	1
Isopropylbenzene	ND		0.80		ppb v/v			02/17/14 16:15	1
Methyl-t-Butyl Ether (MTBE)	ND		0.80		ppb v/v			02/17/14 16:15	1
4-Methyl-2-pentanone (MIBK)	ND		0.40		ppb v/v			02/17/14 16:15	1
Methylene chloride	ND		0.40		ppb v/v			02/17/14 16:15	1
Naphthalene	ND		0.80		ppb v/v			02/17/14 16:15	1
n-Octane	ND		0.40		ppb v/v			02/17/14 16:15	1
Propene	ND		0.40		ppb v/v			02/17/14 16:15	1
n-Propylbenzene	ND		0.40		ppb v/v			02/17/14 16:15	1
Styrene	ND		0.40		ppb v/v			02/17/14 16:15	1
1,1,2,2-Tetrachloroethane	ND		0.40		ppb v/v			02/17/14 16:15	1
Tetrachloroethene	ND		0.40		ppb v/v			02/17/14 16:15	1
Tetrahydrofuran	ND		0.80		ppb v/v			02/17/14 16:15	1
Toluene	ND		0.40		ppb v/v			02/17/14 16:15	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40		ppb v/v			02/17/14 16:15	1
1,2,4-Trichlorobenzene	ND		2.0		ppb v/v			02/17/14 16:15	1
1,1,1-Trichloroethane	ND		0.30		ppb v/v			02/17/14 16:15	1
1,1,2-Trichloroethane	ND		0.40		ppb v/v			02/17/14 16:15	1
Trichloroethene	ND		0.40		ppb v/v			02/17/14 16:15	1
Trichlorofluoromethane	ND		0.40		ppb v/v			02/17/14 16:15	1
1,2,4-Trimethylbenzene	ND		0.80		ppb v/v			02/17/14 16:15	1
1,3,5-Trimethylbenzene	ND		0.40		ppb v/v			02/17/14 16:15	1
2,2,4-Trimethylpentane	ND		0.40		ppb v/v			02/17/14 16:15	1
Vinyl acetate	ND		0.80		ppb v/v			02/17/14 16:15	1
Vinyl bromide	ND		0.80		ppb v/v			02/17/14 16:15	1
Vinyl chloride	ND		0.40		ppb v/v			02/17/14 16:15	1
m,p-Xylene	ND		0.80		ppb v/v			02/17/14 16:15	1
o-Xylene	ND		0.40		ppb v/v			02/17/14 16:15	1
2-Propanol	ND		2.0		ppb v/v			02/17/14 16:15	1
n-Nonane	ND		0.80		ppb v/v			02/17/14 16:15	1

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		12		ug/m3			02/17/14 16:15	1
Allyl chloride	ND		2.5		ug/m3			02/17/14 16:15	1
Benzene	ND		1.3		ug/m3			02/17/14 16:15	1
Benzyl chloride	ND		4.1		ug/m3			02/17/14 16:15	1
Bromodichloromethane	ND		2.0		ug/m3			02/17/14 16:15	1
Bromoform	ND		4.1		ug/m3			02/17/14 16:15	1
Bromomethane	ND		3.1		ug/m3			02/17/14 16:15	1
1,3-Butadiene	ND		1.8		ug/m3			02/17/14 16:15	1
2-Butanone (MEK)	ND		2.4		ug/m3			02/17/14 16:15	1
n-Butylbenzene	ND		2.2		ug/m3			02/17/14 16:15	1
sec-Butylbenzene	ND		2.2		ug/m3			02/17/14 16:15	1
tert-Butylbenzene	ND		4.4		ug/m3			02/17/14 16:15	1
Carbon disulfide	ND		2.5		ug/m3			02/17/14 16:15	1
Carbon tetrachloride	ND		5.0		ug/m3			02/17/14 16:15	1
Chlorobenzene	ND		1.4		ug/m3			02/17/14 16:15	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-36446/10
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Chloroethane	ND		2.1		ug/m3			02/17/14 16:15	1
Chloroform	ND		1.5		ug/m3			02/17/14 16:15	1
Chloromethane	ND		1.7		ug/m3			02/17/14 16:15	1
Cyclohexane	ND		1.4		ug/m3			02/17/14 16:15	1
Dibromochloromethane	ND		3.4		ug/m3			02/17/14 16:15	1
1,2-Dibromoethane (EDB)	ND		6.1		ug/m3			02/17/14 16:15	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2.8		ug/m3			02/17/14 16:15	1
1,2-Dichlorobenzene	ND		2.4		ug/m3			02/17/14 16:15	1
1,3-Dichlorobenzene	ND		2.4		ug/m3			02/17/14 16:15	1
1,4-Dichlorobenzene	ND		2.4		ug/m3			02/17/14 16:15	1
Dichlorodifluoromethane	ND		2.0		ug/m3			02/17/14 16:15	1
1,1-Dichloroethane	ND		1.2		ug/m3			02/17/14 16:15	1
1,2-Dichloroethane	ND		3.2		ug/m3			02/17/14 16:15	1
1,1-Dichloroethene	ND		3.2		ug/m3			02/17/14 16:15	1
cis-1,2-Dichloroethene	ND		1.6		ug/m3			02/17/14 16:15	1
trans-1,2-Dichloroethene	ND		1.6		ug/m3			02/17/14 16:15	1
1,2-Dichloropropane	ND		1.8		ug/m3			02/17/14 16:15	1
cis-1,3-Dichloropropene	ND		1.8		ug/m3			02/17/14 16:15	1
trans-1,3-Dichloropropene	ND		1.8		ug/m3			02/17/14 16:15	1
Ethyl acetate	ND		1.1		ug/m3			02/17/14 16:15	1
Ethylbenzene	ND		1.7		ug/m3			02/17/14 16:15	1
4-Ethyltoluene	ND		2.0		ug/m3			02/17/14 16:15	1
n-Heptane	ND		3.3		ug/m3			02/17/14 16:15	1
Hexachlorobutadiene	ND		21		ug/m3			02/17/14 16:15	1
n-Hexane	ND		2.8		ug/m3			02/17/14 16:15	1
2-Hexanone	ND		1.6		ug/m3			02/17/14 16:15	1
Isopropylbenzene	ND		3.9		ug/m3			02/17/14 16:15	1
Methyl-t-Butyl Ether (MTBE)	ND		2.9		ug/m3			02/17/14 16:15	1
4-Methyl-2-pentanone (MIBK)	ND		1.6		ug/m3			02/17/14 16:15	1
Methylene chloride	ND		1.4		ug/m3			02/17/14 16:15	1
Naphthalene	ND		4.2		ug/m3			02/17/14 16:15	1
n-Octane	ND		1.9		ug/m3			02/17/14 16:15	1
Propene	ND		0.69		ug/m3			02/17/14 16:15	1
n-Propylbenzene	ND		2.0		ug/m3			02/17/14 16:15	1
Styrene	ND		1.7		ug/m3			02/17/14 16:15	1
1,1,2,2-Tetrachloroethane	ND		2.7		ug/m3			02/17/14 16:15	1
Tetrachloroethene	ND		2.7		ug/m3			02/17/14 16:15	1
Tetrahydrofuran	ND		2.4		ug/m3			02/17/14 16:15	1
Toluene	ND		1.5		ug/m3			02/17/14 16:15	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		3.1		ug/m3			02/17/14 16:15	1
1,2,4-Trichlorobenzene	ND		15		ug/m3			02/17/14 16:15	1
1,1,1-Trichloroethane	ND		1.6		ug/m3			02/17/14 16:15	1
1,1,2-Trichloroethane	ND		2.2		ug/m3			02/17/14 16:15	1
Trichloroethene	ND		2.1		ug/m3			02/17/14 16:15	1
Trichlorofluoromethane	ND		2.2		ug/m3			02/17/14 16:15	1
1,2,4-Trimethylbenzene	ND		3.9		ug/m3			02/17/14 16:15	1
1,3,5-Trimethylbenzene	ND		2.0		ug/m3			02/17/14 16:15	1
2,2,4-Trimethylpentane	ND		1.9		ug/m3			02/17/14 16:15	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-36446/10
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Vinyl acetate	ND		2.8	ug/m3			02/17/14 16:15	1
Vinyl bromide	ND		3.5	ug/m3			02/17/14 16:15	1
Vinyl chloride	ND		1.0	ug/m3			02/17/14 16:15	1
m,p-Xylene	ND		3.5	ug/m3			02/17/14 16:15	1
o-Xylene	ND		1.7	ug/m3			02/17/14 16:15	1
2-Propanol	ND		4.9	ug/m3			02/17/14 16:15	1
n-Nonane	ND		4.2	ug/m3			02/17/14 16:15	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*104*		*70 - 130*		*02/17/14 16:15*	*1*
1,2-Dichloroethane-d4 (Surr)	*99*		*70 - 130*		*02/17/14 16:15*	*1*
Toluene-d8 (Surr)	*104*		*70 - 130*		*02/17/14 16:15*	*1*

Lab Sample ID: LCS 320-36446/5
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetone	21.0	17.9		ppb v/v		85	70 - 130
Allyl chloride	20.6	20.4		ppb v/v		99	70 - 130
Benzene	20.6	19.5		ppb v/v		94	70 - 130
Benzyl chloride	20.2	21.1		ppb v/v		105	70 - 130
Bromodichloromethane	20.2	21.0		ppb v/v		104	70 - 130
Bromoform	19.8	21.9		ppb v/v		111	70 - 130
Bromomethane	19.0	18.8		ppb v/v		99	70 - 130
1,3-Butadiene	20.8	17.3		ppb v/v		83	70 - 130
2-Butanone (MEK)	21.2	20.9		ppb v/v		99	70 - 130
n-Butylbenzene	20.0	19.9		ppb v/v		100	70 - 130
sec-Butylbenzene	19.8	19.4		ppb v/v		98	70 - 130
tert-Butylbenzene	20.0	18.6		ppb v/v		93	70 - 130
Carbon disulfide	20.6	17.2		ppb v/v		84	70 - 130
Carbon tetrachloride	20.4	21.4		ppb v/v		105	70 - 130
Chlorobenzene	20.6	20.7		ppb v/v		101	70 - 130
Chloroethane	19.2	19.3		ppb v/v		100	70 - 130
Chloroform	20.4	20.1		ppb v/v		99	70 - 130
Chloromethane	19.4	16.8		ppb v/v		86	70 - 130
Cyclohexane	20.8	20.2		ppb v/v		97	70 - 130
Dibromochloromethane	21.4	22.3		ppb v/v		104	70 - 130
1,2-Dibromoethane (EDB)	20.4	20.4		ppb v/v		100	70 - 130
1,2-Dichloro-1,1,2,2-tetrafluoroethane	19.6	17.5		ppb v/v		89	70 - 130
1,2-Dichlorobenzene	20.0	21.0		ppb v/v		105	70 - 130
1,3-Dichlorobenzene	20.2	22.2		ppb v/v		110	70 - 130
1,4-Dichlorobenzene	19.8	22.0		ppb v/v		111	70 - 130
Dichlorodifluoromethane	19.8	17.3		ppb v/v		87	70 - 130
1,1-Dichloroethane	20.6	19.0		ppb v/v		92	70 - 130
1,2-Dichloroethane	20.6	19.9		ppb v/v		97	70 - 130
1,1-Dichloroethene	21.6	17.2		ppb v/v		80	70 - 130

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-36446/5
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	20.8	18.8		ppb v/v		90	70 - 130
trans-1,2-Dichloroethene	20.4	19.2		ppb v/v		94	70 - 130
1,2-Dichloropropane	20.2	20.7		ppb v/v		102	70 - 130
cis-1,3-Dichloropropene	20.8	20.1		ppb v/v		96	70 - 130
trans-1,3-Dichloropropene	21.2	21.8		ppb v/v		103	70 - 130
Ethyl acetate	20.4	20.4		ppb v/v		100	70 - 130
Ethylbenzene	20.4	20.9		ppb v/v		102	70 - 130
4-Ethyltoluene	20.4	21.1		ppb v/v		103	70 - 130
n-Heptane	20.8	21.0		ppb v/v		101	70 - 130
Hexachlorobutadiene	20.2	21.4		ppb v/v		106	70 - 130
n-Hexane	21.4	20.6		ppb v/v		96	70 - 130
2-Hexanone	21.0	22.1		ppb v/v		105	70 - 130
Isopropylbenzene	19.0	19.7		ppb v/v		104	70 - 130
Methyl-t-Butyl Ether (MTBE)	20.6	20.6		ppb v/v		100	70 - 130
4-Methyl-2-pentanone (MIBK)	20.2	22.5		ppb v/v		111	70 - 130
Methylene chloride	20.6	19.2		ppb v/v		93	70 - 130
Naphthalene	21.0	18.2		ppb v/v		87	70 - 130
n-Octane	20.6	19.7		ppb v/v		96	70 - 130
Propene	19.4	16.4		ppb v/v		85	70 - 130
n-Propylbenzene	19.6	19.8		ppb v/v		101	70 - 130
Styrene	20.2	23.5		ppb v/v		116	70 - 130
1,1,2,2-Tetrachloroethane	20.2	20.7		ppb v/v		102	70 - 130
Tetrachloroethene	19.2	18.2		ppb v/v		95	70 - 130
Tetrahydrofuran	21.4	21.3		ppb v/v		99	70 - 130
Toluene	20.8	23.4		ppb v/v		112	70 - 130
1,1,2-Trichloro-1,2,2-trifluoroetha ne	21.0	18.0		ppb v/v		86	70 - 130
1,2,4-Trichlorobenzene	20.4	19.9		ppb v/v		98	70 - 130
1,1,1-Trichloroethane	20.2	19.2		ppb v/v		95	70 - 130
1,1,2-Trichloroethane	20.0	20.5		ppb v/v		102	70 - 130
Trichloroethene	20.2	21.2		ppb v/v		105	70 - 130
Trichlorofluoromethane	20.0	18.7		ppb v/v		93	70 - 130
1,2,4-Trimethylbenzene	20.0	19.4		ppb v/v		97	70 - 130
1,3,5-Trimethylbenzene	20.0	19.3		ppb v/v		97	70 - 130
2,2,4-Trimethylpentane	20.4	20.1		ppb v/v		99	70 - 130
Vinyl acetate	19.8	21.3		ppb v/v		108	70 - 130
Vinyl bromide	21.2	18.1		ppb v/v		85	70 - 130
Vinyl chloride	19.6	16.5		ppb v/v		84	70 - 130
m,p-Xylene	39.6	40.4		ppb v/v		102	70 - 130
o-Xylene	20.2	20.5		ppb v/v		102	70 - 130
n-Nonane	20.2	20.5		ppb v/v		102	70 - 130

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetone	50	42.5		ug/m3		85	70 - 130
Allyl chloride	64	64.0		ug/m3		99	70 - 130
Benzene	66	62.1		ug/m3		94	70 - 130
Benzyl chloride	100	109		ug/m3		105	70 - 130
Bromodichloromethane	140	141		ug/m3		104	70 - 130

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-36446/5
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Bromoform	200	227		ug/m3		111	70 - 130
Bromomethane	74	73.1		ug/m3		99	70 - 130
1,3-Butadiene	46	38.3		ug/m3		83	70 - 130
2-Butanone (MEK)	63	61.7		ug/m3		99	70 - 130
n-Butylbenzene	110	109		ug/m3		100	70 - 130
sec-Butylbenzene	110	106		ug/m3		98	70 - 130
tert-Butylbenzene	110	102		ug/m3		93	70 - 130
Carbon disulfide	64	53.7		ug/m3		84	70 - 130
Carbon tetrachloride	130	134		ug/m3		105	70 - 130
Chlorobenzene	95	95.3		ug/m3		101	70 - 130
Chloroethane	51	50.9		ug/m3		100	70 - 130
Chloroform	100	98.3		ug/m3		99	70 - 130
Chloromethane	40	34.6		ug/m3		86	70 - 130
Cyclohexane	72	69.4		ug/m3		97	70 - 130
Dibromochloromethane	180	190		ug/m3		104	70 - 130
1,2-Dibromoethane (EDB)	160	157		ug/m3		100	70 - 130
1,2-Dichloro-1,1,2,2-tetrafluoroethane	140	122		ug/m3		89	70 - 130
1,2-Dichlorobenzene	120	126		ug/m3		105	70 - 130
1,3-Dichlorobenzene	120	134		ug/m3		110	70 - 130
1,4-Dichlorobenzene	120	132		ug/m3		111	70 - 130
Dichlorodifluoromethane	98	85.3		ug/m3		87	70 - 130
1,1-Dichloroethane	83	77.0		ug/m3		92	70 - 130
1,2-Dichloroethane	83	80.7		ug/m3		97	70 - 130
1,1-Dichloroethene	86	68.2		ug/m3		80	70 - 130
cis-1,2-Dichloroethene	82	74.5		ug/m3		90	70 - 130
trans-1,2-Dichloroethene	81	76.1		ug/m3		94	70 - 130
1,2-Dichloropropane	93	95.6		ug/m3		102	70 - 130
cis-1,3-Dichloropropene	94	91.1		ug/m3		96	70 - 130
trans-1,3-Dichloropropene	96	98.7		ug/m3		103	70 - 130
Ethyl acetate	74	73.7		ug/m3		100	70 - 130
Ethylbenzene	89	90.6		ug/m3		102	70 - 130
4-Ethyltoluene	100	104		ug/m3		103	70 - 130
n-Heptane	85	86.2		ug/m3		101	70 - 130
Hexachlorobutadiene	220	228		ug/m3		106	70 - 130
n-Hexane	75	72.7		ug/m3		96	70 - 130
2-Hexanone	86	90.7		ug/m3		105	70 - 130
Isopropylbenzene	93	96.7		ug/m3		104	70 - 130
Methyl-t-Butyl Ether (MTBE)	74	74.2		ug/m3		100	70 - 130
4-Methyl-2-pentanone (MIBK)	83	92.1		ug/m3		111	70 - 130
Methylene chloride	72	66.7		ug/m3		93	70 - 130
Naphthalene	110	95.4		ug/m3		87	70 - 130
n-Octane	96	92.0		ug/m3		96	70 - 130
Propene	33	28.3		ug/m3		85	70 - 130
n-Propylbenzene	96	97.4		ug/m3		101	70 - 130
Styrene	86	100		ug/m3		116	70 - 130
1,1,2,2-Tetrachloroethane	140	142		ug/m3		102	70 - 130
Tetrachloroethene	130	124		ug/m3		95	70 - 130

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-36446/5
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Tetrahydrofuran	63	62.7		ug/m3		99	70 - 130
Toluene	78	88.0		ug/m3		112	70 - 130
1,1,2-Trichloro-1,2,2-trifluoroethane	160	138		ug/m3		86	70 - 130
1,2,4-Trichlorobenzene	150	148		ug/m3		98	70 - 130
1,1,1-Trichloroethane	110	105		ug/m3		95	70 - 130
1,1,2-Trichloroethane	110	112		ug/m3		102	70 - 130
Trichloroethene	110	114		ug/m3		105	70 - 130
Trichlorofluoromethane	110	105		ug/m3		93	70 - 130
1,2,4-Trimethylbenzene	98	95.6		ug/m3		97	70 - 130
1,3,5-Trimethylbenzene	98	95.1		ug/m3		97	70 - 130
2,2,4-Trimethylpentane	95	94.1		ug/m3		99	70 - 130
Vinyl acetate	70	75.0		ug/m3		108	70 - 130
Vinyl bromide	93	79.2		ug/m3		85	70 - 130
Vinyl chloride	50	42.2		ug/m3		84	70 - 130
m,p-Xylene	170	175		ug/m3		102	70 - 130
o-Xylene	88	89.1		ug/m3		102	70 - 130
n-Nonane	110	108		ug/m3		102	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*106*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*104*		*70 - 130*
Toluene-d8 (Surr)	*108*		*70 - 130*

Lab Sample ID: LCS 320-36446/7
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2-Propanol	20.4	19.2		ppb v/v		94	70 - 130

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2-Propanol	50	47.2		ug/m3		94	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*108*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*98*		*70 - 130*
Toluene-d8 (Surr)	*105*		*70 - 130*

Lab Sample ID: LCSD 320-36446/6
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetone	21.0	17.7		ppb v/v		84	70 - 130	1	25
Allyl chloride	20.6	20.5		ppb v/v		99	70 - 130	0	25
Benzene	20.6	20.2		ppb v/v		98	70 - 130	4	25
Benzyl chloride	20.2	22.8		ppb v/v		113	70 - 130	8	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36446/6
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Bromodichloromethane	20.2	21.5		ppb v/v		106	70 - 130	2	25
Bromoform	19.8	22.6		ppb v/v		114	70 - 130	3	25
Bromomethane	19.0	17.8		ppb v/v		94	70 - 130	6	25
1,3-Butadiene	20.8	16.2		ppb v/v		78	70 - 130	6	25
2-Butanone (MEK)	21.2	21.3		ppb v/v		101	70 - 130	2	25
n-Butylbenzene	20.0	21.5		ppb v/v		107	70 - 130	8	25
sec-Butylbenzene	19.8	20.5		ppb v/v		103	70 - 130	5	25
tert-Butylbenzene	20.0	19.7		ppb v/v		98	70 - 130	5	25
Carbon disulfide	20.6	16.2		ppb v/v		79	70 - 130	6	25
Carbon tetrachloride	20.4	22.2		ppb v/v		109	70 - 130	4	25
Chlorobenzene	20.6	21.3		ppb v/v		103	70 - 130	3	25
Chloroethane	19.2	19.4		ppb v/v		101	70 - 130	0	25
Chloroform	20.4	20.4		ppb v/v		100	70 - 130	1	25
Chloromethane	19.4	16.5		ppb v/v		85	70 - 130	2	25
Cyclohexane	20.8	21.0		ppb v/v		101	70 - 130	4	25
Dibromochloromethane	21.4	22.8		ppb v/v		106	70 - 130	2	25
1,2-Dibromoethane (EDB)	20.4	21.1		ppb v/v		103	70 - 130	3	25
1,2-Dichloro-1,1,2,2-tetrafluoroethane	19.6	15.7		ppb v/v		80	70 - 130	11	25
1,2-Dichlorobenzene	20.0	22.1		ppb v/v		111	70 - 130	5	25
1,3-Dichlorobenzene	20.2	23.2		ppb v/v		115	70 - 130	5	25
1,4-Dichlorobenzene	19.8	22.7		ppb v/v		115	70 - 130	3	25
Dichlorodifluoromethane	19.8	16.6		ppb v/v		84	70 - 130	4	25
1,1-Dichloroethane	20.6	19.4		ppb v/v		94	70 - 130	2	25
1,2-Dichloroethane	20.6	20.8		ppb v/v		101	70 - 130	4	25
1,1-Dichloroethene	21.6	16.9		ppb v/v		78	70 - 130	2	25
cis-1,2-Dichloroethene	20.8	19.1		ppb v/v		92	70 - 130	2	25
trans-1,2-Dichloroethene	20.4	19.4		ppb v/v		95	70 - 130	1	25
1,2-Dichloropropane	20.2	21.5		ppb v/v		106	70 - 130	4	25
cis-1,3-Dichloropropene	20.8	20.7		ppb v/v		99	70 - 130	3	25
trans-1,3-Dichloropropene	21.2	22.4		ppb v/v		106	70 - 130	3	25
Ethyl acetate	20.4	20.5		ppb v/v		100	70 - 130	0	25
Ethylbenzene	20.4	21.2		ppb v/v		104	70 - 130	2	25
4-Ethyltoluene	20.4	21.8		ppb v/v		107	70 - 130	3	25
n-Heptane	20.8	21.5		ppb v/v		104	70 - 130	2	25
Hexachlorobutadiene	20.2	23.1		ppb v/v		114	70 - 130	8	25
n-Hexane	21.4	20.9		ppb v/v		98	70 - 130	1	25
2-Hexanone	21.0	23.8		ppb v/v		113	70 - 130	7	25
Isopropylbenzene	19.0	20.2		ppb v/v		106	70 - 130	2	25
Methyl-t-Butyl Ether (MTBE)	20.6	20.9		ppb v/v		102	70 - 130	2	25
4-Methyl-2-pentanone (MIBK)	20.2	24.2		ppb v/v		120	70 - 130	7	25
Methylene chloride	20.6	19.0		ppb v/v		92	70 - 130	1	25
Naphthalene	21.0	20.7		ppb v/v		98	70 - 130	13	25
n-Octane	20.6	20.1		ppb v/v		97	70 - 130	2	25
Propene	19.4	15.6		ppb v/v		80	70 - 130	5	25
n-Propylbenzene	19.6	20.5		ppb v/v		105	70 - 130	3	25
Styrene	20.2	24.1		ppb v/v		119	70 - 130	2	25
1,1,2,2-Tetrachloroethane	20.2	21.6		ppb v/v		107	70 - 130	5	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36446/6
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Tetrachloroethene	19.2	18.7		ppb v/v		97	70 - 130	3	25
Tetrahydrofuran	21.4	21.2		ppb v/v		99	70 - 130	0	25
Toluene	20.8	24.1		ppb v/v		116	70 - 130	3	25
1,1,2-Trichloro-1,2,2-trifluoroethane	21.0	18.3		ppb v/v		87	70 - 130	1	25
1,2,4-Trichlorobenzene	20.4	22.7		ppb v/v		111	70 - 130	13	25
1,1,1-Trichloroethane	20.2	19.5		ppb v/v		97	70 - 130	1	25
1,1,2-Trichloroethane	20.0	21.0		ppb v/v		105	70 - 130	3	25
Trichloroethene	20.2	21.9		ppb v/v		108	70 - 130	3	25
Trichlorofluoromethane	20.0	18.0		ppb v/v		90	70 - 130	4	25
1,2,4-Trimethylbenzene	20.0	20.8		ppb v/v		104	70 - 130	7	25
1,3,5-Trimethylbenzene	20.0	20.5		ppb v/v		102	70 - 130	6	25
2,2,4-Trimethylpentane	20.4	21.0		ppb v/v		103	70 - 130	4	25
Vinyl acetate	19.8	21.3		ppb v/v		108	70 - 130	0	25
Vinyl bromide	21.2	17.3		ppb v/v		81	70 - 130	5	25
Vinyl chloride	19.6	15.8		ppb v/v		81	70 - 130	4	25
m,p-Xylene	39.6	41.2		ppb v/v		104	70 - 130	2	25
o-Xylene	20.2	21.1		ppb v/v		105	70 - 130	3	25
n-Nonane	20.2	20.9		ppb v/v		104	70 - 130	2	25

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetone	50	42.1		ug/m3		84	70 - 130	1	25
Allyl chloride	64	64.1		ug/m3		99	70 - 130	0	25
Benzene	66	64.5		ug/m3		98	70 - 130	4	25
Benzyl chloride	100	118		ug/m3		113	70 - 130	8	25
Bromodichloromethane	140	144		ug/m3		106	70 - 130	2	25
Bromoform	200	234		ug/m3		114	70 - 130	3	25
Bromomethane	74	69.1		ug/m3		94	70 - 130	6	25
1,3-Butadiene	46	35.9		ug/m3		78	70 - 130	6	25
2-Butanone (MEK)	63	62.8		ug/m3		101	70 - 130	2	25
n-Butylbenzene	110	118		ug/m3		107	70 - 130	8	25
sec-Butylbenzene	110	112		ug/m3		103	70 - 130	5	25
tert-Butylbenzene	110	108		ug/m3		98	70 - 130	5	25
Carbon disulfide	64	50.6		ug/m3		79	70 - 130	6	25
Carbon tetrachloride	130	139		ug/m3		109	70 - 130	4	25
Chlorobenzene	95	98.1		ug/m3		103	70 - 130	3	25
Chloroethane	51	51.1		ug/m3		101	70 - 130	0	25
Chloroform	100	99.4		ug/m3		100	70 - 130	1	25
Chloromethane	40	34.1		ug/m3		85	70 - 130	2	25
Cyclohexane	72	72.2		ug/m3		101	70 - 130	4	25
Dibromochloromethane	180	194		ug/m3		106	70 - 130	2	25
1,2-Dibromoethane (EDB)	160	162		ug/m3		103	70 - 130	3	25
1,2-Dichloro-1,1,2,2-tetrafluoroethane	140	110		ug/m3		80	70 - 130	11	25
1,2-Dichlorobenzene	120	133		ug/m3		111	70 - 130	5	25
1,3-Dichlorobenzene	120	140		ug/m3		115	70 - 130	5	25
1,4-Dichlorobenzene	120	136		ug/m3		115	70 - 130	3	25
Dichlorodifluoromethane	98	82.0		ug/m3		84	70 - 130	4	25
1,1-Dichloroethane	83	78.3		ug/m3		94	70 - 130	2	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36446/6
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,2-Dichloroethane			83	84.1		ug/m3		101	70 - 130	4	25
1,1-Dichloroethene			86	67.1		ug/m3		78	70 - 130	2	25
cis-1,2-Dichloroethene			82	75.9		ug/m3		92	70 - 130	2	25
trans-1,2-Dichloroethene			81	77.0		ug/m3		95	70 - 130	1	25
1,2-Dichloropropane			93	99.2		ug/m3		106	70 - 130	4	25
cis-1,3-Dichloropropene			94	93.9		ug/m3		99	70 - 130	3	25
trans-1,3-Dichloropropene			96	102		ug/m3		106	70 - 130	3	25
Ethyl acetate			74	73.7		ug/m3		100	70 - 130	0	25
Ethylbenzene			89	92.1		ug/m3		104	70 - 130	2	25
4-Ethyltoluene			100	107		ug/m3		107	70 - 130	3	25
n-Heptane			85	88.2		ug/m3		104	70 - 130	2	25
Hexachlorobutadiene			220	247		ug/m3		114	70 - 130	8	25
n-Hexane			75	73.7		ug/m3		98	70 - 130	1	25
2-Hexanone			86	97.4		ug/m3		113	70 - 130	7	25
Isopropylbenzene			93	99.1		ug/m3		106	70 - 130	2	25
Methyl-t-Butyl Ether (MTBE)			74	75.4		ug/m3		102	70 - 130	2	25
4-Methyl-2-pentanone (MIBK)			83	99.1		ug/m3		120	70 - 130	7	25
Methylene chloride			72	66.1		ug/m3		92	70 - 130	1	25
Naphthalene			110	108		ug/m3		98	70 - 130	13	25
n-Octane			96	93.7		ug/m3		97	70 - 130	2	25
Propene			33	26.9		ug/m3		80	70 - 130	5	25
n-Propylbenzene			96	101		ug/m3		105	70 - 130	3	25
Styrene			86	103		ug/m3		119	70 - 130	2	25
1,1,2,2-Tetrachloroethane			140	149		ug/m3		107	70 - 130	5	25
Tetrachloroethene			130	127		ug/m3		97	70 - 130	3	25
Tetrahydrofuran			63	62.5		ug/m3		99	70 - 130	0	25
Toluene			78	90.8		ug/m3		116	70 - 130	3	25
1,1,2-Trichloro-1,2,2-trifluoroetha ne			160	140		ug/m3		87	70 - 130	1	25
1,2,4-Trichlorobenzene			150	169		ug/m3		111	70 - 130	13	25
1,1,1-Trichloroethane			110	106		ug/m3		97	70 - 130	1	25
1,1,2-Trichloroethane			110	115		ug/m3		105	70 - 130	3	25
Trichloroethene			110	117		ug/m3		108	70 - 130	3	25
Trichlorofluoromethane			110	101		ug/m3		90	70 - 130	4	25
1,2,4-Trimethylbenzene			98	102		ug/m3		104	70 - 130	7	25
1,3,5-Trimethylbenzene			98	101		ug/m3		102	70 - 130	6	25
2,2,4-Trimethylpentane			95	98.1		ug/m3		103	70 - 130	4	25
Vinyl acetate			70	75.0		ug/m3		108	70 - 130	0	25
Vinyl bromide			93	75.5		ug/m3		81	70 - 130	5	25
Vinyl chloride			50	40.4		ug/m3		81	70 - 130	4	25
m,p-Xylene			170	179		ug/m3		104	70 - 130	2	25
o-Xylene			88	91.8		ug/m3		105	70 - 130	3	25
n-Nonane			110	110		ug/m3		104	70 - 130	2	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*107*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*102*		*70 - 130*
Toluene-d8 (Surr)	*107*		*70 - 130*

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36446/8
Matrix: Air
Analysis Batch: 36446

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2-Propanol			20.4	19.5		ppb v/v		95	70 - 130	1	25

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2-Propanol			50	47.8		ug/m3		95	70 - 130	1	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*107*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*98*		*70 - 130*
Toluene-d8 (Surr)	*107*		*70 - 130*

QC Association Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Air - GC/MS VOA

Analysis Batch: 36393

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-5954-1	ambient-VPT-012714	Total/NA	Air	TO-15	
320-5954-2	VML-02-190-VPT-012714	Total/NA	Air	TO-15	
320-5954-3	PER-14A-178-VPT-012714	Total/NA	Air	TO-15	
320-5954-4	PER-14A-192-VPT-012714	Total/NA	Air	TO-15	
320-5954-5	PER-14A-197-VPT-012714	Total/NA	Air	TO-15	
320-5954-6	STEPTEST-VPT-012814	Total/NA	Air	TO-15	
320-5954-7	VEL-3-190-VPT-012814	Total/NA	Air	TO-15	
320-5954-8	VEL-3-175-VPT-012814	Total/NA	Air	TO-15	
320-5954-9	VEL-3-160-VPT-012814	Total/NA	Air	TO-15	
320-5954-10	VML-02-SVE170-VPT-012914	Total/NA	Air	TO-15	
320-5954-12	VML-02-SVE150-VPT-013014	Total/NA	Air	TO-15	
LCS 320-36393/4	Lab Control Sample	Total/NA	Air	TO-15	
LCS 320-36393/6	Lab Control Sample	Total/NA	Air	TO-15	
LCSD 320-36393/5	Lab Control Sample Dup	Total/NA	Air	TO-15	
LCSD 320-36393/7	Lab Control Sample Dup	Total/NA	Air	TO-15	
MB 320-36393/9	Method Blank	Total/NA	Air	TO-15	

Analysis Batch: 36446

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-5954-3 - DL	PER-14A-178-VPT-012714	Total/NA	Air	TO-15	
320-5954-11	VML-01-SVE170-VPT-013014	Total/NA	Air	TO-15	
320-5954-13	VML-02-SVE190-013114	Total/NA	Air	TO-15	
320-5954-14	VML-01-RB190-VPT-020114	Total/NA	Air	TO-15	
LCS 320-36446/5	Lab Control Sample	Total/NA	Air	TO-15	
LCS 320-36446/7	Lab Control Sample	Total/NA	Air	TO-15	
LCSD 320-36446/6	Lab Control Sample Dup	Total/NA	Air	TO-15	
LCSD 320-36446/8	Lab Control Sample Dup	Total/NA	Air	TO-15	
MB 320-36446/10	Method Blank	Total/NA	Air	TO-15	

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Client Sample ID: ambient-VPT-012714 — Lab Sample ID: 320-5954-1

Date Collected: 01/27/14 10:31 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		49.8	10 mL	250 mL	36393	02/15/14 22:02	TAD	TAL SAC

Client Sample ID: VML-02-190-VPT-012714 — Lab Sample ID: 320-5954-2

Date Collected: 01/27/14 12:53 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		5020	0.1 mL	250 mL	36393	02/15/14 22:51	TAD	TAL SAC

Client Sample ID: PER-14A-178-VPT-012714 — Lab Sample ID: 320-5954-3

Date Collected: 01/27/14 16:10 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		5060	0.125 mL	250 mL	36393	02/15/14 23:40	TAD	TAL SAC
Total/NA	Analysis	TO-15	DL	12600	0.05 mL	250 mL	36446	02/17/14 17:53	TAD	TAL SAC

Client Sample ID: PER-14A-192-VPT-012714 — Lab Sample ID: 320-5954-4

Date Collected: 01/27/14 16:30 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		5120	0.125 mL	250 mL	36393	02/16/14 00:29	TAD	TAL SAC

Client Sample ID: PER-14A-197-VPT-012714 — Lab Sample ID: 320-5954-5

Date Collected: 01/27/14 17:13 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		5160	0.125 mL	250 mL	36393	02/16/14 01:18	TAD	TAL SAC

Client Sample ID: STEPTEST-VPT-012814 — Lab Sample ID: 320-5954-6

Date Collected: 01/28/14 12:25 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		7560	0.08 mL	250 mL	36393	02/16/14 02:07	TAD	TAL SAC

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Client Sample ID: VEL-3-190-VPT-012814 — Lab Sample ID: 320-5954-7

Date Collected: 01/28/14 13:01 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		4000	0.1 mL	250 mL	36393	02/16/14 02:55	TAD	TAL SAC

Client Sample ID: VEL-3-175-VPT-012814 — Lab Sample ID: 320-5954-8

Date Collected: 01/28/14 13:20 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		6000	0.1 mL	250 mL	36393	02/16/14 03:44	TAD	TAL SAC

Client Sample ID: VEL-3-160-VPT-012814 — Lab Sample ID: 320-5954-9

Date Collected: 01/28/14 13:41 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		6080	0.1 mL	250 mL	36393	02/16/14 08:30	TAD	TAL SAC

Client Sample ID: VML-02-SVE170-VPT-012914 — Lab Sample ID: 320-5954-10

Date Collected: 01/29/14 15:22 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		12900	0.1 mL	250 mL	36393	02/16/14 09:19	TAD	TAL SAC

Client Sample ID: VML-01-SVE170-VPT-013014 — Lab Sample ID: 320-5954-11

Date Collected: 01/30/14 16:07 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		832	0.625 mL	250 mL	36446	02/17/14 18:41	TAD	TAL SAC

Client Sample ID: VML-02-SVE150-VPT-013014 — Lab Sample ID: 320-5954-12

Date Collected: 01/30/14 16:38 — **Matrix: Air**
Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		5000	0.1 mL	250 mL	36393	02/16/14 10:56	TAD	TAL SAC

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Client Sample ID: VML-02-SVE190-013114

Lab Sample ID: 320-5954-13

Date Collected: 01/31/14 16:44

Matrix: Air

Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		5000	0.08 mL	250 mL	36446	02/17/14 19:30	TAD	TAL SAC

Client Sample ID: VML-01-RB190-VPT-020114

Lab Sample ID: 320-5954-14

Date Collected: 02/01/14 12:23

Matrix: Air

Date Received: 02/04/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		418	1.25 mL	250 mL	36446	02/18/14 05:37	TAD	TAL SAC

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Certification Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Laboratory: TestAmerica Sacramento

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2928-01	03-31-14
Alaska (UST)	State Program	10	UST-055	02-28-14 *
Arizona	State Program	9	AZ0708	08-11-14
Arkansas DEQ	State Program	6	88-0691	06-17-14
California	State Program	9	2897	01-31-15
Colorado	State Program	8	N/A	08-31-14
Connecticut	State Program	1	PH-0691	06-30-15
Florida	NELAP	4	E87570	06-30-14
Guam	State Program	9	N/A	08-31-14
Hawaii	State Program	9	N/A	01-29-15
Illinois	NELAP	5	200060	03-17-15
Kansas	NELAP	7	E-10375	10-31-14
Louisiana	NELAP	6	30612	06-30-14
Michigan	State Program	5	9947	02-28-14 *
Nebraska	State Program	7	NE-OS-22-13	02-28-14 *
Nevada	State Program	9	CA44	07-31-14
New Jersey	NELAP	2	CA005	06-30-14
New York	NELAP	2	11666	03-31-14
Northern Mariana Islands	State Program	9	MP0007	02-28-14 *
Oregon	NELAP	10	CA200005	01-29-15
Pennsylvania	NELAP	3	68-01272	03-31-14
South Carolina	State Program	4	87014	06-30-14
Texas	NELAP	6	T104704399-08-TX	05-31-14
US Fish & Wildlife	Federal		LE148388-0	12-31-14
USDA	Federal		P330-11-00436	12-30-14
USEPA UCMR	Federal	1	CA00044	11-06-14
Utah	NELAP	8	QUAN1	02-28-15
Washington	State Program	10	C581	05-05-14
Wyoming	State Program	8	8TMS-Q	02-28-14 *

* Expired certification is currently pending renewal and is considered valid.

Method Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Method	Method Description	Protocol	Laboratory
TO-15	Volatile Organic Compounds in Ambient Air	EPA	TAL SAC

Protocol References:

EPA = US Environmental Protection Agency

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Sample Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-5954-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
320-5954-1	ambient-VPT-012714	Air	01/27/14 10:31	02/04/14 09:15
320-5954-2	VML-02-190-VPT-012714	Air	01/27/14 12:53	02/04/14 09:15
320-5954-3	PER-14A-178-VPT-012714	Air	01/27/14 16:10	02/04/14 09:15
320-5954-4	PER-14A-192-VPT-012714	Air	01/27/14 16:30	02/04/14 09:15
320-5954-5	PER-14A-197-VPT-012714	Air	01/27/14 17:13	02/04/14 09:15
320-5954-6	STEPTEST-VPT-012814	Air	01/28/14 12:25	02/04/14 09:15
320-5954-7	VEL-3-190-VPT-012814	Air	01/28/14 13:01	02/04/14 09:15
320-5954-8	VEL-3-175-VPT-012814	Air	01/28/14 13:20	02/04/14 09:15
320-5954-9	VEL-3-160-VPT-012814	Air	01/28/14 13:41	02/04/14 09:15
320-5954-10	VML-02-SVE170-VPT-012914	Air	01/29/14 15:22	02/04/14 09:15
320-5954-11	VML-01-SVE170-VPT-013014	Air	01/30/14 16:07	02/04/14 09:15
320-5954-12	VML-02-SVE150-VPT-013014	Air	01/30/14 16:38	02/04/14 09:15
320-5954-13	VML-02-SVE190-013114	Air	01/31/14 16:44	02/04/14 09:15
320-5954-14	VML-01-RB190-VPT-020114	Air	02/01/14 12:23	02/04/14 09:15

TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
phone 916.374.4378 fax 916.372.1059

Canister Samples Chain of Cus

TestAmerica Laboratories, Inc. assumes no liability with respect to the colle

320-5954 Chain of Custody

estAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Bob Boudra

Client Contact Information	Project Manager: Janet Workman	Samples Collected By: EL	COC No:
Company Name: URS Corp	Phone: 803-740-3841		1 of 2 COCs
Address: 333 Wetmore Rd	Email: Robert.Boudra@urs.com		
City/State/Zip Tucson, AZ, 85705			For Lab Use Only:
Phone: 520-887-1800	Site Contact: Janet Workman		Walk-In Client:
FAX:	TA Contact: Janet.workman@urs.com		Lab Sampling:
Project Name:	Anaylsis Turnaround Time		
Site/Location: Park / Euclid	Standard (Specific):		Job / SDG No.:
P O #	Rush (Specifiy):		(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID	TO-15 (Med/Std Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type:	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
ambient - VPT - 012714	1/27/14	1025	1031	27"	2"	7544	34000988	✓										X				
VML-02-190-VPT-012714	1/27/14	1242	1253	29"	3"	7334	34001669	✓											X			
PER-14A-178-VPT-012714	1/27/14	1559	1610	28"	9"	7542	34000640	✓											X			
PER-14A-192-VPT-012714	1/27/14	1620	1630	27"	10"	7230	34001186	✓											X			
PER-14A-197-VPT-012714	1/27/14	1703	1713	29"	10"	7212	34001853	✓											X			
Steptest - VPT - 012814	1/28/14	1216	1285	27"	8"	7229	34000956	✓											X			
VEL-3-190 - VPT - 012814	1/28/14	1256	1301	26"	6"	7186	34001119	✓											X			
VEL-3-175 - VPT - 012814	1/28/14	1310	1320	28"	10"	7313	34001362	✓											X			
VEL-3-100 - VPT - 012814	1/28/14	1330	1341	30"	9"	7554	34000985	✓											X			
VML-02-SVE170-VPT-012914	1/29/14	1516	1522	27"	4"	7691	34001951	✓											X			

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

Special Instructions/QC Requirements & Comments:

Samples Shipped by: Eric Lewis	Date / Time: 2/3/2014 1355	Samples Received by: Kim Nelson 2-4-14 0915
Samples Relinquished by:	Date / Time:	Received by:
Relinquished by:	Date / Time:	Received by:
Lab Use Only: Shipper Name:	Opened by:	Condition:

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

TestAmerica Sacramento
880 Riverside Parkway

West Sacramento, CA 95605
phone 916.374.4378 fax 916.372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact Information	Project Manager: Bob Bondra	Samples Collected By: Erin Lansey	COC No:
Company Name: URS Corporation	Phone: ~~520-887-1850~~ 303-740-3841		2 of 2 COCs
Address: 333 Wetmore Rd Suite 400	Email: Robert.Bondra@urs.com		
City/State/Zip Tucson / AZ / 85705			For Lab Use Only:
Phone: 520-887-1850	Site Contact: Janet Workman		Walk-In Client:
FAX:	TA Contact: Janet.workman@urs.com		Lab Sampling:
Project Name: Park/Euclid	Anaylsis Turnaround Time		
Site/Location: Park/Euclid	Standard (Specific):		Job / SDG No.:
PO #	Rush (Specify):		(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type: Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
VML-01-SVE170-VPT-013014	1/30/14	1604	1607	24"	4"	7690	34000408	X										X			
VML-02-SVE150-VPT-013014	1/30/14	1631	1638	30"	4"	7558	34001118	X										X			
VML-02-SVE190-013114	1/31/14	1637	1644	24"	4"	7321	34000335	X										X			
VML-01-RB190-VPT-020114	2/1/14	1218	1223	27"	4"	7128	34000910	X										X			

Erin Lansey

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

Special Instructions/QC Requirements & Comments:

Samples Shipped by: Erin Lansey	Date / Time: 2/3/14 1355	Samples Received by: Erin Nelson 2-4-14 915
Samples Relinquished by:	Date / Time:	Received by:
Relinquished by:	Date / Time:	Received by:

Lab Use Only: Shipper Name: Opened by: Condition:

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 1

Client/Project:		VFR ID:		
Canister Serial #:	34000983	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.17	02/05/14	AO
FINAL PRESSURE (PSIA)	24.20	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 1.99			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							2/15/2014	MS2			
Canister DF =	1.99	X	Load DF =	5	X	Bag DF =	100	=	FINAL DF 995		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	50		Bvi (mLs)	10				
							Date	Instr.	File #		
							2/15/2014	MS2			
Canister DF =	1.99	X	Load DF =	1.25	X	Bag DF =	20	=	FINAL DF 49.75		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	200		Bvi (mLs)	50				
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 2

Client/Project:		VFR ID:		
Canister Serial #:	34001669	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.08	02/05/14	AO
FINAL PRESSURE (PSIA)	24.30	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.01			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							2/15/2014	MS2			
Canister DF =	2.01	X	Load DF =	10	X	Bag DF =	250	=	FINAL DF 5025		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	25		Bvi (mLs)	4				
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 3

Client/Project:		VFR ID:		
Canister Serial #:	34000640	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	9.11	02/05/14	AO
FINAL PRESSURE (PSIA)	23.04	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.53			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							2/15/2014	MS2			
Canister DF =	2.53	X	Load DF =	10	X	Bag DF =	200	=	FINAL DF 5060		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	25		Bvi (mLs)	5				
							Date	Instr.	File #		
							2/17/2014	MS2			
Canister DF =	2.53	X	Load DF =	10	X	Bag DF =	500	=	FINAL DF 12650		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	25		Bvi (mLs)	2				
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 4

Client/Project:		VFR ID:		
Canister Serial #:	34001186	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	9.12	02/05/14	AO
FINAL PRESSURE (PSIA)	23.35	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.56			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							2/15/2014	MS2			
Canister DF =	2.56	X	Load DF =	10	X	Bag DF =	200	=	FINAL DF 5120		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	25		Bvi (mLs)	5				
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 5

Client/Project:		VFR ID:		
Canister Serial #:	34001853	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	9.00	02/05/14	AO
FINAL PRESSURE (PSIA)	23.20	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.58			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							2/15/2014	MS2			
Canister DF =	2.58	X	Load DF =	10	X	Bag DF =	200	=	FINAL DF 5160		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	25		Bvi (mLs)	5				
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 6

Client/Project:		VFR ID:		
Canister Serial #:	34000980	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	9.83	02/05/14	AO
FINAL PRESSURE (PSIA)	23.74	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.42			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							2/15/2014	MS2			
Canister DF =	2.42	X	Load DF =	6.25	X	Bag DF =	500	=	FINAL DF 7562.5		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	40		Bvi (mLs)	2				
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 7

Client/Project:		VFR ID:		
Canister Serial #:	34001119	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	14.31	02/05/14	AO
FINAL PRESSURE (PSIA)	22.93	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 1.60			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							2/15/2014	MS2			
Canister DF =	1.6	X	Load DF =	10	X	Bag DF =	250	=	FINAL DF 4000		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	25		Bvi (mLs)	4				
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 8

Client/Project:		VFR ID:		
Canister Serial #:	34001382	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	9.61	02/05/14	AO
FINAL PRESSURE (PSIA)	23.11	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.40			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							2/15/2014	MS2			
Canister DF =	2.4	X	Load DF =	10	X	Bag DF =	250	=	FINAL DF 6000		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	25		Bvi (mLs)	4				
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 9

Client/Project:		VFR ID:		
Canister Serial #:	34000985	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	9.56	02/05/14	AO
FINAL PRESSURE (PSIA)	23.24	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.43			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							2/16/2014	MS2			
Canister DF =	2.43	X	Load DF =	10	X	Bag DF =	250	=	FINAL DF 6075		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	25		Bvi (mLs)	4				
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 10

Client/Project:		VFR ID:		
Canister Serial #:	34001951	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.74	02/05/14	AO
FINAL PRESSURE (PSIA)	24.24	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.06			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							2/14/2014	MS2			
Canister DF =	2.06	X	Load DF =	5	X	Bag DF =	100	=	FINAL DF 1030		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	50		Bvi (mLs)	10				
							Date	Instr.	File #		
							2/16/2016	MS2			
Canister DF =	2.06	X	Load DF =	12.5	X	Bag DF =	500	=	FINAL DF 12875		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	20		Bvi (mLs)	2				
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 11

Client/Project:		VFR ID:		
Canister Serial #:	34000668	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.21	02/05/14	AO
FINAL PRESSURE (PSIA)	23.29	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.08			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

Canister DF =	X	Load DF = / LVf (mLs) / LVi (mLs)	X	Bag DF = / BVf (mLs) / Bvi (mLs)	Date / Instr. / File #	=	FINAL DF
2.08	X	10 / 250 / 25	X	200 / 1000 / 5	2/16/2014 / MS2 /	=	4160
2.08	X	2 / 250 / 125	X	200 / 1000 / 5	2/17/2014 / MS2 /	=	832
	X	#DIV/0! / /	X	1 / /	/ /	=	#DIV/0!

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 12

Client/Project:		VFR ID:		
Canister Serial #:	34001118	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.90	02/05/14	AO
FINAL PRESSURE (PSIA)	23.81	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.00			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #	
							2/16/2014	MS2		
Canister DF =	2	X	Load DF =	10	X	Bag DF =	250	=	FINAL DF	5000
			LVf (mLs)	250		BVf (mLs)	1000			
			LVi (mLs)	25		Bvi (mLs)	4			
							Date	Instr.	File #	
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)				
			LVi (mLs)			Bvi (mLs)				
							Date	Instr.	File #	
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)				
			LVi (mLs)			Bvi (mLs)				

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 13

Client/Project:		VFR ID:		
Canister Serial #:	34000335	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	14.54	02/05/14	AO
FINAL PRESSURE (PSIA)	23.31	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 1.60			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

								Date	Instr.	File #	
								2/17/2014	MS2		
Canister DF =	1.6	X	Load DF =	12.5	X	Bag DF =	250	=		FINAL DF	5000
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	20		Bvi (mLs)	4				
								Date	Instr.	File #	
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-5954
Sample # 14

Client/Project:		VFR ID:		
Canister Serial #:	34000910	Duration:		☐ Hrs ☐ Min
Date Cleaned:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.69	02/05/14	AO
FINAL PRESSURE (PSIA)	24.38	02/05/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.09			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

Canister DF =	X	Load DF = / LVf (mLs) / LVi (mLs)	X	Bag DF = / BVf (mLs) / Bvi (mLs)	Date / Instr. / File #	=	FINAL DF
2.09	X	10 / 250 / 25	X	200 / 1000 / 5	2/17/2014 / MS2 /	=	4180
2.09	X	1 / 250 / 250	X	200 / 1000 / 5	2/17/2014 / MS2 /	=	418
	X	#DIV/0! / /	X	1 / /	/ / /	=	#DIV/0!

Login Sample Receipt Checklist

Client: URS Corporation

Job Number: 320-5954-1

Login Number: 5954
List Number: 1
Creator: Nelson, Kym D

List Source: TestAmerica Sacramento

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

320-5573 Chain of Custody

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Canister QC Certification
Individual Certification

Certification Type: TO-15

Date Cleaned/Batch ID: D12/26/13 320-5573

Date of QC: 01/07/14

Canister ID	Filename	Canister ID	Filename
34001067	—		
0640	MSS010715		
1186	MSS010710		
1055	—		
1948	—		
1669	MSS010711		
1118	MSS010714		
1853	MSS010717		
0228	MSS010716		
0983	MSS010713		
0335	MSS 010712		
0943	—		

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

1st level Reviewed By: [signature] Date: 01/08/14

2nd level Reviewed By: [signature] Date: 1/8/2014

Q:\FORMS\QA-821 IND CAN QC 20130729.DOC
QA-821

ERS 7/29/2013

320-5574 Chain of Custody

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Sacramento

Canister QC Certification

Certification Type: TO-15

Date Cleaned/Batch ID D010614 320-5574

Date of QC 01/07/14

Data File Number ~~MS70~~ MS5010706

CR 01/08/14

CANISTER ID NUMBERS

34001950	34000910	
0313	0668	
0985	1382	
* 0960	1951	
1119		
0230		
0950		
0986		

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

1st level Reviewed By: [signature] Date: 01/08/14

2nd level Reviewed By: [signature] Date: 1/8/2014

Q:\FORMS\QA-814 CAN QC CERT 20130729.DOC
QA-814

ERS 7/29/2013

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000640 | Lab Sample ID: 320-5573-2

Matrix: Air | Lab File ID: MS5010715.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/08/2014 00:58

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000640 | Lab Sample ID: 320-5573-2

Matrix: Air | Lab File ID: MS5010715.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/08/2014 00:58

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000640 Lab Sample ID: 320-5573-2

Matrix: Air Lab File ID: MS5010715.D

Analysis Method: TO-15 Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) Date Analyzed: 01/08/2014 00:58

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 33345 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	92		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	103		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

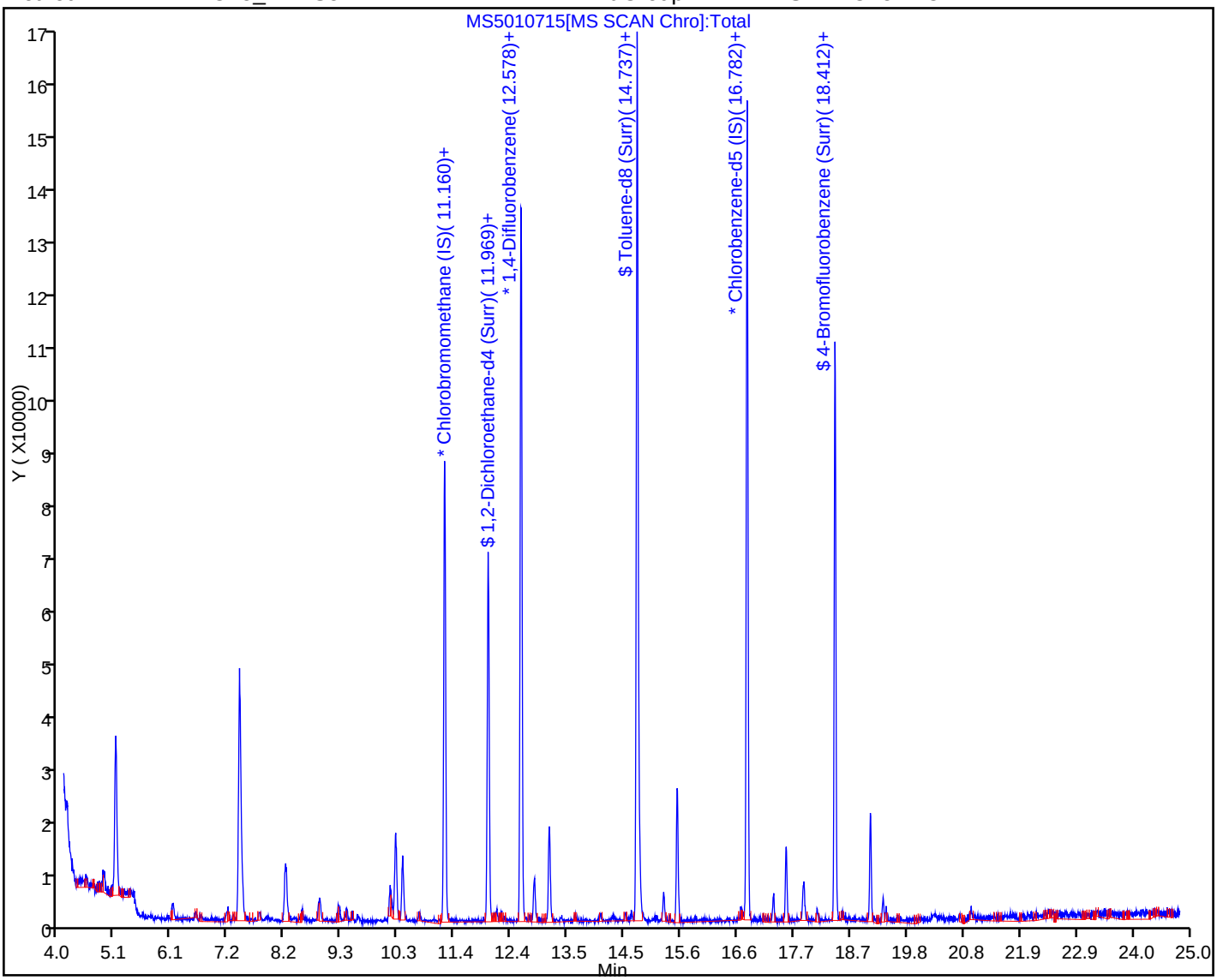
Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010715.D				
Lims ID:	320-5573-A-2	Lab Sample ID:	320-5573-2		
Client ID:	34000640				
Sample Type:	Client				
Inject. Date:	08-Jan-2014 00:58:30	ALS Bottle#:	13	Worklist Smp#:	15
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	SC can# 34000640				
Misc. Info.:	500mL; Can Certification Only!!				
Operator ID:	CR	Instrument ID:	ATMS5		
Method:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\TO15_ATMS5.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	08-Jan-2014 09:35:38	Calib Date:	07-Jan-2014 14:32:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010703.D				
Column 1 :		Detector	MS SCAN		
Process Host:	XAWRK034				
First Level Reviewer: roushc		Date:	08-Jan-2014 09:26:14		

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	91	33944	4.00	
* 2 1,4-Difluorobenzene	114	12.578	12.578	0.0	95	139296	4.12	
* 3 Chlorobenzene-d5 (IS)	117	16.782	16.781	0.001	88	100930	4.12	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.969	0.0	0	55948	4.12	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	95	86547	4.13	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	82	47800	3.78	

Report Date: 08-Jan-2014 09:36:43 Chrom Revision: 2.1 15-Oct-2013 07:52:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010715.D				
Injection Date:	08-Jan-2014 00:58:30	Instrument ID:	ATMS5		
Lims ID:	320-5573-A-2	Lab Sample ID:	320-5573-2		
Client ID:	34000640				
Operator ID:	CR	ALS Bottle#:	13	Worklist Smp#:	15
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001186 | Lab Sample ID: 320-5573-3

Matrix: Air | Lab File ID: MS5010710.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 20:35

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001186 | Lab Sample ID: 320-5573-3

Matrix: Air | Lab File ID: MS5010710.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 20:35

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001186 Lab Sample ID: 320-5573-3

Matrix: Air Lab File ID: MS5010710.D

Analysis Method: TO-15 Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) Date Analyzed: 01/07/2014 20:35

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 33345 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	88		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	104		70-130
2037-26-5	Toluene-d8 (Surr)	101		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

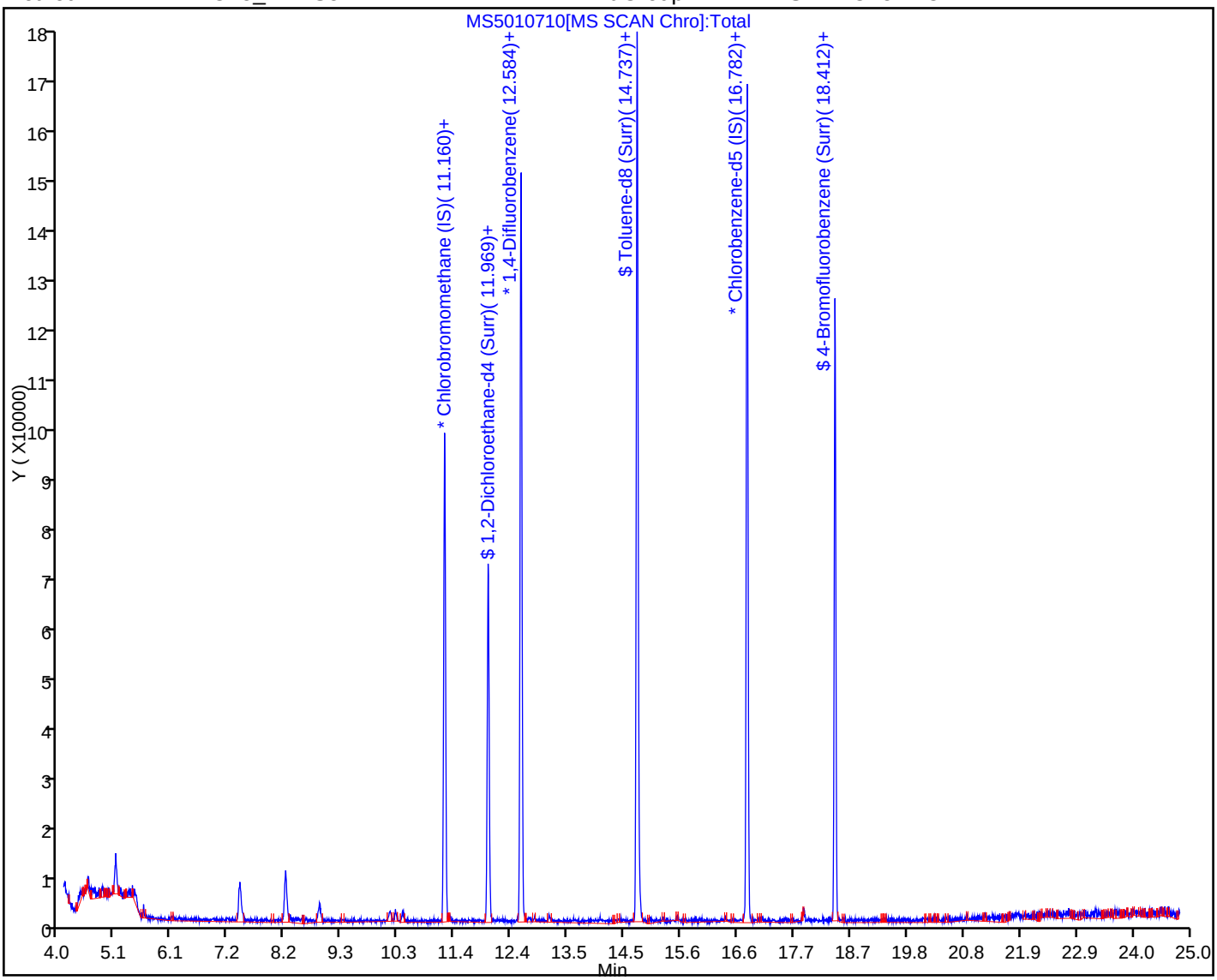
Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010710.D				
Lims ID:	320-5573-A-3	Lab Sample ID:	320-5573-3		
Client ID:	34001186				
Sample Type:	Client				
Inject. Date:	07-Jan-2014 20:35:30	ALS Bottle#:	8	Worklist Smp#:	10
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	SC can# 34001186				
Misc. Info.:	500mL; Can Certification Only!!				
Operator ID:	CR	Instrument ID:	ATMS5		
Method:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\TO15_ATMS5.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	08-Jan-2014 09:35:38	Calib Date:	07-Jan-2014 14:32:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010703.D				
Column 1 :		Detector	MS SCAN		
Process Host:	XAWRK034				
First Level Reviewer: roushc		Date:	08-Jan-2014 09:22:12		

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.166	11.166	0.0	87	37273	4.00	
* 2 1,4-Difluorobenzene	114	12.584	12.578	0.006	95	149914	4.12	
* 3 Chlorobenzene-d5 (IS)	117	16.782	16.781	0.001	88	111920	4.12	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.969	0.0	0	60610	4.14	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	94	94306	4.18	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	81	50881	3.63	

Report Date: 08-Jan-2014 09:36:38 Chrom Revision: 2.1 15-Oct-2013 07:52:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010710.D				
Injection Date:	07-Jan-2014 20:35:30	Instrument ID:	ATMS5		
Lims ID:	320-5573-A-3	Lab Sample ID:	320-5573-3		
Client ID:	34001186				
Operator ID:	CR	ALS Bottle#:	8	Worklist Smp#:	10
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001669 | Lab Sample ID: 320-5573-6

Matrix: Air | Lab File ID: MS5010711.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 21:28

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001669 | Lab Sample ID: 320-5573-6

Matrix: Air | Lab File ID: MS5010711.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 21:28

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001669 Lab Sample ID: 320-5573-6

Matrix: Air Lab File ID: MS5010711.D

Analysis Method: TO-15 Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) Date Analyzed: 01/07/2014 21:28

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 33345 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	82		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	100		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

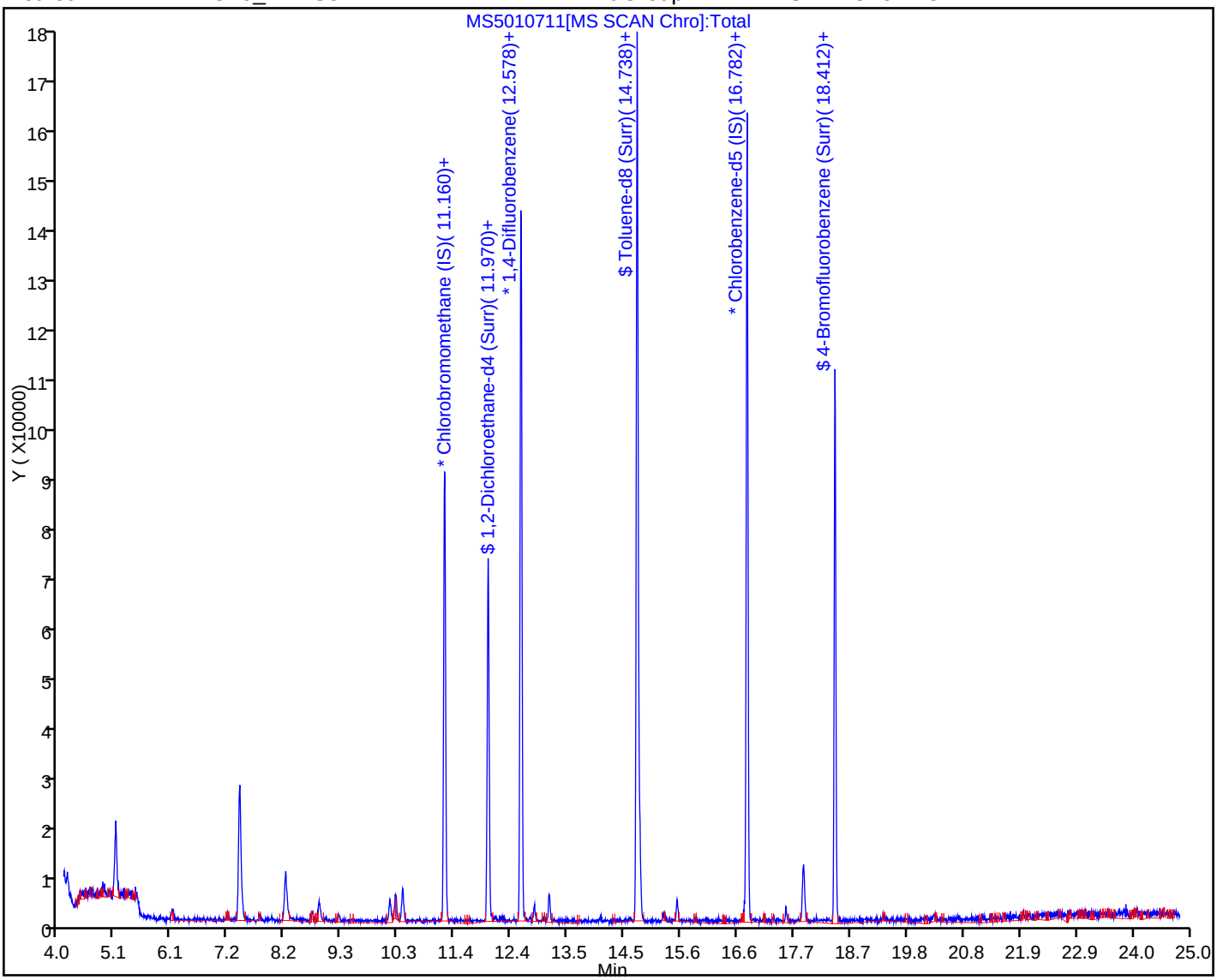
Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010711.D				
Lims ID:	320-5573-A-6	Lab Sample ID:	320-5573-6		
Client ID:	34001669				
Sample Type:	Client				
Inject. Date:	07-Jan-2014 21:28:30	ALS Bottle#:	9	Worklist Smp#:	11
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	SC can# 34001669				
Misc. Info.:	500mL; Can Certification Only!!				
Operator ID:	CR	Instrument ID:	ATMS5		
Method:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\TO15_ATMS5.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	08-Jan-2014 09:35:38	Calib Date:	07-Jan-2014 14:32:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010703.D				
Column 1 :		Detector	MS SCAN		
Process Host:	XAWRK034				
First Level Reviewer: roushc		Date:	08-Jan-2014 09:22:43		

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	89	38283	4.00	
* 2 1,4-Difluorobenzene	114	12.584	12.578	0.006	95	152793	4.12	
* 3 Chlorobenzene-d5 (IS)	117	16.782	16.781	0.001	87	109322	4.12	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.976	11.969	0.007	0	59825	4.01	
$ 5 Toluene-d8 (Surr)	100	14.738	14.737	0.001	94	95132	4.14	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	84	46340	3.38	

Report Date: 08-Jan-2014 09:36:39 Chrom Revision: 2.1 15-Oct-2013 07:52:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010711.D				
Injection Date:	07-Jan-2014 21:28:30	Instrument ID:	ATMS5		
Lims ID:	320-5573-A-6	Lab Sample ID:	320-5573-6		
Client ID:	34001669				
Operator ID:	CR	ALS Bottle#:	9	Worklist Smp#:	11
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001118 | Lab Sample ID: 320-5573-7

Matrix: Air | Lab File ID: MS5010714.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/08/2014 00:06

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001118 | Lab Sample ID: 320-5573-7

Matrix: Air | Lab File ID: MS5010714.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/08/2014 00:06

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001118 Lab Sample ID: 320-5573-7

Matrix: Air Lab File ID: MS5010714.D

Analysis Method: TO-15 Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) Date Analyzed: 01/08/2014 00:06

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 33345 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	84		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	106		70-130
2037-26-5	Toluene-d8 (Surr)	103		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

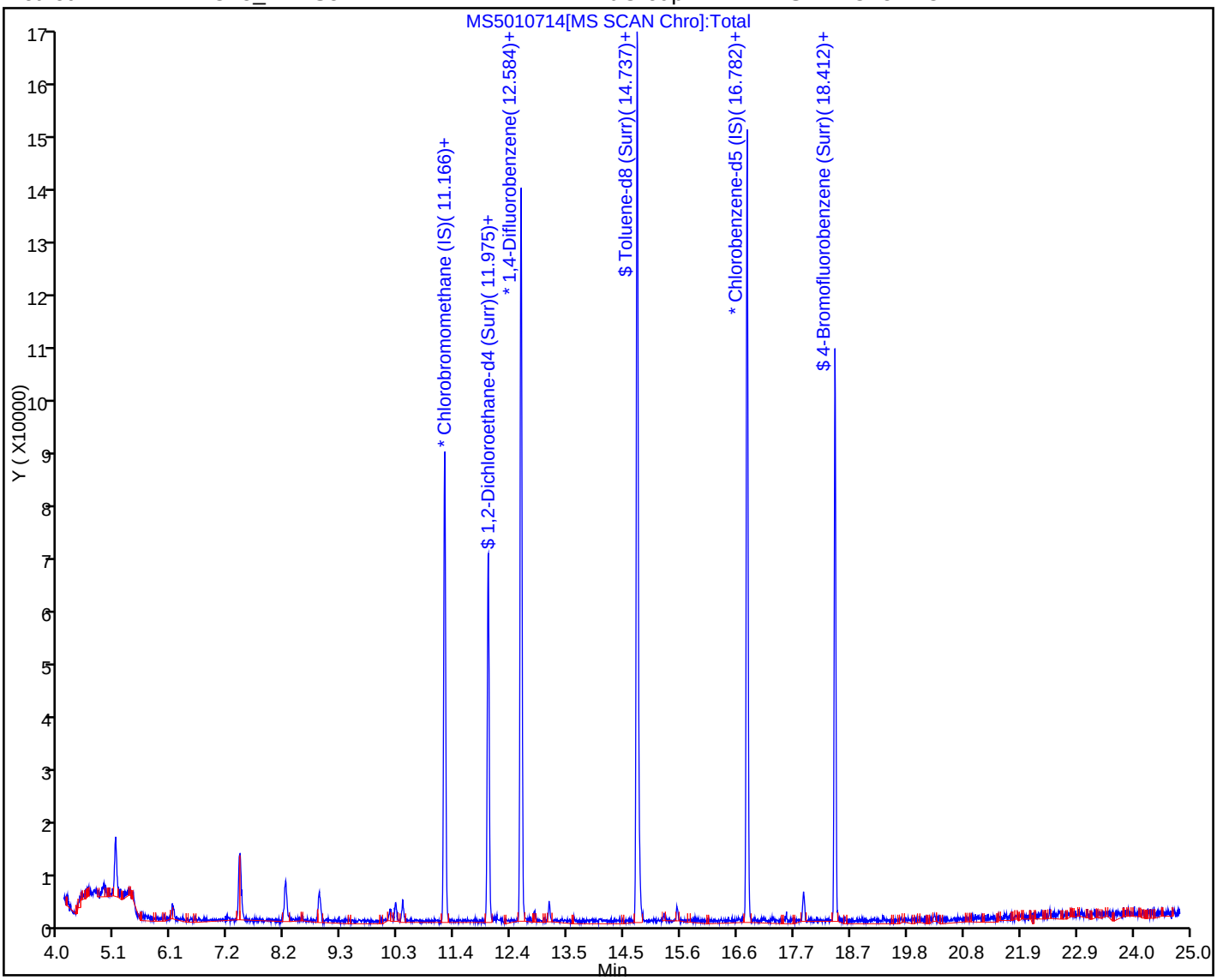
Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010714.D				
Lims ID:	320-5573-A-7	Lab Sample ID:	320-5573-7		
Client ID:	34001118				
Sample Type:	Client				
Inject. Date:	08-Jan-2014 00:06:30	ALS Bottle#:	12	Worklist Smp#:	14
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	SC can# 34001118				
Misc. Info.:	500mL; Can Certification Only!!				
Operator ID:	CR	Instrument ID:	ATMS5		
Method:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\TO15_ATMS5.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	08-Jan-2014 09:35:38	Calib Date:	07-Jan-2014 14:32:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010703.D				
Column 1 :		Detector	MS SCAN		
Process Host:	XAWRK034				
First Level Reviewer: roushc		Date:	08-Jan-2014 09:25:39		

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.166	11.166	0.0	92	35223	4.00	
* 2 1,4-Difluorobenzene	114	12.584	12.578	0.006	92	139476	4.12	
* 3 Chlorobenzene-d5 (IS)	117	16.782	16.781	0.001	87	100237	4.12	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.969	0.0	0	57705	4.24	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	94	89445	4.26	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	79	43537	3.46	

Report Date: 08-Jan-2014 09:36:42 Chrom Revision: 2.1 15-Oct-2013 07:52:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010714.D				
Injection Date:	08-Jan-2014 00:06:30	Instrument ID:	ATMS5		
Lims ID:	320-5573-A-7	Lab Sample ID:	320-5573-7		
Client ID:	34001118				
Operator ID:	CR	ALS Bottle#:	12	Worklist Smp#:	14
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001853 | Lab Sample ID: 320-5573-8

Matrix: Air | Lab File ID: MS5010717.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/08/2014 02:41

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001853 | Lab Sample ID: 320-5573-8

Matrix: Air | Lab File ID: MS5010717.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/08/2014 02:41

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34001853 Lab Sample ID: 320-5573-8

Matrix: Air Lab File ID: MS5010717.D

Analysis Method: TO-15 Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) Date Analyzed: 01/08/2014 02:41

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 33345 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	82		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	101		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

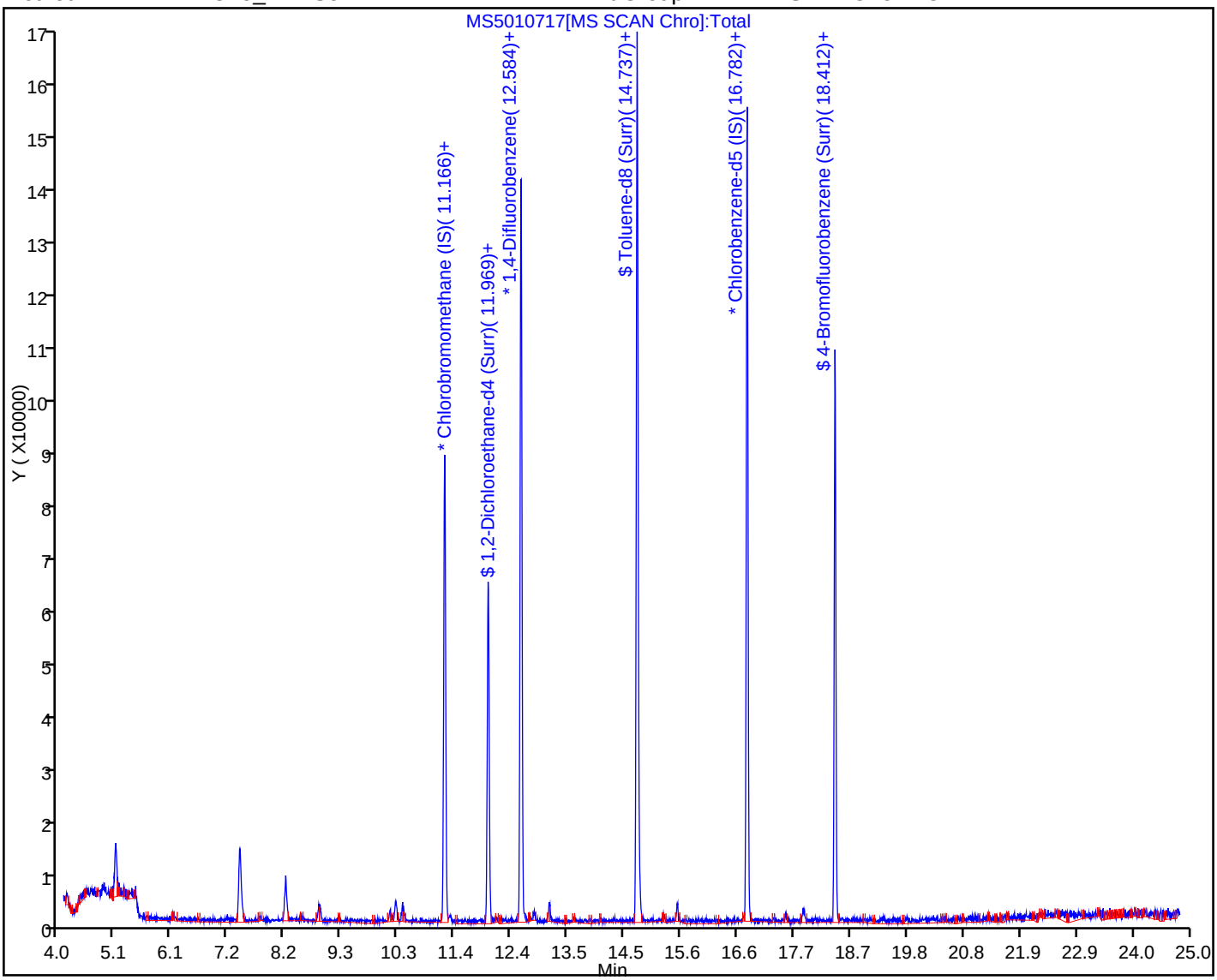
Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010717.D				
Lims ID:	320-5573-A-8	Lab Sample ID:	320-5573-8		
Client ID:	34001853				
Sample Type:	Client				
Inject. Date:	08-Jan-2014 02:41:30	ALS Bottle#:	15	Worklist Smp#:	17
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	SC can# 34001853				
Misc. Info.:	500mL; Can Certification Only!!				
Operator ID:	CR	Instrument ID:	ATMS5		
Method:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\TO15_ATMS5.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	08-Jan-2014 09:35:38	Calib Date:	07-Jan-2014 14:32:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010703.D				
Column 1 :		Detector	MS SCAN		
Process Host:	XAWRK034				
First Level Reviewer: roushc		Date:	08-Jan-2014 09:27:32		

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	92	34960	4.00	
* 2 1,4-Difluorobenzene	114	12.584	12.578	0.006	95	140293	4.12	
* 3 Chlorobenzene-d5 (IS)	117	16.782	16.781	0.001	87	100476	4.12	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.975	11.969	0.006	0	55264	4.04	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	95	86513	4.10	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	84	42621	3.38	

Report Date: 08-Jan-2014 09:36:44 Chrom Revision: 2.1 15-Oct-2013 07:52:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010717.D				
Injection Date:	08-Jan-2014 02:41:30	Instrument ID:	ATMS5		
Lims ID:	320-5573-A-8	Lab Sample ID:	320-5573-8		
Client ID:	34001853				
Operator ID:	CR	ALS Bottle#:	15	Worklist Smp#:	17
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000228 | Lab Sample ID: 320-5573-9

Matrix: Air | Lab File ID: MS5010716.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/08/2014 01:49

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000228 | Lab Sample ID: 320-5573-9

Matrix: Air | Lab File ID: MS5010716.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/08/2014 01:49

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000228 Lab Sample ID: 320-5573-9

Matrix: Air Lab File ID: MS5010716.D

Analysis Method: TO-15 Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) Date Analyzed: 01/08/2014 01:49

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 33345 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	85		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	103		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

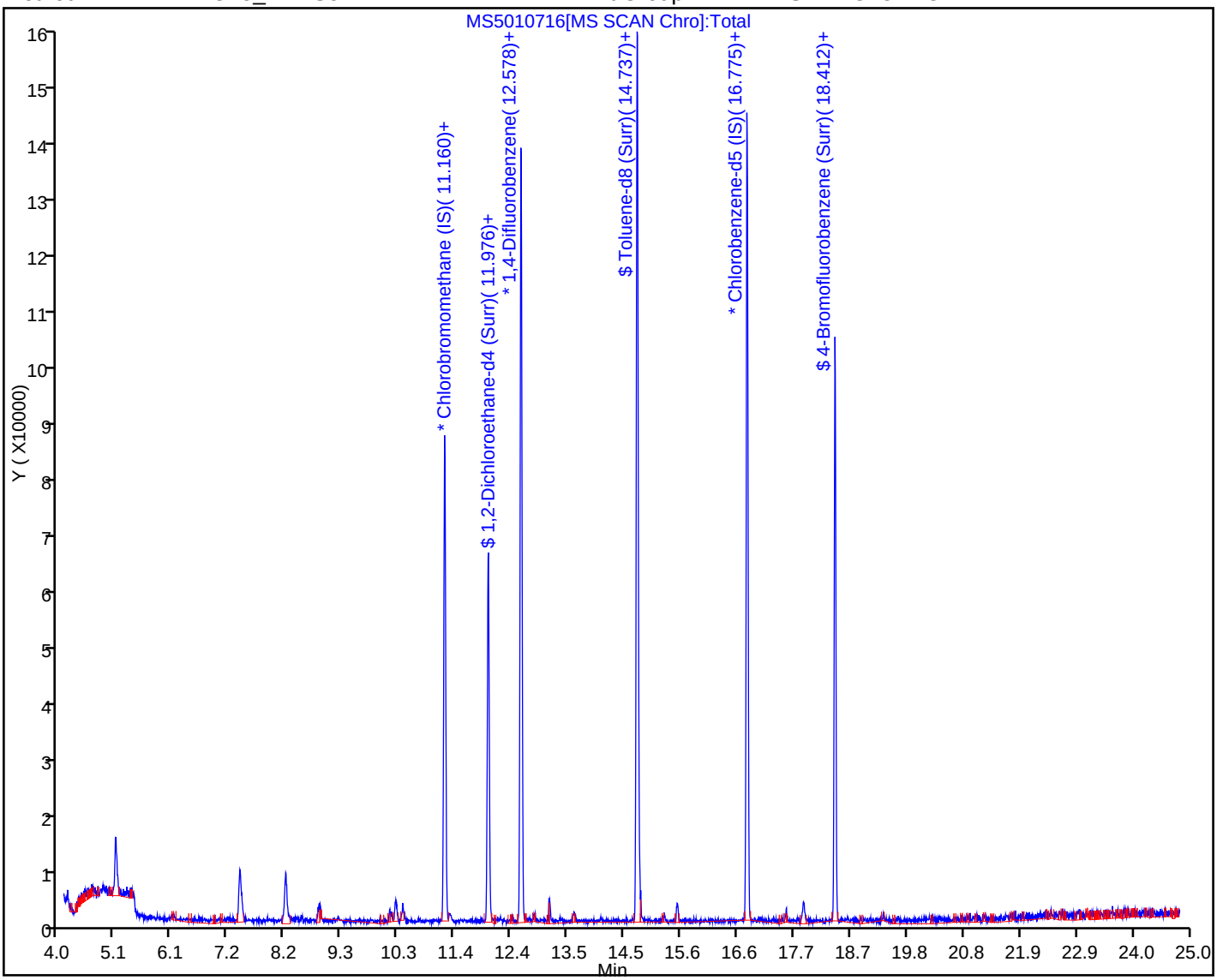
Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010716.D				
Lims ID:	320-5573-A-9	Lab Sample ID:	320-5573-9		
Client ID:	34000228				
Sample Type:	Client				
Inject. Date:	08-Jan-2014 01:49:30	ALS Bottle#:	14	Worklist Smp#:	16
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	SC can# 34000228				
Misc. Info.:	500mL; Can Certification Only!!				
Operator ID:	CR	Instrument ID:	ATMS5		
Method:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\TO15_ATMS5.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	08-Jan-2014 09:35:38	Calib Date:	07-Jan-2014 14:32:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010703.D				
Column 1 :		Detector	MS SCAN		
Process Host:	XAWRK034				
First Level Reviewer: roushc		Date:	08-Jan-2014 09:26:40		

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	88	35146	4.00	
* 2 1,4-Difluorobenzene	114	12.584	12.578	0.006	95	141352	4.12	
* 3 Chlorobenzene-d5 (IS)	117	16.775	16.781	-0.006	87	101765	4.12	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.969	0.0	0	56595	4.10	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	95	87961	4.14	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	81	44609	3.50	

Report Date: 08-Jan-2014 09:36:43 Chrom Revision: 2.1 15-Oct-2013 07:52:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010716.D				
Injection Date:	08-Jan-2014 01:49:30	Instrument ID:	ATMS5		
Lims ID:	320-5573-A-9	Lab Sample ID:	320-5573-9		
Client ID:	34000228				
Operator ID:	CR	ALS Bottle#:	14	Worklist Smp#:	16
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000983 | Lab Sample ID: 320-5573-10

Matrix: Air | Lab File ID: MS5010713.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 23:13

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000983 | Lab Sample ID: 320-5573-10

Matrix: Air | Lab File ID: MS5010713.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 23:13

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000983 Lab Sample ID: 320-5573-10

Matrix: Air Lab File ID: MS5010713.D

Analysis Method: TO-15 Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) Date Analyzed: 01/07/2014 23:13

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 33345 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	83		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	107		70-130
2037-26-5	Toluene-d8 (Surr)	103		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

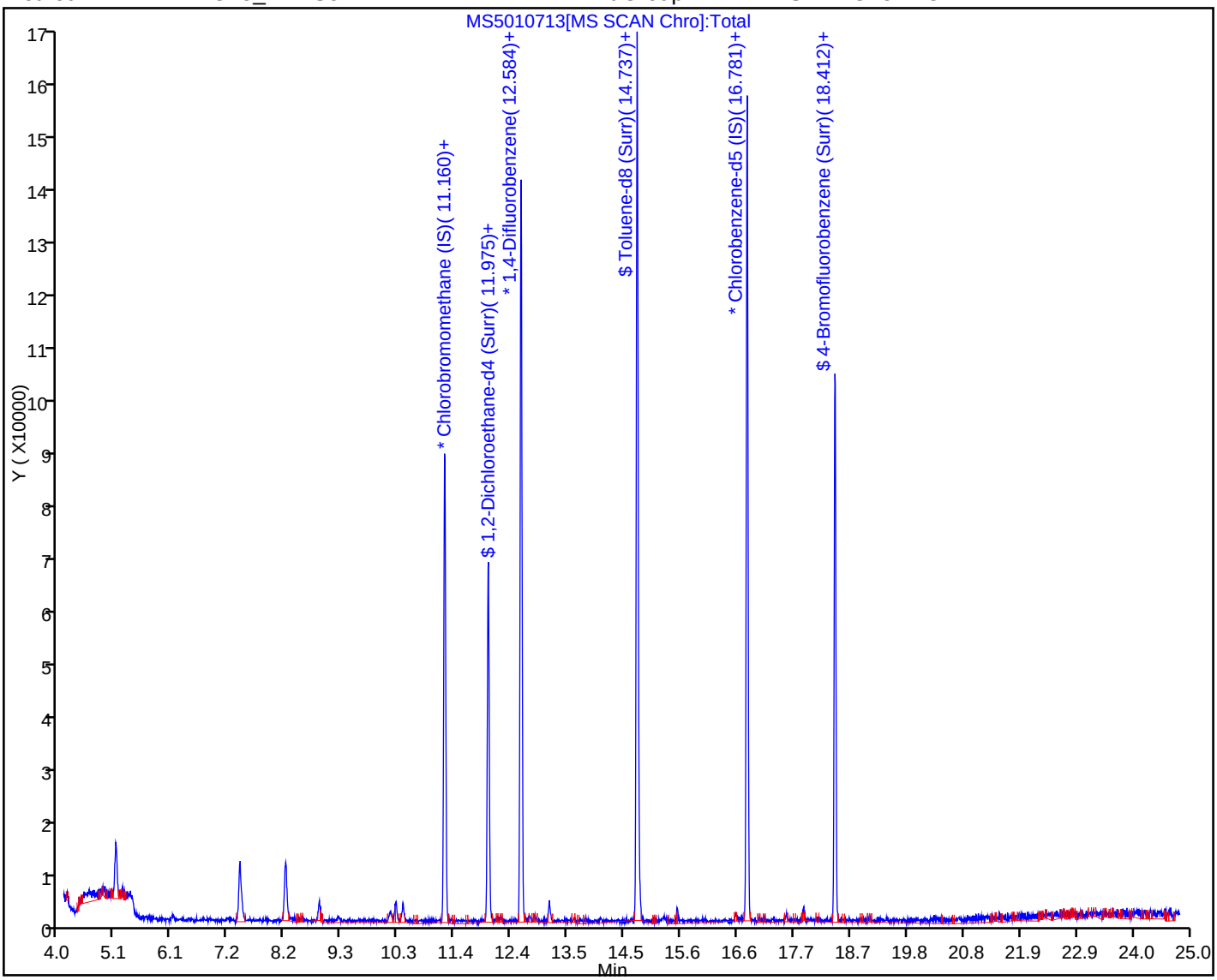
Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010713.D				
Lims ID:	320-5573-A-10	Lab Sample ID:	320-5573-10		
Client ID:	34000983				
Sample Type:	Client				
Inject. Date:	07-Jan-2014 23:13:30	ALS Bottle#:	11	Worklist Smp#:	13
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	SC can# 34000983				
Misc. Info.:	500mL; Can Certification Only!!				
Operator ID:	CR	Instrument ID:	ATMS5		
Method:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\TO15_ATMS5.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	08-Jan-2014 09:35:38	Calib Date:	07-Jan-2014 14:32:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010703.D				
Column 1 :		Detector	MS SCAN		
Process Host:	XAWRK034				
First Level Reviewer: roushc		Date:	08-Jan-2014 09:25:16		

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	90	36834	4.00	
* 2 1,4-Difluorobenzene	114	12.584	12.578	0.006	92	143683	4.12	
* 3 Chlorobenzene-d5 (IS)	117	16.781	16.781	0.0	86	108559	4.12	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.969	0.0	0	59877	4.27	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	94	91835	4.25	
$ 6 4-Bromofluorobenzene (Surr)	95	18.418	18.412	0.006	83	46623	3.43	

Report Date: 08-Jan-2014 09:36:41 Chrom Revision: 2.1 15-Oct-2013 07:52:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010713.D				
Injection Date:	07-Jan-2014 23:13:30	Instrument ID:	ATMS5		
Lims ID:	320-5573-A-10	Lab Sample ID:	320-5573-10		
Client ID:	34000983				
Operator ID:	CR	ALS Bottle#:	11	Worklist Smp#:	13
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000335 | Lab Sample ID: 320-5573-11

Matrix: Air | Lab File ID: MS5010712.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 22:20

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000335 | Lab Sample ID: 320-5573-11

Matrix: Air | Lab File ID: MS5010712.D

Analysis Method: TO-15 | Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 22:20

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-5573-1

SDG No.:

Client Sample ID: 34000335 Lab Sample ID: 320-5573-11

Matrix: Air Lab File ID: MS5010712.D

Analysis Method: TO-15 Date Collected: 12/26/2013 00:00

Sample wt/vol: 500(mL) Date Analyzed: 01/07/2014 22:20

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 33345 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	92		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	104		70-130
2037-26-5	Toluene-d8 (Surr)	104		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

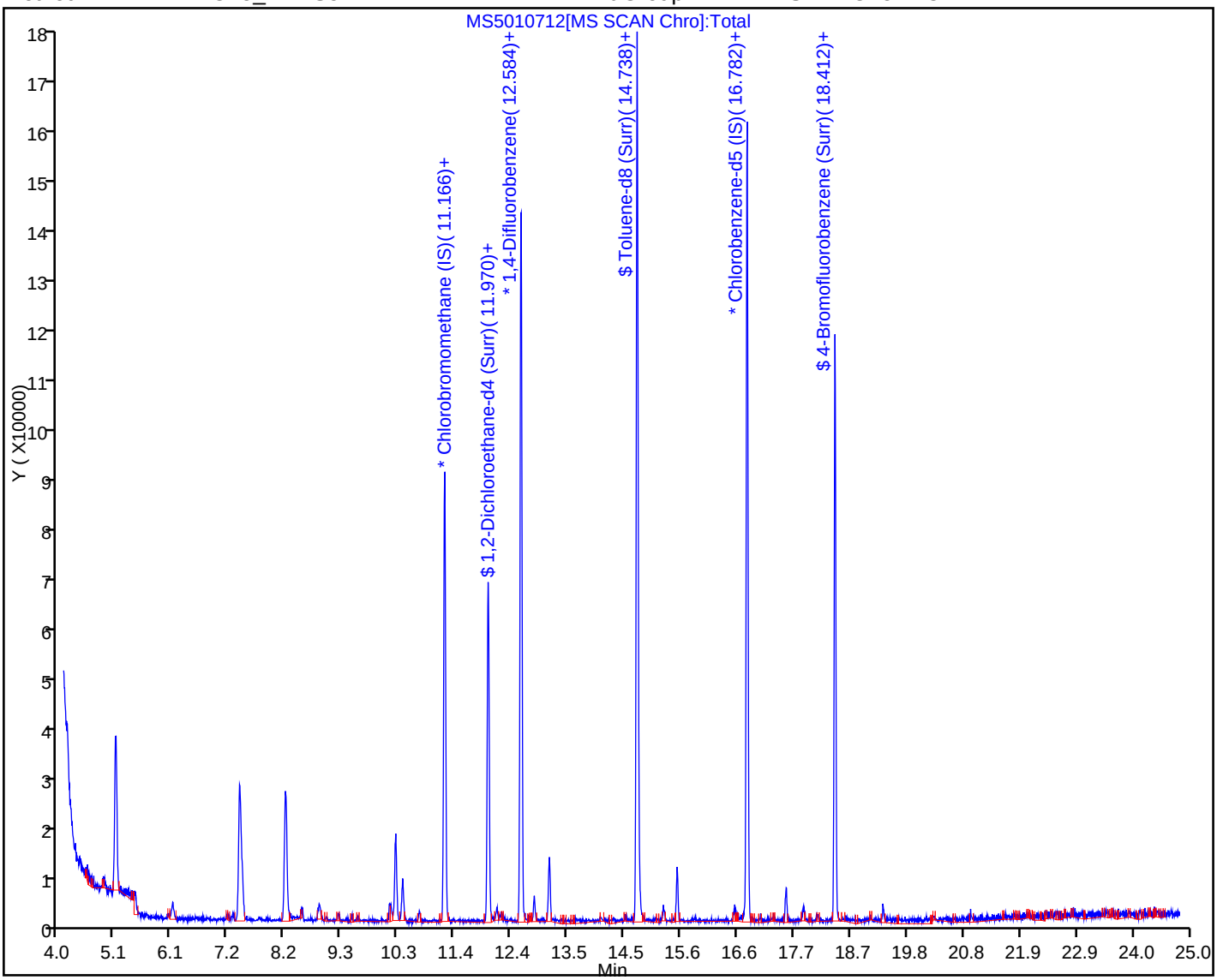
Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010712.D				
Lims ID:	320-5573-A-11	Lab Sample ID:	320-5573-11		
Client ID:	34000335				
Sample Type:	Client				
Inject. Date:	07-Jan-2014 22:20:30	ALS Bottle#:	10	Worklist Smp#:	12
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	SC can# 34000335				
Misc. Info.:	500mL; Can Certification Only!!				
Operator ID:	CR	Instrument ID:	ATMS5		
Method:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\TO15_ATMS5.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	08-Jan-2014 09:35:38	Calib Date:	07-Jan-2014 14:32:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010703.D				
Column 1 :		Detector	MS SCAN		
Process Host:	XAWRK034				
First Level Reviewer: roushc		Date:	08-Jan-2014 09:34:02		

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.166	11.166	0.0	89	37335	4.00	
* 2 1,4-Difluorobenzene	114	12.578	12.578	0.0	95	147895	4.12	
* 3 Chlorobenzene-d5 (IS)	117	16.782	16.781	0.001	89	108696	4.12	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.970	11.969	0.001	0	60050	4.16	
$ 5 Toluene-d8 (Surr)	100	14.738	14.737	0.001	94	95592	4.29	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	81	51425	3.77	

Report Date: 08-Jan-2014 09:36:40 Chrom Revision: 2.1 15-Oct-2013 07:52:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010712.D				
Injection Date:	07-Jan-2014 22:20:30	Instrument ID:	ATMS5		
Lims ID:	320-5573-A-11	Lab Sample ID:	320-5573-11		
Client ID:	34000335				
Operator ID:	CR	ALS Bottle#:	10	Worklist Smp#:	12
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5574-1

SDG No.:

Client Sample ID: 34000960 | Lab Sample ID: 320-5574-4

Matrix: Air | Lab File ID: MS5010706.D

Analysis Method: TO-15 | Date Collected: 01/06/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 17:06

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5574-1

SDG No.:

Client Sample ID: 34000960 | Lab Sample ID: 320-5574-4

Matrix: Air | Lab File ID: MS5010706.D

Analysis Method: TO-15 | Date Collected: 01/06/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 17:06

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-5574-1

SDG No.:

Client Sample ID: 34000960 Lab Sample ID: 320-5574-4

Matrix: Air Lab File ID: MS5010706.D

Analysis Method: TO-15 Date Collected: 01/06/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 01/07/2014 17:06

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 33345 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	84		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	101		70-130
2037-26-5	Toluene-d8 (Surr)	97		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

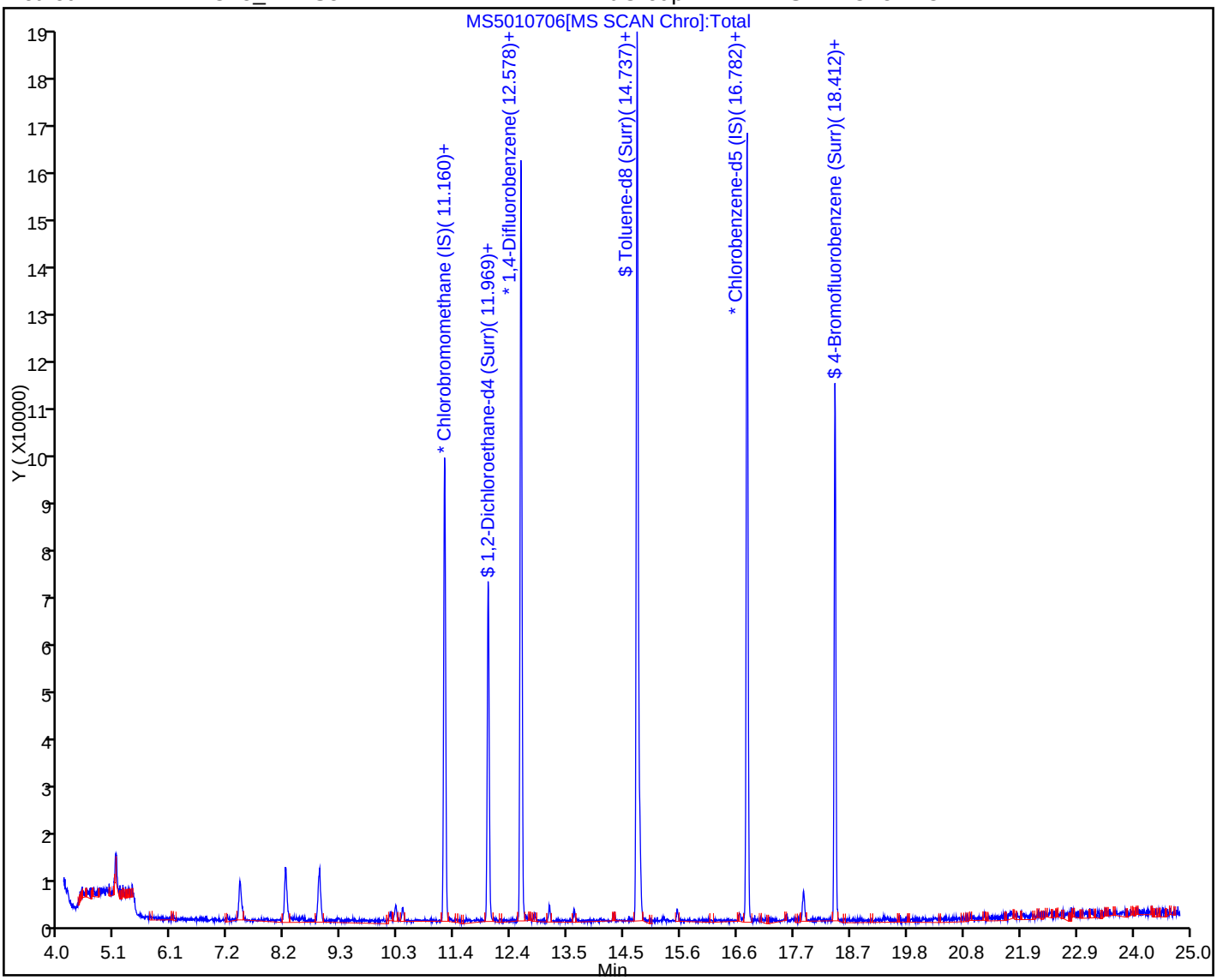
Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010706.D				
Lims ID:	320-5574-A-4	Lab Sample ID:	320-5574-4		
Client ID:	34000960				
Sample Type:	Client				
Inject. Date:	07-Jan-2014 17:06:30	ALS Bottle#:	4	Worklist Smp#:	6
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	SC can# 34000960				
Misc. Info.:	500mL; Can Certification Only!!				
Operator ID:	CR	Instrument ID:	ATMS5		
Method:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\TO15_ATMS5.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	08-Jan-2014 09:35:38	Calib Date:	07-Jan-2014 14:32:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010703.D				
Column 1 :		Detector	MS SCAN		
Process Host:	XAWRK034				
First Level Reviewer: roushc		Date:	08-Jan-2014 09:19:46		

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	91	40815	4.00	
* 2 1,4-Difluorobenzene	114	12.584	12.578	0.006	92	165392	4.12	
* 3 Chlorobenzene-d5 (IS)	117	16.782	16.781	0.001	88	114575	4.12	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.969	0.0	0	65102	4.03	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	95	99888	4.01	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	81	49913	3.47	

Report Date: 08-Jan-2014 09:36:33 Chrom Revision: 2.1 15-Oct-2013 07:52:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010706.D				
Injection Date:	07-Jan-2014 17:06:30	Instrument ID:	ATMS5		
Lims ID:	320-5574-A-4	Lab Sample ID:	320-5574-4		
Client ID:	34000960				
Operator ID:	CR	ALS Bottle#:	4	Worklist Smp#:	6
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Tel: (916)373-5600

TestAmerica Job ID: 320-6137-1
Client Project/Site: Park-Euclid WQARF Site

For:
URS Corporation
8181 East Tufts Ave.
Denver, Colorado 80237

Attn: Mr. Robert Boudra

Authorized for release by:
2/28/2014 12:25:55 PM

Laura Turpen, Project Manager II
(916)373-5600
laura.turpen@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Cover Page 1
Table of Contents 2
Definitions/Glossary 3
Case Narrative 4
Detection Summary 5
Client Sample Results 6
Surrogate Summary 13
QC Sample Results 14
QC Association Summary 25
Lab Chronicle 26
Certification Summary 27
Method Summary 28
Sample Summary 29
Chain of Custody 30
Field Data Sheets 31
Receipt Checklists 33
Clean Canister Certification 34
Pre-Ship Certification 34
Clean Canister Data 35

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 320-6137-1

Laboratory: TestAmerica Sacramento

Narrative

Job Narrative
320-6137-1

Receipt
The samples were received on 2/14/2014 9:30 AM; the samples arrived in good condition.

Air - GC/MS VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Detection Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-6137-1

Client Sample ID: VML-02-150-VPT-021314 — Lab Sample ID: 320-6137-1

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Naphthalene	680		440		ppb v/v	545		TO-15	Total/NA
Toluene	1100		220		ppb v/v	545		TO-15	Total/NA
Trichloroethene	7900		220		ppb v/v	545		TO-15	Total/NA
Vinyl chloride	1200		220		ppb v/v	545		TO-15	Total/NA
m,p-Xylene	470		440		ppb v/v	545		TO-15	Total/NA
cis-1,2-Dichloroethene - DL	56000		870		ppb v/v	2180		TO-15	Total/NA
Tetrachloroethene - DL	63000		870		ppb v/v	2180		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Naphthalene	3500		2300		ug/m3	545		TO-15	Total/NA
Toluene	4100		820		ug/m3	545		TO-15	Total/NA
Trichloroethene	43000		1200		ug/m3	545		TO-15	Total/NA
Vinyl chloride	3000		560		ug/m3	545		TO-15	Total/NA
m,p-Xylene	2100		1900		ug/m3	545		TO-15	Total/NA
cis-1,2-Dichloroethene - DL	220000		3500		ug/m3	2180		TO-15	Total/NA
Tetrachloroethene - DL	430000		5900		ug/m3	2180		TO-15	Total/NA

Client Sample ID: AMBIENT2-VPT-021314 — Lab Sample ID: 320-6137-2

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Acetone	9.7		5.0		ppb v/v	1		TO-15	Total/NA
2-Butanone (MEK)	2.1		0.80		ppb v/v	1		TO-15	Total/NA
Dichlorodifluoromethane	0.42		0.40		ppb v/v	1		TO-15	Total/NA
cis-1,2-Dichloroethene	0.99		0.40		ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	0.60		0.40		ppb v/v	1		TO-15	Total/NA
Toluene	1.2		0.40		ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Acetone	23		12		ug/m3	1		TO-15	Total/NA
2-Butanone (MEK)	6.1		2.4		ug/m3	1		TO-15	Total/NA
Dichlorodifluoromethane	2.1		2.0		ug/m3	1		TO-15	Total/NA
cis-1,2-Dichloroethene	3.9		1.6		ug/m3	1		TO-15	Total/NA
Tetrachloroethene	4.1		2.7		ug/m3	1		TO-15	Total/NA
Toluene	4.7		1.5		ug/m3	1		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-6137-1

Client Sample ID: VML-02-150-VPT-021314

Lab Sample ID: 320-6137-1

Date Collected: 02/13/14 11:55
Matrix: Air
Date Received: 02/14/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		2700		ppb v/v			02/24/14 01:04	545
Allyl chloride	ND		440		ppb v/v			02/24/14 01:04	545
Benzene	ND		220		ppb v/v			02/24/14 01:04	545
Benzyl chloride	ND		440		ppb v/v			02/24/14 01:04	545
Bromodichloromethane	ND		160		ppb v/v			02/24/14 01:04	545
Bromoform	ND		220		ppb v/v			02/24/14 01:04	545
Bromomethane	ND		440		ppb v/v			02/24/14 01:04	545
1,3-Butadiene	ND		440		ppb v/v			02/24/14 01:04	545
2-Butanone (MEK)	ND		440		ppb v/v			02/24/14 01:04	545
n-Butylbenzene	ND		220		ppb v/v			02/24/14 01:04	545
sec-Butylbenzene	ND		220		ppb v/v			02/24/14 01:04	545
tert-Butylbenzene	ND		440		ppb v/v			02/24/14 01:04	545
Carbon disulfide	ND		440		ppb v/v			02/24/14 01:04	545
Carbon tetrachloride	ND		440		ppb v/v			02/24/14 01:04	545
Chlorobenzene	ND		160		ppb v/v			02/24/14 01:04	545
Chloroethane	ND		440		ppb v/v			02/24/14 01:04	545
Chloroform	ND		160		ppb v/v			02/24/14 01:04	545
Chloromethane	ND		440		ppb v/v			02/24/14 01:04	545
Cyclohexane	ND		220		ppb v/v			02/24/14 01:04	545
Dibromochloromethane	ND		220		ppb v/v			02/24/14 01:04	545
1,2-Dibromoethane (EDB)	ND		440		ppb v/v			02/24/14 01:04	545
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		220		ppb v/v			02/24/14 01:04	545
1,2-Dichlorobenzene	ND		220		ppb v/v			02/24/14 01:04	545
1,3-Dichlorobenzene	ND		220		ppb v/v			02/24/14 01:04	545
1,4-Dichlorobenzene	ND		220		ppb v/v			02/24/14 01:04	545
Dichlorodifluoromethane	ND		220		ppb v/v			02/24/14 01:04	545
1,1-Dichloroethane	ND		160		ppb v/v			02/24/14 01:04	545
1,2-Dichloroethane	ND		440		ppb v/v			02/24/14 01:04	545
1,1-Dichloroethene	ND		440		ppb v/v			02/24/14 01:04	545
trans-1,2-Dichloroethene	ND		220		ppb v/v			02/24/14 01:04	545
1,2-Dichloropropane	ND		220		ppb v/v			02/24/14 01:04	545
cis-1,3-Dichloropropene	ND		220		ppb v/v			02/24/14 01:04	545
trans-1,3-Dichloropropene	ND		220		ppb v/v			02/24/14 01:04	545
Ethyl acetate	ND		160		ppb v/v			02/24/14 01:04	545
Ethylbenzene	ND		220		ppb v/v			02/24/14 01:04	545
4-Ethyltoluene	ND		220		ppb v/v			02/24/14 01:04	545
n-Heptane	ND		440		ppb v/v			02/24/14 01:04	545
Hexachlorobutadiene	ND		1100		ppb v/v			02/24/14 01:04	545
n-Hexane	ND		440		ppb v/v			02/24/14 01:04	545
2-Hexanone	ND		220		ppb v/v			02/24/14 01:04	545
Isopropylbenzene	ND		440		ppb v/v			02/24/14 01:04	545
Methyl-t-Butyl Ether (MTBE)	ND		440		ppb v/v			02/24/14 01:04	545
4-Methyl-2-pentanone (MIBK)	ND		220		ppb v/v			02/24/14 01:04	545
Methylene chloride	ND		220		ppb v/v			02/24/14 01:04	545
Naphthalene	**680**		440		ppb v/v			02/24/14 01:04	545
n-Octane	ND		220		ppb v/v			02/24/14 01:04	545
Propene	ND		220		ppb v/v			02/24/14 01:04	545
n-Propylbenzene	ND		220		ppb v/v			02/24/14 01:04	545

Client Sample ID: VML-02-150-VPT-021314

Lab Sample ID: 320-6137-1

Date Collected: 02/13/14 11:55
Matrix: Air
Date Received: 02/14/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Styrene	ND		220	ppb v/v			02/24/14 01:04	545
1,1,2,2-Tetrachloroethane	ND		220	ppb v/v			02/24/14 01:04	545
Tetrahydrofuran	ND		440	ppb v/v			02/24/14 01:04	545
Toluene	**1100**		220	ppb v/v			02/24/14 01:04	545
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		220	ppb v/v			02/24/14 01:04	545
1,2,4-Trichlorobenzene	ND		1100	ppb v/v			02/24/14 01:04	545
1,1,1-Trichloroethane	ND		160	ppb v/v			02/24/14 01:04	545
1,1,2-Trichloroethane	ND		220	ppb v/v			02/24/14 01:04	545
Trichloroethene	**7900**		220	ppb v/v			02/24/14 01:04	545
Trichlorofluoromethane	ND		220	ppb v/v			02/24/14 01:04	545
1,2,4-Trimethylbenzene	ND		440	ppb v/v			02/24/14 01:04	545
1,3,5-Trimethylbenzene	ND		220	ppb v/v			02/24/14 01:04	545
2,2,4-Trimethylpentane	ND		220	ppb v/v			02/24/14 01:04	545
Vinyl acetate	ND		440	ppb v/v			02/24/14 01:04	545
Vinyl bromide	ND		440	ppb v/v			02/24/14 01:04	545
Vinyl chloride	**1200**		220	ppb v/v			02/24/14 01:04	545
m,p-Xylene	**470**		440	ppb v/v			02/24/14 01:04	545
o-Xylene	ND		220	ppb v/v			02/24/14 01:04	545
2-Propanol	ND		1100	ppb v/v			02/24/14 01:04	545
n-Nonane	ND		440	ppb v/v			02/24/14 01:04	545

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		6500	ug/m3			02/24/14 01:04	545
Allyl chloride	ND		1400	ug/m3			02/24/14 01:04	545
Benzene	ND		700	ug/m3			02/24/14 01:04	545
Benzyl chloride	ND		2300	ug/m3			02/24/14 01:04	545
Bromodichloromethane	ND		1100	ug/m3			02/24/14 01:04	545
Bromoform	ND		2300	ug/m3			02/24/14 01:04	545
Bromomethane	ND		1700	ug/m3			02/24/14 01:04	545
1,3-Butadiene	ND		960	ug/m3			02/24/14 01:04	545
2-Butanone (MEK)	ND		1300	ug/m3			02/24/14 01:04	545
n-Butylbenzene	ND		1200	ug/m3			02/24/14 01:04	545
sec-Butylbenzene	ND		1200	ug/m3			02/24/14 01:04	545
tert-Butylbenzene	ND		2400	ug/m3			02/24/14 01:04	545
Carbon disulfide	ND		1400	ug/m3			02/24/14 01:04	545
Carbon tetrachloride	ND		2700	ug/m3			02/24/14 01:04	545
Chlorobenzene	ND		750	ug/m3			02/24/14 01:04	545
Chloroethane	ND		1200	ug/m3			02/24/14 01:04	545
Chloroform	ND		800	ug/m3			02/24/14 01:04	545
Chloromethane	ND		900	ug/m3			02/24/14 01:04	545
Cyclohexane	ND		750	ug/m3			02/24/14 01:04	545
Dibromochloromethane	ND		1900	ug/m3			02/24/14 01:04	545
1,2-Dibromoethane (EDB)	ND		3400	ug/m3			02/24/14 01:04	545
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		1500	ug/m3			02/24/14 01:04	545
1,2-Dichlorobenzene	ND		1300	ug/m3			02/24/14 01:04	545
1,3-Dichlorobenzene	ND		1300	ug/m3			02/24/14 01:04	545
1,4-Dichlorobenzene	ND		1300	ug/m3			02/24/14 01:04	545
Dichlorodifluoromethane	ND		1100	ug/m3			02/24/14 01:04	545
1,1-Dichloroethane	ND		660	ug/m3			02/24/14 01:04	545

Client Sample ID: VML-02-150-VPT-021314

Lab Sample ID: 320-6137-1

Date Collected: 02/13/14 11:55
Matrix: Air
Date Received: 02/14/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane	ND		1800		ug/m3			02/24/14 01:04	545
1,1-Dichloroethene	ND		1700		ug/m3			02/24/14 01:04	545
trans-1,2-Dichloroethene	ND		860		ug/m3			02/24/14 01:04	545
1,2-Dichloropropane	ND		1000		ug/m3			02/24/14 01:04	545
cis-1,3-Dichloropropene	ND		990		ug/m3			02/24/14 01:04	545
trans-1,3-Dichloropropene	ND		990		ug/m3			02/24/14 01:04	545
Ethyl acetate	ND		590		ug/m3			02/24/14 01:04	545
Ethylbenzene	ND		950		ug/m3			02/24/14 01:04	545
4-Ethyltoluene	ND		1100		ug/m3			02/24/14 01:04	545
n-Heptane	ND		1800		ug/m3			02/24/14 01:04	545
Hexachlorobutadiene	ND		12000		ug/m3			02/24/14 01:04	545
n-Hexane	ND		1500		ug/m3			02/24/14 01:04	545
2-Hexanone	ND		890		ug/m3			02/24/14 01:04	545
Isopropylbenzene	ND		2100		ug/m3			02/24/14 01:04	545
Methyl-t-Butyl Ether (MTBE)	ND		1600		ug/m3			02/24/14 01:04	545
4-Methyl-2-pentanone (MIBK)	ND		890		ug/m3			02/24/14 01:04	545
Methylene chloride	ND		760		ug/m3			02/24/14 01:04	545
Naphthalene	**3500**		2300		ug/m3			02/24/14 01:04	545
n-Octane	ND		1000		ug/m3			02/24/14 01:04	545
Propene	ND		380		ug/m3			02/24/14 01:04	545
n-Propylbenzene	ND		1100		ug/m3			02/24/14 01:04	545
Styrene	ND		930		ug/m3			02/24/14 01:04	545
1,1,2,2-Tetrachloroethane	ND		1500		ug/m3			02/24/14 01:04	545
Tetrahydrofuran	ND		1300		ug/m3			02/24/14 01:04	545
Toluene	**4100**		820		ug/m3			02/24/14 01:04	545
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1700		ug/m3			02/24/14 01:04	545
1,2,4-Trichlorobenzene	ND		8100		ug/m3			02/24/14 01:04	545
1,1,1-Trichloroethane	ND		890		ug/m3			02/24/14 01:04	545
1,1,2-Trichloroethane	ND		1200		ug/m3			02/24/14 01:04	545
Trichloroethene	**43000**		1200		ug/m3			02/24/14 01:04	545
Trichlorofluoromethane	ND		1200		ug/m3			02/24/14 01:04	545
1,2,4-Trimethylbenzene	ND		2100		ug/m3			02/24/14 01:04	545
1,3,5-Trimethylbenzene	ND		1100		ug/m3			02/24/14 01:04	545
2,2,4-Trimethylpentane	ND		1000		ug/m3			02/24/14 01:04	545
Vinyl acetate	ND		1500		ug/m3			02/24/14 01:04	545
Vinyl bromide	ND		1900		ug/m3			02/24/14 01:04	545
Vinyl chloride	**3000**		560		ug/m3			02/24/14 01:04	545
m,p-Xylene	**2100**		1900		ug/m3			02/24/14 01:04	545
o-Xylene	ND		950		ug/m3			02/24/14 01:04	545
2-Propanol	ND		2700		ug/m3			02/24/14 01:04	545
n-Nonane	ND		2300		ug/m3			02/24/14 01:04	545

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*101*		*70 - 130*		*02/24/14 01:04*	*545*
1,2-Dichloroethane-d4 (Surr)	*95*		*70 - 130*		*02/24/14 01:04*	*545*
Toluene-d8 (Surr)	*101*		*70 - 130*		*02/24/14 01:04*	*545*

Client Sample Results

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-6137-1

Client Sample ID: VML-02-150-VPT-021314

Lab Sample ID: 320-6137-1

Date Collected: 02/13/14 11:55
Matrix: Air
Date Received: 02/14/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**56000**		870	ppb v/v			02/24/14 09:37	2180
Tetrachloroethene	**63000**		870	ppb v/v			02/24/14 09:37	2180

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**220000**		3500	ug/m3			02/24/14 09:37	2180
Tetrachloroethene	**430000**		5900	ug/m3			02/24/14 09:37	2180

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*101*		*70 - 130*		*02/24/14 09:37*	*2180*
1,2-Dichloroethane-d4 (Surr)	*95*		*70 - 130*		*02/24/14 09:37*	*2180*
Toluene-d8 (Surr)	*102*		*70 - 130*		*02/24/14 09:37*	*2180*

Client Sample ID: AMBIENT2-VPT-021314

Lab Sample ID: 320-6137-2

Date Collected: 02/13/14 09:21
Matrix: Air
Date Received: 02/14/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**9.7**		5.0	ppb v/v			02/24/14 10:30	1
Allyl chloride	ND		0.80	ppb v/v			02/24/14 10:30	1
Benzene	ND		0.40	ppb v/v			02/24/14 10:30	1
Benzyl chloride	ND		0.80	ppb v/v			02/24/14 10:30	1
Bromodichloromethane	ND		0.30	ppb v/v			02/24/14 10:30	1
Bromoform	ND		0.40	ppb v/v			02/24/14 10:30	1
Bromomethane	ND		0.80	ppb v/v			02/24/14 10:30	1
1,3-Butadiene	ND		0.80	ppb v/v			02/24/14 10:30	1
2-Butanone (MEK)	**2.1**		0.80	ppb v/v			02/24/14 10:30	1
n-Butylbenzene	ND		0.40	ppb v/v			02/24/14 10:30	1
sec-Butylbenzene	ND		0.40	ppb v/v			02/24/14 10:30	1
tert-Butylbenzene	ND		0.80	ppb v/v			02/24/14 10:30	1
Carbon disulfide	ND		0.80	ppb v/v			02/24/14 10:30	1
Carbon tetrachloride	ND		0.80	ppb v/v			02/24/14 10:30	1
Chlorobenzene	ND		0.30	ppb v/v			02/24/14 10:30	1
Chloroethane	ND		0.80	ppb v/v			02/24/14 10:30	1
Chloroform	ND		0.30	ppb v/v			02/24/14 10:30	1
Chloromethane	ND		0.80	ppb v/v			02/24/14 10:30	1
Cyclohexane	ND		0.40	ppb v/v			02/24/14 10:30	1
Dibromochloromethane	ND		0.40	ppb v/v			02/24/14 10:30	1
1,2-Dibromoethane (EDB)	ND		0.80	ppb v/v			02/24/14 10:30	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40	ppb v/v			02/24/14 10:30	1
1,2-Dichlorobenzene	ND		0.40	ppb v/v			02/24/14 10:30	1
1,3-Dichlorobenzene	ND		0.40	ppb v/v			02/24/14 10:30	1
1,4-Dichlorobenzene	ND		0.40	ppb v/v			02/24/14 10:30	1
Dichlorodifluoromethane	**0.42**		0.40	ppb v/v			02/24/14 10:30	1
1,1-Dichloroethane	ND		0.30	ppb v/v			02/24/14 10:30	1
1,2-Dichloroethane	ND		0.80	ppb v/v			02/24/14 10:30	1
1,1-Dichloroethene	ND		0.80	ppb v/v			02/24/14 10:30	1
cis-1,2-Dichloroethene	**0.99**		0.40	ppb v/v			02/24/14 10:30	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			02/24/14 10:30	1

Client Sample ID: AMBIENT2-VPT-021314

Lab Sample ID: 320-6137-2

Date Collected: 02/13/14 09:21

Matrix: Air

Date Received: 02/14/14 09:30

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichloropropane	ND		0.40	ppb v/v			02/24/14 10:30	1
cis-1,3-Dichloropropene	ND		0.40	ppb v/v			02/24/14 10:30	1
trans-1,3-Dichloropropene	ND		0.40	ppb v/v			02/24/14 10:30	1
Ethyl acetate	ND		0.30	ppb v/v			02/24/14 10:30	1
Ethylbenzene	ND		0.40	ppb v/v			02/24/14 10:30	1
4-Ethyltoluene	ND		0.40	ppb v/v			02/24/14 10:30	1
n-Heptane	ND		0.80	ppb v/v			02/24/14 10:30	1
Hexachlorobutadiene	ND		2.0	ppb v/v			02/24/14 10:30	1
n-Hexane	ND		0.80	ppb v/v			02/24/14 10:30	1
2-Hexanone	ND		0.40	ppb v/v			02/24/14 10:30	1
Isopropylbenzene	ND		0.80	ppb v/v			02/24/14 10:30	1
Methyl-t-Butyl Ether (MTBE)	ND		0.80	ppb v/v			02/24/14 10:30	1
4-Methyl-2-pentanone (MIBK)	ND		0.40	ppb v/v			02/24/14 10:30	1
Methylene chloride	ND		0.40	ppb v/v			02/24/14 10:30	1
Naphthalene	ND		0.80	ppb v/v			02/24/14 10:30	1
n-Octane	ND		0.40	ppb v/v			02/24/14 10:30	1
Propene	ND		0.40	ppb v/v			02/24/14 10:30	1
n-Propylbenzene	ND		0.40	ppb v/v			02/24/14 10:30	1
Styrene	ND		0.40	ppb v/v			02/24/14 10:30	1
1,1,2,2-Tetrachloroethane	ND		0.40	ppb v/v			02/24/14 10:30	1
Tetrachloroethene	**0.60**		0.40	ppb v/v			02/24/14 10:30	1
Tetrahydrofuran	ND		0.80	ppb v/v			02/24/14 10:30	1
Toluene	**1.2**		0.40	ppb v/v			02/24/14 10:30	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40	ppb v/v			02/24/14 10:30	1
1,2,4-Trichlorobenzene	ND		2.0	ppb v/v			02/24/14 10:30	1
1,1,1-Trichloroethane	ND		0.30	ppb v/v			02/24/14 10:30	1
1,1,2-Trichloroethane	ND		0.40	ppb v/v			02/24/14 10:30	1
Trichloroethene	ND		0.40	ppb v/v			02/24/14 10:30	1
Trichlorofluoromethane	ND		0.40	ppb v/v			02/24/14 10:30	1
1,2,4-Trimethylbenzene	ND		0.80	ppb v/v			02/24/14 10:30	1
1,3,5-Trimethylbenzene	ND		0.40	ppb v/v			02/24/14 10:30	1
2,2,4-Trimethylpentane	ND		0.40	ppb v/v			02/24/14 10:30	1
Vinyl acetate	ND		0.80	ppb v/v			02/24/14 10:30	1
Vinyl bromide	ND		0.80	ppb v/v			02/24/14 10:30	1
Vinyl chloride	ND		0.40	ppb v/v			02/24/14 10:30	1
m,p-Xylene	ND		0.80	ppb v/v			02/24/14 10:30	1
o-Xylene	ND		0.40	ppb v/v			02/24/14 10:30	1
2-Propanol	ND		2.0	ppb v/v			02/24/14 10:30	1
n-Nonane	ND		0.80	ppb v/v			02/24/14 10:30	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**23**		12	ug/m3			02/24/14 10:30	1
Allyl chloride	ND		2.5	ug/m3			02/24/14 10:30	1
Benzene	ND		1.3	ug/m3			02/24/14 10:30	1
Benzyl chloride	ND		4.1	ug/m3			02/24/14 10:30	1
Bromodichloromethane	ND		2.0	ug/m3			02/24/14 10:30	1
Bromoform	ND		4.1	ug/m3			02/24/14 10:30	1
Bromomethane	ND		3.1	ug/m3			02/24/14 10:30	1
1,3-Butadiene	ND		1.8	ug/m3			02/24/14 10:30	1

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-6137-1

Client Sample ID: AMBIENT2-VPT-021314
Date Collected: 02/13/14 09:21
Date Received: 02/14/14 09:30
Sample Container: Summa Canister 1L

Lab Sample ID: 320-6137-2
Matrix: Air

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
2-Butanone (MEK)	**6.1**		2.4	ug/m3			02/24/14 10:30	1
n-Butylbenzene	ND		2.2	ug/m3			02/24/14 10:30	1
sec-Butylbenzene	ND		2.2	ug/m3			02/24/14 10:30	1
tert-Butylbenzene	ND		4.4	ug/m3			02/24/14 10:30	1
Carbon disulfide	ND		2.5	ug/m3			02/24/14 10:30	1
Carbon tetrachloride	ND		5.0	ug/m3			02/24/14 10:30	1
Chlorobenzene	ND		1.4	ug/m3			02/24/14 10:30	1
Chloroethane	ND		2.1	ug/m3			02/24/14 10:30	1
Chloroform	ND		1.5	ug/m3			02/24/14 10:30	1
Chloromethane	ND		1.7	ug/m3			02/24/14 10:30	1
Cyclohexane	ND		1.4	ug/m3			02/24/14 10:30	1
Dibromochloromethane	ND		3.4	ug/m3			02/24/14 10:30	1
1,2-Dibromoethane (EDB)	ND		6.1	ug/m3			02/24/14 10:30	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2.8	ug/m3			02/24/14 10:30	1
1,2-Dichlorobenzene	ND		2.4	ug/m3			02/24/14 10:30	1
1,3-Dichlorobenzene	ND		2.4	ug/m3			02/24/14 10:30	1
1,4-Dichlorobenzene	ND		2.4	ug/m3			02/24/14 10:30	1
Dichlorodifluoromethane	**2.1**		2.0	ug/m3			02/24/14 10:30	1
1,1-Dichloroethane	ND		1.2	ug/m3			02/24/14 10:30	1
1,2-Dichloroethane	ND		3.2	ug/m3			02/24/14 10:30	1
1,1-Dichloroethene	ND		3.2	ug/m3			02/24/14 10:30	1
cis-1,2-Dichloroethene	**3.9**		1.6	ug/m3			02/24/14 10:30	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			02/24/14 10:30	1
1,2-Dichloropropane	ND		1.8	ug/m3			02/24/14 10:30	1
cis-1,3-Dichloropropene	ND		1.8	ug/m3			02/24/14 10:30	1
trans-1,3-Dichloropropene	ND		1.8	ug/m3			02/24/14 10:30	1
Ethyl acetate	ND		1.1	ug/m3			02/24/14 10:30	1
Ethylbenzene	ND		1.7	ug/m3			02/24/14 10:30	1
4-Ethyltoluene	ND		2.0	ug/m3			02/24/14 10:30	1
n-Heptane	ND		3.3	ug/m3			02/24/14 10:30	1
Hexachlorobutadiene	ND		21	ug/m3			02/24/14 10:30	1
n-Hexane	ND		2.8	ug/m3			02/24/14 10:30	1
2-Hexanone	ND		1.6	ug/m3			02/24/14 10:30	1
Isopropylbenzene	ND		3.9	ug/m3			02/24/14 10:30	1
Methyl-t-Butyl Ether (MTBE)	ND		2.9	ug/m3			02/24/14 10:30	1
4-Methyl-2-pentanone (MIBK)	ND		1.6	ug/m3			02/24/14 10:30	1
Methylene chloride	ND		1.4	ug/m3			02/24/14 10:30	1
Naphthalene	ND		4.2	ug/m3			02/24/14 10:30	1
n-Octane	ND		1.9	ug/m3			02/24/14 10:30	1
Propene	ND		0.69	ug/m3			02/24/14 10:30	1
n-Propylbenzene	ND		2.0	ug/m3			02/24/14 10:30	1
Styrene	ND		1.7	ug/m3			02/24/14 10:30	1
1,1,2,2-Tetrachloroethane	ND		2.7	ug/m3			02/24/14 10:30	1
Tetrachloroethene	**4.1**		2.7	ug/m3			02/24/14 10:30	1
Tetrahydrofuran	ND		2.4	ug/m3			02/24/14 10:30	1
Toluene	**4.7**		1.5	ug/m3			02/24/14 10:30	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		3.1	ug/m3			02/24/14 10:30	1
1,2,4-Trichlorobenzene	ND		15	ug/m3			02/24/14 10:30	1

Client Sample Results

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-6137-1

Client Sample ID: AMBIENT2-VPT-021314

Lab Sample ID: 320-6137-2

Date Collected: 02/13/14 09:21
Date Received: 02/14/14 09:30
Sample Container: Summa Canister 1L

Matrix: Air

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.6		ug/m3			02/24/14 10:30	1
1,1,2-Trichloroethane	ND		2.2		ug/m3			02/24/14 10:30	1
Trichloroethene	ND		2.1		ug/m3			02/24/14 10:30	1
Trichlorofluoromethane	ND		2.2		ug/m3			02/24/14 10:30	1
1,2,4-Trimethylbenzene	ND		3.9		ug/m3			02/24/14 10:30	1
1,3,5-Trimethylbenzene	ND		2.0		ug/m3			02/24/14 10:30	1
2,2,4-Trimethylpentane	ND		1.9		ug/m3			02/24/14 10:30	1
Vinyl acetate	ND		2.8		ug/m3			02/24/14 10:30	1
Vinyl bromide	ND		3.5		ug/m3			02/24/14 10:30	1
Vinyl chloride	ND		1.0		ug/m3			02/24/14 10:30	1
m,p-Xylene	ND		3.5		ug/m3			02/24/14 10:30	1
o-Xylene	ND		1.7		ug/m3			02/24/14 10:30	1
2-Propanol	ND		4.9		ug/m3			02/24/14 10:30	1
n-Nonane	ND		4.2		ug/m3			02/24/14 10:30	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*		*02/24/14 10:30*	*1*
1,2-Dichloroethane-d4 (Surr)	*95*		*70 - 130*		*02/24/14 10:30*	*1*
Toluene-d8 (Surr)	*104*		*70 - 130*		*02/24/14 10:30*	*1*

Surrogate Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-6137-1

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Matrix: Air **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		BFB	12DCE	TOL
Lab Sample ID	Client Sample ID	(70-130)	(70-130)	(70-130)
320-6137-1	VML-02-150-VPT-021314	101	95	101
320-6137-1 - DL	VML-02-150-VPT-021314	101	95	102
320-6137-2	AMBIENT2-VPT-021314	105	95	104
LCS 320-36918/5	Lab Control Sample	105	100	109
LCS 320-36918/7	Lab Control Sample	101	94	104
LCSD 320-36918/6	Lab Control Sample Dup	104	99	108
LCSD 320-36918/8	Lab Control Sample Dup	103	96	104
MB 320-36918/10	Method Blank	102	95	103

Surrogate Legend

BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)
TOL = Toluene-d8 (Surr)

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Lab Sample ID: MB 320-36918/10
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		5.0		ppb v/v			02/23/14 20:54	1
Allyl chloride	ND		0.80		ppb v/v			02/23/14 20:54	1
Benzene	ND		0.40		ppb v/v			02/23/14 20:54	1
Benzyl chloride	ND		0.80		ppb v/v			02/23/14 20:54	1
Bromodichloromethane	ND		0.30		ppb v/v			02/23/14 20:54	1
Bromoform	ND		0.40		ppb v/v			02/23/14 20:54	1
Bromomethane	ND		0.80		ppb v/v			02/23/14 20:54	1
1,3-Butadiene	ND		0.80		ppb v/v			02/23/14 20:54	1
2-Butanone (MEK)	ND		0.80		ppb v/v			02/23/14 20:54	1
n-Butylbenzene	ND		0.40		ppb v/v			02/23/14 20:54	1
sec-Butylbenzene	ND		0.40		ppb v/v			02/23/14 20:54	1
tert-Butylbenzene	ND		0.80		ppb v/v			02/23/14 20:54	1
Carbon disulfide	ND		0.80		ppb v/v			02/23/14 20:54	1
Carbon tetrachloride	ND		0.80		ppb v/v			02/23/14 20:54	1
Chlorobenzene	ND		0.30		ppb v/v			02/23/14 20:54	1
Chloroethane	ND		0.80		ppb v/v			02/23/14 20:54	1
Chloroform	ND		0.30		ppb v/v			02/23/14 20:54	1
Chloromethane	ND		0.80		ppb v/v			02/23/14 20:54	1
Cyclohexane	ND		0.40		ppb v/v			02/23/14 20:54	1
Dibromochloromethane	ND		0.40		ppb v/v			02/23/14 20:54	1
1,2-Dibromoethane (EDB)	ND		0.80		ppb v/v			02/23/14 20:54	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40		ppb v/v			02/23/14 20:54	1
1,2-Dichlorobenzene	ND		0.40		ppb v/v			02/23/14 20:54	1
1,3-Dichlorobenzene	ND		0.40		ppb v/v			02/23/14 20:54	1
1,4-Dichlorobenzene	ND		0.40		ppb v/v			02/23/14 20:54	1
Dichlorodifluoromethane	ND		0.40		ppb v/v			02/23/14 20:54	1
1,1-Dichloroethane	ND		0.30		ppb v/v			02/23/14 20:54	1
1,2-Dichloroethane	ND		0.80		ppb v/v			02/23/14 20:54	1
1,1-Dichloroethene	ND		0.80		ppb v/v			02/23/14 20:54	1
cis-1,2-Dichloroethene	ND		0.40		ppb v/v			02/23/14 20:54	1
trans-1,2-Dichloroethene	ND		0.40		ppb v/v			02/23/14 20:54	1
1,2-Dichloropropane	ND		0.40		ppb v/v			02/23/14 20:54	1
cis-1,3-Dichloropropene	ND		0.40		ppb v/v			02/23/14 20:54	1
trans-1,3-Dichloropropene	ND		0.40		ppb v/v			02/23/14 20:54	1
Ethyl acetate	ND		0.30		ppb v/v			02/23/14 20:54	1
Ethylbenzene	ND		0.40		ppb v/v			02/23/14 20:54	1
4-Ethyltoluene	ND		0.40		ppb v/v			02/23/14 20:54	1
n-Heptane	ND		0.80		ppb v/v			02/23/14 20:54	1
Hexachlorobutadiene	ND		2.0		ppb v/v			02/23/14 20:54	1
n-Hexane	ND		0.80		ppb v/v			02/23/14 20:54	1
2-Hexanone	ND		0.40		ppb v/v			02/23/14 20:54	1
Isopropylbenzene	ND		0.80		ppb v/v			02/23/14 20:54	1
Methyl-t-Butyl Ether (MTBE)	ND		0.80		ppb v/v			02/23/14 20:54	1
4-Methyl-2-pentanone (MIBK)	ND		0.40		ppb v/v			02/23/14 20:54	1
Methylene chloride	ND		0.40		ppb v/v			02/23/14 20:54	1
Naphthalene	ND		0.80		ppb v/v			02/23/14 20:54	1
n-Octane	ND		0.40		ppb v/v			02/23/14 20:54	1
Propene	ND		0.40		ppb v/v			02/23/14 20:54	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-36918/10
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
n-Propylbenzene	ND		0.40		ppb v/v			02/23/14 20:54	1
Styrene	ND		0.40		ppb v/v			02/23/14 20:54	1
1,1,2,2-Tetrachloroethane	ND		0.40		ppb v/v			02/23/14 20:54	1
Tetrachloroethene	ND		0.40		ppb v/v			02/23/14 20:54	1
Tetrahydrofuran	ND		0.80		ppb v/v			02/23/14 20:54	1
Toluene	ND		0.40		ppb v/v			02/23/14 20:54	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40		ppb v/v			02/23/14 20:54	1
1,2,4-Trichlorobenzene	ND		2.0		ppb v/v			02/23/14 20:54	1
1,1,1-Trichloroethane	ND		0.30		ppb v/v			02/23/14 20:54	1
1,1,2-Trichloroethane	ND		0.40		ppb v/v			02/23/14 20:54	1
Trichloroethene	ND		0.40		ppb v/v			02/23/14 20:54	1
Trichlorofluoromethane	ND		0.40		ppb v/v			02/23/14 20:54	1
1,2,4-Trimethylbenzene	ND		0.80		ppb v/v			02/23/14 20:54	1
1,3,5-Trimethylbenzene	ND		0.40		ppb v/v			02/23/14 20:54	1
2,2,4-Trimethylpentane	ND		0.40		ppb v/v			02/23/14 20:54	1
Vinyl acetate	ND		0.80		ppb v/v			02/23/14 20:54	1
Vinyl bromide	ND		0.80		ppb v/v			02/23/14 20:54	1
Vinyl chloride	ND		0.40		ppb v/v			02/23/14 20:54	1
m,p-Xylene	ND		0.80		ppb v/v			02/23/14 20:54	1
o-Xylene	ND		0.40		ppb v/v			02/23/14 20:54	1
2-Propanol	ND		2.0		ppb v/v			02/23/14 20:54	1
n-Nonane	ND		0.80		ppb v/v			02/23/14 20:54	1

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		12		ug/m3			02/23/14 20:54	1
Allyl chloride	ND		2.5		ug/m3			02/23/14 20:54	1
Benzene	ND		1.3		ug/m3			02/23/14 20:54	1
Benzyl chloride	ND		4.1		ug/m3			02/23/14 20:54	1
Bromodichloromethane	ND		2.0		ug/m3			02/23/14 20:54	1
Bromoform	ND		4.1		ug/m3			02/23/14 20:54	1
Bromomethane	ND		3.1		ug/m3			02/23/14 20:54	1
1,3-Butadiene	ND		1.8		ug/m3			02/23/14 20:54	1
2-Butanone (MEK)	ND		2.4		ug/m3			02/23/14 20:54	1
n-Butylbenzene	ND		2.2		ug/m3			02/23/14 20:54	1
sec-Butylbenzene	ND		2.2		ug/m3			02/23/14 20:54	1
tert-Butylbenzene	ND		4.4		ug/m3			02/23/14 20:54	1
Carbon disulfide	ND		2.5		ug/m3			02/23/14 20:54	1
Carbon tetrachloride	ND		5.0		ug/m3			02/23/14 20:54	1
Chlorobenzene	ND		1.4		ug/m3			02/23/14 20:54	1
Chloroethane	ND		2.1		ug/m3			02/23/14 20:54	1
Chloroform	ND		1.5		ug/m3			02/23/14 20:54	1
Chloromethane	ND		1.7		ug/m3			02/23/14 20:54	1
Cyclohexane	ND		1.4		ug/m3			02/23/14 20:54	1
Dibromochloromethane	ND		3.4		ug/m3			02/23/14 20:54	1
1,2-Dibromoethane (EDB)	ND		6.1		ug/m3			02/23/14 20:54	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2.8		ug/m3			02/23/14 20:54	1
1,2-Dichlorobenzene	ND		2.4		ug/m3			02/23/14 20:54	1
1,3-Dichlorobenzene	ND		2.4		ug/m3			02/23/14 20:54	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-36918/10
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,4-Dichlorobenzene	ND		2.4		ug/m3			02/23/14 20:54	1
Dichlorodifluoromethane	ND		2.0		ug/m3			02/23/14 20:54	1
1,1-Dichloroethane	ND		1.2		ug/m3			02/23/14 20:54	1
1,2-Dichloroethane	ND		3.2		ug/m3			02/23/14 20:54	1
1,1-Dichloroethene	ND		3.2		ug/m3			02/23/14 20:54	1
cis-1,2-Dichloroethene	ND		1.6		ug/m3			02/23/14 20:54	1
trans-1,2-Dichloroethene	ND		1.6		ug/m3			02/23/14 20:54	1
1,2-Dichloropropane	ND		1.8		ug/m3			02/23/14 20:54	1
cis-1,3-Dichloropropene	ND		1.8		ug/m3			02/23/14 20:54	1
trans-1,3-Dichloropropene	ND		1.8		ug/m3			02/23/14 20:54	1
Ethyl acetate	ND		1.1		ug/m3			02/23/14 20:54	1
Ethylbenzene	ND		1.7		ug/m3			02/23/14 20:54	1
4-Ethyltoluene	ND		2.0		ug/m3			02/23/14 20:54	1
n-Heptane	ND		3.3		ug/m3			02/23/14 20:54	1
Hexachlorobutadiene	ND		21		ug/m3			02/23/14 20:54	1
n-Hexane	ND		2.8		ug/m3			02/23/14 20:54	1
2-Hexanone	ND		1.6		ug/m3			02/23/14 20:54	1
Isopropylbenzene	ND		3.9		ug/m3			02/23/14 20:54	1
Methyl-t-Butyl Ether (MTBE)	ND		2.9		ug/m3			02/23/14 20:54	1
4-Methyl-2-pentanone (MIBK)	ND		1.6		ug/m3			02/23/14 20:54	1
Methylene chloride	ND		1.4		ug/m3			02/23/14 20:54	1
Naphthalene	ND		4.2		ug/m3			02/23/14 20:54	1
n-Octane	ND		1.9		ug/m3			02/23/14 20:54	1
Propene	ND		0.69		ug/m3			02/23/14 20:54	1
n-Propylbenzene	ND		2.0		ug/m3			02/23/14 20:54	1
Styrene	ND		1.7		ug/m3			02/23/14 20:54	1
1,1,2,2-Tetrachloroethane	ND		2.7		ug/m3			02/23/14 20:54	1
Tetrachloroethene	ND		2.7		ug/m3			02/23/14 20:54	1
Tetrahydrofuran	ND		2.4		ug/m3			02/23/14 20:54	1
Toluene	ND		1.5		ug/m3			02/23/14 20:54	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		3.1		ug/m3			02/23/14 20:54	1
1,2,4-Trichlorobenzene	ND		15		ug/m3			02/23/14 20:54	1
1,1,1-Trichloroethane	ND		1.6		ug/m3			02/23/14 20:54	1
1,1,2-Trichloroethane	ND		2.2		ug/m3			02/23/14 20:54	1
Trichloroethene	ND		2.1		ug/m3			02/23/14 20:54	1
Trichlorofluoromethane	ND		2.2		ug/m3			02/23/14 20:54	1
1,2,4-Trimethylbenzene	ND		3.9		ug/m3			02/23/14 20:54	1
1,3,5-Trimethylbenzene	ND		2.0		ug/m3			02/23/14 20:54	1
2,2,4-Trimethylpentane	ND		1.9		ug/m3			02/23/14 20:54	1
Vinyl acetate	ND		2.8		ug/m3			02/23/14 20:54	1
Vinyl bromide	ND		3.5		ug/m3			02/23/14 20:54	1
Vinyl chloride	ND		1.0		ug/m3			02/23/14 20:54	1
m,p-Xylene	ND		3.5		ug/m3			02/23/14 20:54	1
o-Xylene	ND		1.7		ug/m3			02/23/14 20:54	1
2-Propanol	ND		4.9		ug/m3			02/23/14 20:54	1
n-Nonane	ND		4.2		ug/m3			02/23/14 20:54	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-36918/10
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Method Blank
Prep Type: Total/NA

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	102		70 - 130		02/23/14 20:54	1
1,2-Dichloroethane-d4 (Surr)	95		70 - 130		02/23/14 20:54	1
Toluene-d8 (Surr)	103		70 - 130		02/23/14 20:54	1

Lab Sample ID: LCS 320-36918/5
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetone	20.2	18.9		ppb v/v		93	70 - 130
Allyl chloride	21.0	19.8		ppb v/v		94	70 - 130
Benzene	20.2	18.4		ppb v/v		91	70 - 130
Benzyl chloride	21.8	19.6		ppb v/v		90	70 - 130
Bromodichloromethane	20.4	18.7		ppb v/v		91	70 - 130
Bromoform	20.6	20.0		ppb v/v		97	70 - 130
Bromomethane	20.2	18.4		ppb v/v		91	70 - 130
1,3-Butadiene	20.4	18.3		ppb v/v		90	70 - 130
2-Butanone (MEK)	20.8	20.5		ppb v/v		99	70 - 130
n-Butylbenzene	21.2	22.9		ppb v/v		108	70 - 130
sec-Butylbenzene	20.6	21.2		ppb v/v		103	70 - 130
tert-Butylbenzene	20.8	20.3		ppb v/v		97	70 - 130
Carbon disulfide	20.6	16.4		ppb v/v		80	70 - 130
Carbon tetrachloride	20.8	19.7		ppb v/v		95	70 - 130
Chlorobenzene	21.2	20.2		ppb v/v		95	70 - 130
Chloroethane	20.0	18.3		ppb v/v		91	70 - 130
Chloroform	20.4	18.4		ppb v/v		90	70 - 130
Chloromethane	20.4	17.8		ppb v/v		87	70 - 130
Cyclohexane	20.4	18.2		ppb v/v		89	70 - 130
Dibromochloromethane	22.8	19.4		ppb v/v		85	70 - 130
1,2-Dibromoethane (EDB)	20.8	20.1		ppb v/v		96	70 - 130
1,2-Dichloro-1,1,2,2-tetrafluoroethane	20.2	16.3		ppb v/v		81	70 - 130
1,2-Dichlorobenzene	21.4	23.8		ppb v/v		111	70 - 130
1,3-Dichlorobenzene	21.8	23.8		ppb v/v		109	70 - 130
1,4-Dichlorobenzene	20.8	24.6		ppb v/v		118	70 - 130
Dichlorodifluoromethane	20.0	15.4		ppb v/v		77	70 - 130
1,1-Dichloroethane	19.8	18.0		ppb v/v		91	70 - 130
1,2-Dichloroethane	20.6	19.2		ppb v/v		93	70 - 130
1,1-Dichloroethene	19.2	16.9		ppb v/v		88	70 - 130
cis-1,2-Dichloroethene	20.4	18.4		ppb v/v		90	70 - 130
trans-1,2-Dichloroethene	20.2	18.0		ppb v/v		89	70 - 130
1,2-Dichloropropane	20.6	19.9		ppb v/v		97	70 - 130
cis-1,3-Dichloropropene	21.2	20.8		ppb v/v		98	70 - 130
trans-1,3-Dichloropropene	19.8	20.0		ppb v/v		101	70 - 130
Ethyl acetate	20.4	19.9		ppb v/v		98	70 - 130
Ethylbenzene	21.0	21.2		ppb v/v		101	70 - 130
4-Ethyltoluene	20.6	21.4		ppb v/v		104	70 - 130
n-Heptane	20.6	18.9		ppb v/v		92	70 - 130

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-36918/5
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Hexachlorobutadiene	21.2	27.0		ppb v/v		127	70 - 130
n-Hexane	20.0	17.5		ppb v/v		87	70 - 130
2-Hexanone	21.8	23.4		ppb v/v		107	70 - 130
Isopropylbenzene	21.0	21.4		ppb v/v		102	70 - 130
Methyl-t-Butyl Ether (MTBE)	20.6	20.0		ppb v/v		97	70 - 130
4-Methyl-2-pentanone (MIBK)	21.0	23.4		ppb v/v		111	70 - 130
Methylene chloride	21.0	16.6		ppb v/v		79	70 - 130
Naphthalene	21.0	24.5		ppb v/v		117	70 - 130
n-Octane	20.6	17.6		ppb v/v		85	70 - 130
Propene	21.2	16.8		ppb v/v		79	70 - 130
n-Propylbenzene	20.0	20.9		ppb v/v		105	70 - 130
Styrene	21.4	23.7		ppb v/v		111	70 - 130
1,1,2,2-Tetrachloroethane	21.4	22.9		ppb v/v		107	70 - 130
Tetrachloroethene	19.6	16.5		ppb v/v		84	70 - 130
Tetrahydrofuran	20.6	20.6		ppb v/v		100	70 - 130
Toluene	20.8	22.8		ppb v/v		110	70 - 130
1,1,2-Trichloro-1,2,2-trifluoroetha ne	19.0	17.0		ppb v/v		89	70 - 130
1,2,4-Trichlorobenzene	21.4	25.7		ppb v/v		120	70 - 130
1,1,1-Trichloroethane	20.0	17.7		ppb v/v		89	70 - 130
1,1,2-Trichloroethane	20.8	19.4		ppb v/v		93	70 - 130
Trichloroethene	20.4	18.8		ppb v/v		92	70 - 130
Trichlorofluoromethane	19.4	17.2		ppb v/v		89	70 - 130
1,2,4-Trimethylbenzene	20.8	22.1		ppb v/v		106	70 - 130
1,3,5-Trimethylbenzene	21.2	21.4		ppb v/v		101	70 - 130
2,2,4-Trimethylpentane	20.2	18.3		ppb v/v		91	70 - 130
Vinyl acetate	21.6	23.2		ppb v/v		107	70 - 130
Vinyl bromide	20.6	18.6		ppb v/v		90	70 - 130
Vinyl chloride	20.4	17.7		ppb v/v		87	70 - 130
m,p-Xylene	41.2	41.4		ppb v/v		101	70 - 130
o-Xylene	21.4	21.0		ppb v/v		98	70 - 130
n-Nonane	20.0	19.9		ppb v/v		100	70 - 130

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetone	48	44.8		ug/m3		93	70 - 130
Allyl chloride	66	61.9		ug/m3		94	70 - 130
Benzene	65	58.7		ug/m3		91	70 - 130
Benzyl chloride	110	102		ug/m3		90	70 - 130
Bromodichloromethane	140	125		ug/m3		91	70 - 130
Bromoform	210	207		ug/m3		97	70 - 130
Bromomethane	78	71.6		ug/m3		91	70 - 130
1,3-Butadiene	45	40.5		ug/m3		90	70 - 130
2-Butanone (MEK)	61	60.5		ug/m3		99	70 - 130
n-Butylbenzene	120	126		ug/m3		108	70 - 130
sec-Butylbenzene	110	116		ug/m3		103	70 - 130
tert-Butylbenzene	110	111		ug/m3		97	70 - 130
Carbon disulfide	64	51.2		ug/m3		80	70 - 130
Carbon tetrachloride	130	124		ug/m3		95	70 - 130

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-36918/5
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chlorobenzene	98	93.1		ug/m3		95	70 - 130
Chloroethane	53	48.2		ug/m3		91	70 - 130
Chloroform	100	90.1		ug/m3		90	70 - 130
Chloromethane	42	36.8		ug/m3		87	70 - 130
Cyclohexane	70	62.7		ug/m3		89	70 - 130
Dibromochloromethane	190	165		ug/m3		85	70 - 130
1,2-Dibromoethane (EDB)	160	154		ug/m3		96	70 - 130
1,2-Dichloro-1,1,2,2-tetrafluoroethane	140	114		ug/m3		81	70 - 130
1,2-Dichlorobenzene	130	143		ug/m3		111	70 - 130
1,3-Dichlorobenzene	130	143		ug/m3		109	70 - 130
1,4-Dichlorobenzene	130	148		ug/m3		118	70 - 130
Dichlorodifluoromethane	99	76.3		ug/m3		77	70 - 130
1,1-Dichloroethane	80	72.9		ug/m3		91	70 - 130
1,2-Dichloroethane	83	77.8		ug/m3		93	70 - 130
1,1-Dichloroethene	76	67.1		ug/m3		88	70 - 130
cis-1,2-Dichloroethene	81	72.8		ug/m3		90	70 - 130
trans-1,2-Dichloroethene	80	71.4		ug/m3		89	70 - 130
1,2-Dichloropropane	95	92.0		ug/m3		97	70 - 130
cis-1,3-Dichloropropene	96	94.3		ug/m3		98	70 - 130
trans-1,3-Dichloropropene	90	90.9		ug/m3		101	70 - 130
Ethyl acetate	74	71.7		ug/m3		98	70 - 130
Ethylbenzene	91	91.9		ug/m3		101	70 - 130
4-Ethyltoluene	100	105		ug/m3		104	70 - 130
n-Heptane	84	77.6		ug/m3		92	70 - 130
Hexachlorobutadiene	230	287		ug/m3		127	70 - 130
n-Hexane	70	61.6		ug/m3		87	70 - 130
2-Hexanone	89	95.9		ug/m3		107	70 - 130
Isopropylbenzene	100	105		ug/m3		102	70 - 130
Methyl-t-Butyl Ether (MTBE)	74	72.2		ug/m3		97	70 - 130
4-Methyl-2-pentanone (MIBK)	86	95.7		ug/m3		111	70 - 130
Methylene chloride	73	57.8		ug/m3		79	70 - 130
Naphthalene	110	128		ug/m3		117	70 - 130
n-Octane	96	82.1		ug/m3		85	70 - 130
Propene	36	28.8		ug/m3		79	70 - 130
n-Propylbenzene	98	103		ug/m3		105	70 - 130
Styrene	91	101		ug/m3		111	70 - 130
1,1,2,2-Tetrachloroethane	150	157		ug/m3		107	70 - 130
Tetrachloroethene	130	112		ug/m3		84	70 - 130
Tetrahydrofuran	61	60.7		ug/m3		100	70 - 130
Toluene	78	86.0		ug/m3		110	70 - 130
1,1,2-Trichloro-1,2,2-trifluoroethane	150	130		ug/m3		89	70 - 130
1,2,4-Trichlorobenzene	160	191		ug/m3		120	70 - 130
1,1,1-Trichloroethane	110	96.6		ug/m3		89	70 - 130
1,1,2-Trichloroethane	110	106		ug/m3		93	70 - 130
Trichloroethene	110	101		ug/m3		92	70 - 130
Trichlorofluoromethane	110	96.6		ug/m3		89	70 - 130
1,2,4-Trimethylbenzene	100	109		ug/m3		106	70 - 130

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-36918/5
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,3,5-Trimethylbenzene	100	105		ug/m3		101	70 - 130
2,2,4-Trimethylpentane	94	85.6		ug/m3		91	70 - 130
Vinyl acetate	76	81.7		ug/m3		107	70 - 130
Vinyl bromide	90	81.4		ug/m3		90	70 - 130
Vinyl chloride	52	45.4		ug/m3		87	70 - 130
m,p-Xylene	180	180		ug/m3		101	70 - 130
o-Xylene	93	91.0		ug/m3		98	70 - 130
n-Nonane	100	105		ug/m3		100	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*
Toluene-d8 (Surr)	*109*		*70 - 130*

Lab Sample ID: LCS 320-36918/7
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2-Propanol	20.4	20.4		ppb v/v		100	70 - 130

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2-Propanol	50	50.1		ug/m3		100	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*101*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*94*		*70 - 130*
Toluene-d8 (Surr)	*104*		*70 - 130*

Lab Sample ID: LCSD 320-36918/6
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetone	20.2	17.9		ppb v/v		89	70 - 130	5	25
Allyl chloride	21.0	18.7		ppb v/v		89	70 - 130	5	25
Benzene	20.2	17.5		ppb v/v		87	70 - 130	5	25
Benzyl chloride	21.8	18.9		ppb v/v		87	70 - 130	4	25
Bromodichloromethane	20.4	17.7		ppb v/v		87	70 - 130	5	25
Bromoform	20.6	19.5		ppb v/v		95	70 - 130	2	25
Bromomethane	20.2	17.7		ppb v/v		88	70 - 130	4	25
1,3-Butadiene	20.4	17.8		ppb v/v		87	70 - 130	3	25
2-Butanone (MEK)	20.8	19.8		ppb v/v		95	70 - 130	3	25
n-Butylbenzene	21.2	22.2		ppb v/v		105	70 - 130	3	25
sec-Butylbenzene	20.6	20.4		ppb v/v		99	70 - 130	4	25
tert-Butylbenzene	20.8	19.3		ppb v/v		93	70 - 130	5	25
Carbon disulfide	20.6	16.0		ppb v/v		78	70 - 130	3	25
Carbon tetrachloride	20.8	18.6		ppb v/v		90	70 - 130	6	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36918/6
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chlorobenzene	21.2	19.6		ppb v/v		93	70 - 130	3	25
Chloroethane	20.0	17.6		ppb v/v		88	70 - 130	4	25
Chloroform	20.4	17.8		ppb v/v		87	70 - 130	4	25
Chloromethane	20.4	17.3		ppb v/v		85	70 - 130	3	25
Cyclohexane	20.4	17.2		ppb v/v		84	70 - 130	6	25
Dibromochloromethane	22.8	18.7		ppb v/v		82	70 - 130	4	25
1,2-Dibromoethane (EDB)	20.8	19.4		ppb v/v		93	70 - 130	3	25
1,2-Dichloro-1,1,2,2-tetrafluoroethane	20.2	16.1		ppb v/v		80	70 - 130	1	25
1,2-Dichlorobenzene	21.4	23.2		ppb v/v		109	70 - 130	2	25
1,3-Dichlorobenzene	21.8	23.1		ppb v/v		106	70 - 130	3	25
1,4-Dichlorobenzene	20.8	23.8		ppb v/v		115	70 - 130	3	25
Dichlorodifluoromethane	20.0	15.0		ppb v/v		75	70 - 130	3	25
1,1-Dichloroethane	19.8	17.4		ppb v/v		88	70 - 130	3	25
1,2-Dichloroethane	20.6	18.1		ppb v/v		88	70 - 130	6	25
1,1-Dichloroethene	19.2	16.4		ppb v/v		85	70 - 130	3	25
cis-1,2-Dichloroethene	20.4	17.6		ppb v/v		86	70 - 130	5	25
trans-1,2-Dichloroethene	20.2	17.5		ppb v/v		87	70 - 130	3	25
1,2-Dichloropropane	20.6	18.7		ppb v/v		91	70 - 130	6	25
cis-1,3-Dichloropropene	21.2	19.7		ppb v/v		93	70 - 130	5	25
trans-1,3-Dichloropropene	19.8	19.5		ppb v/v		98	70 - 130	3	25
Ethyl acetate	20.4	19.1		ppb v/v		94	70 - 130	4	25
Ethylbenzene	21.0	20.5		ppb v/v		98	70 - 130	3	25
4-Ethyltoluene	20.6	20.8		ppb v/v		101	70 - 130	3	25
n-Heptane	20.6	17.8		ppb v/v		87	70 - 130	6	25
Hexachlorobutadiene	21.2	26.0		ppb v/v		122	70 - 130	4	25
n-Hexane	20.0	16.6		ppb v/v		83	70 - 130	5	25
2-Hexanone	21.8	23.2		ppb v/v		106	70 - 130	1	25
Isopropylbenzene	21.0	20.6		ppb v/v		98	70 - 130	4	25
Methyl-t-Butyl Ether (MTBE)	20.6	19.2		ppb v/v		93	70 - 130	4	25
4-Methyl-2-pentanone (MIBK)	21.0	22.2		ppb v/v		106	70 - 130	5	25
Methylene chloride	21.0	15.8		ppb v/v		75	70 - 130	5	25
Naphthalene	21.0	24.4		ppb v/v		116	70 - 130	0	25
n-Octane	20.6	17.0		ppb v/v		82	70 - 130	4	25
Propene	21.2	15.9		ppb v/v		75	70 - 130	5	25
n-Propylbenzene	20.0	20.2		ppb v/v		101	70 - 130	4	25
Styrene	21.4	23.0		ppb v/v		107	70 - 130	3	25
1,1,2,2-Tetrachloroethane	21.4	22.2		ppb v/v		104	70 - 130	3	25
Tetrachloroethene	19.6	16.1		ppb v/v		82	70 - 130	2	25
Tetrahydrofuran	20.6	19.8		ppb v/v		96	70 - 130	4	25
Toluene	20.8	21.6		ppb v/v		104	70 - 130	6	25
1,1,2-Trichloro-1,2,2-trifluoroethane	19.0	16.3		ppb v/v		86	70 - 130	4	25
1,2,4-Trichlorobenzene	21.4	25.0		ppb v/v		117	70 - 130	3	25
1,1,1-Trichloroethane	20.0	17.1		ppb v/v		85	70 - 130	4	25
1,1,2-Trichloroethane	20.8	18.8		ppb v/v		91	70 - 130	3	25
Trichloroethene	20.4	17.8		ppb v/v		87	70 - 130	5	25
Trichlorofluoromethane	19.4	16.8		ppb v/v		87	70 - 130	2	25
1,2,4-Trimethylbenzene	20.8	21.7		ppb v/v		105	70 - 130	2	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36918/6
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,3,5-Trimethylbenzene	21.2	20.4		ppb v/v		96	70 - 130	5	25
2,2,4-Trimethylpentane	20.2	17.3		ppb v/v		86	70 - 130	5	25
Vinyl acetate	21.6	22.1		ppb v/v		102	70 - 130	5	25
Vinyl bromide	20.6	18.0		ppb v/v		87	70 - 130	4	25
Vinyl chloride	20.4	17.3		ppb v/v		85	70 - 130	2	25
m,p-Xylene	41.2	40.4		ppb v/v		98	70 - 130	3	25
o-Xylene	21.4	20.3		ppb v/v		95	70 - 130	3	25
n-Nonane	20.0	19.2		ppb v/v		96	70 - 130	4	25

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetone	48	42.5		ug/m3		89	70 - 130	5	25
Allyl chloride	66	58.6		ug/m3		89	70 - 130	5	25
Benzene	65	56.0		ug/m3		87	70 - 130	5	25
Benzyl chloride	110	97.8		ug/m3		87	70 - 130	4	25
Bromodichloromethane	140	119		ug/m3		87	70 - 130	5	25
Bromoform	210	202		ug/m3		95	70 - 130	2	25
Bromomethane	78	68.8		ug/m3		88	70 - 130	4	25
1,3-Butadiene	45	39.4		ug/m3		87	70 - 130	3	25
2-Butanone (MEK)	61	58.4		ug/m3		95	70 - 130	3	25
n-Butylbenzene	120	122		ug/m3		105	70 - 130	3	25
sec-Butylbenzene	110	112		ug/m3		99	70 - 130	4	25
tert-Butylbenzene	110	106		ug/m3		93	70 - 130	5	25
Carbon disulfide	64	49.8		ug/m3		78	70 - 130	3	25
Carbon tetrachloride	130	117		ug/m3		90	70 - 130	6	25
Chlorobenzene	98	90.3		ug/m3		93	70 - 130	3	25
Chloroethane	53	46.4		ug/m3		88	70 - 130	4	25
Chloroform	100	86.7		ug/m3		87	70 - 130	4	25
Chloromethane	42	35.7		ug/m3		85	70 - 130	3	25
Cyclohexane	70	59.3		ug/m3		84	70 - 130	6	25
Dibromochloromethane	190	159		ug/m3		82	70 - 130	4	25
1,2-Dibromoethane (EDB)	160	149		ug/m3		93	70 - 130	3	25
1,2-Dichloro-1,1,2,2-tetrafluoroethane	140	112		ug/m3		80	70 - 130	1	25
1,2-Dichlorobenzene	130	140		ug/m3		109	70 - 130	2	25
1,3-Dichlorobenzene	130	139		ug/m3		106	70 - 130	3	25
1,4-Dichlorobenzene	130	143		ug/m3		115	70 - 130	3	25
Dichlorodifluoromethane	99	74.1		ug/m3		75	70 - 130	3	25
1,1-Dichloroethane	80	70.5		ug/m3		88	70 - 130	3	25
1,2-Dichloroethane	83	73.2		ug/m3		88	70 - 130	6	25
1,1-Dichloroethene	76	65.0		ug/m3		85	70 - 130	3	25
cis-1,2-Dichloroethene	81	69.6		ug/m3		86	70 - 130	5	25
trans-1,2-Dichloroethene	80	69.3		ug/m3		87	70 - 130	3	25
1,2-Dichloropropane	95	86.3		ug/m3		91	70 - 130	6	25
cis-1,3-Dichloropropene	96	89.4		ug/m3		93	70 - 130	5	25
trans-1,3-Dichloropropene	90	88.5		ug/m3		98	70 - 130	3	25
Ethyl acetate	74	68.8		ug/m3		94	70 - 130	4	25
Ethylbenzene	91	89.1		ug/m3		98	70 - 130	3	25
4-Ethyltoluene	100	102		ug/m3		101	70 - 130	3	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36918/6
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
n-Heptane			84	73.1		ug/m3		87	70 - 130	6	25
Hexachlorobutadiene			230	277		ug/m3		122	70 - 130	4	25
n-Hexane			70	58.6		ug/m3		83	70 - 130	5	25
2-Hexanone			89	95.1		ug/m3		106	70 - 130	1	25
Isopropylbenzene			100	101		ug/m3		98	70 - 130	4	25
Methyl-t-Butyl Ether (MTBE)			74	69.4		ug/m3		93	70 - 130	4	25
4-Methyl-2-pentanone (MIBK)			86	91.1		ug/m3		106	70 - 130	5	25
Methylene chloride			73	54.9		ug/m3		75	70 - 130	5	25
Naphthalene			110	128		ug/m3		116	70 - 130	0	25
n-Octane			96	79.3		ug/m3		82	70 - 130	4	25
Propene			36	27.3		ug/m3		75	70 - 130	5	25
n-Propylbenzene			98	99.1		ug/m3		101	70 - 130	4	25
Styrene			91	97.9		ug/m3		107	70 - 130	3	25
1,1,2,2-Tetrachloroethane			150	153		ug/m3		104	70 - 130	3	25
Tetrachloroethene			130	109		ug/m3		82	70 - 130	2	25
Tetrahydrofuran			61	58.5		ug/m3		96	70 - 130	4	25
Toluene			78	81.3		ug/m3		104	70 - 130	6	25
1,1,2-Trichloro-1,2,2-trifluoroetha ne			150	125		ug/m3		86	70 - 130	4	25
1,2,4-Trichlorobenzene			160	185		ug/m3		117	70 - 130	3	25
1,1,1-Trichloroethane			110	93.0		ug/m3		85	70 - 130	4	25
1,1,2-Trichloroethane			110	103		ug/m3		91	70 - 130	3	25
Trichloroethene			110	95.7		ug/m3		87	70 - 130	5	25
Trichlorofluoromethane			110	94.4		ug/m3		87	70 - 130	2	25
1,2,4-Trimethylbenzene			100	107		ug/m3		105	70 - 130	2	25
1,3,5-Trimethylbenzene			100	100		ug/m3		96	70 - 130	5	25
2,2,4-Trimethylpentane			94	81.0		ug/m3		86	70 - 130	5	25
Vinyl acetate			76	77.9		ug/m3		102	70 - 130	5	25
Vinyl bromide			90	78.6		ug/m3		87	70 - 130	4	25
Vinyl chloride			52	44.3		ug/m3		85	70 - 130	2	25
m,p-Xylene			180	175		ug/m3		98	70 - 130	3	25
o-Xylene			93	88.0		ug/m3		95	70 - 130	3	25
n-Nonane			100	101		ug/m3		96	70 - 130	4	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*104*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*99*		*70 - 130*
Toluene-d8 (Surr)	*108*		*70 - 130*

Lab Sample ID: LCSD 320-36918/8
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2-Propanol			20.4	20.5		ppb v/v		100	70 - 130	0	25

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2-Propanol			50	50.3		ug/m3		100	70 - 130	0	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-36918/8
Matrix: Air
Analysis Batch: 36918

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
4-Bromofluorobenzene (Surr)	103		70 - 130
1,2-Dichloroethane-d4 (Surr)	96		70 - 130
Toluene-d8 (Surr)	104		70 - 130

QC Association Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-6137-1

Air - GC/MS VOA

Analysis Batch: 36918

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-6137-1	VML-02-150-VPT-021314	Total/NA	Air	TO-15	
320-6137-1 - DL	VML-02-150-VPT-021314	Total/NA	Air	TO-15	
320-6137-2	AMBIENT2-VPT-021314	Total/NA	Air	TO-15	
LCS 320-36918/5	Lab Control Sample	Total/NA	Air	TO-15	
LCS 320-36918/7	Lab Control Sample	Total/NA	Air	TO-15	
LCSD 320-36918/6	Lab Control Sample Dup	Total/NA	Air	TO-15	
LCSD 320-36918/8	Lab Control Sample Dup	Total/NA	Air	TO-15	
MB 320-36918/10	Method Blank	Total/NA	Air	TO-15	

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-6137-1

Client Sample ID: VML-02-150-VPT-021314

Lab Sample ID: 320-6137-1

Date Collected: 02/13/14 11:55

Matrix: Air

Date Received: 02/14/14 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		545	1 mL	250 mL	36918	02/24/14 01:04	TAD	TAL SAC
Total/NA	Analysis	TO-15	DL	2180	0.25 mL	250 mL	36918	02/24/14 09:37	TAD	TAL SAC

Client Sample ID: AMBIENT2-VPT-021314

Lab Sample ID: 320-6137-2

Date Collected: 02/13/14 09:21

Matrix: Air

Date Received: 02/14/14 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	486 mL	250 mL	36918	02/24/14 10:30	TAD	TAL SAC

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Certification Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-6137-1

Laboratory: TestAmerica Sacramento

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2928-01	03-31-14
Alaska (UST)	State Program	10	UST-055	02-28-14 *
Arizona	State Program	9	AZ0708	08-11-14
Arkansas DEQ	State Program	6	88-0691	06-17-14
California	State Program	9	2897	01-31-15
Colorado	State Program	8	N/A	08-31-14
Connecticut	State Program	1	PH-0691	06-30-15
Florida	NELAP	4	E87570	06-30-14
Guam	State Program	9	N/A	08-31-14
Hawaii	State Program	9	N/A	01-29-15
Illinois	NELAP	5	200060	03-17-15
Kansas	NELAP	7	E-10375	10-31-14
Louisiana	NELAP	6	30612	06-30-14
Michigan	State Program	5	9947	01-31-15
Nebraska	State Program	7	NE-OS-22-13	02-28-14 *
Nevada	State Program	9	CA44	07-31-14
New Jersey	NELAP	2	CA005	06-30-14
New York	NELAP	2	11666	03-31-14
Northern Mariana Islands	State Program	9	MP0007	02-28-14 *
Oregon	NELAP	10	CA200005	01-29-15
Pennsylvania	NELAP	3	9947	03-31-14
South Carolina	State Program	4	87014	06-30-14
Texas	NELAP	6	T104704399-08-TX	05-31-14
US Fish & Wildlife	Federal		LE148388-0	12-31-14
USDA	Federal		P330-11-00436	12-30-14
USEPA UCMR	Federal	1	CA00044	11-06-14
Utah	NELAP	8	QUAN1	02-28-15
Washington	State Program	10	C581	05-05-14
Wyoming	State Program	8	8TMS-Q	02-28-14 *

* Expired certification is currently pending renewal and is considered valid.

Method Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-6137-1

Method	Method Description	Protocol	Laboratory
TO-15	Volatile Organic Compounds in Ambient Air	EPA	TAL SAC

Protocol References:

EPA = US Environmental Protection Agency

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Sample Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-6137-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
320-6137-1	VML-02-150-VPT-021314	Air	02/13/14 11:55	02/14/14 09:30
320-6137-2	AMBIENT2-VPT-021314	Air	02/13/14 09:21	02/14/14 09:30

TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
phone 916.374.4378 fax 916.372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
TestAmerica Laboratories, Inc.

Client Contact Information	Project Manager: Robert Boudra	Samples Collected By: EL	COC No:
Company Name: WRS Corp	Phone: -		1 of 1 COCs
Address: 333 Wetmore Rd Suite 400	Email: Robert.Boudra@wrs.com		
City/State/Zip Tucson, Az, 85705			For Lab Use Only:
Phone: 520-887-1800	Site Contact: Janet Workman		Walk-in Client:
FAX:	TA Contact: Janet.Workman@wrs.com		Lab Sampling:
Project Name: Park/Euclid	Anaylsis Turnaround Time		
Site/Location:	Standard (Specific): X		Job / SDG No.: 22241866.00406
P O #	Rush (Specify):		(See below for Add't Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID EL	Canister ID	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
VML-D2-150-VPT-021314	2/13/14	1150	1155	28"	4"	34000713	7129	X											X			
Ambient 2 - VPT - 021314	2/13/14	0915	0921	27"	2"	34000960	7339	X											X			
— EL																						
Bad Canister/Flow Controller →						34000230	7233															Pressure Stayed at zero when in the open position

320-6137 Chain of Custody

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

Special Instructions/QC Requirements & Comments:

Samples Shipped by: Erin Fogarty	Date / Time: 2/13/14 1530	Samples Received by: 2-14-14 930	
Samples Relinquished by:	Date / Time:	Received by:	
Relinquished by:	Date / Time:	Received by:	
Lab Use Only: Shipper Name:	Opened by:	Condition:	

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-6137
Sample # 1

Client/Project:		VFR ID:		
Canister Serial #:	34000313	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8	01/14/14	JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.64	02/17/14	AO
FINAL PRESSURE (PSIA)	25.41	02/17/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.18			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							2/23/2014	MS2			
Canister DF =	2.18	X	Load DF =	2.5	X	Bag DF =	100	=	FINAL DF 545		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	100		Bvi (mLs)	10				
							Date	Instr.	File #		
							2/24/2014	MS2			
Canister DF =	2.18	X	Load DF =	10	X	Bag DF =	100	=	FINAL DF 2180		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	25		Bvi (mLs)	10				
							Date	Instr.	File #		
Canister DF =		X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-6137
Sample # 2

Client/Project:		VFR ID:		
Canister Serial #:	34000960	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8	01/14/14	JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.97	02/17/14	AO
FINAL PRESSURE (PSIA)	25.14	02/17/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 1.94			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
					#DIV/0!
					#DIV/0!
					#DIV/0!

Analytical Dilution Factors

Date	Instr.	File #
2/23/2014	MS2	

Canister DF = 1.95 X Load DF = 1.6666667 (LVf (mLs) 250, LVi (mLs) 150) X Bag DF = 1 (BVf (mLs), Bvi (mLs)) = FINAL DF 3.25

Date	Instr.	File #
2/24/2014	MS2	

Canister DF = 1.95 X Load DF = 0.5144033 (LVf (mLs) 250, LVi (mLs) 486) X Bag DF = 1 (BVf (mLs), Bvi (mLs)) = FINAL DF 1.00308642

Date	Instr.	File #

Canister DF = X Load DF = #DIV/0! (LVf (mLs), LVi (mLs)) X Bag DF = 1 (BVf (mLs), Bvi (mLs)) = FINAL DF #DIV/0!

Login Sample Receipt Checklist

Client: URS Corporation

Job Number: 320-6137-1

Login Number: 6137

List Number: 1

Creator: Hytrek, Cheryl

List Source: TestAmerica Sacramento

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

320-5574 Chain of Custody

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Sacramento

Canister QC Certification

Certification Type: TO-15

Date Cleaned/Batch ID D010614 320-5574

Date of QC 01/07/14

Data File Number ~~MS70~~ MS5010706

CR 01/08/14

CANISTER ID NUMBERS

34001950	34000910	
0313	0668	
0985	1382	
* 0960	1951	
1119		
0230		
0950		
0986		

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

1st level Reviewed By: _____ Date: 01/08/14

2nd level Reviewed By: _____ Date: 1/8/2014

Q:\FORMS\QA-814 CAN QC CERT 20130729.DOC
QA-814

ERS 7/29/2013

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5574-1

SDG No.:

Client Sample ID: 34000960 | Lab Sample ID: 320-5574-4

Matrix: Air | Lab File ID: MS5010706.D

Analysis Method: TO-15 | Date Collected: 01/06/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 17:06

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-5574-1

SDG No.:

Client Sample ID: 34000960 | Lab Sample ID: 320-5574-4

Matrix: Air | Lab File ID: MS5010706.D

Analysis Method: TO-15 | Date Collected: 01/06/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 01/07/2014 17:06

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 33345 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-5574-1

SDG No.:

Client Sample ID: 34000960 Lab Sample ID: 320-5574-4

Matrix: Air Lab File ID: MS5010706.D

Analysis Method: TO-15 Date Collected: 01/06/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 01/07/2014 17:06

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 33345 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	84		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	101		70-130
2037-26-5	Toluene-d8 (Surr)	97		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

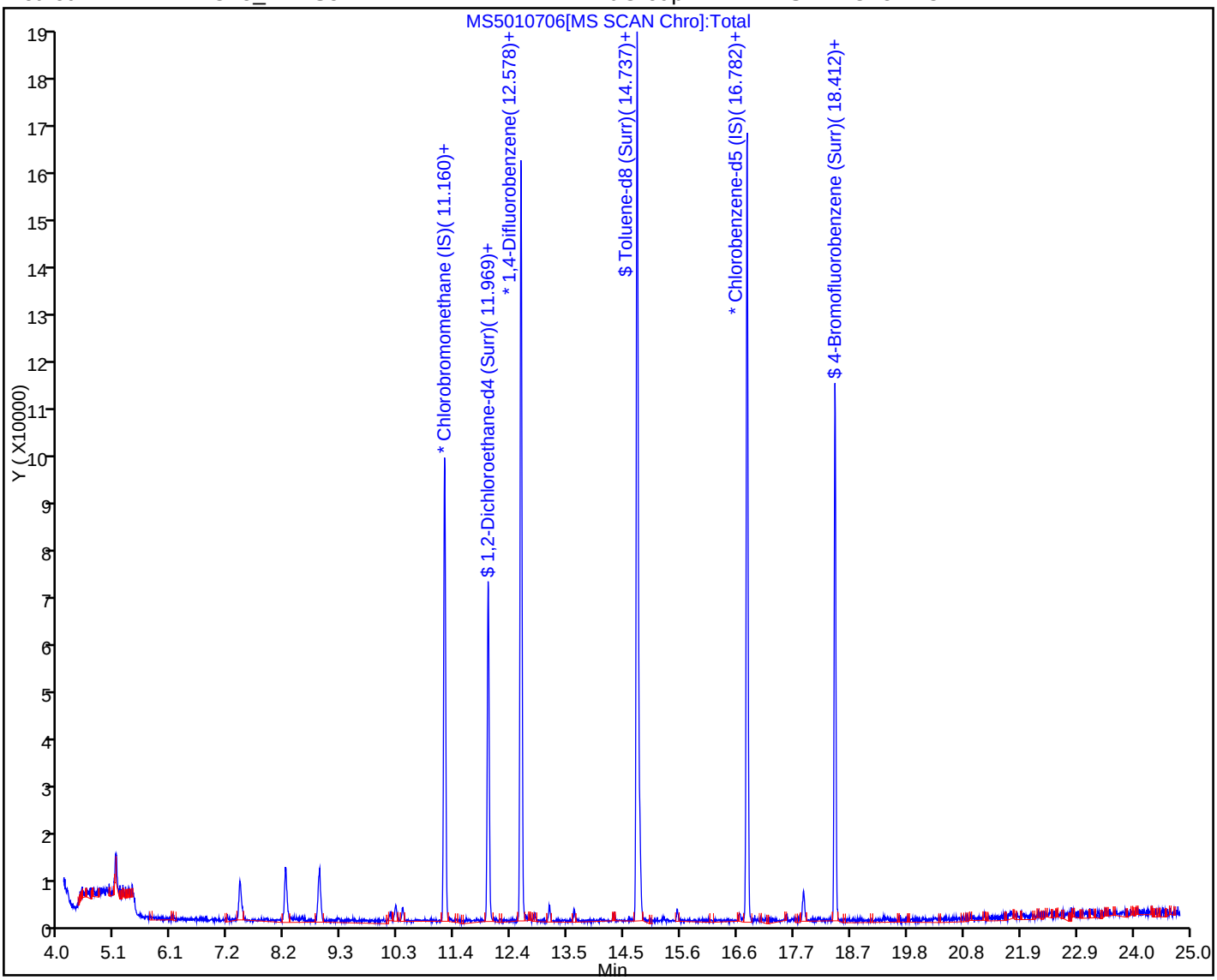
Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010706.D				
Lims ID:	320-5574-A-4	Lab Sample ID:	320-5574-4		
Client ID:	34000960				
Sample Type:	Client				
Inject. Date:	07-Jan-2014 17:06:30	ALS Bottle#:	4	Worklist Smp#:	6
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	SC can# 34000960				
Misc. Info.:	500mL; Can Certification Only!!				
Operator ID:	CR	Instrument ID:	ATMS5		
Method:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\TO15_ATMS5.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	08-Jan-2014 09:35:38	Calib Date:	07-Jan-2014 14:32:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010703.D				
Column 1 :		Detector	MS SCAN		
Process Host:	XAWRK034				
First Level Reviewer: roushc		Date:	08-Jan-2014 09:19:46		

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	91	40815	4.00	
* 2 1,4-Difluorobenzene	114	12.584	12.578	0.006	92	165392	4.12	
* 3 Chlorobenzene-d5 (IS)	117	16.782	16.781	0.001	88	114575	4.12	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.969	0.0	0	65102	4.03	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	95	99888	4.01	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	81	49913	3.47	

Report Date: 08-Jan-2014 09:36:33 Chrom Revision: 2.1 15-Oct-2013 07:52:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140107-9710.b\MS5010706.D				
Injection Date:	07-Jan-2014 17:06:30	Instrument ID:	ATMS5		
Lims ID:	320-5574-A-4	Lab Sample ID:	320-5574-4		
Client ID:	34000960				
Operator ID:	CR	ALS Bottle#:	4	Worklist Smp#:	6
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



WORK PLAN

LOWER VADOSE ZONE SOIL VAPOR EXTRACTION EARLY RESPONSE ACTION

PARK-EUCLID WQARF SITE TUCSON, ARIZONA

Registered Professional Engineer (Chemical)
CERTIFICATE NO.
37331
JANET M.
WORKMAN
Date Signed 6-4-14
ARIZONA, U.S.A.
EXPIRES 03-31-2017

Prepared for

Park-Euclid RP Group

June 4, 2014

URS

URS Corporation
8181 E. Tufts Avenue
Denver, CO 80237

Project No. 22241866.00406

TABLE OF CONTENTS

Section 1 Introduction 1-1

1.1 Purpose and Approach 1-1
1.2 Background 1-1

Section 2 Treatment Alternative Evaluation – Rationale for ERA 2-1

2.1 Lower Vadose Zone and Regional Aquifer Conditions 2-1
2.2 SVE Pilot Test 2-1
2.3 Treatment Alternative Rationale 2-2

Section 3 Description of the Work 3-1

3.1 SVE System Design and Permitting 3-1
3.1.1 System Conceptual Design 3-1
3.1.2 Equipment Procurement 3-2
3.1.3 Permitting 3-2
3.2 Equipment Installation 3-3
3.3 System Start-UP 3-3
3.4 System Operation and Maintenance 3-3
3.4.1 Permit Compliance 3-4
3.4.2 System Performance Monitoring 3-4
3.4.3 Condensate Handling 3-4
3.4.4 Granular Activated Carbon and PIZB 3-5
3.4.5 Reporting 3-5
3.5 System Shutdown and Rebound Testing 3-5

Section 4 Community Involvement Activities 4-1

4.1 Community Involvement Approach 4-1
4.2 Community Involvement Plan 4-1

Section 5 Schedule 5-1

Section 6 References 6-1

TABLE OF CONTENTS

List of Tables

Table 1 Lower Vadose Zone SVE System Monitoring and Sampling Summary

List of Figures

Figure 1 Site Location

Figure 2 Well Locations at Mission Plant Area

Figure 3 Time Series Graph PER-14A

List of Appendices

Appendix A Site Visit Log Forms

Appendix B PDEQ Permit Conditions

List of Acronyms

inH_2O	inches water column
µg/L	micrograms per liter
AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
bgs	below ground surface
CAB	Community Advisory Board
CIP	Community Involvement Plan
cDCE	cis-1,2-dichloroethene
ERA	Early Response Action
FS	Feasibility Study
the Group	The Park-Euclid Group
LVZ	Lower Vadose Zone
Mission	Mission Linen Supply
Mission Plant	301 South Park Avenue Mission Facility
MBE	Miller Brooks Environmental, Inc.
MPE	multi-phase extraction
O&M	operation and maintenance
PCE	tetrachloroethene
PDB	passive diffusion bag sampler
PDEQ	Pima County Department of Environmental Quality
PID	photoionization detector
PVC	poly vinyl chloride
ROI	radius of influence
RI	Remedial Investigation
scfm	standard cubic feet per minute
SVE	soil vapor extraction
TCE	trichloroethene
the Site	Park – Euclid WQARF Site
URS	URS Corporation
UVZ	Upper Vadose Zone
VC	vinyl chloride
VOCs	volatile organic compounds
WQARF	Water Quality Assurance Revolving Fund

Certification Page

This Early Response Action Work Plan for the Park – Euclid Water Quality Assurance Revolving Fund (WQARF) Site in Tucson, Arizona was prepared by URS Corporation (URS) on behalf of the Park – Euclid Group. This report has been prepared under the supervision of the undersigned and is consistent with the usual thoroughness and competence of the environmental and engineering professions. Interpretations are in accordance with generally accepted engineering principles and practices. No other warranty is expressed or implied.

Registered Professional Engineer (Chemical)
CERTIFICATE NO.
37331
JANET M.
WORKMAN
Date Signed 6-4-14
ARIZONA, U.S.A.
EXPIRES 03-31-2017

Janet M. Workman
Arizona Professional Chemical Engineer
Number 37331

Robert A. Boudra
Principal Hydrogeologist
Project Manager

1.1 PURPOSE AND APPROACH

This Early Response Action (ERA) Work Plan (Work Plan) describes the overall scope of work and specific field activities that will be used during implementation of a Lower Vadose Zone (LVZ) Soil Vapor Extraction (SVE) ERA for the Park-Euclid WQARF Site (the Site) in Tucson, Arizona (Figure 1). This ERA is proposed in accordance with Arizona Administrative Code (AAC) Title 18, Chapter 16, Section 405, A.1 through A.4 to address a current risk to the environment posed by volatile organic compounds (VOCs) within the LVZ, to help protect the water supply in the Regional Aquifer, to clean up VOCs in LVZ source area, and to prevent documented VOCs in the LVZ from reaching the Regional Aquifer, thereby reducing the ultimate scope and cost of the final remedy for the Site. This work is being performed by the Park – Euclid Group (the Group) under an Agreement to Conduct Work with the Arizona Department of Environmental Quality (ADEQ) dated July 16, 2010. The objective of the LVZ ERA is to remove chlorinated volatile organic compounds (VOCs) from the LVZ and the capillary zone above the Regional Aquifer beneath the Mission Linen Supply (Mission) Facility located at 301 South Park Avenue in Tucson (the Mission Plant).

This Work Plan was developed in accordance with the requirements of the AAC Title 18, Chapter 16, Section 405.D. Specifically the Work Plan will address the rationale for implementing SVE in the LVZ (Section 2.0), describe the design, installation, start-up, and operation of the SVE system (Section 3.0), describe the community involvement activities required by AAC R18-16-404 and the Park-Euclid Community Involvement Plan (Section 4.0), and propose a schedule for the ERA implementation (Section 5.0).

1.2 BACKGROUND

In the late 1960s, the previous owners of the Mission Plant, Haskell Linen, began dry cleaning operations at the plant. Dry cleaning ceased in 1985, two years after Mission purchased the facility from Haskell Linen. According to past reports, accidental spills of tetrachloroethene (PCE) occurred in the vicinity of the former dry cleaning area, resulting in releases of liquid PCE to the subsurface through joints and cracks in the concrete slab of the building, and through discharges to floor drains, sewer lines, and sumps. Soil and soil vapor sampling have identified elevated concentrations of chlorinated VOCs consisting of PCE and its degradation products trichloroethene (TCE), cis-1,2-dichloroethene (cDCE), and vinyl chloride (VC) in both the shallow soil and groundwater beneath the Site.

The upper vadose zone underlying the Site extends to a depth of approximately 90 feet below ground surface (bgs) where the Perched Aquifer is encountered. A significant quantity of free-phase diesel fuel (originating from an offsite source) is present at the water-table surface of the Perched Aquifer beneath the Site and contains elevated concentrations of chlorinated VOCs. Former water supply wells for the Mission Plant, termed Old Well and MP-1, were sources of contamination to the Regional Aquifer as the annular space surrounding the casing of the former water-supply wells are the suspected conduits that allowed contaminants in the Perched Aquifer to reach the deeper Regional Aquifer and the LVZ underlying the Perched Aquifer. These supply wells were properly abandoned and sealed in the 1990s.

Site investigations associated with the Perched and Regional Aquifers are summarized in the November 15, 2011 *Final Remedial Investigation Report* (RI) prepared by Tetra Tech GEO (TTG) for ADEQ (TTG, 2011).

In 2013, The Group submitted a Feasibility Study (FS) Work Plan (URS, 2013), which was approved by ADEQ on June 17, 2013. Field activities associated with the FS Work Plan began in January 2014, including a pilot test of SVE in the LVZ, as summarized in Section 2.2.

2.1 LOWER VADOSE ZONE AND REGIONAL AQUIFER CONDITIONS

As described in the RI (TTG, 2011), the subsurface beneath the Site can be divided into five hydrostratigraphic zones. Each of these five zones is comprised of interbedded sands and clays. The sediments are largely unconsolidated, although thin intervals of partially indurated sediments are encountered during drilling. From shallowest to deepest, the five zones include the:

- Upper Vadose Zone (UVZ) from 0 to 85 feet bgs;
- Perched Aquifer from 85 to 95 feet bgs;
- Upper Aquitard from 90 to 110 feet bgs;
- LVZ from 110 to 200 feet bgs; and
- Regional Aquifer from 200 feet to an undetermined depth greater than 500 feet bgs.

The LVZ and upper portion of the Regional Aquifer are the zones of interest with respect to this Work Plan and are described further below.

The LVZ was characterized by ADEQ and its consultants during the RI (TTG, 2011), which included completing three LVZ soil vapor wells (i.e., VML-01, VML-02, and VEL-03) in the immediate vicinity of the Mission Plant (Figure 2). In addition to soil vapor samples from the three vapor wells, discrete soil samples were collected from the LVZ for laboratory analysis in VML-01 and VML-02 and from Regional Aquifer groundwater monitoring wells PER-14, PER-14A, and WR-347B during drilling. The RI analytical results documented significant concentrations of petroleum hydrocarbons and VOCs in the LVZ above the Regional Aquifer in the immediate vicinity of the Mission Plant, particularly in the interval from 165 to 190 feet bgs. Routine vapor sampling has been conducted at VML-01 and VML-02 since 2012 has identified PCE and its degradation products TCE and cDCE in soil vapor at both soil vapor monitoring wells, with typically greater concentrations at VML-02.

VOC concentrations in groundwater at PER-14A increased substantially between when the well was installed in October 2008 to early 2012, with subsequent decreasing concentrations (Figure 3). In particular, PCE and cDCE increased in concentration from 2.1 and less than 1.0 micrograms per liter (µg/L), respectively when the well was initially installed to 400 and 2,000 µg/L, respectively, during the February 2012 monitoring event. Since February 2012, concentrations of PCE and cDCE at PER-14A have decreased to below150 µg/L and 500 µg/L, respectively (Figure 3). Significantly, elevated concentrations of PCE degradation products (i.e., TCE and cDCE) suggest that the source of the contamination is likely elevated VOC and petroleum hydrocarbon concentrations in the LVZ. Prior to 2011, these degradation products were observed within the LVZ in soil and soil vapor, but were not observed in groundwater within the Regional Aquifer at these elevated concentrations.

2.2 SVE PILOT TEST

The FS Work Plan recommended that a short-term SVE pilot test be performed in the LVZ to evaluate its potential to remove VOCs from documented soil contamination in the LVZ that are suspected to serve as a source of contamination to the upper portion of the Regional Aquifer. The proposed pilot test was conducted in January 2014 with follow-up rebound vapor sampling

occurring in February 2014. The results and conclusions from the LVZ SVE Pilot Test are detailed in a Technical Memorandum from URS to ADEQ dated June 2, 2014 (URS, 2014).

Notable findings from the LVZ SVE pilot test include:

- SVE is believed to be a feasible technology to effectively remove VOCs from the LVZ.
- The contamination source within the LVZ is estimated to be relatively limited (i.e., approximately 36,400 cubic yards of soil) based on VOC vapor concentration decreases during the test and a lack of rebound during the 30 days following cessation of the SVE pilot test.
- The radius of influence (ROI) for the test extraction well (VEL-03) varied by depth interval and was estimated from observed vacuums and concentration changes in observation points. The ROI was calculated to be approximately 66 feet and greater than 150 feet at depth intervals of 170 and 190 feet bgs, respectively.
- Implementation of SVE is anticipated to improve groundwater quality near PER-14A.
- The operational life for LVZ SVE was estimated to be about 9 months to remove the VOC mass in the LVZ estimated from the pilot test, based on predictive modeling.

2.3 TREATMENT ALTERNATIVE RATIONALE

The remedial objective for groundwater at the Site, as defined in the Remedial Objectives Report (ADEQ, 2008), is:

> To protect for the use of the groundwater supply by the University of Arizona near the Park-Euclid WQARF site from contamination from the site. This action is needed for the present time and for as long as the UA wells are used for potable purposes, the resource remains available, and their use is threatened as a result of contamination from the Park-Euclid WQARF site. This action is also needed to protect potential future use of the groundwater supply for the City of Tucson, which is not expected within the next five to ten years.

The purpose of this ERA is to help achieve the above objective by removing VOCs in the LVZ that could continue to act as source of contamination to the Regional Aquifer. Based on the results of the SVE pilot test, SVE is recommended as an ERA for the LVZ.

3.1 SVE SYSTEM DESIGN AND PERMITTING

The goal of the LVZ SVE ERA is to remove VOCs from the LVZ contamination source to protect Regional Aquifer groundwater from future contamination.

3.1.1 System Conceptual Design

This section provides an overview of the design elements for the proposed ERA LVZ SVE. The final design details will be determined during execution of the Work Plan. The ERA LVZ SVE system is proposed to consist of the following elements:

- SVE blower – The SVE blower is tentatively proposed to be a 1 horsepower, 110-volt, regenerative blower capable of imposing a vacuum of 25 inches water (in H_2O) column at a flow rate of about 65 standard cubic feet per minute (scfm). The location of the SVE blower is proposed to be adjacent to the existing multi-phase extraction (MPE) system piping located at the north end of the loading dock at the Mission Plant (Figure 2).
- Extraction wells – The SVE blower will be used to concurrently extract vapor from wells VEL-3 and PER-14A. Well VEL-3 is expected to produce about 55 scfm and Well PER-14A is expected to produce less than 10 scfm at the applied vacuum of 25 in H_2O.
- Wellhead connections and extraction piping – Extraction piping will connect well VEL-3 from the existing wellhead to the SVE blower assembly using above-ground Schedule 80 poly vinyl chloride (PVC) piping. The piping will be located within an existing fenced treatment compound. Because VEL-3 is also located within the existing fenced treatment compound, the protective lid will be removed from the well vault and the PVC piping will be directly connected to the well casing. Because PER-14A is located outside of the fenced area, this wellhead will be modified to allow underground piping to connect to the well casing using a tee fitting. The underground piping will be routed within a short piping trench into the directly adjacent fenced treatment compound where the piping will transition to aboveground Schedule 80 PVC piping. Piping diameter and lengths and fitting types will be determined during execution of the Work Plan. (Note that the PER-14A top-of-casing elevation will be re-surveyed following re-construction of the wellhead.)
- Moisture knockout – A moisture knockout vessel will be specified for installation between the extraction wells and the inlet side of the SVE blower.
- Controls – The use of controls to shut down the SVE system when the condensate level in the moisture knockout exceeds a designated level will be considered when finalizing the design. An hour meter will be used to track hours of operation of the SVE blower.
- Vapor abatement – Vapor abatement of the VOC-laden extracted vapor is proposed to consist of the existing vapor treatment system associated with the MPE system, which includes three 2,000-pound granular activated carbon (GAC) vessels in series and one "polishing" vessel filled with 500-pounds of permanganate-impregnated zeolite beads (PIZB - Hydrosil HS-600). The MPE system is currently offline and will not operate concurrently with the proposed SVE system.

- Discharge piping – Vapor exhaust piping from SVE blower is proposed to consist of a combination of SCH 80 PVC pipe and flexible hose to connect to the existing vapor abatement equipment piping manifold. Discharge piping to atmosphere for the assembled extraction system will consist of the existing discharge stack for the MPE system.
- Electrical service – the electrical service for the SVE blower is proposed to consist of an existing 110-volt electrical outlet adjacent to the loading dock at the Mission Plant and within the existing footprint of the MPE system. The blower will be connected to the outlet using a power cord.

Final design is considered to be a component of execution of this Work Plan; however, a formal design report will not be generated. ERA design activities to be conducted prior to installation will include the following:

- Final sizing and specification of the vacuum blower to be used for the SVE system.
- Sizing and specification of the moisture knockout vessel.
- Evaluation of the requirement for and specification for controls for the SVE system.
- Evaluation and specification of the electrical supply required for the SVE system and verification that the existing electrical outlet is suitable for the temporary operation of the SVE blower. Should the electrical outlet not be of sufficient amperage for operation of the SVE system, an Arizona-licensed electrical engineer will be subcontracted to design the electrical supply for the SVE blower and controls and to prepare electrical drawings suitable for submittal to the City of Tucson Development Services.

URS does not anticipate that formal construction drawings will be required for this installation. Diagrams will consist of a process flow diagram, a site plan indicating blower placement, location of above-ground piping runs, and the location of the electrical outlet to power the blower. A simple wellhead construction diagram indicating the underground piping connection to PER-14A and a trench cross-section will be prepared to guide field personnel in the installation of the system.

3.1.2 Equipment Procurement

URS will evaluate whether rental or purchase of SVE equipment is more cost effective for the estimated 9-month operation time. URS will solicit bids for the equipment and will select the vendor who can provide the specified equipment for the lowest cost.

3.1.3 Permitting

The ERA will involve modification of the existing air permit and may involve a Tucson Development Services (i.e., building) permit. These permits are described in the sections below.

3.1.3.1 Air Permit

Prior to delivery of the equipment to the Site, URS will coordinate with the Pima County Department of Environmental Quality (PDEQ) Air Quality Program to modify the existing permit (see Appendix B) to use the existing MPE system vapor abatement equipment (i.e., three 2,000-pound GAC vessels and a single vessel containing 500 pounds of PIZB) to treat extracted

vapors from the SVE system. The MPE system is currently off-line and will remain shut down during the SVE system operation. URS anticipates that such a modification may be made as a "Facility Change Without Permit Revision" and will require only a seven-day advance notice to the PDEQ. URS will investigate the option to modify the permit to allow operation in either MPE mode (at 150 scfm) or SVE mode (at less than 100 scfm) Note that all existing permit conditions will apply to the SVE system including flow rate restrictions (150 standard cubic feet per minute) and emission concentration limits.

3.1.3.2 Building Permit

URS does not anticipate that a City of Tucson Development Services permit will be required for this system. If hard-wiring of the electrical service is required (i.e., the adjacent electrical outlet is not sufficient to power the SVE blower), URS will prepare construction drawings and apply for a Development Services permit.

3.2 EQUIPMENT INSTALLATION

URS will install the SVE system in accordance with the developed process flow diagram, Site plan, and wellhead construction diagram. URS field technicians will place the SVE blower and moisture knockout vessel at their designated locations and construct the above-ground piping runs and connections. A licensed subcontractor will be used to make the underground connection to PER-14A and re-construct the wellhead. If necessary, a licensed electrician will be subcontracted to install electrical wiring and conduit to the SVE blower.

3.3 SYSTEM START-UP

A brief description of the system start-up activities is presented below:

1. Initial temporary system start-up. The system will be started and initial system monitoring and sampling of the vapor influent (designated as VSP-3) and effluent (designated as VSP-8) streams will be conducted. The system will be shut down following this sampling pending receipt of the analytical results. Following confirmation that the analytical results meet the requirements of the air operating permit, the system will be started for continuous operation. The sampling frequency during system start-up will be on a semi-weekly basis for one week, followed by weekly sampling for three weeks. A summary of proposed system operational monitoring and permit compliance sampling is provided in Table 1 and includes analytical methods, sample locations, and sampling frequency.
2. System monitoring will be conducted during each visit. Monitoring will consist of photoionization detector (PID) measurements, vacuum measurements, and mechanical system checks as laid out in the Site Visit Log Forms (Appendix A). Site visits will be conducted daily for the first week of continuous operation, and twice weekly for an additional 3 weeks before moving to the routine operation phase.

3.4 SYSTEM OPERATION AND MAINTENANCE

Normal operation and maintenance (O&M) will occur on a weekly basis following the start-up phase. During weekly inspections, the Site Visit Log will be completed and air and liquid

sampling will be conducted at the frequency required by the air quality permit (Table 1). A visual inspection of the wellhead connection and above-ground piping will also be performed on a weekly basis. Additionally, any necessary minor repair tasks will be completed. Major repair tasks will be logged and reported to the URS project manager immediately. The URS project manager will then notify the Group and ADEQ prior to initiating repairs.

Regular system operation is expected to continue until VOC vapor concentrations have been reduced to an asymptotic level, which is expected to occur within 9 months.

3.4.1 Permit Compliance

The treatment system will be operated in compliance with the air operating permit. Pima County Air Quality Operating Permit #2144 governs the ambient treated vapor discharges and vapor system operating limits. The existing permit is attached as Appendix B.

Generally, during routine operation, the permit requires monthly collection of vapor influent and effluent samples for laboratory analysis and weekly monitoring of the vapor treatment system operation using a PID. Vapor samples submitted for laboratory analysis will be analyzed by an Arizona-licensed laboratory for VOCs using U.S. EPA Method TO-15.

3.4.2 System Performance Monitoring

Soil vapor and groundwater concentration data will continue to be collected as part of long-term monitoring and to support FS evaluation.

Soil vapor samples will be collected from VEL-03, PER-14A, and each of the four wells within the well clusters at VML-01 and VML-02 prior to SVE startup and on a quarterly basis following startup. Soil vapor samples will be analyzed at an Arizona-licensed laboratory using EPA Method TO-15 for target analytes (i.e., PCE, TCE, cDCE, and VC). Soil vapor samples from VEL-03 and PER-14A will consist of grab samples collected from the extracted soil vapor during system operation. Samples will be collected from VML-01 and VML-02 in accordance with URS soil vapor sampling procedures described in the Long-Term Monitoring Work Plan (URS, 2010). The LVZ SVE system will be temporarily shut down during sampling of VML-01 and VML-02.

Groundwater samples will be collected on a quarterly basis from well PER-14A during SVE operation to evaluate whether SVE operation favorably impacts groundwater quality in this well. Groundwater samples will be collected using passive diffusion bag samplers (PDBs) in accordance with the procedures described in the Long-Term Monitoring Work Plan (URS, 2010). Groundwater samples will be submitted to an Arizona-licensed laboratory for analysis of VOCs using U.S. EPA Method 8260b.

3.4.3 Condensate Handling

Condensate from the SVE system is expected to be generated during the winter season. Condensate will be pumped from the SVE moisture knockout through liquid-phase GAC and into the MPE system treated water tank for eventual discharge into the sanitary sewer in accordance with the discharge permit for the MPE system.

3.4.4 Granular Activated Carbon and PIZB

GAC performance will be monitored in accordance with the existing requirements of Air Permit 2144. When breakthrough of the lead GAC vessel occurs, the spent GAC will be replaced with fresh GAC and the vessel will be moved into the lag vessel position. The intermediate vessel will be moved into the lead position, and the vessel previously in the lag position will be moved into the intermediate position. The movement of vessels from lead to lag to intermediate positions is achieved using an existing valve manifold.

Status of the PIZB will be monitored using PID readings, effluent analytical results, and based on visual confirmation, as the PIZB color changes from purple to brown when the permanganate reacts with any VOCs that may not be adsorbed in the GAC vessels.

3.4.5 Reporting

Reports summarizing system operation and compliance sampling will be produced following the start-up period and following the end of each quarter of operation. Reports will also include results of sampling associated with performance monitoring.

Reports will be submitted to ADEQ and the Group within 60 days of the end of the Reporting Period. Reporting periods will consist of calendar quarters.

3.5 SYSTEM SHUTDOWN AND REBOUND TESTING

Once SVE concentrations have reached an asymptotic level for a period of three consecutive months, which is predicted to occur by 9 months of SVE operation, the SVE system will be shut down and rebound testing will commence. Should asymptotic levels not be achieved within the 9-month operation period, an evaluation will be conducted to determine whether or not to continue SVE operation or to conduct rebound testing.

Rebound testing will consist of collection of soil vapor samples from VML-01, VML-02, VEL-03, and PER-14A in accordance with the standard operating procedures established for long-term monitoring (URS, 2010). Samples will be collected on a monthly basis for 3 months and on a quarterly basis thereafter for two quarters to evaluate whether or not VOC concentrations rebound to levels above the concentrations observed at the conclusion of the SVE system operation. Such rebound may indicate volatilization of VOCs from a low permeability zone in soil into soil vapor or volatilization of VOCs from regional groundwater into soil vapor.

If soil vapor concentrations rebound, the continued long-term operation of the LVZ SVE system will be considered. In addition, if soil vapor concentrations rebound and the LVZ SVE system is not reactivated, the continuation of quarterly groundwater sampling at PER-14A will be evaluated to determine if increasing soil vapor concentrations have a long-term impact on groundwater quality within this well.

4.1 COMMUNITY INVOLVEMENT APPROACH

ADEQ prepared a Community Involvement Plan (CIP) for the Site in accordance with the AAC R18-16-404 and A.R.S §49-287.03. The plan was originally published September 2004 and was prepared by ADEQ and LL Decker & Associates (ADEQ, 2004). At this time ADEQ retains all responsibility for leading community involvement activities.

4.2 COMMUNITY INVOLVEMENT PLAN

Community involvement activities for the ERA will include a short presentation at an ADEQ-led Community Advisory Board (CAB) meeting to summarize results of the LVZ SVE pilot test, describe the proposed LVZ SVE system and operation, and answer community questions. Additionally, regular community correspondence provided by ADEQ will include any applicable information on the ERA operation deemed appropriate by ADEQ. The Group will assist ADEQ with community involvement activities, on an as needed basis.

A proposed schedule for the implementation of the ERA is provided below:

Activity	Tentative Completion or Start Date[1]
Submittal of ERA Work Plan to ADEQ	June 5, 2014
ADEQ Notice of Work Plan Approval	July 3, 2014
Group Approval of ERA Work Authorization	August 1, 2014
SVE System Final Design and Permit Notifications	August 29, 2014
SVE System Procurement	October 10, 2014
PER-14A Wellhead Modifications	October 10, 2014
System Installation and Startup[2]	October 17, 2014
Receipt of Startup Sampling Analytical Results	October 31, 2014
Normal SVE Operation Begins	November 3, 2014
SVE System Shutdown	July 31, 2015

Notes:

[1] If the SVE blower cannot be operated using electrical power from an existing 110-volt outlet, the design and permitting schedule will be modified to reflect the preparation of electrical design drawings and City of Tucson Development Services permitting.

[2] Tentative startup date. The actual startup date will depend upon receipt of permit approval from the Pima Department of Environmental Quality.

The sampling schedule is provided in Table 1. The reporting schedule is provided in Section 3.4.5.

Arizona Administrative Code. Title 18, Chapter 16.

Arizona Department of Environmental Quality (ADEQ), 2004. Community Involvement Plan. Park-Euclid WQARF Site, Tucson, Arizona. September.

ADEQ, 2008. Remedial Objectives Report, Park – Euclid Water Quality Assurance Revolving Fund Site, Tucson, Arizona. April 15.

Tetra Tech GEO (TTG), 2011. Final Remedial Investigation Report, Park-Euclid WQARF Site, Tucson, Arizona. Prepared for: Arizona Department of Environmental Quality. November 15.

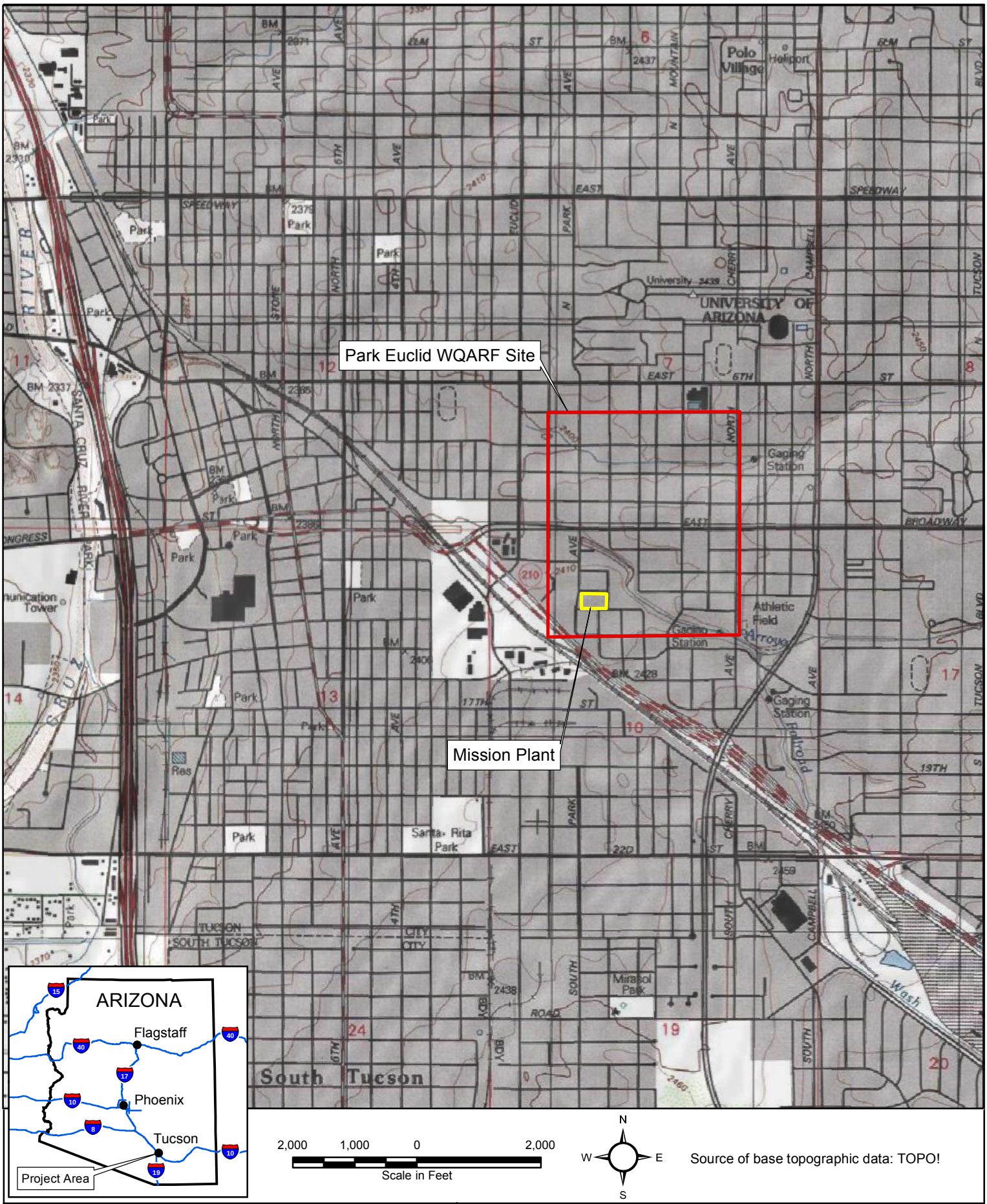
URS Corporation (URS), 2010. Work Plan for Long – Term Monitoring, Park – Euclid WQARF Site, Tucson, Arizona. Prepared for: Park – Euclid Responsible Parties. November 19.

URS, 2013. Work Plan for Feasibility Study and Associated Activities, Park – Euclid WQARF Site, Tucson, Arizona. Prepared for: Park – Euclid Responsible Parties. June 21.

URS, 2014. Lower Vadose Zone SVE Pilot Test Technical Memorandum, Park-Euclid WQARF Site. Prepared for: Park-Euclid Group, June 2.

Table 1
Lower Vadose Zone SVE System Monitoring and Sampling Summary
Park-Euclid WQARF Site
Tucson, Arizona

Activity Type	Activity	Well/Sample Location	Event Frequency	Analysis Method
Performance Monitoring	Groundwater Sampling	PER-14A	Quarterly	8260B
	Soil Vapor Sampling	VML-02 (130, 150, 170, 190) VEL-03 PER-14A	Prior to Startup and Quarterly thereafter	TO-15
Compliance Monitoring	Inlet and Effluent Vapor Sampling and Analysis	VSP-3 (Inlet) and VSP-8 (Outlet)	Startup Twice Weekly (for 1 week) Weekly (for 3 weeks) Monthly thereafter	TO-15 and TO-3
		VSP-3 (Inlet) and VSP-8 (Outlet) and intermediate points VSP-5 through VSP-7	Daily (for 1 week) Twice Weekly (for 3 weeks) Weekly thereafter	Field (PID)
	Flow Rate Monitoring	Adjacent to VSP-8	Daily (for 1 week) Twice Weekly (for 3 weeks) Weekly thereafter	Field (Thermal Anemometer)



Source of base topographic data: TOPO!

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

Date: May 2014

SITE LOCATION
PARK-EUCLID WQARF SITE
301 SOUTH PARK AVENUE
TUCSON, ARIZONA

Y:/GIS/Projects/Mission/Park_Euclid/Proj13/FS_Final/Fig1_SiteLocation.mxd

Figure 1

Aerial Photography Source: Pima County, Arizona GIS 2010

URS

Project Name: Park-Euclid WQARF Site

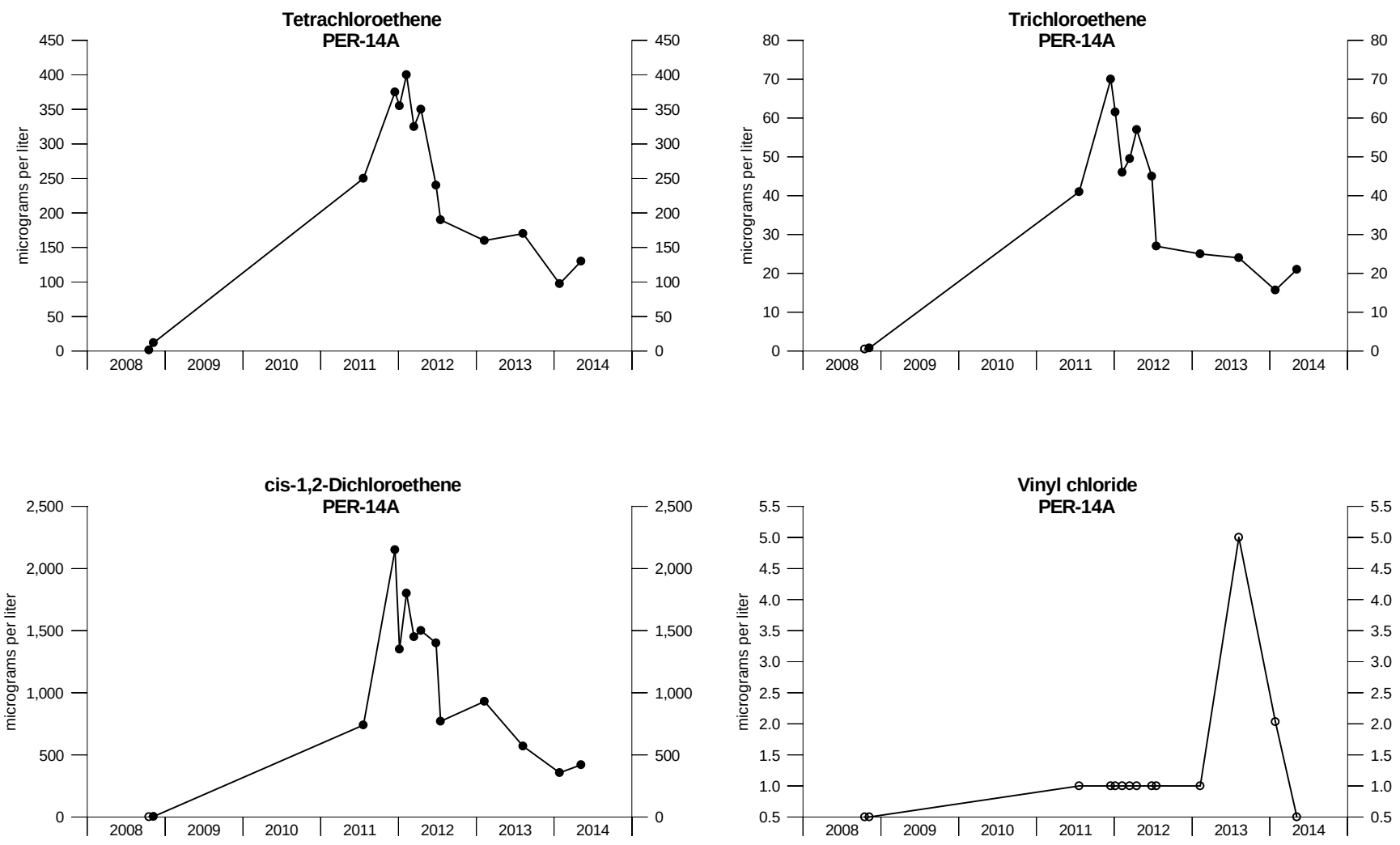
Job No: 22241866

Date: May 2014

WELL LOCATIONS AT MISSION PLANT AREA
PARK-EUCLID WQARF SITE
301 SOUTH PARK AVENUE
TUCSON, ARIZONA

Proj/Mission.../Park_Euclid/Proj13/FS_Final/Fig2_Plant_Wells.mxd

Figure 2



EXPLANATION

● - Detected Concentration
○ - Not Detected (Shown as RL)

URS

Project Name: Park - Euclid WQARF Site

Job No: 22241866 | Date: May 2014

Figure 3. Time Series Graph
PER-14A
Park - Euclid WQARF Site
Tucson, Arizona

Appendix A
Site Visit Log Forms

Appendix A
Site Visit Log Forms

System Operational Monitoring

Sampling Point	Date	Time	Parameter	Value	Units	Acceptable	Comment
Blower			Oil Level		Yes/No	Yes	checked and recorded Monthly
Blower			Grease Level		Yes/No	Yes	checked and recorded Monthly
Blower			Vacuum		inches H20	0 - 30	
PER-14A			Vacuum		inches H20	0 - 30	
VEL-03			Vacuum		inches H20	0 - 30	
VML-02 (130)			Vacuum		inches H20	0 - 30	
VML-02 (150)			Vacuum		inches H20	0 - 30	
VML-02 (170)			Vacuum		inches H20	0 - 30	
VML-02 (190)			Vacuum		inches H20	0 - 30	
SVE			Total Operation		hours	>= previous	Vacuum Blower
Condensate Level			Height above bottom		Inches		Sight Glass

Monitoring Completed By:

NOTES:
1) all date/time values: mm/dd/yy hh:mm (military time)
2) for yes/no values: yes=true; no=false

Vapor Stream Monitoring
Exhaust Stream Number 2

Sampling Point	Position	Date	Time	Parameter	Value	Units	Acceptable	Comment
VEL-03				Flow Velocity		ft per min		
VEL-03				Temperature		degrees F		
VEL-03				Total VOC		ppm		
PER-14A				Flow Velocity		ft per min		
PER-14A				Temperature		degrees F		
PER-14A				Total VOC		ppm		
VSP-3				Flow Velocity		ft per min	>=0	
VSP-3				Temperature		degrees F	>=0	
VSP-3				Total VOC		ppm	>=0	
VSP-4				Flow Velocity		ft per min	>=0	
VSP-4				Pressure		inches H_2O	0-30	
VSP-4				Temperature		degrees F	>=0	
VSP-4				Total VOC		ppm	>=0	
VSP-5				Flow Velocity		ft per min	>=0	
VSP-5				Pressure		inches H_2O	0-30	
VSP-5				Temperature		degrees F	>=0	
VSP-5				Total VOC		ppm	>=0	
VSP-6				Flow Velocity		ft per min	>=0	
VSP-6				Pressure		inches H_2O	0-30	
VSP-6				Temperature		degrees F	>=0	
VSP-6				Total VOC		ppm	>=0	

Vapor Stream Monitoring
Exhaust Stream Number 2

Sampling Point	Position	Date	Time	Parameter	Value	Units	Acceptable	Comment
VSP-7				Flow Velocity		ft per min	>=0	
VSP-7				Temperature		degrees F	>=0	
VSP-7				Total VOC		ppm	>=0	
VSP-8				Flow Velocity		ft per min	>=0	
VSP-8				Pressure		inches H_2O	0-30	
VSP-8				Temperature		degrees F	>=0	
VSP-8				Total VOC		ppm	>=0	
Discharge				Flow Velocity		ft per min	>=0	If velocity is greater than 1800 ft/min, call Will Neese.
Discharge				Temperature		degrees F	>=0	Gauge on Vertical Discharge.
Discharge				Visual Omissions (Opacity)		Yes/No	No	If Yes, Call Will Neese Immediately
Discharge				Odorous Emmissions		Yes/No	No	If Yes, Call Will Neese Immediately, and shutdown system

Monitoring Completed By:

NOTES:
1) all date/time values: mm/dd/yy hh:mm (military time)
2) for yes/no values: yes=true; no=false

Appendix B
PDEQ Permit Conditions

PIMA COUNTY DEPARTMENT OF ENVIRONMENTAL QUALITY

150 West Congress Street •Tucson, AZ 85701 •Phone: (520) 740-3340

AIR QUALITY OPERATING PERMIT

(As required by Title 17.12, Article II, Pima County Code)

ISSUED TO

MISSION LINEN SUPPLY
301 SOUTH PARK AVENUE
TUCSON, AZ 85705

This air quality operating permit does not relieve applicant of responsibility for meeting all air pollution regulations

THIS PERMIT ISSUED SUBJECT TO THE **Specific Conditions and Attachments 1, 2, 3 & 4**

PDEQ PERMIT NUMBER **2144** PERMIT CLASS **III** EXPIRATION DATE **October 18, 2011**

PERMIT ISSUED THIS **NINETEENTH** DAY OF **OCTOBER TWO THOUSAND AND SIX**

SIGNATURE — ***Tina Gingras Air Program Manager, PDEQ***
TITLE

Permit Issued To:
Mission Linen Supply
Permit Number: 2144

TABLE OF CONTENTS

Permit Summary 3

Specific Conditions 4

I. Applicability 4
II. Emission Limits and Standards 4
III. Monitoring Requirements 7
IV. Recordkeeping Requirements 9
V. Reporting requirements 10
VI. Testing Requirements 10

Additional Permit Conditions 12

Attachment 1: Applicable Regulations 13

Attachment 2: Equipment List 14

Attachment 3: Weekly Recordkeeping Table (By URS – Approved by PDEQ) 15

Attachment 4: Monthly Recordkeeping Table (By URS – Approved by PDEQ) 15

Permit Issued To:
Mission Linen Supply
Permit Number: 2144

SUMMARY

This operating permit is a new 5-yr permit issued to Mission Linen, the permittee. Mission Linen is a former dry cleaning facility that had tetrachloroethylene (PCE) spills which have migrated to underlying soils and may also have reached sewer lines through floor drains and sumps. PCE and its degradation products, trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), and vinyl chloride have also dissolved within diesel fuel, which lies atop a shallow aquifer at this location. Mission Linen is currently permitted by the Arizona Department of Environmental Quality (ADEQ) to operate a Soil Vapor Extraction system (SVE) with Granular Activated Carbon beds (GAC) and permanganate-impregnated zeolite bead treatment (PIZB). Previous testing at the site demonstrates that the subsurface contamination does not contain gasoline range organic (GRO) compounds. Therefore, the Mission Linen site represents the reverse scenario as that seen for typical SVE applications (where a site is remediated for GRO and halogenated organic compounds are not anticipated), in that there is no GRO and halogenated organic compounds are included in the contamination being remediated. Therefore, the provisions of the general permit for SVE systems are not appropriate for this site.

To accelerate cleanup of the diesel fuel/ PCE mixture from the subsurface, Mission Linen conducted a Multi Phase Extraction (MPE) pilot test in September 2003. The results showed that MPE was a feasible method of removing the diesel fuel/ PCE mixture. The equipment to be permitted is a MPE remediation system to be used for the extraction of the mixture of diesel fuel, groundwater, and soil vapor from the subsurface through a series of wells. After the liquid/vapor mixture has been extracted, the liquid stream (diesel and water) will be separated from the vapor stream in the unvented Total Fluid Recovery Vessel (TFRV) upstream of the liquid ring blower. The vapor stream is pulled from the TFRV by the liquid ring blower. The liquid stream is transferred from the TFRV to an oil/water separator (OWS). The OWS is passively vented through a GAC bed (Exhaust Stream #1). The vapor stream from the TFRV passes through the liquid ring blower and volatile organic compounds are removed by three GAC beds, in series. The treated vapor stream then passes through the PIZB vessel and is emitted to the atmosphere (Exhaust Stream #2). The PIZB removes vinyl chloride that "rolls" through the GAC beds as it is displaced by PCE and TCE. Vinyl Chloride rolls through GAC as it is displaced by PCE and TCE.

The unit will be located at the Mission Linen Supply facility on South Park Avenue in Tucson, Arizona. This is the only piece of equipment that will be operated at the site.

As mentioned above, there are two types of pollution control equipment that will be utilized at the site.

1. Vapor phase Carbon Units (VPC) and Granular Activated Carbon beds (GAC) will be used to treat the Volatile Organic Compounds (VOCs), PCE, TCE and cis-1,2-DCE from both Exhaust Stream #1 and #2.

2. Permanganate-impregnated zeolite beads will be used as a polisher following the GAC beds to remove vinyl chloride from Exhaust Stream #2.

The source is a Class III synthetic minor stationary source due to the air pollution equipment that is used with the MPE system.

Permit Issued To:
Mission Linen Supply
Permit Number: 2144

Specific Conditions
[References are to Title 17 of the Pima County Code unless otherwise noted]

These Specific Conditions contain equipment specific requirements for the operation of a MPE system located at 301 South Park in Tucson AZ.

I. APPLICABILITY

A. Affected Emission Source or Process:

The affected emission source is a MPE to be operated at all times with a permanganate-impregnated zeolite bead bed and granular activated carbon (GAC) beds in Exhaust Stream #2 and a GAC bed in Exhaust Stream #1

B. Affected Emission Source Classification: **Class III Synthetic Minor Stationary Source for HAPs and VOCs.**

II. EMISSION LIMITS AND STANDARDS

A. Multi Phase Extraction System (MPE)

1. Particulate Matter Standard

The Permittee shall not discharge into the atmosphere in any one hour from any unclassified process source in total quantities in excess of the amount calculated by the following equation: [PCC 17.16.430.A.1.a]

$E = 3.59Q^{0.62}$

Where:

E = the maximum allowable particulate emissions rate in pounds-mass per hour.
Q = the heat input in million Btu per hour.

2. Opacity Standard

The Permittee shall not cause or permit the effluent from a single emission point, multiple emission point, or fugitive emissions source to have an average optical density equal to or greater than 20%; [PCC 17.16.040.A]

3. Visibility Limiting Standard [PCC 17.16.050.D]

The Permittee shall not allow the diffusion of visible emissions including fugitive dust beyond the property boundary line within which the emissions become airborne without taking reasonably necessary and feasible precautions to control generation of airborne particulate matter. Sources may be required to cease temporarily the activity or operation which is causing or contributing to the emissions until reasonably necessary and feasible precautions are taken.

a. This provision shall not apply when wind speeds exceed twenty-five (25) miles per hour (using the Beaufort Scale of Wind-Speed Equivalents, or as recorded by the National Weather Service). This exception does not apply if control measures have not been taken or were not commensurate with the size or scope of the emission source.

b. This shall not apply to the generation of airborne particulate matter from undisturbed land.

4. Odor Limiting Standard

The Permittee shall not emit gaseous or odorous materials from equipment, operations or premises under his control in such quantities or concentrations as to cause air pollution.

[PCC 17.16.430.D]

5. Where a stack, vent or other outlet is at such a level that fumes, gas, mist, odor, smoke, vapor or any combination thereof constituting air pollution are discharged to adjoining property, the control officer may require the installation of abatement equipment or the alteration of such stack, vent or other outlet by the owner or operator thereof to a degree that will adequately dilute, reduce or eliminate the discharge of air pollution to adjoining property. [PCC 17.16.430.G]

[Material Permit Condition]

6. The Permittee is not authorized to use the MPE system when the nominal airflow rate through the soil vapor treatment train is greater than 150 scfm through the vapor/ liquid treatment train in order to guarantee the maximum concentrations for effective processing of the pollutants.

[PCC 17.16.430.G]

7. The Permittee is not allowed to directly discharge uncontrolled emissions into the atmosphere at any time. [PCC 17.12.185.A.2]

B. Fuel Limitation

Other than electric energy for powering the blower, MPE and ancillary equipment, the Permittee shall not use any other fuel/ product without first applying for and receiving the appropriate revision pursuant to PCC 17.12.240, PCC 17.12.255, and PCC 17.12.260.

C. Operational Limitations

The Permittee shall operate the following air pollution controls at all times that liquid extraction is employed. Controls shall be fully operational upon startup of the MPE.

[Material Permit Condition]

1. Granular Activated Carbon, (GAC) & Permanganate-Impregnated Zeolite Bead Unit, (PIZB)

The Permittee shall use the three 2000-lb GAC units and PIZB equipment identified in Attachment 2 to absorb VOCs and HAPs contained in Exhaust Stream #2. The equipment shall be operated as follows: [PCC 17.12.190.B][PCC 17.16.430.G]

[Federally Enforceable & Material Permit Condition]

a. The PIZB unit shall be used at all times to remove vinyl chloride rolling through the GAC bed train in exhaust stream #2 only when the nominal flow rate is no greater than 150 scfm through the system.

b. The PIZB unit shall be installed, maintained, and operated in accordance with the manufacturer's specifications.

c. A flow meter shall be installed and maintained at the exit of exhaust stream #2 to measure and display the total flow rate.

d. The three 2000 lb GAC units in exhaust stream #2 shall at all times be used when the MPE is in operation and the nominal flow rate is no more than 150 scfm through the system.

e. Exhaust stream #2 stack emission limitations:

   i. The Permittee shall limit the concentration of tetrachloroethene (PCE) to not more than 34.9 parts per million volume (ppmv).

   ii. The Permittee shall limit the concentration of trichloroethene (TCE) to not more than 15 ppmv.

   iii. The Permittee shall limit the concentration of vinyl chloride to not more than 0.7 ppmv.

   iv. The Permittee shall limit the concentration of cis-1,2-dichloroethene (cis-1,2-DCE) to not more than 39 ppmv.

   v. The Permittee shall limit the concentration of ethylbenzene to not more than 0.95 ppmv.

   vi. The Permittee shall limit the concentration of total xylenes to not more than 1.7 ppmv.

   vii. The Permittee shall limit the concentration of volatile fuel hydrocarbons to not more than 99 ppmv.

f. The Permittee shall operate and maintain the vapor-phase GAC units in exhaust stream #2 pursuant to an Operations & Maintenance Plan (O & M Plan) approved by PDEQ.

g. The GAC units shall be installed, maintained, and operated in accordance with the manufacturer's specifications.

h. GAC unit change-out for exhaust stream #2 shall be performed within three weeks following initial discovery (based on weekly PID readings) of breakthrough on the first of the three GAC beds in series. If change-out cannot be performed within that timeframe, operation of the system shall be suspended until the change-out has been performed.

   Breakthrough for.II.C.1.h of the Specific Conditions shall be defined as the point at which the effluent concentration for the initial GAC bed, as measured with the photoionization detector (PID), approaches a value that is within 10% of the influent concentration (i.e., greater than 90% of the influent value).

i. Upon discovery that the vinyl chloride concentration in the effluent of the PIZB (as determined through analysis of grab samples collected on the schedule set forth in Section III(C)(1)(c) of this permit) is equal to or greater than 0.63 ppmv (i.e., 90% of the emission limit set forth in this permit), operation of the MPE system shall be suspended until PIZB change-out has been performed.

2. Vapor Phase Carbon Unit (VPC) – Exhaust Stream #1

The permittee shall use the VPC identified in Attachment 2 to absorb VOCs and HAPs contained in Exhaust Stream #1. The equipment shall be operated as follows:[PCC 17.16.430.G][PCC 17.12.190.B]
[Federally Enforceable &Material Permit Condition]

a. The 200 lb VPC in exhaust stream #1 shall at all times be used when the MPE is in operation, i.e. the permittee shall always operate the vapor phase GAC unit unless it is being replaced while the MPE system has heen shut down as proposed in the application.

b. The 200 lb VPC unit in exhaust stream #1 shall be specified to deliver no less than 90% control of VOCs.

c. The Permittee shall operate and maintain the VPC in exhaust stream #1 pursuant to an Operations & Maintenance Plan (O & M Plan) approved by PDEQ.

d. The VPC shall be installed, maintained, and operated in accordance with the manufacturer's specifications.

e. VPC change-out for exhaust stream #1 shall be performed within three weeks following the initial discovery (based on weekly PID readings) that the effluent concentrations have reached the value of 5%, as proposed in the application, of the influent concentration as measured according to III.C.2 of the Specific Conditions.

III. MONITORING REQUIREMENTS [PCC 17.12.185.A.3]

A. Multi Phase Extraction System

1. Particulate Matter Monitoring

Not required.

2. Opacity Standard Monitoring

See III.C.1.d.

3. Odor Monitoring & Discharge to adjoining property

See III.C.3.

B. Fuel Limitation

None. The Permittee need only show that electrical power is being used during inspections.

C. Operational Limitations

1. Granular Activated Carbon & Permanganate-Impregnated Zeolite Bead Unit (Exhaust Stream #2).

a. The Permittee shall during system operation, take readings of the influent & effluent gas

concentrations for each GAC unit and the PIZB vessel using a handheld PID. The readings shall be taken once a week unless otherwise approved by the Control Officer.

b. Within 10 hours of initial startup, the Permittee shall collect a grab sample of system effluent vapor. The sample shall be obtained during a period of operation that is representative of continuous operation of the system. The Permittee shall analyze the gas samples by using EPA's Compendium Method TO-15 (TO-15) for volatile organic compounds (VOCs). At the conclusion of the first day of operation, the system shall be shut down pending receipt of laboratory results indicating compliance with the emission limitations set forth in II.C.1.e of the Specific Conditions.

c. Following the initial startup, the Permittee shall determine the concentrations of VOCs in the influent and effluent of the vapor abatement system by collecting grab samples according to the schedule below:

   i. Daily for the first five days of continuous operation. This shall be referred to as schedule #1.

   ii. Twice weekly for the next two weeks of operation. This shall be referred to as schedule #2.

   iii. Weekly for the next four weeks of operation. This shall be referred to as schedule #3.

   iv. Monthly thereafter. This shall be referred to as schedule #4.

   If the grab samples show that the emission limitations set forth in II.C.1.e of the Specific Conditions were exceeded, the Permittee shall take corrective action to reduce the concentration of VOCs to the limits established by this permit. The Permittee shall return to TO-15 sampling frequency schedule #1 following the corrective action(s).

d. The Permittee shall observe the stack of exhaust stream #2 of the MPE at least once each week for evidence of visible emissions. If the permittee sees emissions that, on an instantaneous basis, appears to exceed 20%, then the Permittee shall, if practicable, take a six-minute Method 9 observation of the plume. If the emissions are 20% or more, this shall be recorded and reported as an excess emission and a permit deviation.

2. VPC – Exhaust Stream #1

The Permittee shall during system operation, take readings of the influent & effluent gas concentration for the VPC using a handheld PID. The readings shall be taken once a week unless otherwise approved by the Control Officer.

3. The Permittee shall perform weekly checks on the MPE, VPC, PIZB and all the associated equipment and connections to ensure that there are no leaks, breaks or openings and that the equipment is operating according to the O & M Plan, manufacturer's specifications or good modern engineering practices.

IV RECORDKEEPING REQUIREMENTS [PCC 17.12.185.A.4]

A. Multi Phase Extraction System [PCC 17.12.185.A.4]

1. The Permittee shall use the tabular format represented in Attachment 3 to record the results of III.C.1.a and III.C.2 of the Specific Conditions as follows:

   a. Date of PID readings;
   b. Type of Air Pollution Control in use (VPC, GAC or PIZB);
   c. The name of company or entity that performed the PID monitoring;
   d. The exhaust stream number according to the permit application;
   e. The concentration of gases in the influent gas stream (ppm_V);
   f. The PID readings for the inlet and outlet of each GAC canister and the PIZB;
   g. The flow rate upstream of the first GAC canister, $Q_{process}$ (scfm); and
   h. The exhaust gas flow rate, $Q_{process}$ (scfm).

2. The Permittee shall use the tabular format represented in Attachment 4 to record the results of III.C.1.b & c of the Specific Conditions as follows:

   a. Date of TO-15 sampling;
   b. Type of air pollution control in use (VPC, GAC or PIZB);
   c. The name of company or entity that performed TO-15 sampling;
   d. The concentration of VOCs and HAPs upstream of the first GAC canister;
   e. The concentration of VOCs and HAPs at the emission outlet;
   f. The VOC and HAP removal efficiency of GAC canisters;

3. The Permittee shall record the results of III.C.1.d of the Specific Conditions in a log containing the date of the check, the person making the check, the specific stack observed, and whether visible emissions were observed. If visible emissions were observed, the Permittee shall include in the log entry any corrective action taken.

4. The Permittee shall record the results of III.C.3 of the Specific Conditions in a log containing the date of the check, the person making the check and the specific equipment observed. If deviations from normal operations are observed, the Permittee shall include in the log entry any corrective action taken.

5. The Permittee shall display the name, address and phone number of a contact person at the site of the MPE in a manner as to be clearly visible and accessible.

B. Records For The Facility [PCC 17.12.185.A.4]

1. All required records shall be maintained either in an unchangeable electronic format or handwritten logbook of indelible ink for a minimum period of five (5) years after the date of such record and shall be made readily available to the Department upon request for inspection.

2. Location of Records. The Permittee shall retain all records relating to this permit, and a copy of the permit at the permit site or main Tucson office. The Permittee shall comply with the permit posting requirements of PCC 17.12.080 unless otherwise allowed by the Control Officer. All records shall be maintained in accordance with the requirements of PCC 17.12.180.A.4.b.

V. REPORTING REQUIREMENTS [PCC 17.12.185.A.5 & 17.12.185.D.3.d]

A. Multi Phase Extraction System

1. A written report of the results of all sampling tests required for the first month of operation under III.C.1.b of the Specific Conditions shall be submitted to the Control Officer within 60 days of sampling. The report shall be submitted in accordance with the Arizona Testing Manual and PCC 17.12.050.B and shall use tabular format of Attachment 3.

   Reports of all other sampling not requested above shall be kept on site or at the main Tucson office and not submitted unless requested by the Control Officer.

2. The Permittee shall submit an O & M Plan within 60 days of permit issuance consisting of: [PCC 17.12.030]

   a. The process operating parameters and limits,

   b. Maintenance procedures and schedules, and

   c. Documentation methods necessary to demonstrate proper operation and maintenance of the air pollution control system.

B. Emissions Inventory Reporting: [PCC 17.12.320]

The Permittee shall complete and submit to the control officer, when requested, an annual emissions inventory questionnaire pursuant to 17.12.320 of the Pima County Code.

VI. TESTING REQUIREMENTS [A.R.S. §49-480.B and PCC 17.12.185.A.3.a]

For purposes of District enforcement, these test methods shall be used, provided that for the purpose of establishing whether or not the facility has violated or is in violation of any provision of this permit, nothing in this permit shall preclude the use, including the exclusive use, of any credible evidence or information relevant to whether a source would have been in compliance with applicable federal requirements if the appropriate performance or compliance procedures or methods had been performed.

A. Should the Permittee desire to test, or be required to test the equipment to demonstrate compliance with the limits in this permit, the Permittee shall contact the control officer for testing requirements. [PCC 17.20.010.B]

B. PID Calibration Tests. [PCC 17.20.010.B]

1. Prior to start up, the Permittee shall perform a calibration test of the PID, record the results in a log as described in B.V.B.2 of the Specific Conditions below and submit the results to the Control Officer.

2. After start-up, the Permittee shall perform a calibration test of the PID bi-weekly (every two weeks) to ensure that it is accurately indicating VOC concentration. The results shall be recorded in a log containing the date of the test, the person making the test and the deviation from normal that is observed. If no deviation from normal is observed, this shall be recorded in the log. If deviations from normal are observed, the Permittee shall include in the log entry any corrective action taken.

C. The Permittee shall use the following EPA approved test methods to conduct performance tests for the specified pollutants:

1. Particulate Matter. EPA Reference Method 5 shall be used to monitor compliance with II.A.1 of the Specific Conditions when mass emission testing is required by the Control Officer. [PCC 17.20.010.B]

2. EPA Reference Method 9 shall be used to monitor compliance with II.A.2 of the Specific Conditions and when an opacity test is required by the Control Officer.

3. EPA Compendium Method TO-15 for VOCs and HAPs, including halogenated organic compounds.

4. The Permittee may submit an alternate and equivalent test method that is listed in 40 CFR Subpart 60, Appendix A, to the Control Officer in a test plan, for approval by the Control Officer.

ADDITIONAL PERMIT CONDITIONS

I. COMPLIANCE WITH PERMIT CONDITIONS [PCC 17.12.185.A.7.a & b]

A. The Permittee shall comply with all conditions of this permit including all applicable requirements of Arizona air quality statutes and the air quality rules. Any permit noncompliance constitutes a violation of the Arizona Revised Statutes and is grounds for enforcement action; for permit termination, revocation and reissuance, or revision; or for denial of a permit renewal application. In addition, noncompliance with any federally enforceable requirement constitutes a violation of the Clean Air Act.

B. The Permittee shall report to the Control Officer any emissions in excess of the limits established by this permit. The report shall be in 2 parts as specified below: [PCC 17.12.185.A.5 & PCC 17.12.040]

1 Notification by telephone or facsimile within 24 hours of the time the Permittee first learned of the occurrence of excess emission that includes all available information pursuant to PCC 17.12.040.B. To report excess emissions call **520-740-3340** or fax to **520-882-7709.**

2. Detailed written notification by submission of an excess emissions report within 72 hours of the notification in I.B.1 above. **Send to PDEQ 150 W. Congress St., Tucson, Arizona 85701.**

C. It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. The permit does not convey any property rights of any sort, or any exclusive privilege to the permit holder.

E. The Permittee shall pay fees to the Control Officer pursuant to PCC 17.12.510. [PCC 17.12.185.A.9 & PCC 17.12.510]

II. PERMIT REVISION, REOPENING, REVOCATION AND REISSUANCE, OR TERMINATION FOR CAUSE [PCC 17.12.185.A.7.c]

The permit may be revised, reopened, revoked and reissued, or terminated for cause pursuant to PCC 17.12.270. The filing of a request by the Permittee for a permit revision, revocation and reissuance, or termination; or of a notification of planned changes or anticipated noncompliance does not stay any permit condition.

III. DUTY TO PROVIDE INFORMATION [PCC 17.12.165.G & PCC 17.12.185.A.7.e]

A. The Permittee shall furnish to the Control Officer, within a reasonable time, any information that the Control Officer may request in writing to determine whether cause exists for revising, revoking and reissuing, or terminating the permit or to determine compliance with the permit. Upon request, the Permittee shall also furnish to the Control Officer copies of records required to be kept by the permit. For information claimed to be confidential, the Permittee shall furnish a copy of such records to the Control Officer along with a claim of confidentiality.

B. If the Permittee has failed to submit any relevant facts or if the Permittee has submitted incorrect information in the permit application, the Permittee shall, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information.

IV. SEVERABILITY CLAUSE [PCC 17.12.185.A.6]

The provisions of this permit are severable. If any provision of this permit is held invalid, the remainder of this permit shall not be affected thereby.

Attachment 1: APPLICABLE REGULATIONS
Air Quality Control Permit No. 2144
For
Mission Linen Supply

REQUIREMENTS SPECIFICALLY IDENTIFIED AS APPLICABLE

Pima County Code (PCC) Title 17, Chapter 17.16:

17.16.010	Local Rules and Standards; Applicability of more than one Standard
17.16.040	Standards and Applicability (Includes NESHAP)
17.16.050	Visibility Limiting Standard
17.16.130	Applicability
17.16.430	Standards of Performance for Unclassified Sources
17.20.010	Source Sampling, Monitoring, and Testing

Attachment 2: EQUIPMENT LIST
Air Quality Control Permit No. 2144
For
Mission Linen Supply

EQUIPMENT TYPE	EQUIPMENT NAME	MODEL	SERIAL NUMBER	MAXIMUM RATED CAPACITY	PRIMARY USE	FUEL TYPE
Multi Phase Extraction System	ES & S	To Be Supplied	To Be Supplied	1000 acfm LRP Blower	Liquid & Vapor Extraction	N/A
Three 2000 lb Granular Activated Carbon Units	US Filter	VSC-2000	N/A	150 scfm	Removal of VOCs & HAPs	N/A
200 lb Vapor Phase Carbon Unit	US Filter	VSC-200	N/A	200 scfm	Removal of VOCs & HAPs	N/A
500 lb Permanganate-Impregnated Zeolite Bead Unit	Hydrosil	HS-600 or equivalent	N/A	150 scfm	Removal of HAPs	N/A

Attachment 3: WEEKLY RECORDKEEPING TABLE (Use URS' proposed table – Approved by PDEQ)

Attachment 4: MONTHLY RECORDKEEPING TABLE (Use URS' proposed table - Approved by PDEQ)

PIMA COUNTY
ENVIRONMENTAL QUALITY
33 N. Stone Ave., Suite 700
Tucson, Arizona 85701-1429
www.deq.pima.gov
Printed on recycled paper

Ursula Kramer Nelson, P.E.
Director

(520) 724-7400
FAX (520) 838-7432

October 27, 2014

BY E-MAIL
msaposnik@missionlinen.com

Mr. Mark Saposnik
Environmental Compliance Engineer
Mission Linen Supply
715 E. Montecito St.
Santa Barbara, CA 93103

Re: Renewal Permit, Mission Linen Supply, Air Quality Operating Permit #2144
Pima County Permit Action Reference 2144-2P

Enclosed is the final air quality operating permit for Mission Linen Supply located at 301 S, Park Ave, Tucson, AZ 85705. The permit contains the following; Specific Conditions that apply to your facility, Additional Permit Conditions which are general permit conditions required in all Class II permits and apply to all facilities located in Pima County, Attachment 1 is a list of applicable regulations and Attachment 2 consists of the equipment list. Attachment 3 contains copies of the approved MPE/SVE recordkeeping format.

Please note the permit requires the submission of an O & M Plan for the MPE/SVE system within 60 days of permit issuance. Please submit a revised plan to incorporate any changes for approval by PDEQ.

Please keep a copy of the permit at the 301 S, Park Ave. location for the life of the permit term. This issuance is effective October 28, 2014 and will remain valid for 5 years.

If you have any questions or need additional information, please contact me at (520) 724-7400.

Sincerely,

James M. Jones
Senior Air Permit Engineer

Attached: Final Permit and Technical Support Documents

PIMA COUNTY DEPARTMENT OF ENVIRONMENTAL QUALITY

AIR PROGRAM

33 N. Stone Avenue, Suite 700 • Tucson, AZ 85701 • Phone: (520) 243-7400

AIR QUALITY OPERATING PERMIT

(As required by Title 17.12, Article II, Pima County Code)

ISSUED TO

MISSION LINEN SUPPLY

301 S. PARK, AVE

TUCSON, AZ 85705

This air quality operating permit does not relieve applicant of responsibility for meeting all air pollution regulations

THIS PERMIT ISSUED SUBJECT TO THE SPECIFIC AND ADDITIONAL CONDITIONS IDENTIFIED IN THIS PERMIT

PERMIT NUMBER **2144** PERMIT CLASS **III**

ISSUED **October 28, 2014** EXPIRES**: October 27, 2019**

Rupesh Patel, Air Permit Manager, PDEQ

SIGNATURE, TITLE

Table of Contents

Permit Summary 3

Specific Conditions 5

Applicability 5

Section 1 – Multi Phase Extraction (MPE) and Alternate Soil Vapor Extraction (SVE) System 6

Emission Limitations and Standards 6
Monitoring Requirements 9
Recordkeeping Requirements 10
Reporting Requirements 11
Testing Requirements 12

Section 2 – Industrial Laundering Operations 13

Emission Limitations and Standards 13
Monitoring Requirements 13
Recordkeeping Requirements 13
Reporting Requirements 14
Testing Requirements 14

Section 3 – Fossil-Fuel Fired Industrial and Commercial Equipment 15

Emission Limitations and Standards 15
Monitoring Requirements 15
Recordkeeping Requirements 15
Reporting Requirements 15
Testing Requirements 16

Section 4 – Facility Wide Operations 17

Emission Limitations and Standards 17
Monitoring Requirements 18
Recordkeeping Requirements 19
Reporting Requirements 19
Facility Changes 19
Testing Requirements 20

Additional Permit Requirements 21

Attachment 1: Applicable Regulations 22

Attachment 2: Equipment Lists 23

Attachment 3: MPE/SVE Recordkeeping Format for Weekly PID Readings 25

Attachment 4: MPE/SVE Recordkeeping Format for Analytical Data from Exhaust Stream #2 26

Permit Summary

This operating permit is a renewal of the 5-yr permit issued to Mission Linen Supply. Mission Linen Supply owns and operates a Multi-Phase Extraction (MPE) and alternate Soil Vapor Extraction (SVE) system as well as a linen supply, uniform rental, and industrial laundering business at 301 S. Park Ave, Tucson AZ. The facility constitutes a **Class III, Synthetic Minor Source** of volatile organic compounds (VOC) and hazardous air pollutants (HAPS). The facility operates under the following industrial classifications:

- MPE/ SVE systems: SIC code: 1799 (NAICS 562910)
- Linen supply and Industrial Laundering Operations: SIC codes: 7213,7218 (NAICS 812331,812332)

Background

The facility originally operated a soil vapor extraction unit with vapor-phase granular activated carbon under a portable source permit, issued by the Arizona Department of Environmental Quality (ADEQ), to clean up VOC contamination from the former dry cleaning facility. The extraction system was originally permitted by the Pima County Department of Environmental Quality on October 19, 2006. URS Corporation (URS) is the consultant for Mission Linen and operates the MPE and alternate SVE system on their behalf.

MPE and Alternate SVE System

The MPE system is used for the extraction of the mixture of diesel fuel, groundwater, and soil vapor from the subsurface through a series of wells. After the liquid/vapor mixture has been extracted, the liquid stream (diesel and water) is separated from the vapor stream in the unvented Total Fluid Recovery Vessel (TFRV) upstream of the liquid ring blower. The vapor stream is pulled from the TFRV by the liquid ring blower. The liquid stream is transferred from the TFRV to an oil/water separator (OWS). The OWS is passively vented through a Granulated Activated Carbon (GAC) bed (Exhaust Stream #1). The vapor stream from the TFRV passes through the liquid ring blower and volatile organic compounds are removed by three GAC beds, in series. The treated vapor stream then passes through the Permanganate-Impregnated Zeolite Bead (PIZB) unit and is emitted to the atmosphere (Exhaust Stream #2). The installed air pollution control (APC) equipment utilized by the extraction system is necessary to control and reduce air emissions of HAPs and VOCs to permissible concentrations from the exhaust streams. The installed APC incudes a Vapor phase Carbon Unit (VPC) and GAC beds to treat the VOC's, PCE, TCE and cis-1, 2-DCE from both exhaust streams (#1 and #2). An additional PIZB bed is used as a polisher downstream of the GAC beds in Exhaust Stream #2 to remove vinyl chloride that "rolls" through the GAC beds as it is displaced by PCE and TCE.

For this renewal, a request was submitted by URS to modify the existing extraction system and allow for flexibility in the permit to operate an alternate SVE train and blower. The alternate SVE system is designed to extract soil vapors from wells screened in a lower zone of the subsurface and will extract similar VOC species as the MPE system. When operating the system in SVE mode, the SVE blower will be connected through piping and valves to the installed air pollution control (APC) train (Exhaust Train #2) and be subject to the same emissions limits, monitoring, and recordkeeping provisions. Only one extraction system will be operated at a time (MPE mode or SVE mode). While operating in one mode the other extraction train will be shut down by turning off its associated pump/blower and isolating it with a shutoff valve.

Linen Supply and Industrial Laundering Operations

A minor permit revision dated April 18, 2014, was submitted by the Permittee to include the linen supply and industrial laundering operations into the current permit after receiving information from industry sources that VOC and HAP emissions result from the washing and drying of soiled industrial towels. Approximately 7,000,000 pounds (clean dry weight) of textiles are laundered annually at the facility. The laundering of soiled industrial shop towels make up a smaller portion of this total. Entrained solvents and chemicals present on the soiled industrial shop towels contribute VOC and HAP emissions from the facility. The facility minimizes the impact of emissions by not accepting towels that are saturated with solvents. The facility has voluntarily limited the amount of shop towels laundered at the facility not to exceed 3,000,000 lbs of shop towels and 100,000 lbs of printer towels to reduce potential emissions from these sources.

Fossil Fuel Fired Industrial and Commercial Equipment

The facility also operates a boiler and commercial dryers that provide heat for the processes and operations at the facility. The boiler and dryers supply indirect heat from the combustion of natural gas and are subject to local performance standards for fossil-fuel fired industrial and commercial equipment.

The Potential to Emit for the facility is based on the voluntary industrial shop towel limits and continuous operation of the natural gas fired equipment and MPE or alternate SVE systems.

The following emission rates are for reference purposes and are used to establish whether or not the source is a major source in terms of the Title V permit program. They are not intended to be enforced by direct measurement unless otherwise noted in the Specific Conditions of this permit.

Facility Wide Potential to Emit						
Pollutant	**NO_X**	**CO**	**SO_X**	**PM_{10}**	**VOC**	**HAP's**
Tons/Year	14.64	12.30	0.09	1.11	34.71	13.49

All provisions of this Permit that are federally enforceable or material permit conditions are specifically indicated as such.

Specific Conditions

Applicability

I. The Specific Conditions contained in this permit apply to the facilities, equipment, sources and operations listed in the permit application and shall not relieve the Permittee or its subcontractors from compliance with all local or county codes, state statutes and federal laws or from obtaining permits for other operations or activities when required. [PCC 17.12.010.D & PCC 17.12.165]

II. The facility covered by this permit constitutes an existing **Class III; Synthetic Minor Stationary Source for HAPs and VOCs.** The Specific Conditions contained in this permit apply to the following affected facilities, equipment, sources, and operations at the facility:

A. Multiphase Extraction (MPE) and Alternate Soil Vapor Extraction (SVE) System

Applicable to the MPE and alternate SVE system: The affected emission source is a MPE and alternate SVE system and associated equipment with exhaust streams #1 and #2 that are to be equipped and operated at all times with air pollution controls.

[PCC 17.16.430, PCC 17.12.185.A.2 & PCC 17.12.190.B]

[Federally Enforceable Condition]

B. Industrial Laundering Operations

Applicable to the industrial shop and printer towel laundering operations.

[PCC 17.16.430, PCC 17.12.185.A.2 & PCC 17.12.190.B]

[Federally Enforceable Condition]

C. Fossil Fuel Fired Industrial and Commercial Equipment

Applicable to the fossil-fuel fired industrial and commercial equipment: The affected equipment is all industrial and commercial installations which are less than 250 MMBTU/hr; but in aggregate on any premises are rated greater than 0.5 MMBTU/hr in which fuel is burned for the primary purpose of producing steam, hot water, hot air or other liquids, gases, or solids. [PCC 17.16.165.A]

D. Facility-Wide Operations

Applicable to Facility Wide Operations: All sources of air contaminants operating at the facility.

[PCC 17.16.010.A & PCC 17.16.430]

III. The Specific Conditions applicable to the facility are grouped into the following permit sections:

Section 1: Multiphase Extraction (MPE) and Alternate Soil Vapor Extraction (SVE) System

Section 2: Industrial Laundering Operations

Section 3: Fossil Fuel Fired Industrial and Commercial Equipment

Section 4: Facility Wide Operations

IV. If more than one emission limit or emission standard is applicable to the same source, the more stringent standard or emission limit shall apply. [PCC 17.16.010.B]

Section 1

Multi-Phase Extraction (MPE) and Alternate Soil Vapor Extraction (SVE) System

The provisions of this Section are applicable to the affected Multi-Phase Extraction (MPE) and alternate Soil Vapor Extraction (SVE) system, exhaust streams #1 and #2, and APC equipment identified in Table I of Attachment 2. All provisions of this Section that are federally enforceable or material permit conditions are specifically indicated as such. **The affected emission source is a MPE and alternate SVE system to be operated at all times with air pollution controls (APC) in Exhaust Stream #1 and #2 as described in Table I of Attachment 2 and this Section.** [PCC 17.16.430, PCC 17.12.185.A.2 & PCC 17.12.190.B]

I. Emission Limitations and Standards [PCC 17.12.185.A.2]

A. Particulate Matter Standard

The Permittee shall not discharge into the atmosphere in any one hour from any unclassified process source in total quantities in excess of the amount calculated by the following equation: [PCC 17.16.430.A.1.a]

$$E = 3.59Q^{0.62}$$

Where: E = the maximum allowable particulate emissions rate in pounds-mass per hour.
Q = the heat input in million Btu per hour.

B. Opacity Standard

The Permittee shall not cause or permit the effluent from a single emission point, multiple emission point, or fugitive emissions source to have an average optical density equal to or greater than 20%. [PCC 17.16.040.A]

C. Visibility Limiting Standard [PCC 17.16.050.D]

The Permittee shall not allow the diffusion of visible emissions including fugitive dust beyond the property boundary line within which the emissions become airborne without taking reasonably necessary and feasible precautions to control generation of airborne particulate matter. Sources may be required to cease temporarily the activity or operation which is causing or contributing to the emissions until reasonably necessary and feasible precautions are taken.

1. This provision shall not apply when wind speeds exceed twenty-five (25) miles per hour (using the Beaufort Scale of Wind-Speed Equivalents, or as recorded by the National Weather Service). This exception does not apply if control measures have not been taken or were not commensurate with the size or scope of the emission source.

2. This shall not apply to the generation of airborne particulate matter from undisturbed land.

D. Odor Limiting Standard

The Permittee shall not emit gaseous or odorous materials from equipment, operations or premises under his control in such quantities or concentrations as to cause air pollution. [PCC 17.16.430.D]

E. Air Flow Limit

The Permittee is not authorized to use the extraction system when the nominal airflow rate through the soil vapor treatment train is greater than 150 scfm in order to guarantee the maximum concentrations for effective processing of the pollutants. [PCC 17.16.430.G]

F. Air Pollution Control (APC) Requirement

The Permittee is not allowed to directly discharge uncontrolled emissions from the extraction system into the atmosphere at any time. [PCC 17.12.190.B]

G. Non Compliance with applicable standards

Where a stack, vent or other outlet is at such a level that fumes, gas, mist, odor, smoke, vapor or any combination thereof constituting air pollution are discharged to adjoining property, the control officer may require the installation of abatement equipment or the alteration of such stack, vent or other outlet by the owner or operator thereof to a degree that will adequately dilute, reduce or eliminate the discharge of air pollution to adjoining property. [PCC 17.16.430.G]

[Material Permit Condition]

H. Fuel Limitation

Other than electric energy for powering the pump/blower, extraction system, and ancillary equipment, the Permittee shall not use any other fuel/product without first applying for and receiving the appropriate revision pursuant to PCC 17.12.240, PCC 17.12.255, and PCC 17.12.260.

I. Operating Limitations

The Permittee shall operate the following air pollution controls (APC) at all times that extraction system is employed using the MPE or alternate SVE system. The Permittee shall only operate the system in one extraction mode at a time (MPE or SVE). When operating in either mode, the other extraction system shall be shut down by turning off its associated pump/blower and isolating that system with a shutoff valve. Controls shall be fully operational upon startup of the system in either mode.

[PCC 17.12.350.A.3.e]

[Material Permit Condition]

1. Granular Activated Carbon, (GAC) & Permanganate-Impregnated Zeolite Bead Unit, (PIZB)

The Permittee shall use the three 2000-lb GAC units and PIZB equipment identified in Attachment 2 to absorb VOCs and HAPs contained in Exhaust Stream #2. The equipment shall be operated as follows: [PCC 17.12.190.B, PCC 17.16.430.G & PCC 17.12.350.A.3.e]

[Federally Enforceable & Material Permit Conditions]

a. The PIZB unit shall be used at all times to remove vinyl chloride rolling through the GAC bed train in exhaust stream #2 only when the nominal flow rate is no greater than 150 scfm through the system.

b. The PIZB unit shall be installed, maintained, and operated in accordance with the manufacturer's specifications.

c. A flow meter shall be installed and maintained at the exit of exhaust stream #2 to measure and display the total flow rate.

d. The three 2000 lb GAC units in exhaust stream #2 shall at all times be used when the extraction system is in operation and the nominal flow rate is no more than 150 scfm through the extraction system.

e. Exhaust stream #2 stack emission limitations.

i. The Permittee shall limit the concentration of tetrachloroethene (PCE) to not more than 34.9 parts per million volume (ppmv).

ii. The Permittee shall limit the concentration of trichloroethene (TCE) to not more than 15 ppmv.

iii. The Permittee shall limit the concentration of vinyl chloride to not more than 0.7 ppmv.

iv. The Permittee shall limit the concentration of cis-1, 2-dichloroethene (cis-1, 2-DCE) to not more than 210 ppmv.

v. The Permittee shall limit the concentration of ethylbenzene to not more than 0.95 ppmv.

vi. The Permittee shall limit the concentration of total xylenes to not more than 1.7 ppmv.

vii. The Permittee shall limit the concentration of volatile fuel hydrocarbons to not more than 99 ppmv.

f. The Permittee shall operate and maintain the vapor-phase GAC units in exhaust stream #2 pursuant to an Operations & Maintenance Plan (O & M Plan) approved by PDEQ.

g. The GAC units shall be installed, maintained, and operated in accordance with the manufacturer's specifications.

h. GAC unit change-out for exhaust stream #2 shall be performed within three weeks following initial discovery – based on weekly photoionization detector (PID) readings – of breakthrough on the first of the three GAC beds in series. If change-out cannot be performed within that timeframe, operation of the system shall be suspended until the change-out has been performed.

Breakthrough for I.1.h. of this Section shall be defined as the point at which the effluent concentration for the initial GAC bed, as measured with the PID, approaches a value that is within 10% of the influent concentration (i.e., greater than 90% of the influent value).

i. Upon discovery that the vinyl chloride concentration in the effluent of the PIZB (as determined through analysis of grab samples collected on the schedule set forth in section II.E.1.c of this Section) is equal to or greater than 0.63 ppmv (i.e., 90% of the emission limit set forth in this permit), operation of the system shall be suspended until PIZB change-out has been performed.

2. Vapor Phase Carbon Unit (VPC) – Exhaust Stream #1

The Permittee shall use the VPC identified in Attachment 2 to absorb VOCs and HAPs contained in Exhaust Stream #1. The equipment shall be operated as follows:

[PCC 17.16.430.G, PCC 17.12.190.B & PCC 17.12.350.A.3.]

[Federally Enforceable &Material Permit Conditions]

a. The 200 lb VPC in exhaust stream #1 shall at all times be used when the system is operating, i.e. the Permittee shall always operate the vapor phase GAC unit unless it is being replaced while the system has been shut down as proposed in the application.

b. The 200 lb VPC unit in exhaust stream #1 shall be specified to deliver no less than 90% control of VOCs.

c. The Permittee shall operate and maintain the VPC in exhaust stream #1 pursuant to an Operations & Maintenance Plan (O & M Plan) approved by PDEQ.

d. The VPC shall be installed, maintained, and operated in accordance with the manufacturer's specifications.

e. VPC change-out for exhaust stream #1 shall be performed within three weeks following the initial discovery (based on weekly PID readings) that the effluent concentrations have reached the value of 5%, as proposed in the application, of the influent concentration as measured according to II.E.2 of this Section.

II. Monitoring Requirements [PCC 17.12.185.A.3]

A. Particulate Matter Monitoring.

Not required.

B. Opacity Standard Monitoring

See II.E.1.d of this Section

C. Odor Monitoring & Discharge to adjoining property

See II.E.3 of this Section

D. Fuel Limitation

None. The Permittee need only show that electrical power is being used during inspections.

E. Operational Limitations

1. Granular Activated Carbon & Permanganate-Impregnated Zeolite Bead Unit –Exhaust Stream #2

a. The Permittee shall during system operation, take readings of the influent & effluent gas concentrations for each GAC unit and the PIZB vessel using a handheld PID. The readings shall be taken once a week unless otherwise approved by the Control Officer.

b. Within 10 hours of initial startup, the Permittee shall collect a grab sample of system effluent vapor. The sample shall be obtained during a period of operation that is representative of continuous operation of the system. The Permittee shall analyze the gas samples by using EPA's Compendium Method TO-15 (TO-15) for volatile organic compounds (VOCs). At the conclusion of the first day of operation, the system shall be shut down pending receipt of laboratory results indicating compliance with the emission limitations set forth in I.I.1.e of this Section.

c. Following the initial startup, the Permittee shall determine the concentrations of VOCs in the influent and effluent of the vapor abatement system by collecting grab samples according to the schedule below:

i. Daily for the first five days of continuous operation. This shall be referred to as schedule #1.

ii. Twice weekly for the next two weeks of operation. This shall be referred to as schedule #2.

iii. Weekly for the next four weeks of operation. This shall be referred to as schedule #3.

iv. Monthly thereafter. This shall be referred to as schedule #4.

If the grab samples show that the emission limitations set forth in I.I.1.e of this Section were exceeded, the Permittee shall take corrective action to reduce the concentration of VOCs to the limits established by this permit. The Permittee shall return to TO-15 sampling frequency schedule #1 following the corrective action(s).

d. The Permittee shall observe the stack of exhaust stream #2 at least once each week for evidence of visible emissions. If the Permittee sees emissions that, on an instantaneous basis, appears to exceed 20%, then the Permittee shall, if practicable, take a six-minute Method 9 observation of the plume. If the emissions are 20% or more, this shall be recorded and reported as an excess emission.

2. VPC – Exhaust Stream #1

The Permittee shall during system operation, take readings of the influent & effluent gas concentration for the VPC using a handheld PID. The readings shall be taken once a week unless otherwise approved by the Control Officer.

3. The Permittee shall perform weekly checks on the MPE, SVE, VPC, PIZB and all the associated equipment and connections to ensure that there are no leaks, breaks or openings and that the equipment is operating according to the approved O & M Plan, manufacturer's specifications or good modern engineering practices.

III. Recordkeeping Requirements

[PCC 17.12.185.A.4]

A. The Permittee shall use the tabular format represented in Attachment 3 to record the results of II.E.1.a and II.E.2 of this Section as follows:

1. Date of PID readings;
2. Type of Air Pollution Control in use (VPC, GAC or PIZB);
3. The name of company or entity that performed the PID monitoring;
4. The exhaust stream number according to the permit application;
5. The concentration of gases in the influent gas stream (ppmV);
6. The PID readings for the inlet and outlet of each GAC canister and the PIZB;
7. The flow rate upstream of the first GAC canister, $Q_{process}$ (scfm); and
8. The exhaust gas flow rate, $Q_{process}$ (scfm).

B. The Permittee shall use the tabular format represented in Attachment 4 to record the results of II.E.1.b & c of the Specific Conditions as follows:

1. Date of TO-15 sampling;
2. Type of air pollution control in use (VPC, GAC or PIZB);
3. The name of company or entity that performed TO-15 sampling;
4. The concentration of VOCs and HAPs upstream of the first GAC canister;
5. The concentration of VOCs and HAPs at the emission outlet;
6. The VOC and HAP removal efficiency of GAC canisters;

C. The Permittee shall record the results of II.E.1.d of this Section in a log containing the date of the check, the person making the check, the specific stack observed, and whether visible emissions were observed. If visible emissions were observed, the Permittee shall include in the log entry any corrective action taken.

D. The Permittee shall record the results of II.E.3 of this Section in a log containing the date of the check, the person making the check and the specific equipment observed. If deviations from normal operations are observed, the Permittee shall include in the log entry any corrective action taken.

E. The Permittee shall display the name, address and phone number of a contact person at the site of the extraction system in a manner as to be clearly visible and accessible.

F. Records Retention [PCC 17.12.185.A.4]

All required records shall be maintained either in an unchangeable electronic format or handwritten logbook of indelible ink for a minimum period of five (5) years after the date of such record and shall be made readily available to the Department upon request for inspection.

G. Location of Records.

The Permittee shall retain all records relating to this permit, and a copy of the permit at the permit site or main Tucson office. The Permittee shall comply with the permit posting requirements of PCC 17.12.080 unless otherwise allowed by the Control Officer. All records shall be maintained in accordance with the requirements of PCC 17.12.185.A.4.b.

IV. Reporting Requirements [PCC 17.12.185.A.5]

A. A written report of the results of all sampling tests required for the first month of operation under II.E.1.b of this Section shall be submitted to the Control Officer within 60 days of sampling. The report shall be submitted in accordance with the Arizona Testing Manual and PCC 17.12.050.B and shall use tabular format of Attachment 3.

Reports of all other sampling not requested above shall be kept on site or at the main Tucson office and not submitted unless requested by the Control Officer.

B. The Permittee shall submit an O & M Plan within 60 days of permit issuance consisting of: [PCC 17.12.030]

1. The process operating parameters and limits,

2. Maintenance procedures and schedules, and

3. Documentation methods necessary to demonstrate proper operation and maintenance of the air pollution control system.

C. Excess Emissions

The Permittee shall report to the Control Officer any emissions in excess of the limits established by this Section in accordance with Section I.B of the Additional Permit Requirements.

[PCC 17.12.185.A.5 & PCC 17.12.040]

V. Testing Requirements

[PCC 17.12.050, PCC 17.12.185.A.3.a & PCC 17.20.010]

For purposes of demonstrating compliance, these test methods shall be used, provided that for the purpose of establishing whether or not the facility has violated or is in violation of any provision of this permit, nothing in this permit shall preclude the use, including the exclusive use, of any credible evidence or information relevant to whether a source would have been in compliance with applicable federal requirements if the appropriate performance or compliance procedures or methods had been performed.

A. Should the Permittee desire to test, or be required to test the equipment to demonstrate compliance with the limits in this permit, the Permittee shall contact the control officer for testing requirements.

[PCC 17.20.010.B]

B. PID Calibration Tests. [PCC 17.20.010.B]

1. Prior to start up, the Permittee shall perform a calibration test of the PID, record the results in a log as described below in V.B.2 of this Section and submit the results to the Control Officer.

2. After start-up, the Permittee shall perform a calibration test of the PID bi-weekly (every two weeks) to ensure that it is accurately indicating VOC concentration. The results shall be recorded in a log containing the date of the test, the person making the test and the deviation from normal that is observed. If no deviation from normal is observed, this shall be recorded in the log. If deviations from normal are observed, the Permittee shall include in the log entry any corrective action taken.

C. The Permittee shall use the following EPA approved test methods to conduct performance tests for the specified pollutants:

1. Particulate Matter. EPA Reference Method 5 shall be used to monitor compliance with I.A of this Section when mass emission testing is required by the Control Officer. [PCC 17.20.010.B]

2. EPA Reference Method 9 shall be used to monitor compliance with I.B of this Section and when an opacity test is required by the Control Officer.

3. EPA Compendium Method TO-15 for VOCs and HAPs, including halogenated organic compounds.

4. The Permittee may submit an alternate and equivalent test method that is listed in 40 CFR Subpart 60, Appendix A, to the Control Officer in a test plan, for approval by the Control Officer.

Section 2

Industrial Laundering Operations

The provisions of this Section are applicable to the industrial laundering operations and equipment (washers and dryers) identified in Table II of Attachment 2. All provisions of this Section that are federally enforceable or material permit conditions are specifically indicated as such.

I. Emission Limitations and Standards [PCC 17.12.185.A.2]

A. Shop Towel Throughput Limit

The Permittee shall limit the soiled weight of shop towels laundered at the facility not to exceed 3,000,000 lb. per year, calculated as 12 month rolling total. [PCC 17.12.185.B.1.b & PCC.17.12.190.B]

[Federally Enforceable Condition]

B. Printer Towel Throughput Limit

The Permittee shall limit the soiled weight of printer towels laundered at the facility not to exceed 100,000 lb. per year, calculated as a 12 month rolling total. [PCC 17.12.185.B.1.b & PCC 17.12.190.B]

[Federally Enforceable Condition]

C. Process Weight Determination

The Permittee shall install, calibrate, maintain, and operate weighing devices if not already installed which can be used to determine daily the soiled weight of shop towels and printer towels laundered. The weighing devices shall have an accuracy of ± five percent over their operating range.

[PCC 17.12.190.B & PCC 17.12.350.A.3.c]

[Material Permit Condition]

II. Monitoring Requirements

A. Industrial Towel Throughput [PCC 17.12.185.A.3]

The Permittee shall monitor the amounts of soiled shop towels and printer towels laundered at the facility by weighing the amounts of each separately prior laundering.

B. Process Weight Determination

The Permittee shall ensure that the weighing device used to monitor the amount of towels processed is regularly maintained and calibrated according to the manufacturer's specifications.

III. Recordkeeping Requirements [PCC 17.12.185.A.4]

A. Industrial Towels

1. The Permittee shall record the following information:

   a. The weight of shop towels and printer towels laundered at the facility each day.

   b. The weight of shop towels and printer towels laundered at the facility each month.

c. The twelve-month rolling total weight of shop towels and printer towels laundered at the facility. The twelve month rolling total weight of shop towels and printer towels processed shall be calculated by adding the current month's weight to the sum of the previous eleven consecutive months' totals. The information shall be recorded by the eleventh day of the following month.

B. Process Weight Determination

The Permittee shall keep all records of maintenance and calibration for the weighing devices used to monitor the amounts of shop and printer towels laundered at the facility.

C. Onsite Records

All records shall be retained on-site by the Permittee for at least five years from the date of generation and shall be made available for review upon the Control Officer's request.

IV. Reporting Requirements [PCC 17.12.185.A.5]

Excess Emissions

The Permittee shall report to the Control Officer any emissions in excess of the limits established by this Section in accordance with section I.B of the Additional Permit Conditions. [PCC 17.12.185.A.5 & PCC 17.12.040]

V. Testing Requirements [PCC 17.12.045, PCC 17.12.050 & PCC 17.20.010]

None Required.

Section 3

Fossil-Fuel Fired Industrial and Commercial Equipment

The provisions of this Section are applicable to the existing affected fossil-fuel fired industrial and commercial equipment (boilers and dryers) identified in Table II of Attachment 2. All provisions of this Section that are federally enforceable or material permit conditions are specifically indicated as such.

I. Emission Limitations and Standards [PCC 17.12.185.A.2]

A. Opacity Standard

The Permittee shall not cause or permit the effluent from any boiler or dryer to have an average optical density equal to or greater than twenty percent (20%) opacity. [PCC 17.16.040.A]

B. Fuel Limitation

The Permittee shall burn only natural gas in the affected boiler(s) and dryer(s).
[Material Permit Condition]

II. Monitoring Requirements

Opacity Monitoring

A demonstration to show compliance with the emission limitation for opacity in I.A of this Section shall not be required since the percent of opacity of visible emissions while combusting natural gas is inherently low. The Permittee shall operate and maintain the boiler and dryers at all times – including periods of startup, shutdown, and malfunction – in a manner consistent with good air pollution control practices and consistent with manufacturer's guidelines. [PCC 17.12.185.A.3]

III. Recordkeeping Requirements [PCC 17.12.185.A.4]

A. Opacity Checks

The Permittee shall record the date and time of the check, the name of the person conducting the check, the results of the check, and the type of corrective action taken (if required).

B. Onsite Records

All records shall be retained on-site by the Permittee for at least five years from the date of generation and shall be made available for review upon the Control Officer's request.

IV. Reporting Requirements [PCC 17.12.185.A.5]

Excess Emissions

The Permittee shall report to the Control Officer any emissions in excess of the limits established by this Section in accordance with section I.B of the Additional Permit Conditions. [PCC 17.12.185.A.5 & PCC 17.12.040]

V. Testing Requirements [PCC 17.12.045, PCC 17.12.050 & PCC 17.20.010]

For purposes of demonstrating compliance, these test methods shall be used, provided that for the purpose of establishing whether or not the facility has violated or is in violation of any provision of this permit, nothing in this permit shall preclude the use, including the exclusive use, of any credible evidence or information relevant to whether a facility would have been in compliance with applicable federal requirements if the appropriate performance or compliance procedures or methods had been performed.

A. Opacity

When required, the Permittee shall perform EPA Reference Method 9, Appendix A in 40 CFR 60 visible emissions observations on the boilers and heaters to demonstrate compliance with the opacity standard.

B. Fuel Limitation

When required the Permittee need only demonstrate that pipeline quality natural gas was fired exclusively since the sulfur content of pipeline quality natural gas is regulated by the Federal Energy Regulatory Commission. [PCC 17.12.185.A.3 & PCC 17.20.010]

C. Alternative Test Method

The Permittee may submit an alternate and equivalent test method(s) that is listed in 40 CFR Subpart 60, Appendix A, to the Control Officer in a test plan, for approval by the Control Officer. [PCC 17.12.045.D]

Section 4

Facility Wide Operations

The provisions of this Section are applicable to facility wide operations and all sources of air contaminants operating at the facility. All provisions of this Section are locally enforceable unless otherwise noted.

I. Emission Limitations and Standards [PCC 17.12.185.A.2]

A. Air Pollution Control

1. The Permittee shall not cause or permit the planning, construction, installation, erection, modification, use or operation of an emission source which will cause or contribute to a violation of a performance standard in Title 17 of the Pima County Code. [PCC 17.16.020.A]

2. Materials including solvents or other volatile compounds, paints, acids, alkalies, pesticides, fertilizers and manure shall be processed, stored, used and transported in such a manner and by such means that they will not evaporate, leak, escape or be otherwise discharged into the ambient air so as to cause or contribute to air pollution. Where means are available to reduce effectively the contribution to air pollution from evaporation, leakage or discharge, the installation and use of such control methods, devices, or equipment shall be mandatory. [PCC 17.16.430.F]

3. Where a stack, vent or other outlet is at such a level that fumes, gas mist, odor, smoke, vapor or any combination thereof constituting air pollution are discharged to adjoining property, the Control Officer may require the installation of abatement equipment or the alteration of such stack, vent or other outlet by the owner or operator thereof to a degree that will adequately reduce or eliminate the discharge of air pollution to adjoining property. [PCC 17.16.020.B]

B. Odor Limiting Standards

The Permittee shall not emit gaseous or odorous materials from equipment, operations or premises under the Permittee's control in such quantities or concentrations as to cause air pollution. [PCC 17.16.030]

C. Opacity Limit

Except as otherwise specified in this section, the opacity of all plumes and effluents from all point and non-point sources shall not exceed 20% as determined by EPA Reference Method 9, Appendix A 40 CFR 60. [PCC 17.16.050.B & PCC 17.16.130.B.1]

D. Visibility Limiting Standard [PCC 17.16.050]

1. The Permittee shall not cause, suffer, allow or permit operations or activities likely to result in excessive amounts of airborne dust without taking reasonable precautions to prevent excessive amounts of particulate matter from becoming airborne.

2. The Permittee shall not cause, suffer, allow, or permit diffusion of visible emissions, including fugitive dust, beyond the property boundary line within which the emissions become airborne, without taking reasonably necessary and feasible precautions to control generation of airborne particulate matter. Sources may be required to cease temporarily the activity or operation which is causing or contributing to the emissions until reasonably necessary and feasible precautions are taken.

a. This provision shall not apply when wind speeds exceed twenty-five (25) miles per hour (using the Beaufort Scale of Wind-Speed Equivalents, or as recorded by the National Weather Service). This exception does not apply if control measures have not been taken or were not commensurate with the size or scope of the emission source.

b. This provision shall not apply to the generation of airborne particulate matter from undisturbed land.

E. Concealment [PCC 17.20.040]

No person shall construct, install, erect, use, replace, modify, or operate an emission source so as to conceal an emission which would otherwise be a violation of a control standard established herein. Concealment shall include:

1. The use of gaseous diluents to achieve compliance with an opacity standard or with a standard which is based on the concentration of a pollutant in the gases discharged to the atmosphere;

2. Operating in a piecemeal fashion to avoid compliance with a standard that would otherwise apply to the source on the basis of its size; and

3. Operating in a manner, under conditions, or during such times that emissions cannot be observed.

II. Monitoring Requirements [PCC 17.12.185.A.3]

A. Odor

Monitoring for gaseous or odorous materials at the facility to determine compliance with the standard in I.B of this Section is not normally necessary as the use of good modern practices prevents the emission of gaseous or odorous materials in such quantities or concentrations as to cause air pollution. The Control Officer may ask the Permittee to monitor and control gaseous or odorous emissions if the Control Officer has reasonable cause to believe a violation of a standard has occurred.

B. Visible Emissions (VE)

1. The Permittee shall not be required to conduct periodic VE checks to demonstrate compliance with I.C and I.D of this Section unless the Control Officer has reason to believe that a violation of a standard has occurred or that reasonably necessary and feasible precautions to control the generation of airborne particulate matter are not being taken. At the request of the Control Officer, the Permittee shall conduct and record periodic VE checks, while the facility is in operation, from all point and nonpoint sources.

2. If the Permittee observes a plume at any time that, on an instantaneous basis, appears to exceed 20 percent opacity, or observes a plume crossing property boundaries, the Permittee shall, if practicable, conduct a VE opacity determination in accordance with EPA Reference Method 9. If the results exceed the applicable opacity limit, or the emissions cross the property boundary, this shall be recorded and reported as an excess emission.

III. Recordkeeping Requirements [PCC 17.12.185.A.3 & 4]

A. Visible Emissions (VE)

The Permittee shall maintain records of periodic VE checks in II.B of this Section (if required) and any VE opacity determinations. Records shall include at a minimum:

a. The date and time of the monitoring,

b. The name of the person conducting the monitoring,

c. The particular piece of equipment or area being monitored; and,

d. The results of the monitoring to include whether excessive emissions were observed. If excessive emissions were observed, the record shall include the corrective action taken and the results of the required follow-up VE opacity determination.

B. Record Retention

The Permittee shall retain records of all required monitoring and support information for at least 5 years from the date of the monitoring sample, measurement, report, or application. Support information includes copies of all reports required by the permit. [PCC 17.12.185.4.b]

C. Recordkeeping for Compliance Determinations

The Permittee shall retain a copy of the permit onsite including all required monitoring records and support information. In addition, all equipment identified in the permit equipment list shall be marked with a unique, clearly visible, and accessible ID to identify the piece of equipment. The Permittee shall be considered in compliance by demonstrating that sufficient information on the equipment and facility operations is periodically collected, recorded, and maintained to assure that the compliance status of any specific condition of this permit can be readily ascertained at any time. [PCC 17.12.080 & PCC 17.24.020.A]

IV. Reporting Requirements [PCC 17.12.185.A.5]

A. Excess Emissions

The Permittee shall report to the Control Officer any emissions in excess of the limits established by this permit in accordance with I.B of the Additional Permit Conditions. [PCC 17.12.185.A.5 & PCC 17.12.040]

B. Emissions Inventory Reporting [PCC 17.12.320]

The Permittee shall complete and submit to the Control Officer, when requested, an annual emissions inventory questionnaire pursuant to PCC.17.12.320 of the Pima County Code.

V. Facility Changes

When applicable, the Permittee shall submit the proper notification and follow the required permit revision procedures pursuant to PCC 17.12.240, PCC 17.12.255.B or PCC 17.12.260.

VI. Testing Requirements

[PCC 17.12.045, PCC 17.12.050 & PCC 17.20.010]

For purposes of demonstrating compliance, these test methods shall be used, provided that for the purpose of establishing whether or not the facility has violated or is in violation of any provision of this permit, nothing in this permit shall preclude the use, including the exclusive use, of any credible evidence or information relevant to whether a source would have been in compliance with applicable federal requirements if the appropriate performance or compliance procedures or methods had been performed.

Opacity

When required, the Permittee shall perform EPA Reference Method 9, Appendix A in 40 CFR 60 visible emissions observations to demonstrate compliance with the opacity standard.

Additional Permit Requirements

I. Compliance with Permit Conditions [PCC 17.12.185.A.7.a & b]

A. The Permittee shall comply with all conditions of this permit including all applicable requirements of Arizona air quality statutes and the air quality rules. Any permit noncompliance constitutes a violation of the Arizona Revised Statutes and is grounds for enforcement action; for permit termination, revocation and reissuance, or revision; or for denial of a permit renewal application. In addition, noncompliance with any federally enforceable requirement constitutes a violation of the Clean Air Act.

B. The Permittee shall report to the Control Officer any emissions in excess of the limits established by this permit. The report shall be in 2 parts as specified below: [PCC 17.12.185.A.5 & PCC 17.12.040]

1. Notification by telephone or facsimile within 24 hours of the time the Permittee first learned of the occurrence of excess emission that includes all available information from 17.12.040.B. The number to report excess emissions is **520-724-7400.** The facsimile number is **520-838-7432.**

2. Detailed written notification by submission of an excess emissions report within 72 hours of the notification under I.B.1 above. **Send to PDEQ 33 N. Stone Avenue, Suite 700, Tucson, Arizona 85701.**

C. It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. The permit does not convey any property rights of any sort, or any exclusive privilege to the permit holder.

E. The Permittee shall pay fees to the Control Officer pursuant to PCC 17.12.520.
[PCC 17.12.185.A.8 & PCC 17.12.520]

II. Permit Revision, Reopening, Revocation and Reissuance, or Termination for Cause [PCC 17.12.185.A.7.c]

The permit may be revised, reopened, revoked and reissued, or terminated for cause pursuant to PCC 17.12.270. The filing of a request by the Permittee for a permit revision, revocation and reissuance, or termination; or of a notification of planned changes or anticipated noncompliance does not stay any permit condition.

III. Duty to Provide Information [PCC 17.12.165.G & PCC 17.12.185.A.7.e]

A. The Permittee shall furnish to the Control Officer, within a reasonable time, any information that the Control Officer may request in writing to determine whether cause exists for revising, revoking and reissuing, or terminating the permit or to determine compliance with the permit. Upon request, the Permittee shall also furnish to the Control Officer copies of records required to be kept by the permit. For information claimed to be confidential, the Permittee shall furnish a copy of such records to the Control Officer along with a claim of confidentiality.

B. If the Permittee has failed to submit any relevant facts or if the Permittee has submitted incorrect information in the permit application, the Permittee shall, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information.

IV. Severability Clause [PCC 17.12.185.A.6]

The provisions of this permit are severable. If any provision of this permit is held invalid, the remainder of this permit shall not be affected thereby.

Attachment 1

Applicable Regulations

Code of Federal Regulations

Chapter 40 Part 60:

Appendix A-4 Method 9 – Visual determination of the opacity of emissions from stationary sources

Pima County Code Title 17, Chapter 17.12:

17.12.010	Statutory authority
17.12.020	Planning, constructing, or operating without a permit
17.12.040	Reporting requirements
17.12.045	Test methods and procedures
17.12.050	Performance tests
17.12.080	Permit Display or Posting
17.12.165	Permit application processing procedures for Class II and Class III permits
17.12.185	Permit contents for Class II and Class III permits
17.12.190	Permits containing synthetic emission limitations and standards
17.12.235	Facility changes that require a permit revision
17.12.240	Procedures for certain changes that do not require a permit revision Class II or Class III
17.12.255	Minor Permit Revision
17.12.260	Significant Permit Revision
17.12.350	Material Permit Condition
17.12.520	Fees related to Class II and Class III permits

Pima County Code Title 17, Chapter 17.16:

17.16.010	Local rules and standards; Applicability of more than one standard
17.16.020	Noncompliance with applicable standards
17.16.030	Odor limiting standards
17.12.040	Standards and applicability (Includes NESHAP)
17.16.050	Visibility limiting standard
17.16.130	Applicability
17.16.165	Standards of performance for fossil-fuel fired industrial and commercial equipment
17.16.430	Standards of performance for unclassified sources

Pima County Code Title 17, Chapter 17.20:

17.20.010	Source sampling, monitoring and testing
17.20.040	Concealment of emissions

Pima County Code Title 17, Chapter 17.24:

17.24.020	Recordkeeping for compliance determination

Attachment 2: Equipment List

Table I **Multiphase Extraction and Alternate Soil Vapor Extraction System with APC**

Type of Equipment	Description	Manufacturer	Model	Serial/Part No.	Max Rated Capacity	Primary Use
MPE (Fuels Used: None)	Multiphase Extraction System	N/A	N/A	N/A	1000 ACFM LRP Blower	Liquid & Vapor Extraction
SVE (Fuels Used: None)	Soil Vapor Extraction System	Geotech	N/A	86090006M	95 ICFM	Soil Vapor Extraction
Exhaust Stream #2 APC: Requirement: Route exhaust through 3 GAC units followed by PIZB in series prior to discharge						
GAC (Fuels Used: None)	3, 2000 lb GAC units	US Filter or Equivalent	VSC-2000	N/A	150 scfm	Removal of VOCs & HAPs
PIZB (Fuel Used: None)	500 lb Permanganate-Impregnated Zeolite Bead Unit	Hydrosil	HS600 or equivalent	N/A	150 scfm	Removal of Vinyl Chloride
Exhaust Stream #1 APC requirement: Route exhaust through VPC prior to discharge						
VPC (Fuels Used: None)	Vapor Phase Carbon (GAC) Unit	US Filter or Equivalent	VSC-200	N/A	200 scfm	Removal of VOC's & HAPs

Attachment 2(Continued): Equipment List

Table II Linen Supply and Industrial Laundering Facility Equipment

Type of Equipment	MFR	Model	Serial Number/ Unique ID	Maximum Rated Capacity	Fuels Used	Date of MFR	Date Installed
Boiler	E. Keeler Co.	D-K-9-7	14226	27, 300 CFH	Nat. Gas	1965	1982
Washer #1	ELLIS	Z472T	1614	900 lbs	N/A	11-2005	11-2005
Washer #2	ELLIS	Z472T	1610	900 lbs	N/A	11-2005	11-2005
Washer #3	ELLIS	Z472AN	1615	900 lbs	N/A	11-2005	11-2005
Washer #4	WASHTECH	T2W-7115T5	7100-0043	250 lbs	N/A	11-2012	12-2012
Washer #5	JENSEN	LTH125HP211215RNNSA	008550	125 lbs	N/A	10-2002	10-2002
Washer #6	ELLIS	Z472J	1061	900 lbs	N/A	07-2000	08-2010
Washer #8`	ELLIS	Z472G	658	675 lbs	N/A	08-1996	08-1996
Dryer #1	CLM	400 GLA	51002	450 lbs 1.95 MMBTU/hr	Nat. Gas	11-2005	11-2005
Dryer #2	CLM	400 GLA	51003	450 lbs 1.95 MMBTU/hr	Nat. Gas	11-2005	11-2005
Dryer #3	CLM	400 GLA	51004	450 lbs 1.95 MMBTU/hr	Nat. Gas	11-2005	11-2005
Dryer #4	Speed Queen	ST170NRQF6G1W01	0611010065	170 lbs 0.395 MMBTU/hr	Nat. Gas	06-2001	12-2001

Attachment 3: MPE/SVE Recordkeeping Format for Weekly PID Readings

General Information			Operating Conditions											Samples Collected			
					Exhaust Steam #1 VOC Conc.		Exhaust Stream #2 Flow		Exhaust Stream #2 VOC Concentrations (ppmv)								
Date	Staff	MPE or SVE Pump/Blower Hour Meter Reading	Visible Emissions?	Odorous Emissions?	Passive Tank Vents (VSP-9)	Passive Stack Effluent (VSP-10)	GAC Influent Flow (VSP-3) (scfm)	Exhaust Stack Flow (VSP-8) (scfm)	Influent GAC (VSP-3)	Influent GAC2 (VSP-4)	Influent GAC3 (VSP-5)	Influent PIZB (VSP-7)	Stack Effluent (VSP-8)	Sample ID:	Time:	Sample ID:	Time:

Attachment 4: MPE/SVE Recordkeeping Format for Analytical Data from Exhaust Stream #2

Monitoring Period	Sample Date	Analytical Testing Company	Flowrate (scfm)	Operation Time (hours)	TCE (VSP-3) [ppmv]	TCE (VSP-8) [ppmv]	TCE Removed from Subsurface (lbs)	TCE Removed by GAC (lbs)	Control Efficiency %	PCE (VSP-3) [ppmv]	PCE (VSP-8) [ppmv]	PCE Removed from Subsurface (lbs)	PCE Removed by GAC (lbs)	Control Efficiency %
Permit Emission Limits (ppmv)						15.0					34.9			

(Form Continued Below)

Cis-1,2 Dichloroethene (VSP-3) [ppmv]	Cis-1,2 Dichloroethene (VSP-8) [ppmv]	DCE Removed from Subsurface (lbs)	DCE Removed by GAC (lbs)	Control Efficiency %	Vinyl Chloride (VSP-3) [ppmv]	Vinyl Chloride (VSP-8) [ppmv]	VC Removed from Subsurface (lbs)	VC Removed by GAC (lbs)	Control Efficiency %	Ethylbenzene (VSP-3) [ppmv]	Ethylbenzene (VSP-8) [ppmv]	EB Removed from Subsurface (lbs)	EB Removed by GAC (lbs)	Control Efficiency %
	210					0.7				0.95				

(Form Continued On Next Page)

Attachment 4 (Continued): MPE/SVE Recordkeeping Format for Analytical Data from Exhaust Stream #2

Total Xylenes (VSP-3) [ppmv]	Total Xylenes (VSP-8) [ppmv]	TX Removed from Subsurface (lbs)	TX Removed by GAC (lbs)	Control Efficiency %	Volatile Fuel Hydrocarbons (VSP-3) [ppmv]	Volatile Fuel Hydrocarbons (VSP-8) [ppmv]	Total VOC's Removed from Subsurface (lbs)	Total VOC's Removed by GAC (lbs)	Control Efficiency %
	1.7					**99**			

(Form Continued From Previous Page)

TECHNICAL SUPPORT DOCUMENT (TSD)

October, 2014

I. GENERAL COMMENTS:

A. Company Information

1. Mission Linen Supply

2. Physical and Mailing Address: 301 South Park Avenue, Tucson, AZ 85705

B. Background

This air quality operating permit is a renewal of the 5-yr permit issued to Mission Linen Supply. Mission Linen Supply (applicant) owns and operates a Multi-Phase Extraction (MPE) and alternate (SVE) remediation system and a linen supply, uniform rental, and industrial laundering business at 301 S. Park Ave. The Mission Linen Supply facility constitutes a **Class III, Synthetic Minor Source** of volatile organic compounds (VOC) and hazardous air pollutants (HAPS). The facility operates under the following industrial classifications:

- MPE and alternate SVE remediation system SIC code: 1799 (NAICS 562910)
- Linen supply and industrial laundering operations SIC codes: 7213,7218 (NAICS 812331,812332)

MPE and Alternate SVE Remediation System

The installed MPE remediation system was permitted by the Pima County Department of Environmental Quality (PDEQ) on October 19, 2006. URS Corporation (URS) is the consultant for Mission Linen and operates the MPE remediation system on their behalf.

The facility is a former dry cleaning facility contaminated by tetrachloroethylene (PCE) spills which have migrated to underlying soils and may also have reached sewer lines through floor drains and sumps. PCE and its degradation products, trichloroethylene (TCE), cis-1, 2-dichloroethene (cis-1, 2-DCE), and vinyl chloride have also dissolved within diesel fuel, which lies atop the shallow aquifer at this location. The layer of diesel fuel which migrated onto the Mission Linen site from an upgradient source, contains up to 10% dissolved PCE at the location beneath the former dry cleaning area. The installed MPE system extracts and treats VOC contaminated diesel fuel, groundwater, and soil gas from a series of extraction wells at this location.

Previous to the installation of the MPE remediation system, a portable soil vapor extraction (SVE) system operated intermittently at the facility from February 2000 through February 2006. The previous SVE system consisted of an extraction blower and vapor phase granular activated carbon (GAC) and included a 500-pound permanganate-impregnated zeolite bead (PIZB) vessel to polish the exhaust gas and was permitted under ADEQ permit numbers 1001072 and 1001312. To accelerate cleanup of the diesel fuel/ PCE mixture from the subsurface, Mission Linen Supply conducted a Multi-Phase Extraction (MPE) pilot test in September 2003. The results showed that the MPE system was a feasible method of removing and treating the diesel fuel/ PCE mixture. Materials to be treated by the MPE system are VOC contaminated diesel fuel, groundwater, and soil gas. Specific pollutants identified in the application include PCE, TCE, Cis-1, 2-DCE, Ethylbenzene, Total Xylenes, and Volatile Fuel Hydrocarbons. A general permit for SVEU systems was not deemed appropriate for this site because the exhaust streams from the MPE do not contain gasoline range organic compounds and halogenated organic compounds are included in the contamination being remediated.

On July 25, 2014, a request to modify the existing MPE system was submitted by URS to allow for an alternate mode of operation using a soil vapor extraction (SVE) train. This request was processed as an addition to the renewal permit application. The alternate SVE system is designed to extract soil vapors from wells screened in a lower zone of the subsurface and will extract similar VOC species. When operating in SVE mode, the SVE blower will be connected through piping and valves to the existing air pollution control (APC) train and subject to the same emissions limits, monitoring, and recordkeeping provisions. Only one extraction system will be operated at a time (MPE mode or SVE mode). While operating in one mode (MPE or SVE) the other extraction train will remain shut down by turning off its associated pump/blower and isolating it with a shutoff valve.

Linen Supply and Industrial Laundering Operations

On April 18, 2014, a permit revision was submitted to include the linen supply and industrial laundering operations after receiving information from industry sources that VOC and HAP emissions result from the washing and drying of soiled industrial towels. The applicant has requested limitations on their industrial shop towel laundering operations to remain a synthetic minor source of VOC and HAPs. In addition, the application includes a boiler and four commercial dryers subject to local performance standards for fossil-fuel fired industrial and commercial equipment that are fired with natural gas.

C. Attainment Classification

The source is in an area that is in attainment for all pollutants.

II. SOURCE DESCRIPTION

A. MPE and Alternate SVE Remediation System

The MPE system and process consists of the application of high vacuum by means of liquid ring pump within a series of wells to extract a mixture of diesel fuel, groundwater, and soil vapor from the subsurface. A number of new and existing wells (11 total) are used for purposes of extracting these fluids. In the processing equipment, the liquid streams (diesel fuel and water) are separated from the vapor stream. (Refer to Figure 4 of the application for a process diagram).

The alternate SVE system and process will consist of the application of vacuum by means of a regenerative blower to wells screened in a lower zone of the subsurface to extract soil vapor. URS intends to only operate one extraction system at a time (MPE mode or SVE mode). While operating in one mode (MPE or SVE) the other extraction train will remain shut down by turning off its associated pump/blower and isolating it with a shutoff valve.

1. Treatment of Gases (MPE or SVE mode):

Extracted soil gas and fluids are treated to remove the VOCs and HAPS by routing them through APC consisting of three 2000 lb vapor-phase GAC vessels and a 500 lb PIZB vessel connected in series prior to discharge. The PIZB vessel is used as a polisher to oxidize any of the vinyl chloride present in the vapor stream that may “roll through” the GAC and be displaced by the PCE and TCE. The treated soil gas is discharged to the atmosphere through a vent on the building roof (Exhaust stream #2 on Figure 4 of application).

When operating in MPE mode the extracted vapor is routed through a series of filters to remove oil mist and dust, an air-to-air heat exchanger to cool the soil vapor stream, and a knockout vessel to collect moisture and condensate from the vapor stream prior to passing the vapors through the APC system. When operating in SVE mode the extracted vapor is routed through the APC system. Valves are used to connect and shutoff the separate extraction trains to the APC system (see system process flow diagram Attachment 1 of this TSD).

2. **Treatment of Liquid Stream (MPE mode):**

The extracted liquid stream from the MPE system passes through an oil/water separator where hydrocarbon liquids (predominantly diesel fuel) are separated from the water. The water is routed to treatment in a series of sealed vessels consisting of an oil-adsorbing clay bed to remove hydrocarbons that may pass through the oil/ water separator and liquid-phase GAC to remove VOCs. Treated water is either used in the laundry or routed to the wastewater treatment system for the facility. There are no emission points in the water treatment portion of the process. The hydrocarbon liquid is routed from the oil/ water separator to a product storage tank for temporary storage and eventual transportation off-site. The vents on the oil/ water separator and product storage tank are routed to a vapor-phase GAC for treatment (Exhaust stream #1 on Figure 4 of application).

3. **MPE or Alternate SVE System Operating Plan:**

a. **Vapor Phase Carbon Drum (Exhaust Stream #1)**

A handheld photoionization detector (PID) will be used to monitor the influent and effluent side of the 200-lb vapor-phase GAC controlling vapors from the breathing and working losses in the liquid oil water separator and liquid product recovery storage tanks once each week during system operation. When effluent concentrations are within 5% of influent concentration, the GAC unit will be replaced. .

b. **2000-lb GAC and PIZB vessels (Exhaust Stream #2)**

Influent, effluent, and intermediate sampling points between 2000-lb GAC vessels will be monitored on a weekly basis using a hand-held PID. The influent sampling point will be prior to the initial GAC vessel and the effluent point will be after the discharge from the vessel containing the PIZB prior to the point at which the treated air stream is discharged to the atmosphere.

Field measurement of the VOC concentration will be used to determine GAC "breakthrough" which in this case is defined as the point at which the effluent concentration on the initial GAC bed is within 10% of the influent concentration to that vessel. If breakthrough in the initial GAC bed is detected, the GAC within that vessel will be scheduled for replacement and the remaining GAC vessels will be moved forward in the series (i.e., the secondary vessel becomes the initial vessel and the tertiary vessel becomes the secondary vessel). The vessel with the new GAC will be placed as the tertiary vessel.

To ensure compliance with permit conditions, influent and effluent grab samples from the vapor abatement system are collected on a daily basis for the first five days of continuous operation (schedule 1), twice weekly for the following two weeks of operation (schedule 2), weekly, for the following four weeks of operation (schedule 3) and monthly thereafter (schedule 4). The samples will be submitted to a laboratory for analysis of VOCs using EPA's Compendium Method TO-15.

B. Linen Supply and Industrial Laundering Operations

The applicant also operates a large linen supply and industrial laundering business. Goods processed at the Tucson facility include sheets, towels, table linens, healthcare items, industrial towels, garments, mats and a number of other items. Goods are provided to customers on a rental basis. Clean goods are delivered to the customer at a varied frequency from bi-weekly to daily depending on the delivery volumes. At the time that the clean goods are delivered, soiled items are also picked up and brought back to the facility where they are sorted, washed, dried, and either pressed or folded before being sent back to the customer.

Approximately 7,000,000 pounds (clean dry weight) of textiles are washed annually at the facility. Currently about 87,000 pounds of soiled industrial shop towels make up this total. The plant presently runs one full shift Monday through Thursday, 5AM to 2PM, and a partial shift on Fridays and Saturdays, 5 AM to 11 AM. There is some seasonality to the business so the operating schedule varies somewhat throughout the year. The linen supply and industrial laundering facility operates year-round, 52 weeks per year. The facility currently operates 2080 hours/year based on the current operating schedule.

Soiled goods are unloaded at the back of the plant by the delivery trucks when they return from deliveries at the end of the day. After unloading, the goods are sorted by wash classification. Washing is performed using a total of seven washer/extractors with capacities ranging from 100 pounds to 900 pounds (clean dry weight). After washing, some items are dried before going to finishing and some items, such as sheets and table linen, go directly to the ironers for pressing. Motel terry towels and industrial towels are always dried before being bagged or folded. After pressing and folding, clean goods are stored until they are delivered back to the customer.

The chemicals used for washing consist of Lauryl Alcohol Ethoxylate (LAE) surfactants, sodium hydroxide, chlorine bleach, hydrogen peroxide, laundry sour (fluorosilicic acid), anti-chlor (sodium thiosulfate), as well as fabric softeners, bacteriostats, etc.

While the laundering chemicals do not contribute to VOC/HAP emissions from the washers and dryers, entrained solvents and chemicals present on the soiled towels picked up from some customers do contribute emissions. The applicant minimizes the impact of these chemicals on the operations by maintaining a policy of not accepting towels that are saturated with solvents. If the towels appear to be saturated to the point where they will not pass a paint filter test [1] they are not accepted and left with the customer. [1] (Ref. SW 846 - EPA Test Methods for Evaluating Solid Waste, Method 9095B).

C. Fossil Fuel Fired Industrial and Commercial Equipment

The facility also operates a boiler and commercial dryers that provide heat for the processes and operations at the facility. The boiler and dryers supply indirect heat from the combustion of natural gas and are subject to local performance standards for fossil-fuel fired industrial and commercial equipment.

III. REGULATORY HISTORY

A. Testing & Inspections

Periodic photo ionization detector (PID) monitoring and EPA, Method TO-15 sampling of the influent and effluent VOC and HAP concentrations from the extraction system have been routinely conducted by URS for compliance with the existing permit conditions. In addition, regular inspections have been conducted by PDEQ since the initial permit was issued. The most recent full compliance evaluation (FCE) was conducted on November 26, 2008.

B. Excess Emissions

Mission Linen has submitted the following permit deviation reports to PDEQ as required under the existing operating permit:

October 21, 2011 reported emissions of vinyl chloride in excess of the permit limits. Vapor samples collected November 3, 2011 showed emissions to be below permit limitations. As a mitigation step, a permanganate-impregnated zeolite bead treatment (PIZB) process was installed to specifically address the potential of vinyl chloride in the vapor stream.

[PDEQ did not take any further action and the issue was adequately resolved on December 1, 2011.]

C Enforcement Actions

Mission Linen has to date resolved all enforcement actions. The following enforcement actions have been issued by PDEQ:

Following an inspection on November 26, 2008, an opportunity to correct was issued for failure to change out the vapor phase carbon unit (VPC) within three weeks following the initial discovery that the effluent concentration reached a value within 5% of the influent concentration and for failure to submit written notice of the change of the liquid ring pump.

[This opportunity to correct was adequately resolved on February 10, 2009.]

D. Permitting Actions

The following is a summary of the facility permit actions. Mission Linen submitted several notifications under the existing operating permit for minor facility changes that did not require a permit revision. On April 18, 2014, the applicant submitted an application for a minor permit revision to incorporate limitations on emissions from the linen supply and industrial laundering operations and fuel burning equipment at the facility. On July 25, 2014, URS submitted a request to incorporate in the permit the operation of an alternate SVE system designed to extract soil vapors from a lower zone of the subsurface that contain the same VOC and HAP species as those collected by the MPE system. The proposed remediation system will be redesigned to use the existing MPE air pollution controls and to enable switching between the MPE or SVE extraction modes, while shutting down and isolating the other extraction system.

IV. EMISSIONS ESTIMATES

A. MPE

Based on several assumptions, a material balance was used to estimate the concentrations of VOC & HAP species in the hydrocarbon liquids. Refer to Section 2.2 of the 01/28/2005 application for a listing of assumptions. PDEQ has checked and verified URS' PTE calculations. Results of these calculations are summarized in the tables below. The potential maximum VOC, HAPs emissions are based on the maximum concentrations measured from the wells for PCE, TCE, cis-1,2-DCE and vinyl chloride (based on Miller Brooks, September 2003, Monitoring Report and Draft Remedial Investigation Report) and air stream pilot test data collected during MPE testing for ethylbenzene, xylenes and volatile fuel hydrocarbons. The estimated emissions were based on the maximum concentrations and a maximum design vapor extraction flow rate of 4248 liters per minute (150 cfm) through the soil vapor gas treatment units. Refer to Section 2.2 (pages 2-3 to 2-7) of the 01/28/2005 application for potential to emit (PTE) calculations.

PDEQ has verified and updated URS's PTE calculations to include data presented in their renewal application dated July 11, 2014. Emissions of VOC & HAPs from the MPE system without controls are shown in the tables below. More information can also be found in Tables 2 & 3 of the 01/28/2005 application and the 07/18/2011renewal application.

Table 1.[1]
Summary of Estimated HAP and VOC emissions from Product Tank & Oil Water Separator
Mission Linen MPE System - Exhaust Stream #1

Description	PCE	TCE	DCE	VOCs	Diesel	Total HAPs	Total VOCs
Product Tank (lbs/yr) [2]	4.18	2.75	0.18	4.59	4.75	7.11	16.45
Oil-Water Separator (lbs/yr) [2]	0.29	0.24	0.02	0.57	0.29	0.55	1.41
Uncontrolled Emissions (lbs/yr)	4.47	2.99	0.20	5.16	5.14	7.66	17.96
Uncontrolled Emissions (tons/yr)	0.0022	0.0015	0.0001	0.0026	0.0026	**0.0038**	**0.009**
Controlled Emissions (lbs/yr)	0.45	0.30	0.02	0.52	0.51	0.77	1.80
Controlled Emissions (tons yr)	0.0002	0.0002	0.00	0.0003	0.0003	**0.0004**	**0.001**

[1.] For a more detailed table, refer to Table 2 in the 01/28/2005 and 07/18/2011 applications.
[2.] Emissions from vessels, upstream of controls based on results from TANKS 4.09 for pure species, and prorated for liquid weight fraction. Gasoline was used as surrogate to represent VOCs in the recovered product. The recovered hydrocarbon liquid does not contain gasoline.

Table 2.
Estimated HAP and VOC emissions from Exhaust Stream #2
Mission Linen MPE System.

Description	PCE	TCE	DCE	Vinyl Chloride	Ethyl Benzene	Xylenes	VOCs	Total HAPs	Total VOCs
Vapor conc. (ppmv) [1]	4700	1200	210	6	0.95	1.7	990	N/A	N/A
Uncontrolled Emissions (tons/yr) [2]	71.7	14.6	1.87	0.054	0.0093	0.0166	11.6	**88.25**	**99.85**
Controlled Emissions (tons/yr) [3]	0.533	0.182	1.87	0.0063	0.0093	0.0166	1.16	**2.62**	**3.78**

[1] Vapor concentrations are assumed 80% of the mass extracted in the well product.
[2] Operating schedule is based on full-time operation, 90% of the year (7,884 hr/yr).
[3] Based on proposed emission limits developed from ISC3 modeling for PCE, TCE, Vinyl Chloride and 90% removal efficiency for VOCs.

Table 3.
Total Estimated HAP and VOC emissions from MPE and Alternate SVE System (Exhaust Streams 1 & 2)

Description	PCE	TCE	DCE	Vinyl Chloride	Ethyl Benzene	Xylenes	VOCs	Total HAPs	Total VOCs
Uncontrolled Emissions (tons/yr) [2]	71.7	14.6	1.87	0.054	0.0093	0.0166	11.6	**88.25**	**99.85**
Controlled Emissions (tons/ yr) [3]	0.533	0.182	1.87	0.0063	0.0093	0.0166	1.16	**2.62**	**3.78**

As shown in Table 3, the uncontrolled emissions from the MPE system demonstrate that the applicant meets the permitting thresholds for requiring a Class III permit. After applying pollution controls to the MPE system and, the emissions estimate is reduced to 2.62 tons/yr for HAPs and 3.78 tons/yr for VOCs allowing for 10% downtime of the MPE system. The use of the pollution controls on the MPE system will be taken as a synthetic minor limitation.

B. Alternate SVE System

The alternate SVE extraction system (SVE Mode) has been designed to extract vapors from a lower zone of the subsurface from a number of wells. The volatile organic compounds extracted within the soil will be the same as for the MPE system. Although the relative concentrations may vary, the same assumptions have been applied for the estimated maximum vapor concentrations . The soil vapor from the SVE system will be discharged to the existing air pollution controls with same flow rate limitations and emission limits and resulting in the same estimated emissions for the remediation system when operating in SVE mode.

C. Linen Supply and Industrial Laundering Operations

The applicant has submitted a minor permit application to include their linen supply and industrial laundering operations and associated equipment in the permit. No federal National Emissions Standards for Hazardous Air Pollutants (NESHAP) or New Source Performance Standards (NSPS) emissions source category standards apply to these operations and there are no EPA established emission factors for this industry sector. While information on the emissions from these operations is limited, the applicant has received information and PDEQ has verified that VOC's and HAP's can be emitted as a result of laundering and drying soiled industrial towels that contain entrained solvents. The applicant has provided emission estimates from this operation using the most conservative emission factors found from their research. The factors submitted as a basis for estimating the emissions were developed by the Minnesota Pollution Control Agency as a result of emissions testing conducted at G & K Services Inc., Minneapolis, MN (October 22-24, 2003) using established EPA methods and was used to classify the sources potential to emit from these operations.

For comparison, PDEQ also reviewed a fugitive air emissions estimate and data presented in a document from the EPA Office of Water, titled, "*Technical Development Document for Final Action Regarding Pretreatment Standards for the Industrial Laundries Point Source Category (Revised March 2000)*". The EPA model provides a lower estimate of VOC and HAP emissions for the facility when normalized to year round production and the estimated wastewater flows calculated from the Tucson facility using the maximum washer throughput. According to the study data from 7 industrial laundering facilities , the primary volatile and semivolatile organics emitted , that account for 80% of

the emissions from the laundering operations, based on the worst case wastewater concentrations of organic species measured, in decreasing order are: n-Decane (60%) , Acetone (7%), Pthalate (6 %), Xylene (4.5%), tetrachloroethene (3%), and Toluene (3%). The emission factors submitted by the applicant (ref. G & K) provides estimates that are 17% greater for total VOC, and 116% greater for total HAP than the EPA published study estimates.

PDEQ reviewed the emissions testing information and the proposed emission factors and are in general agreement with the testing methodology and basis for their development. The emission factors appear to be representative of the ambient air emissions from a similar industrial laundering operation under actual conditions and provide more conservative estimates than the data published in the referenced EPA study. PDEQ concurs with the applicant, that the proposed annual throughput limitation of 3,000,000 lb of soiled shop towels and 100,000 lb of soiled print towels will limit the emissions to a significant margin below the major source thresholds of 100 tons per year VOC and 25 tons per year of combined HAPs, while allowing the applicant flexibility to expand its industrial towel laundering operations if needs require. The estimated emissions are summarized in the Table below.

Table 4.
Total Estimated VOC and HAP emissions from laundering of soiled shop towels with Annual Throughput Limitations (3,000,000 lb of soiled shop towels and 100,000 lb of soiled print towels)

Pollutant	Shop Towels Tons/year	Printer Towels Tons/Year	Total Tons/Year
Total VOC's	23.64	6.06	29.70
Total HAP's	9.57	0.73	10.30

C. Fossil Fuel Fired Commercial and Industrial Equipment

In their permit revision, the applicant has also included natural gas fired equipment including a boiler and commercial dryers used for process heating at the industrial laundering facility that are subject to local performance standards. The emissions from the combustion of natural gas in the boiler and dryers are given in the following Table.

Table 5.
Total Estimated emissions from Natural Gas Combustion in Boiler and Dryers (8760 hours)

Description	NO_X	CO	SOx	PM_{10}	HAPS	VOC's
Uncontrolled Emissions (tons/yr)	14.64	12.30	0.09	1.11	0.28	0.81

D. Facility Wide PTE

Based on the potential to emit the source's class is a Class III synthetic minor stationary source for HAPs and VOCs. The total facility wide potential to emit (PTE) from all operations is provided in the following Table.

Table 6.
Facility Wide Potential to Emit with Controls (8760 hours)

Pollutant	NOx	CO	SOx	PM_{10}	VOC	HAP's
Tons/Year	14.64	12.30	0.09	1.11	34.71	13.49

VI. APPLICABLE REQUIREMENTS

The stationary source is not subject to any federal rules or performance standards for source categories in 40 CFR Part 60, NSPS or 40 CFR Part 63,NESHAP. The following requirements from Title 17 of the Pima County Code are applicable to the source:

40 CFR 60 Appendix A-4 Reference Test Method 9

Pima County Code (PCC) Title 17, Chapter 12: Permits and Permit Revisions

17.12.010 Statutory authority
17.12.020 Planning, constructing, or operating without a permit
17.12.040 Reporting requirements
17.12.045 Test methods and procedures
17.12.050 Performance tests
17.12.080 Permit display or posting
17.12.165 Permit application processing procedures for Class II and Class III permits
17.12.185 Permit contents for Class II and Class III permits
17.12.235 Facility changes that require a permit revision
17.12.240 Procedures for certain changes that do not require a permit revision Class II or Class III
17.12.255 Minor Permit Revision
17.12.260 Significant Permit Revision
17.12.270 Permit Reopenings – Revocation and reissuance – Termination
17.12.350 Material Permit Condition
17.12.520 Fees related to Class II and Class III permits

Pima County Code (PCC) Title 17, Chapter 16: New and Existing Stationary Source Performance Standards

17.16.010 Local rules and standards - Applicability of more than one standard
17.16.020 Noncompliance with applicable standards
17.16.030 Odor limiting standards
17.16.040 Standards and applicability (Includes NESHAP)
17.16.050 Visibility limiting standard
17.16.130 Applicability
17.16.165 Standards of performance for fossil-fuel fired industrial and commercial equipment
17.16.430 Standards of performance for unclassified sources

Pima County Code (PCC) Title 17, Chapter 20: Emission Source Testing and Monitoring

17.20.010 Source sampling, monitoring, testing
17.20.040 Concealment of emissions

Pima County Code Title 17, Chapter 24: Emission Source Recordkeeping and Reporting

17.24.020 Recordkeeping for compliance determination

VII. PERMIT CONTENTS

A. Section I – MPE and Alternate SVE System

Emission Limits/ Standards:

17.16.430.A.1.a	PM Standard
17.16.040.A & 17.16.130.B.3	Opacity Standard
17.16.050.D	Visibility Limiting Standard
17.16.430.D	Odor Limiting Standard
17.16.430.G	Processing of VOCs
17.16.430.G	Use of abatement equipment
17.16.430.G	Flow through Limit
17.12.190.B	No direct discharge into the atmosphere

Fuel Limitation

Change of fuels with appropriate revision.

Operating Limitations

17.12.190.B & 17.16.430.G	Conditions for GAC & PIZB use.
17.12.190.B & 17.16.430.G	Conditions for Vapor Phase Carbon use

Monitoring:

17.12.185.A.3	PM monitoring not required unless requested by the Control Officer.
17.12.185.A.3	Opacity & Odor monitoring (See operational limitations)
17.12.185.A.3	Fuel Limitation: None

Operational Limitations

17.12.185.A.3	Monitoring of gas concentrations in GAC & PIZB
17.12.185.A.3	Grab-sample schedule from vapor abatement system
17.12.185.A.3	Observe exhaust stacks for evidence of visible emissions
17.12.185.A.3	Monitoring of gas concentrations in VPC
17.12.185.A.3	Weekly performance checks of equipment

Recordkeeping Requirements:

17.12.185.A.4	Recordkeeping of gas concentrations
17.12.185.A.4	Record results of opacity observations
17.12.185.A.4	Record results of performance observations
17.12.185.A.4	Display contact information at the site of the system
17.12.185.A.4	Location of Records

Reporting Requirements:

17.12.185.A.5	Submittal of initial system test report required by permit
17.12.185.A.5	Submittal of other reports requested by the Control Officer
17.12.030 & 17.12.185.A.3.d.	Submit O & M plan within 60 days of permit issuance
17.12.320	Emissions Inventory reporting

Testing Requirements:

17.20.010.B	Testing upon Control Officer's request
17.20.010.B	Calibration tests for PID 17.20.010.B
17.20.010.B	Compliance with Particulate Matter Standard
17.12.185.A.3	Compliance with Opacity Standard
17.12.185.A.3	Testing before startup

B. Section II: Industrial Laundering Operations

The provisions of this Section are applicable to the industrial laundering operations and equipment (washers and dryers) identified in Table II of Attachment 2.

Standard	Discussion	Authority
I.A	Voluntary annual throughput limitations for industrial laundered shop towels.	17.12.185.B.1.b 17.12.190.B
I.B	Voluntary annual throughput limitations for industrial laundered print towels.	17.12.185.B.1.b 17.12.190.B
I.C	Requirement to install, calibrate, maintain, and operate weighing devices to weigh soiled shop and printer towels processed, and to maintain an accuracy of 5% over the operating range of the devices.	PCC 17.12.190.B 17.12.350.A.3.c
II.A	Requirement to weigh separately the amounts of printer towels and shop towels processed.	PCC 17.12.185.A.3
II.B.	Requirement to regularly maintain and calibrate the weighing device according to the manufacturer's specifications.	PCC 17.12.185.A.3
III.A	Requirement to keep records of the daily, monthly, and twelve month rolling total weight of shop towels and printer towels processed.	PCC 17.12.185.A.4
III.B	Requirement to keep all records of maintenance and calibration for the weighing devices.	PCC 17.12.185.A.4
IV.	Requirement to report to the Control Officer any emissions in excess of the limits.	PCC 17.12.A.5 PCC 17.12.040
V.	Testing is not required.	PCC 17.12.045 PCC 17.12.050 PCC 17.20.010

C. Section II: Fossil-Fuel Fired Industrial and Commercial Equipment

The provisions of this Section apply to Fossil-Fuel fired Industrial and Commercial Equipment (Boilers and Dryers) specifically listed in Table 2 of Attachment 2 of the permit.

Standard	Discussion	Authority
I.A	Opacity Standard - By law, the Permittee cannot allow any equipment under his control to emit effluents (such as exhaust from the boiler) that exceed specific values of opacity (the degree to which light cannot pass through the plume of effluent/exhaust.) The value of opacity that cannot be exceeded is stated in the permit for the boiler.	PCC 17.16.040.A
I.B	Fuel Limitation – The Permittee may demonstrate compliance with the fuel limitation requirement by documenting the specific fuel supplied to the boiler.	PCC 17.12.185.A.3
II	The opacity of visible emissions from the boilers while combusting natural gas fuel is inherently low and is not significant enough to warrant a regular monitoring demonstration of compliance with the standard; as such the Permittee is required to operate and maintain the boilers at all times - including periods of startup, shutdown, and malfunction - in a manner consistent with good air pollution control practices and consistent with manufacturer's guidelines.	PCC 17.12.185.A.3
III.A	Recordkeeping Requirements – Provision to record all opacity checks to demonstrate compliance with the opacity standard.	PCC 17.12.185.A.4
III.B	Records retention requirement to allow the Control Officer an opportunity to review historical monitoring data to determine compliance with the permit requirements	PCC 17.12.185.A.4
IV.	Reporting requirements for emissions in excess of the limits are identified in the Additional Permit Requirements of this permit.	PCC 17.12.185.A.5
V.A	When required, opacity measurements are required to be performed according to EPA Reference Method 9.	PCC 17.20.010
V.B	Since the sulfur content of pipeline quality natural gas is regulated by the Federal Energy Regulatory Commission, identifying that pipeline quality natural gas was fired exclusively in the applicable boiler would suffice to demonstrate compliance with the fuel limitation standard.	PCC 17.12.185.A.3, PCC 17.20.010
V.C	The Permittee may seek approval for the use of alternative test methods to demonstrate compliance with applicable emission limitation standards.	PCC 17.12.045.D

D. Section IV: Facility Wide Operations

The provisions of this Category apply to Facility Wide operations and all sources of air contaminants operating at the facility.

Standard	Discussion	Authority
I.A.1	This a general requirement applicable to all facilities to not permit the planning, construction, installation erection, modification, use or operation of an emission source which will cause or contribute to a violation of a performance standard in Title 17.	PCC 17.12.185.A.2 PCC 17.16.020.A
I.A.2.	General pollution control requirement for unclassified sources to install and use control methods, devices, and equipment where means are available to reduce effectively the contribution to air pollution from evaporation, leakage, or discharge.	PCC 17.16.430.F
I.A.3	This a general requirement applicable to all facilities to install abatement equipment or alter the stack, vent or other outlet at the request of the Control Officer where the outlet is at such a level that emissions constituting air pollution are discharged to adjoining property.	PCC17.12.185.A.2 PCC 17.16.020.B
I.B	This general odor limiting standard applies to all facilities and sources in Pima County.	PCC 17.12.185.A.2 PCC 17.16.030
I.C	This general opacity limit applies to facility wide point and nonpoint sources in eastern Pima County for facilities located outside of the Tohono O'Odham, Pasqua Yaqui, and San Xavier Indian Reservations.	PCC 17.16.050.B PCC 17.16.130.B.1
I.D	This is the Pima County general visibility limiting standard and applies to all facilities and limits emissions to 20% opacity as measured by EPA Method 9 and the diffusion of visible emissions beyond the property boundary line.	PCC 17.16.050
I.E.	General conditions applicable to all facilities prohibiting the concealment of emissions taken directly from PCC 17.20.040.	PCC 17.20.040
II.A	Demonstration of compliance with the odor limiting standard is not required unless asked by the Control Officer when the Control officer has reasonable casue.to believe a violation of the odor limiting standard has been committed.	PCC 17.12.185.A.3
II.B	Demonstration of the general opacity and fugitive emission requirements is not required unless requested by the Control Officer.	PCC 17.12.185.A.3
III.A	This provision defines the required elements in the facility wide opacity and visible emission checks.	PCC 17.12.185.A.3&4

Standard	Discussion	Authority
III.B	This provision defines the required retention of records.	PCC 17.12.185A.4.b
III.C	This provision defines the permit posting, record locations, and recordkeeping requirements for compliance determinations.	PCC 17.12.080 PCC 17.24.20.A
IV.	Reporting requirements for emissions in excess of the limits are provided in I.B of the Additional Permit Requirements.	PCC 17.12.185.A.5 PCC 17.12.040
V.	Facility Changes - The facility may make a physical change or change in method of operation if the conditions identified for a permit revision are met.	PCC 17.12.240 PCC 17.12.255 PCC 17.12.260
VI.	When required, opacity measurements are required to be performed according to EPA Reference Method 9.	PCC 17.12.050 PCC 17.20.010

E. Additional Permit Requirements

Standard	Discussion	Authority
I	Compliance with Permit Conditions: This section of the permit identifies generic conditions that are applicable to all Class II and Class III sources.	PCC 17.12.185 A.7.a &b, PCC 17.12.185.A.5 17.12.040, 17.12.185.A.9, and, PCC 17.12.510
II	Permit Revision, Reopening, Revocation and Reissuance, or Termination for Cause: The Permittee and Control Officer are provided means of revising, reopening, or terminating the permit for cause.	PCC 17.12.185.A.7.c
III	Duty to provide information: The Permittee is required to furnish records to the Control Officer when requested.	PCC 17.12.165.G & PCC 17.12.185.A.7.e
IV	Severability Clause: This generic condition provides an avenue for the permit to be enforceable even if a part of the permit is found to be invalid.	PCC 17.12.185.A.6

VIII. ALTERNATE OPERATING SCENARIOS

The applicant has not requested any alternate operating scenarios for the system. An increase in extraction wells discussed in the permit application would not be an alternate operating scenario.

The requested change in this renewal to modify the current remediation system design and permit to enable operation of an alternate SVE extraction train, i.e. to be able to switch operation of the remediation system between the two modes of extraction would not be an alternate operating scenario for permitting purposes since the soil vapor discharge from the system while operating in SVE mode will be connected to the same soil vapor treatment train and exhaust stream subject to the same permit requirements without introducing or triggering any new applicable requirements.

IX. MISCELLANEOUS COMMENTS

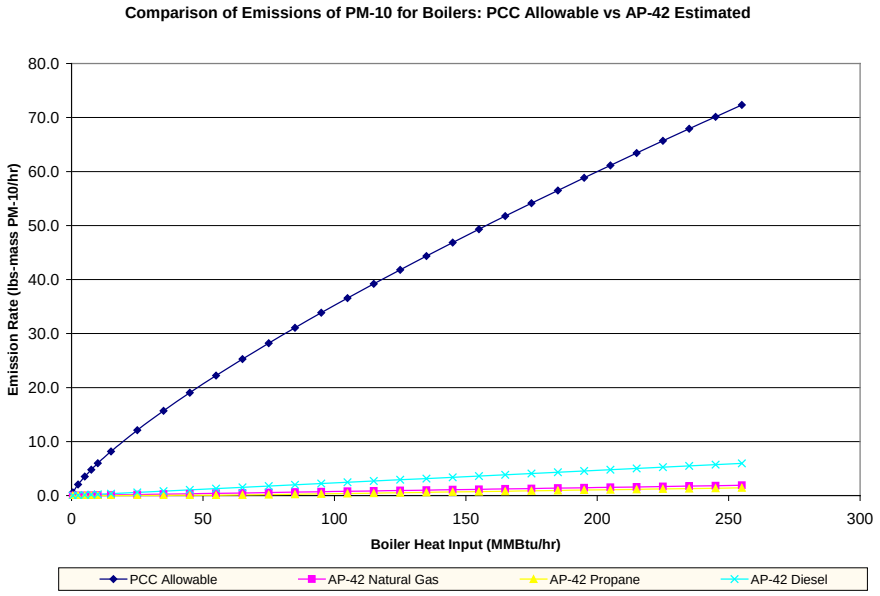
A. Sulfur Dioxide:

Even though the sulfur content limit is 0.9% by weight in Pima County, natural gas delivered to Pima County consistently shows sulfur levels below this limit as shown in past records of fuel supplier specifications/ purchase records which verify sulfur content of the fuel fired. The limitation for use of natural gas will ensure high sulfur fuel is not fired allowing the omission of the rule in PCC 17.16.165.G. These rules are incorporated by reference in Attachment 1 of the permit.

Compliance with the fuel limitation requirements of the Specific Conditions shall ensure compliance with the Sulfur Dioxide standard of PCC 17.16.165.E; which limit the emission of SO_2 to 1.0 pound per million BTU heat input, when burning low sulfur fuel. Since this source does not use diesel or fuel oil it is not necessary to include this standard in the permit even though there is fossil-fuel fired equipment at the facility. The rule specifically applies to sources that use diesel fuel.

B. Particulate Matter:

PCC 17.16.165.C limits the emissions of particulate matter from commercial and industrial fossil-fuel fired equipment (including but not limited to boilers.) This rule has not been included in the permit as allowable emissions are consistently over an entire order of magnitude higher than EPA AP-42 estimated potential emissions. The chart below, illustrates the point.



Comparative Chart of Allowable Particulate Emissions Under Pima County Code, Title 17, and Estimated Potential Emissions based on EPA AP-42 Estimates for External Combustion Sources. Allowable emissions are consistently over ten times estimated potential emissions. Therefore, it is not necessary to include the standard in the permit explicitly, but by reference in Attachment 1.

X. IMPACTS TO AMBIENT AIR QUALITY

Not a major source and so no studies are required

XI. CONTROL TECHNOLOGY DETERMINATION

No control technologies needed to be determined.

XII. PREVIOUS PERMIT CONDITIONS

The permit was divided into sections to include additional sections for the fossil fuel fired commercial and industrial equipment and the industrial laundering operations. Also, a general facility wide section has been added which is applicable to all facility wide sources and all sources of air contaminants at the facility.

MPE and Alternate SVE Remediation System

Minor changes in the provisions were made to clarify their application to the system and for operation in the MPE or SVE mode of extraction rather than the MPE only. The requirements for both extraction modes are identical. The condition in I.I. was changed to clarify that when operating in either the MPE or SVE mode, the other extraction system will be shut down and isolated.

MISSION LINEN SUPPLY
OPERATION AND MAINTENANCE (O&M) PLAN FOR A MULTI PHASE EXTRACTION AND SOIL VAPOR EXTRACTION WITH GAC CONTROL UNITS
301 SOUTH PARK AVENUE, TUCSON, ARIZONA 85705
SUBMITTED TO THE
PIMA COUNTY DEPARTMENT OF ENVIRONMENTAL QUALITY
REGULATION: PIMA COUNTY CODE (PCC) 17.12.030

I) GENERAL INFORMATION

Business Name: Mission Linen Supply

Business Address: 301 South Park Avenue
Tucson, Arizona 85705

Permit Number: 2144

Date of Preparation/Revision: December 18, 2014

General Description of facility operations:

The facility that this O&M plan is written is a remediation system for petroleum- and chlorinated-contaminated soil and groundwater, consisting of a multi-phase extraction unit (MPE), a soil vapor extraction unit (SVE), an air pollution control (APC) unit, and a liquid pollution control (LPC) unit. The MPE unit extracts air, volatile organic compound (VOC) vapors [(including hazardous air pollutants (HAPs)], groundwater, and a mixture of diesel fuel and tetrachloroethene [(PCE), (i.e. product)] from the subsurface. The SVE unit extracts air and VOC vapors from the subsurface. The LPC unit separates the groundwater from the product using an oil/water separator. The product is stored in an onsite product tank which is periodically drained. Vapors emitted from the LPC unit are captured and piped to the APC unit. The APC unit transfers VOC vapors generated by the subsurface vapors and the vapors from the LPC unit by routing them through three 2,000-pound vapor-phase granular activated carbon (GAC) vessels and a 500-pound permanganate-impregnated zeolite bead (PIZB) vessel (exhaust stream #2).

Description of process(es) ducted to control device(s), including pollutants controlled:

The MPE system consists of a liquid ring pump which is connected to six MPE wells with the potential to expand to 11 MPE wells located within the operating facility located at 301 South Park Avenue. The extracted VOC vapors are routed through the APC which consists of three 2,000-pound vapor-phase GAC vessels and a 500-pound PIZB vessel. The extracted liquid/product mixture is routed through an oil/water separator and the product is stored in a recovery tank. VOC vapor emissions from the oil/water separator and the product recovery tank are routed to a 200-pound GAC vessel (exhaust stream #1).

Pollutants controlled by both systems include petroleum hydrocarbons (containing ethylbenzene and total xylenes) and chlorinated solvent compounds [including PCE, trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC)].

The SVE system consists of a SVE blower which is connected to two SVE extraction wells. The vapor stream on the SVE system will be tied into the existing APC for the MPE system. Pollutants controlled are the same as the MPE system.

Complete description of control device(s) covered by the O&M plan including manufacturer, model, rated capacity, total number of identical units, equipment identification number, etc.:

Equipment ID	Manufacturer	Model	Capacity	Number Units
MPE Liquid Ring Pump	Travaini	TRHE 100-1600	150 scfm	1
SVE Blower	Rotron	DR404	0-95 scfm	1
APC (Exhaust Stream #2)	US Filter or Equivalent	VSC-2000	500 scfm*	3
APC (Exhaust Stream #2)	Hydrosil	HS600 or equivalent	100 scfm	1
APC (Exhaust Stream #1)	US Filter or Equivalent	VSC-200	100 scfm	1
*Although the VSC-2000 GAC vessels are rated for 500 scfm, the maximum flow through the vessels will be 150 scfm based on the MPE liquid ring pump size.				

Field data sheets used to record data from the MPE and SVE systems, other hand-held devices, and sample analysis are presented in Attachment 1.

II) OPERATION PLAN

List the operating parameters to be monitored including the units of measure (inches H2O, deg F, gpm, etc.), operating limits (upper and lower limits), and frequency of recording measurements (daily, continuous, etc.). List the method of recording measurements (manual, stripchart recorder, data acquisition system, etc.) and type of instrumentation (magnehelic, temperature sensor, flowmeter, etc.) with instrument display range for each operating parameter:

OPERATING PARAMETER	PORT ID /LOCATION	OPERATING LIMITS	UNITS OF MEASURE	RECORDING FREQUENCY	RECORD METHOD	INSTRUMENT TYPE	DISPLAY RANGE
Exhaust Stream #1 Influent Concentration	VSP-9	0 – 1,000	ppmv	Weekly	Manually recorded on field data sheet	PID or FID	0 to 2,000
Exhaust Stream #1 Effluent Concentration	VSP-10	up to 10 percent of VSP-9 (0 – 100)	ppmv	Weekly	Manually recorded on field data sheet	PID or FID	0 to 2,000
Exhaust Stream #2 Influent Concentration	VSP-3 VSP-4 VSP-5 VSP-7	0 – 8,400*	ppmv	Weekly	Manually recorded on field data sheet	PID or FID	0 to 2,000
	VSP-3	NA	ppmv	At least monthly	EPA TO-15 analysis of grab samples	GC/MS	Per Method
Exhaust Stream #2 Effluent Concentration	VSP-8	0 – 15**	ppmv	Weekly	Manually recorded on field data sheet	PID or FID	0 to 2,000
	VSP-8	Compound specific as per permit emission limits	Ppmv	Monthly or more frequently as per permit requirements	EPA TO-15 analysis of grab samples	GC/MS	Per Method
Exhaust Stream #1 Influent Concentration	VSP-9	0-4	Feet per minute	Weekly	Manually recorded on field data sheet	thermal anemometer	0 to 6,000

OPERATING PARAMETER	PORT ID /LOCATION	OPERATING LIMITS	UNITS OF MEASURE	RECORDING FREQUENCY	RECORD METHOD	INSTRUMENT TYPE	DISPLAY RANGE
Exhaust Stream #1 Effluent Concentration	VSP-10	0-4	Feet per minute	Weekly	Manually recorded on field data sheet	thermal anemometer	0 to 6,000
Exhaust Stream #2 Influent Flow	VSP-3 VSP-4 VSP-5 VSP-7	500 – 1,800	Feet per minute	Weekly	Manually recorded on field data sheet	thermal anemometer	0 to 6,000
Exhaust Stream #2 Effluent Flow	VSP-8	500 – 2,000	Feet per minute	Weekly	Manually recorded on field data sheet	thermal anemometer	0 to 6,000
APC Effluent Stream Temperature	VSP-8	30°F – 140°F	°F	Weekly	Manually recorded on field data sheet	In-Line Temperature Indicator	0°F – 250°F
Individual Temperature Readings	VSP-3 VSP-4 VSP-5 VSP-6 VSP-7 VSP-8 VSP-9 VSP-10	30°F – 140°F	°F	Weekly	Manually recorded on field data sheet	thermal anemometer	-40°F – 212°F
Individual and Combined Vacuum/ Pressure MPE and SVE System	MPE-1 MPE-2 MPE-3 MPE-4 MPE-5 MPE-6 MPE Trunk Line	0 – 25	Inches Hg Vacuum	Weekly	Manually recorded on field data sheet	In-Line Vacuum/ Pressure Indicator	0 – 30
	VSP-3 VSP-4 VSP-5 VSP-6 VSP-7 VSP-8 VSP-9 VSP-10	0 - 30	Inches WC Pressure	Weekly	Manually recorded on field data sheet	Gauge	0 - 30

OPERATING PARAMETER	PORT ID /LOCATION	OPERATING LIMITS	UNITS OF MEASURE	RECORDING FREQUENCY	RECORD METHOD	INSTRUMENT TYPE	DISPLAY RANGE
	PER-14A VEL-03	0 – 30	Inches WC Vacuum	Weekly	Manually recorded on field data sheet	Gauge	0 - 30

* Although the permit application assumes total VOCs of up to 8,400 ppmv, current influent concentrations are typically less than 2,000 ppmv.
** PID field readings are used as an indicator of VOC breakthrough – laboratory samples are used to evaluate compliance with permit conditions.

III) MAINTENANCE PLAN

The MPE and SVE systems are constructed of commonly available components from suppliers such as WW Grainger. Accordingly, most of the components can be purchased locally and replaced as the need arises. Furthermore, the MPE and SVE systems are designed and constructed to operate continuously for years before the key components begin to wear out. However, the technicians that visit the site on a weekly basis are trained to notice and respond to the following anomalous conditions:

- Leaks or blockages in the piping between the extraction wells and the MPE and/or SVE systems;
- Fan bearings needing lubrication;
- Liquid ring pump temperature control (i.e. overheating);
- Cracked, damaged, plugged, or non-normal operation/condition of all flexible hose and hose connections;
- Impediments to free operation of the dilution dampers;
- Low or insufficient performance of the heat exchangers due to lint build-up;
- Cracks, hot spots, or other deformities in the outer shell; and
- Broken wires, dirty contacts, deteriorating insulation, evidence of moisture and other undesired conditions within the control panels.

In addition, routine maintenance activities are performed on an as needed basis and per the manufacturer's recommendations. A list of routine maintenance activities and associated frequency is provided below:

SYSTEM	EQUIPMENT	ACTIVITY	FREQUENCY
MPE	Travaini Liquid Ring Pump	Change Motor Oil	Every 2,000 Hours
MPE	Travaini Liquid Ring Pump	Change Seal Oil	Every 2,000 Hours
MPE	Travaini Seal Oil Reservoir	Add Seal Oil	As needed
MPE	Travaini Seal Oil Reservoir	Add Grease	As needed
MPE	Influent Air Stream	Change Air Filter	Every 3 months, as necessary
SVE	High Vacuum Switch	Drain	Monthly
SVE	Transfer Pump	Check Pump Operation	Monthly
SVE	Moisture Separator	Check Pressure Drop Across Demister	Quarterly
SVE	Blower Motor	Check Amp Draw	Quarterly

In addition to the above maintenance tasks, technicians inspect the systems for loose fittings, irregular pressure drop of moisture separators, motor amp draws, liquid level functionality, pressure gauge functionality, transfer pump performance, and other irregularities as needed and make the appropriate modifications to resolve an issue. Maintenance activities are recorded in the Site Visit form and the Site Log which are also presented in Attachment 1.

IV) ADDITIONAL INFORMATION

None.

ATTACHMENT 1

SITE VISIT AND FIELD DATA LOGS

System Operational Monitoring

Sampling Point	Position	Date	Time	Parameter	Value	Units	Acceptable	Comment
MPE Blower				Oil Level		Yes/No	Yes	checked and recorded Monthly
MPE Blower				Grease Level		Yes/No	Yes	checked and recorded Monthly
MPE Blower				Vacuum		inches Hg	0-30	
MPE Blower				Pressure		inches Hg	0-30	
MPE-1				Vacuum		inches Hg	>= previous	recorded Monthly
MPE-2				Vacuum		inches Hg	0 - 30	
MPE-3				Vacuum		inches Hg	0 - 30	
MPE-4				Vacuum		inches Hg	0 - 30	
MPE-5				Vacuum		inches Hg	0 - 30	
MPE-6				Vacuum		inches Hg	0 - 30	
PER-14A				Vacuum		inches Hg	0 - 30	
VEL-3				Vacuum		inches Hg	0 - 30	
LRP				Total Operation		hours	>= previous	Liquid Ring Pump
P-2				Total Operation		hours	>= previous	Transfer Pump
P-5				Total Operation		hours	>= previous	Product Pump
P-6				Total Operation		hours	>= previous	Water Sump
P-11				Total Operation		hours	>= previous	Treat. Pump
SVE Blower				Total Operation		hours	>= previous	
SVE Blower				Pressure		inches Hg	0-30	
SVE Blower				Vacuum		inches Hg	0-30	

Monitoring Completed By:

NOTES:
1) all date/time values: mm/dd/yy hh:mm (military time)
2) for yes/no values: yes=true; no=false

Liquid System Monitoring

Sampling Point	Position	Date	Time	Parameter	Value	Units	Acceptable	Comment
LSP-1				Pressure		psi	0 - 30	
LSP-1				Total Flow		gallons	>= previous	recorded Monthly
LSP-2				Total Flow		gallons	>= previous	recorded Monthly
LSP-3				Pressure		psi	0 - 30	
LSP-4				Pressure		psi	0 - 30	
LSP-5				Pressure		psi	0 - 30	
LSP-6				Pressure		psi	0 - 30	
LSP-7				Pressure		psi	0 - 30	
LSP-8				Pressure		psi	0 - 30	
LSP-9				Pressure		psi	0 - 30	
LSP-10				Pressure		psi	0 - 30	
FM-4				Total Flow		gallons	>= previous	recorded Monthly
FM-5				Total Flow		gallons	>= previous	recorded Monthly

Monitoring Completed By:

NOTES:
1) all date/time values: mm/dd/yy hh:mm (military time)
2) for yes/no values: yes=true; no=false

Vapor Monitoring Stream #1

Sampling Point	Position	Date	Time	Parameter	Value	Units	Acceptable	Comment
VSP-9				Flow Velocity		ft per min	>=0	
VSP-9				Temperature		degrees F	>=0	
VSP-9				Total VOC		ppm	>=0	
VSP-10				Flow Velocity		ft per min	>=0	
VSP-10				Temperature		degrees F	>=0	
VSP-10				Total VOC		ppm	>=0	If Effluent TVOC is > 95% of Influent, Call Janet Workman for Changeout

Monitoring Completed By:

NOTES:
1) all date/time values: mm/dd/yy hh:mm (military time)
2) for yes/no values: yes=true; no=false
3) Janet Workman: (602) 371-1100

Vapor Stream Monitoring
Exhaust Stream Number 2

Sampling Point	Position	Date	Time	Parameter	Value	Units	Acceptable	Comment
VSP-3				Flow Velocity		ft per min	>=0	
VSP-3				Temperature		degrees F	>=0	
VSP-3				Total VOC		ppm	>=0	
VSP-4				Flow Velocity		ft per min	>=0	
VSP-4				Pressure		inches H_2O	0-30	
VSP-4				Temperature		degrees F	>=0	
VSP-4				Total VOC		ppm	>=0	
VSP-5				Flow Velocity		ft per min	>=0	
VSP-5				Pressure		inches H_2O	0-30	
VSP-5				Temperature		degrees F	>=0	
VSP-5				Total VOC		ppm	>=0	
VSP-6				Flow Velocity		ft per min	>=0	
VSP-6				Pressure		inches H_2O	0-30	
VSP-6				Temperature		degrees F	>=0	
VSP-6				Total VOC		ppm	>=0	
VSP-7				Flow Velocity		ft per min	>=0	
VSP-7				Temperature		degrees F	>=0	
VSP-7				Total VOC		ppm	>=0	

Vapor Stream Monitoring
Exhaust Stream Number 2

Sampling Point	Position	Date	Time	Parameter	Value	Units	Acceptable	Comment
VSP-8				Flow Velocity		ft per min	>=0	
VSP-8				Pressure		inches H_2O	0-100	
VSP-8				Temperature		degrees F	>=0	
VSP-8				Total VOC		ppm	>=0	
Discharge				Flow Velocity		ft per min	>=0	If velocity is greater than 1800 ft/min, call Janet Workman.
Discharge				Temperature		degrees F	>=0	Gauge on Vertical Discharge. Use this temperature in calculations below.
Discharge				Visual Omissions (Opacity)		Yes/No	No	If Yes, Call Janet Workman Immediately
Discharge				Odorous Emmissions		Yes/No	No	If Yes, Call Janet Workman Immediately, and shutdown system

Monitoring Completed By:

NOTES:
1) all date/time values: mm/dd/yy hh:mm (military time)
2) for yes/no values: yes=true; no=false
3) Janet Workman: (602) 371-1100

Appendix C

Perched Aquifer Groundwater Biotreatability Test Tech Memo

TO: Gretchen Wagenseller, Project Manager, Superfund Programs Unit, Arizona Department of Environmental Quality

FROM: Janet Workman, Principal Engineer, URS
Geoffrey Uhlemann, Environmental Engineer, URS

CC: James Sakrison, Esq.
Mr. Tony Mancuso
Joseph Drazek, Esq.
Mr. Donald Moore
Robert Boudra, Project Manager, URS

Registered Professional Engineer (Chemical)
CERTIFICATE NO. 37331
JANET M. WORKMAN
Date Signed 9-18-14
ARIZONA, U.S.A.
EXPIRES 03-31-2017

DATE: September 18, 2014

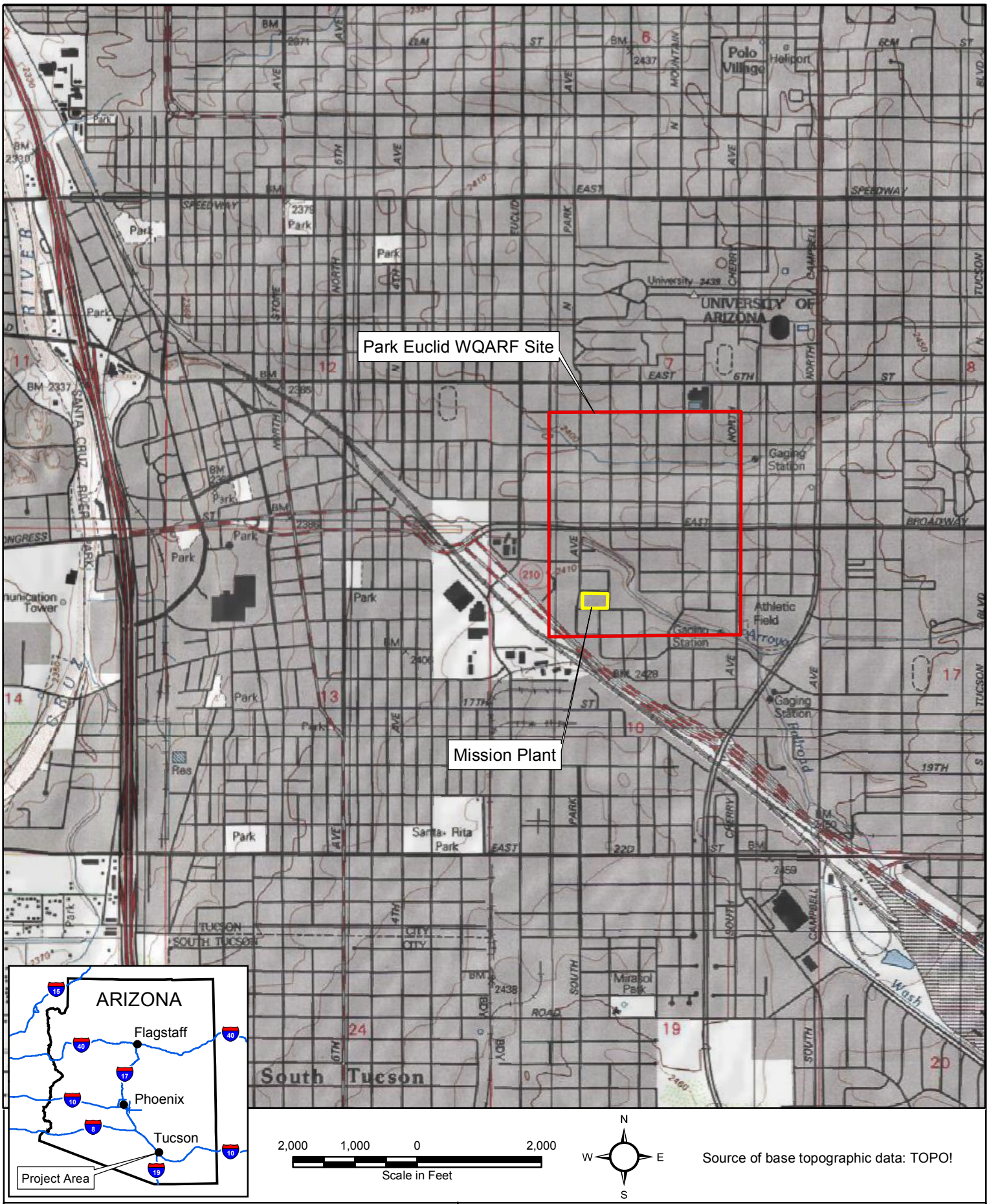
SUBJECT: Summary of Perched Aquifer Groundwater Biotreatability Bench-Scale Test
Park Euclid WQARF Site - 301 South Park Avenue, Tucson, Arizona

---

URS Corporation (URS) prepared this technical memorandum on behalf of The Park - Euclid Group (The Group) to present results from the biotreatability bench-scale test (the Study) conducted at SiREM Laboratory using groundwater and diesel product extracted from various monitoring wells completed in the Perched Aquifer beneath Mission Linen Supply's 301 South Park Avenue plant (the Mission Plant), which falls within the boundaries of the Park Euclid WQARF Site (the Site) in Tucson, Arizona (Figure 1). The purpose of the Study was to assess anaerobic biodegradation of aqueous Site contaminants, namely tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cDCE), and Vinyl Chloride (VC) in the presence of diesel product. This technical memorandum summarizes the Study setup and sampling activities, as well as the test conclusions and their implications for considering chlorinated solvent remediation in the Perched Aquifer. It is presented in the following sections:

1. Site and Study Background
2. Summary of Study Setup and Sampling Activities
3. Study Conclusions and Recommendations
4. References

Group representatives held a meeting on May 1, 2014 with Arizona Department of Environmental Quality (ADEQ) representatives and Tony Young (Assistant Attorney General) to discuss various project specifics, including schedule, the long-term monitoring program, groundwater modeling efforts, and the status and progress of the Feasibility Study (FS). Associated with the FS, URS presented preliminary findings from the Study with results through April 16, 2014. This technical memorandum presents Study results through completion and summarizes conclusions that will support the elimination of bioaugmentation in the FS as a



URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

Date: September 2014

SITE LOCATION MAP
PARK-EUCLID WQARF SITE
301 SOUTH PARK AVENUE
TUCSON, ARIZONA

Mission/P-E/Park_Euclid/Semi_Annual_2014Apr/maps/Fig1_SiteLocation.mxd

Figure 1

viable groundwater remedy in the Perched Aquifer beneath the Mission Plant. The Study setup, sampling activities, and results are presented in detail in SiREM's Report titled *Laboratory Biotreatability Study to Evaluate Remediation of Chlorinated VOCs in Groundwater* included as Attachment A. Field documentation associated with the collection of groundwater and product for analysis and use during the test is included in Attachment B.

1.0 SITE AND STUDY BACKGROUND

URS operated a multiphase extraction (MPE) system as an early response action (ERA) in the Perched Aquifer from October 2011 until it was shutdown April 2014. This system operated continuously with the exception of down periods for routine or non-routine maintenance. Routine monitoring during this time documented decreasing PCE concentrations and increasing cDCE concentrations over time in the source area. The increasing presence of cDCE and VC in the source area presented increasing operational costs associated with MPE treatment, prompting a consideration of alternative Perched Aquifer remedies. Therefore, URS evaluated historical concentration data from the Perched Aquifer with respect to PCE degradation and cDCE accumulation along with reviewing the Environmental Science & Technology article titled *Assessment of in Situ Reductive Dechlorination Using Compound-Specific Stable Isotopes, Functional Gene PCR, and Geochemical Data* (Carreón-Diazconti, et al., 2009). Decreases in PCE concentration and increases in daughter compound concentrations without corresponding reductions in overall VOC mass suggested that biodegradation is not proceeding with significant frequency beyond cDCE and VC at most locations, however, at least one location (SVE-103) showed evidence of overall VOC mass reduction attributed to bioremediation.

A few months after finalizing the FS work plan in June 2013 (URS, 2013a), URS concluded that bench- and/or field-scale tests should be conducted to evaluate whether bioaugmentation of the Perched Aquifer would be likely to promote and/or accelerate complete degradation of the chlorinated compounds to ethene/ethane as an alternative remedy to continued operation of the MPE. URS submitted a *Perched Aquifer Bioaugmentation Study Work Plan* (Work Plan) to ADEQ on December 6, 2013 (URS, 2013b). The Work Plan recommended baseline sampling from 10 Perched Aquifer wells, biotreatability bench-scale testing of Perched Aquifer groundwater with SiREM, and field-scale pilot testing contingent on the success of the bench-scale testing.

The normal anaerobic biodegradation pathway for PCE in the subsurface in the presence of the appropriate bacteria is PCE → TCE→ cDCE→ VC→ ethene/ethane. The dissolved gasses, ethene and ethane, are non-hazardous, and therefore, when this degradation process proceeds all the way to completion, the resulting degradation products are no longer hazardous, and biodegradation is considered complete. In many cases, however, the degradation process "stalls" at cDCE and/or VC as a result of the absence the Dehalococcoides (Dhc) which is the bacteria species that allows the degradation cycle to proceed past cDCE. Perched Aquifer VOC

concentration data suggest cDCE stall is occurring in the Perched Aquifer beneath the Mission Plant; therefore, the purpose of pilot testing bioaugmentation, as described in the Work Plan was to:

1. Evaluate whether the bacteria needed to complete the degradation of PCE and its daughter products to ethene/ethane (Dhc) is present at the site, at what locations, and in what quantities.
2. Evaluate whether the introduction into the Perched Aquifer of specially formulated commercial version of Dhc that is known to be capable of degrading DCE and VC to non-hazardous end products could be a cost effective alternative for remediation of this zone beneath the Mission Plant.

2.0 SUMMARY OF STUDY SETUP AND SAMPLING ACTIVITIES

The Study was conducted to evaluate the efficacy of anaerobic biodegradation of Site contaminants in the Perched Aquifer in the presence of diesel product. Study activities were conducted from January 22 to July 15, 2014, as discussed below.

2.1.1 Baseline Groundwater Sampling and Analysis

Baseline groundwater sampling activities were conducted on January 22, 2014 and involved sample collection at 9 of the 10 Perched Aquifer wells (SVE-101 had insufficient water to be sampled). Field documentation is included in Attachment B. Additional sample volume (approximately 2 gallons) was collected from MPE-1 for use in the microcosm study. Samples were analyzed for PCE and its degradation products by Method 8260B, as well as methane, ethene, and ethane by RSK-175, as presented in Table 1. Assay results for Gene-Trac® Dhc and VC Reductase (vcrA) are included in Attachment C.

Overall, Dhc was present (or quantifiable) in five of the nine samples. The greatest Dhc population was represented in SVE-103, which helps explain the elevated VC and ethene concentrations observed (Table 1) that are attributed to successful biodegradation. SVE-103 is the only location where VC concentrations are greater than cDCE concentrations, indicating that biodegradation processes at this location have passed the cDCE stall observed at many of the Perched Aquifer wells.

2.1.2 Microcosm Construction and Incubation

This section summarizes the microcosm setup and sampling activities, which are detailed in Attachment A. The microcosms were constructed in triplicate in an anaerobic maintained chamber by filling sterile 250 milliliter (mL) glass bottles with 200 mL of Site groundwater and 0.5 mL of the collected light non-aqueous phase liquid (LNAPL) (or diesel product) to reflect the oil/water ratio in the received Site groundwater. The microcosms were constructed in triplicate and included two types of controls (anaerobic sterile and anaerobic active) and three treatment

types (lactate only, KB-1® [cultured Dhc] only, and lactate and KB-1®) for a total of 15 microcosms.

Microcosms were amended with neat PCE and cDCE on January 30, 2014 (before Day 0) to achieve target concentrations of 1.0 mg/L and 50 mg/L, respectively. Treatment microcosms were amended with electron donor on January 31, 2014 (Day 0) and bioaugmented with KB-1® on February 28, 2014 (Day 28). Throughout the Study, the microcosms were covered and incubated in the anaerobic chamber at approximately 22 degrees Celsius (room temperature). Due to slow degradation rates, the electron donor amended microcosms were amended with lactate again on May 8, 2014 (Day 97), the bioaugmented treatments were bioaugmented again on May 30, 2014 (Day 119), and electron donor amended microcosms were amended with lactate a third time on July 3, 2014 (Day 153).

2.1.3 Microcosm Sampling and Analysis

Aqueous samples were collected from the control and treatment microcosms on a biweekly basis for analysis of chlorinated volatile organic compounds (cVOCs), dissolved gases (ethene, ethane, and methane) and pH. Aqueous samples were also collected less frequently for analysis of volatile fatty acids (VFA) and anions (sulfate, nitrate, nitrite, chloride, phosphate, bromide). Details of sampling procedures and results are presented in Attachment A. Additional charts illustrating concentration over time are included in Attachment D.

3.0 STUDY CONCLUSIONS AND RECOMMENDATIONS

Overall, the total ethenes present (as measured in moles) did not decrease in any of the control or treatment microcosms throughout the duration of the Study, nor was ethene produced in any of the microcosms. VC was eventually generated in the treatment microcosms, with the greatest levels observed in the lactate and KB-1® augmented treatment set, but not in the control microcosms. Therefore, augmenting with lactate (biostimulation) and KB-1® (bioaugmentation) accelerated partial anaerobic degradation, with the production of VC; however, cDCE concentrations remained elevated and ethene was not produced, indicating that complete anaerobic degradation was not achieved. It is likely that the presence of diesel LNAPL inhibited anaerobic degradation.

The Study ended upon receipt of analytical results from July 15, 2014, because it was determined that since complete anaerobic degradation could not be achieved in a controlled microcosm with several amendment events, that the field application of bioaugmentation would not be feasible or effective. Therefore, complete anaerobic biodegradation appears to be a localized phenomenon (such as in the vicinity of SVE-103) that could not feasibly be replicated elsewhere in the Perched Aquifer, and therefore, bioaugmentation is likely not a viable groundwater remedy for the entire Perched Aquifer beneath the site. Product thicknesses have historically varied considerably at SVE-103, but have remained at or below 0.03 foot for the last two years, which

may have enabled biodegradation processes to progress with less hindrance from direct contact with free-phase product. Field-scale pilot testing of bioaugmentation in the Perched Aquifer will not be conducted and bioaugmentation will not be developed as a viable groundwater remedy for the Perched Aquifer in the FS.

4.0 REFERENCES

Carreón-Diazconti, C., J. Santamaría, J. Berkompas, J. A. Field, and M. L. Brusseau. 2009. Assessment of in Situ Reductive Dechlorination Using Compound-Specific Stable Isotopes, Functional Gene PCR, and Geochemical Data. Environmental Science & Technology, Volume 43, pp. 4301 – 4307.

URS, 2013a. Work Plan, Feasibility Study and Associated Activities, Park-Euclid WQARF Site, Tucson, Arizona, URS Corporation, June 21.

URS, 2013b. Work Plan, Perched Aquifer Bioaugmentation Study, Park-Euclid WQARF Site, Tucson, Arizona, URS Corporation, December 6.

ATTACHMENTS

Table 1	Summary of Groundwater Analytical Results
Attachment A	SiREM's Laboratory Biotreatability Study
Attachment B	Field Documentation
Attachment C	Laboratory Analytical Data Reports
Attachment D	Concentration Time-Series Charts

Table 1
Summary of Groundwater Analytical Results
Bioaugmentation Test Baseline - January 2014
Park - Euclid WQARF Site, Tucson, Arizona

Location ID	Type	Sample Date	c-1,2-DCE	Ethane	Ethene	Methane	PCE
		Analyte	c-1,2-DCE	Ethane	Ethene	Methane	PCE
		Fraction	T	T	T	T	T
		Units	ug/L	ug/L	ug/L	ug/L	ug/L
MPE-1	SA	01/22/2014	11000	<5.0	<5.0	130	<50
MPE-2	SA	01/22/2014	9900	<5.0	<5.0	460	190
MPE-3	SA	01/22/2014	18000	<5.0	<5.0	<5.0	<50
MPM-1	SA	01/22/2014	75000	<5.0	<5.0	11	<50
PEP-10	SA	01/22/2014	2.4	<5.0	14	3500	<0.50
PEP-8	SA	01/22/2014	60	<5.0	<5.0	7500	<25
PEP-9	SA	01/22/2014	8200	<5.0	17	190	<100
SVE-103	SA	01/22/2014	2800	<90	4100	4900	<500
SVE-104	SA	01/22/2014	120000	<5.0	15	100	<50

SA - Field Original, FD - Field Duplicate
T - Total, D - Dissolved
< 0.50 - Not detected at or above the reporting limit.

Table 1
Summary of Groundwater Analytical Results
Bioaugmentation Test Baseline - January 2014
Park - Euclid WQARF Site, Tucson, Arizona

Location ID	Type	Sample Date	t-1,2-DCE T ug/L	TCE T ug/L	VC T ug/L		
		Analyte Fraction Units					
MPE-1	SA	01/22/2014	<50	390	<50	----	----
MPE-2	SA	01/22/2014	30	340	1.7	----	----
MPE-3	SA	01/22/2014	170	170	<50	----	----
MPM-1	SA	01/22/2014	210	180	<50	----	----
PEP-10	SA	01/22/2014	1.2	<0.50	26	----	----
PEP-8	SA	01/22/2014	<25	<25	<25	----	----
PEP-9	SA	01/22/2014	<100	<100	140	----	----
SVE-103	SA	01/22/2014	<500	<500	9500	----	----
SVE-104	SA	01/22/2014	1700	170	2000	----	----

SA - Field Original, FD - Field Duplicate
T - Total, D - Dissolved
< 0.50 - Not detected at or above the reporting limit.

Attachment A
SiREM's Laboratory Biotreatability Study

Prepared for:

URS Corporation
7720 North 16th Street
Suite 100
Phoenix, Arizona
85020

Final Report

Laboratory Biotreatability Study to Evaluate Remediation of Chlorinated VOCs in Groundwater

Park Euclid Site, Phoenix, Arizona

Prepared by:

130 Research Lane, Suite 2
Guelph, Ontario N1G 5G3

SiREM Ref: TL0292.26

13 Aug 2014

siremlab.com

TABLE OF CONTENTS

Page

1. INTRODUCTION 1
   1.1 Summary of Biodegradation Processes 1
2. MATERIALS AND METHODS 1
   2.1 Microcosm Construction and Incubation 1
   2.2 Microcosm Sampling and Analysis 3
      2.2.1 Microcosm Sampling 3
      2.2.2 Analysis of cVOCs and Dissolved Hydrocarbon Gases 3
      2.2.3 Analysis of Anions and Total Volatile Fatty Acids 4
      2.2.4 Analysis of Volatile Fatty Acids 4
      2.2.5 Analysis of pH 5
      2.2.6 External Analysis of Total Petroleum Hydrocarbons 5
3. RESULTS 5
4. REFERENCES 6

LIST OF TABLES

Table 1: Summary of Microcosm Controls, Treatments and Amendments
Table 2: Summary of Microcosm Chlorinated VOC and DHG Results
Table 3: Summary of Microcosm Anion Results
Table 4: Summary of Microcosm VFA Results
Table 5: Summary of Microcosm pH Results

LIST OF FIGURES

Figure 1: Pathways for the Degradation of Chlorinated Ethenes
Figure 2: Chlorinated Compound Concentration Trends in Anaerobic Sterile Control Microcosms
Figure 3: Chlorinated Compound Concentration Trends in Anaerobic Active Control Microcosms
Figure 4: Chlorinated Compound Concentration Trends in Lactate Amended Microcosms
Figure 5: Chlorinated Compound Concentration Trends in Lactate Amended and KB-1 Bioaugmented Microcosms
Figure 6 Chlorinated Compound Concentration Trends in KB-1 Bioaugmented Microcosms

LIST OF APPENDICES

Appendix A: Chain of Custody Documentation
Appendix B: Henry's Law Calculation
Appendix C: ALS External Analysis Report

LIST OF ABBREVIATIONS

ALS	ALS Global
BTEX	benzene, toluene, ethyl benzene, xylenes
CO_2	carbon dioxide
cDCE	*cis*-1,2-dichloroethene
cVOC	chlorinated volatile organic compound
Dhc	*Dehalococcoides*
ÁC	degrees Celsius
ÁC/min	degrees Celsius per minute
DHG	dissolved hydrocarbon gases
ERD	enhanced reductive dechlorination
GC	gas chromatograph
IC	ion chromatograph
LNAPL	light non-aqueous phase liquid
Õg/L	micrograms per liter
ÕL	microliter
min	minutes
mg/L	milligrams per liter
mL	milliliters
mL/min	milliliters per minute
mM	millimolar
mmol/bottle	millimoles per bottle
ORP	oxidation-reduction potential
%	percent
QL	quantitation limit
RPM	revolutions per minute
SiREM	SiREM Laboratory
PCE	tetrachloroethene
TPH	total petroleum hydrocarbons
TCE	trichloroethene
URS	URS Corporation
VC	vinyl chloride
VFA	volatile fatty acid
VOA	volatile organic analysis
VOC	volatile organic compound

1. INTRODUCTION

URS Corporation (URS) retained SiREM Laboratory (SiREM) to perform a laboratory biotreatability study to assess the potential for in situ bioremediation of chlorinated volatile organic compounds (cVOCs) in groundwater at the Park Euclid Site in Phoenix, Arizona (the Site). The purpose of the study was to assess anaerobic biodegradation of the Site contaminants, namely tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (*c*DCE). The site water also contained dissolved diesel products.

The ground water (MPE-1GPT-012214) used in this study was collected by URS personnel on 22 January 2014 and received by SiREM on 24 January 2014. Refer to Appendix A for the chain of custody documentation received with the materials.

The remainder of this report contains a summary of key biodegradation processes (Section 1.1), the experimental materials and methods (Section 2), the results and discussion of the microcosm study (Section 3), and report references (Section 4).

1.1 Summary of Biodegradation Processes

Biological degradation products of PCE include TCE, *c*DCE, vinyl chloride (VC) and the fully dechlorinated end product ethene. Figure 1 contains degradation pathways for the chlorinated ethenes.

Natural attenuation processes can occur in situ and are often mediated by indigenous microbial populations present at contaminated sites. Enhanced reductive dechlorination (ERD) can, in certain cases, be achieved by stimulating the indigenous microbial populations through the addition of electron donors. Bioaugmentation is the process in which a microbial population known to promote ERD or other biodegradation processes is introduced to groundwater to enhance the rate or extent of biodegradation. KB-1È is a natural microbial consortium containing microorganisms (including *Dehalococcoides* [Dhc]) known to be responsible for mediating the complete dechlorination of TCE, cDCE and VC to ethene (Major et al., 2002; Duhamel et al., 2002). KB-1È is used to introduce *Dhc* and complete dechlorination activity to sites exhibiting slow or incomplete dechlorination of chlorinated ethene and ethane compounds.

2. MATERIALS AND METHODS

The following sections describe the materials and methods used for microcosm construction and incubation (Section 2.1), and microcosm sampling and analysis (Section 2.2).

2.1 Microcosm Construction and Incubation

Biotreatability microcosms were constructed in an anaerobic chamber (Coy Laboratory Products, Grass Lake, MI) containing the Site groundwater and all of the materials required to construct the treatment and control microcosms. The chamber atmosphere is maintained with approximately 80 percent (%) nitrogen, 10% carbon dioxide (CO_2) and 10% hydrogen (Linde Gases, Guelph, ON). Hydrogen in the anaerobic chamber atmosphere functions to scavenge

trace oxygen via a reaction with a palladium catalyst. Anaerobic conditions in the anaerobic chamber were monitored using an indicator containing resazurin (Sigma, St. Louis, MO) in a mineral medium, which turns pink in the presence of oxygen.

Prior to microcosm construction, the light non-aqueous phase liquid (LNAPL) mixed with the Site water was collected in a sterile 20 mL volatile organic vial. During microcosm construction, the Site water was mixed thoroughly to ensure reproducibility between replicates.

Microcosms were constructed by filling sterile 250 milliliter (mL) (nominal volume) screw cap Boston round clear glass bottles (Systems Plus, New Hamburg, ON) 200 mL of Site groundwater. To the microcosms 0.5 mL of the collected LNAPL was added to reflect the oil/water ratio in the received Site groundwater. The bottles were capped with Mininert™ closures to allow repetitive sampling with minimal cVOC loss and to allow nutrient amendment, as needed, throughout the incubation period. All treatment and control microcosms were constructed in triplicate. Table 1 summarizes the details of microcosm construction and the amendments used for the treatment and control microcosms.

Anaerobic sterile control microcosms were constructed to quantify potential abiotic and experimental cVOC losses from the microcosms. The sterile control microcosms were filled with 200 mL of Site groundwater and 0.5 mL of Site LNAPL and amended with mercuric chloride and sodium azide as described in Table 1.

All microcosms were sampled and incubated in the anaerobic chamber. During quiescent incubation, all microcosms were covered to minimize photodegradation, and stored horizontally to minimize cVOC losses via the (submerged) Mininert™ closure. Microcosms were incubated for a period of up to 165 days at approximately 22 degrees Celsius (ÁC) (room temperature).

URS specified that the initial PCE, TCE, and *c*DCE concentrations in the microcosms should be 1.0 milligrams per liter (mg/L), 1.0 mg/L, and 50 mg/L, respectively, to represent concentrations measured at the Site. The initial concentrations of PCE and *c*DCE measured in the prepared microcosms were not at the target concentration; therefore on 30 January 14 (Day -1), the microcosms were amended with PCE and *c*DCE to achieve the target concentration of 1.0 mg/L and 50 mg/L, respectively. The measured TCE concentrations were at the target concentration and did not have to be amended with TCE.

Treatment microcosms were amended with electron donor on 31 January 2014 (Day 0). Sodium lactate (JRW Bioremediation, Lenexa, KS) was the selected electron donor evaluated in this study. The first microcosm of each treatment and control was amended with resazurin (Sigma, St. Louis, MO) to monitor redox conditions. Resazurin turns from pink to clear in the absence of oxygen and can be used to indicate the on-set of reducing conditions. Details of contaminant spiking, electron donor addition and resazurin amendment are provided in Tables 1 and Table 2.

Bioaugmentation may improve the extent and rate of chlorinated ethenes dechlorination. Microcosms are typically bioaugmented after reducing conditions required by the KB-1È culture

are achieved. Suitable reducing conditions are typically achieved after electron donor addition and are assessed qualitatively by both changes in the resazurin indicator color (from pink to clear) and measurement of the oxidation-reduction potential (ORP). The ORP was measured in two randomly selected microcosms on 28 February 2014 (Day 28) to be -164 millivolts (mV) and -140 mV in microcosms 12 and 15, respectively. The resazurin colour had also changed from pink to clear in all treatment microcosms. One set of the electron donor amended microcosms and one set of Site groundwater microcosms were bioaugmented with KB-1È culture on 28 February 2014 (Day 28).

Due to slow degradation rates and after consultation with URS, it was decided to amend the electron donor amended microcosms with lactate again on 8 May 14 (Day 97). For similar reasons, the bioaugmented treatments were re-bioaugmented on 30 May 14 (Day 119). The electron donor amended microcosms were amended with lactate a third time on 3 July 14 (Day 153). Details of lactate and KB-1È bioaugmentation events are provided in Tables 1 and 2.

2.2 Microcosm Sampling and Analysis

2.2.1 Microcosm Sampling

Aqueous samples were collected from the control and treatment microcosms on a biweekly (i.e. every two weeks) basis for analysis of cVOCs, dissolved hydrocarbon gases (DHGs ï ethene, ethane, and methane) and pH. Aqueous samples were also collected less frequently for analysis of volatile fatty acids (VFAs ï lactate, acetate, propionate, formate, butyrate and pyruvate) and anions (sulfate, nitrate, nitrite, chloride, phosphate, bromide). The microcosms were sampled using gas-tight 250 microliters (ÕL) and 1 mL Hamilton glass syringes. Separate sets of syringes were used for the bioaugmented and non-bioaugmented treatments to minimize the potential for transfer of KB-1È microorganisms from bioaugmented to non-bioaugmented treatments. Syringes were cleaned with acidified water (pH ~2) and rinsed 10 times with deionized water between samples to ensure that volatile organic compounds (VOCs) and microorganisms were not transferred between different samples or treatments. On Day 3 (3 February 2014) three microcosms were sampled for baseline analysis of Total Petroleum Hydrocarbons (TPH) products. The analytical methods employed by SiREM are described below.

2.2.2 Analysis of cVOCs and Dissolved Hydrocarbon Gases

This section describes the methods used to quantify the cVOCs and DHGs. The quantitation limits (QL) for the chlorinated ethenes and DHGs were typically 10 micrograms per liter (Õg/L) in the microcosms based on the lowest concentration standards that were included in the linear calibration trend.

Aqueous cVOC and DHG concentrations in the microcosms were measured using a Hewlett-Packard (Hewlett Packard 7890) gas chromatograph (GC) equipped with an auto sampler (Hewlett Packard G1888) programmed to heat each sample vial to 75ÁC for 45 minutes (min) prior to headspace injection into a GSQ Plot column (0.53 millimeters x 30 meters, J&W) and a flame ionization detector. Sample vials were heated to ensure that all VOCs in the aqueous

sample would partition into the headspace. The injector temperature was 200ÁC, and the detector temperature was 250ÁC. The oven temperature was programmed as follows: 35ÁC for 2 min, increased to 100ÁC at 50 degrees Celsius per minute (ÁC/min), then increased to 185ÁC at 25ÁC/min and held at 185ÁC for 6.80 min. The carrier gas was helium at a flow rate of 11 milliliters per minute (mL/min).

After withdrawing a 100 ÕL sample (as described in section 2.2.1), the sample was injected into a 10 mL auto sampler vial containing 5.90 mL of acidified deionized water (pH ~2). The water was acidified to inhibit microbial activity between microcosm sampling and GC analysis. The vial was sealed with an inert Teflon^{È}-coated septum and aluminium crimp cap for automated injection of 3 mL of headspace onto the GC. One cVOC standard was analysed with each set of samples to verify the instrument ten-point calibration curve. Calibration was performed using external standard solutions (Sigma, St Louis, MO), where known volumes of standard solutions were added to acidified water in auto sampler vials and analysed as described above for microcosm samples. Data were integrated using Chemstation Software (Agilent Technologies, Santa Clara, CA).

2.2.3 Analysis of Anions and Total Volatile Fatty Acids

Anions and total VFA analysis was performed on a Thermo-Fisher ICS-2100 ion chromatograph (IC) equipped with a Thermo-Fisher AS-DV auto sampler and an AS18 column. The sample loop volume was 25 ÕL. An isocratic separation was performed using 33 millimolar (mM) reagent grade sodium hydroxide (Thermo Scientific, Oakville, ON) eluent for 15 min. One standard was analysed with each set of samples tested in order to verify the seven-point calibration using external standards of known concentrations. External standards were prepared gravimetrically using chemicals of the highest purity available (Sigma St Louis, MO or Bioshop, Burlington, ON). Data were integrated using Chromeleon 7 Chromatography software (Thermo Scientific, Oakville, ON). The QLs were as follows: 0.07 mg/L total VFA, 0.07 mg/L chloride, 0.09 mg/L nitrite, 0.09 mg/L nitrate, 0.07 mg/L sulfate, 0.07 mg/L phosphate and 0.08 mg/L bromide. The total VFA value includes lactate, formate, acetate, propionate, pyruvate and butyrate. The VFA method described below (Section 2.2.4) is used to quantify individual VFAs.

A 0.5 mL sample was withdrawn (as described in section 2.2.1), after which the sample was placed in a 1.5 mL micro-centrifuge tube. Samples were centrifuged for five minutes at 13,000 revolutions per minute (RPM) to remove solids. The supernatant was removed, diluted 50-fold in deionized water and placed in a Thermo-Fisher auto sampler vial with a cap that filters the sample during automated injection onto the IC.

2.2.4 Analysis of Volatile Fatty Acids

Individual VFAs (lactate, acetate, propionate, formate, butyrate and pyruvate) analysis was performed on a Thermo-Fisher ICS-2100 IC equipped with a Thermo-Fisher AS-DV auto sampler and an AS11-HC column, the sample loop volume was 25 ÕL. A gradient separation was performed using the following eluent profile; 1.0 mM sodium hydroxide for 8.0 min to 15 mM at 18.0 min and proceeding to 30 mM at 28.0 min with a flow rate of 0.25 mL/min.

Calibration was performed using external standards of known concentrations. One standard was analysed with each set of samples to verify the instrumentôs seven-point calibration curve produced using external standards of known concentrations. External standards were prepared gravimetrically using chemicals of the highest purity available (Sigma St Louis, MO or Bioshop, Burlington, ON). Data were integrated using Chromeleon 7 chromatography software (Thermo Scientific, Oakville, ON). The QLs were as follows: lactate 0.40 mg/L, acetate 0.54 mg/L, propionate 0.31 mg/L, formate 0.23 mg/L, butyrate 0.41 mg/L and pyruvate 0.69 mg/L.

A 0.5 mL sample was withdrawn (as described in section 2.2.1), after which the sample was placed in a 1.5 mL micro-centrifuge tube. Samples were centrifuged for five minutes at 13,000 RPM in a microcentrifuge to remove solids. The supernatant was removed, diluted 50-fold in deionized water and placed in a Thermo-Fisher auto sampler vial with a cap that filters the sample during automated injection onto the IC.

2.2.5 Analysis of pH

The pH measurements were performed using an Oakton pH spear with a combination pH electrode (Oakton, Vernon Hills, IL). A 0.5 mL sample was taken (as described in section 2.2.1), the vial was removed from the glove box and the pH was measured on the lab bench. The pH spear was calibrated at each sampling event according to the manufacturerôs instructions using pH 4.0, 7.0 and 10 standards.

2.2.6 External Analysis of Total Petroleum Hydrocarbons

Analysis of TPH was completed at ALS Global (ALS) in Waterloo, ON. Three sacrificial microcosms were prepared for baseline analysis in the same way as the active controls. They were sampled on 31 January 14 (Day 0). The samples were collected in two 40 mL volatile organic analysis (VOA) vials for benzene, toluene, ethyl benzene and xylene (BTEX) and F1 Hydrocarbon analysis and one 100 mL amber glass bottle for F2-F4 Hydrocarbon analysis. F1 Hydrocarbon analysis refers to analysis of hydrocarbon species of chain lengths between 6 and 10 carbons in length. Similarly, F2 refers to hydrocarbon species between 10 and 16 carbons, F3 refers to hydrocarbon species between 16 and 34 carbons, and F4 refers to hydrocarbons 34 to 50 carbons in chain length.

3. RESULTS

Tables 2, 3, 4 and 5 provide cVOC, ethene, methane, anion, VFA, and pH data from the control and treatment microcosms over the incubation period for the study. All cVOC, ethene, and methane concentrations are presented in units of mg/L and millimoles per microcosm bottle (mmol/bottle) to demonstrate mass balances on a molar basis. Concentrations were converted from mg/L to mmol/bottle using Henryôs Law as demonstrated in Appendix B. External results from ALS are presented in Appendix C.

4. REFERENCES

Duhamel, M., S.D. Wehr, L. Yu, H. Rizvi, D. Seepersad, S. Dworatzek, E.E. Cox, and E.A.Edwards. 2002. Comparison of anaerobic dechlorinating enrichment cultures maintained on tetrachloroethene, trichloroethene, cis-1,2-dichloroethene and vinyl chloride. Water Research 36: 4193-4202.

Major, D.W., M.L. McMaster, E.E. Cox, E.A. Edwards, S.M. Dworatzek, E.R. Hendrickson, M.G. Starr, J.A. Payne, and L.W. Buonamici. 2002. Field demonstration of successful bioaugmentation to achieve dechlorination of tetrachloroethene to ethene. Environmental Science and Technology 36: 5106-5116.

TABLES

TABLE 1: SUMMARY OF MICROCOSM CONTROLS, TREATMENTS AND AMENDMENTS
Park Euclid Site, Phoenix, Arizona

Treatment/Control	Assigned Bottle Number	Number of Microcosms	Geologic Material (g)	Groundwater (mL)	Headspace (mL)	Sodium Azide	Mercuric Chloride	Rezasurin	Tetrachloroethene (PCE)	cis-1,2-Dichloroethene (*c* DCE)	Lactate	KB-1
Anaerobic Sterile Control	1 to 3	3	N/A	200	50	Amended with 0.5 mL of a 5% solution on Day -2.	Amended with 2.8 mL of a 2.7% solution on Day -2.	Amend first replicate with 100 µL resazurin.	Spiked with 1310 µL of sat. PCE to a target concentration of 1 mg/L.	Spiked with 6 µL of neat *c* DCE to a target concentration of 50 mg/L.	NA	NA
Anaerobic Active Control	4 to 6	3	N/A	200	50	NA	NA	Amend first replicate with 100 µL resazurin.	Spiked with 1310 µL of sat. PCE to a target concentration of 1 mg/L.	Spiked with 6 µL of neat *c* DCE to a target concentration of 50 mg/L.	NA	NA
Lactate	7 to 9	3	N/A	200	50	NA	NA	Amend first replicate with 100 µL resazurin.	Spiked with 1310 µL of sat. PCE to a target concentration of 1 mg/L.	Spiked with 6 µL of neat *c* DCE to a target concentration of 50 mg/L.	Amended with 122 µL of 60% sodium lactate to a target lactate concentration of 366 mg/L on Days 1, 97, and 153.	NA
Lactate and KB-1[E]	10 to 12	3	N/A	200	50	NA	NA	Amend first replicate with 100 µL resazurin.	Spiked with 1310 µL of sat. PCE to a target concentration of 1 mg/L.	Spiked with 6 µL of neat *c* DCE to a target concentration of 50 mg/L.	Amended with 122 µL of 60% sodium lactate to a target lactate concentration of 366 mg/L on Days 1, 97, and 153.	Bioaugmented with KB-1[E] on Days 28 and 119.
KB-1[E] Only	13 to 15	3	N/A	200	50	NA	NA	Amend first replicate with 100 µL resazurin.	Spiked with 1310 µL of sat. PCE to a target concentration of 1 mg/L.	Spiked with 6 µL of neat *c* DCE to a target concentration of 50 mg/L.	NA	Bioaugmented with KB-1[E] on Days 28 and 119.

Notes:

cDCE - cis-1,2-dichloroethene
g - grams
mg/L - milligrams per liter
mL - milliliters
NA - not applicable
PCE - tetrachloroethene
% - percent
µL - microliters

TABLE 2: SUMMARY OF MICROCOSM CHLORINATED VOC AND DHG RESULTS
Park Euclid Site, Phoenix, Arizona

Treatment	Date	Day	Replicate	Bottle	Chlorinated Ethenes							Chlorinated Ethanes	Methane and Electron Donors	Comment
					PCE	TCE	cDCE	tDCE	VC	Ethene	Total Ethenes	Ethane	Methane	
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mmol/bottle	mg/L	mg/L	
Anaerobic Sterile Control	29-Jan-14	-2												Poisoned with mercuric chloride and sodium azide.
														Amended first replicate with 100 ÕL resazurin.
	30-Jan-14	-1												Spiked with cDCE and PCE to a target concentrations of 50 mg/L and 1.0 mg/L, respectively.
	31-Jan-14	0	ANSC-1	1	0.80	1.2	57	0.28	<0.10	<0.10	--	<0.10	0.22	
			ANSC-2	2	1.3	1.7	66	0.32	<0.10	<0.10	--	<0.10	0.22	
			ANSC-3	3	0.49	0.96	53	0.24	<0.10	<0.10	--	<0.10	0.22	
			Average Concentration (mg/L)		0.85	1.3	59	0.28	ND	ND	--	ND	0.22	
			Standard Deviation (mmoles)		5.8E-04	6.5E-04	1.5E-02	9.1E-05	0.0E+00	0.0E+00	--	0.0E+00	5.9E-05	
			Average Total mmoles		**0.0013**	**0.0022**	**0.13**	**0.0006**	**ND**	**ND**	**1.3E-01**	**ND**	**0.021**	
	14-Feb-14	14	ANSC-1	1	1.7	1.8	68	0.35	<0.10	<0.10	--	<0.10	0.22	
			ANSC-2	2	1.4	1.7	67	<0.10	<0.10	<0.10	--	<0.10	0.22	
			ANSC-3	3	0.61	1.0	53	0.25	<0.10	<0.10	--	<0.10	0.21	
			Average Concentration (mg/L)		1.2	1.5	63	0.20	ND	ND	--	ND	0.22	
			Standard Deviation (mmoles)		8.3E-04	7.5E-04	1.9E-02	4.0E-04	0.0E+00	0.0E+00	--	0.0E+00	1.5E-04	
			Average Total mmoles		**0.0018**	**0.0026**	**0.14**	**0.0004**	**ND**	**ND**	**1.4E-01**	**ND**	**0.021**	
	28-Feb-14	28	ANSC-1	1	0.51	0.91	52	0.26	<0.10	<0.10	--	<0.10	0.25	
			ANSC-2	2	0.95	1.2	58	0.28	<0.10	<0.10	--	<0.10	0.25	
			ANSC-3	3	0.39	0.90	53	0.23	<0.10	<0.10	--	<0.10	0.25	
			Average Concentration (mg/L)		0.62	1.0	54	0.26	ND	ND	--	ND	0.25	
			Standard Deviation (mmoles)		4.4E-04	3.4E-04	7.3E-03	5.0E-05	0.0E+00	0.0E+00	--	0.0E+00	6.6E-05	
			Average Total mmoles		**0.00092**	**0.0017**	**0.12**	**0.0006**	**ND**	**ND**	**1.2E-01**	**ND**	**0.024**	
	14-Mar-14	42	ANSC-1	1	0.71	1.2	56	0.28	<0.10	<0.10	--	<0.10	0.20	
			ANSC-2	2	1.6	1.7	64	0.32	<0.10	<0.10	--	<0.10	0.20	
			ANSC-3	3	0.59	0.99	51	0.24	<0.10	<0.10	--	<0.10	0.20	
			Average Concentration (mg/L)		0.97	1.3	57	0.28	ND	ND	--	ND	0.20	
			Standard Deviation (mmoles)		8.3E-04	6.8E-04	1.4E-02	9.6E-05	0.0E+00	0.0E+00	--	0.0E+00	1.3E-04	
			Average Total mmoles		**0.0014**	**0.0022**	**0.13**	**0.0006**	**ND**	**ND**	**1.3E-01**	**ND**	**0.019**	
	15-Jul-14	165	ANSC-1	1	0.29	0.75	52	0.25	<0.10	<0.10	--	<0.10	0.19	
			ANSC-2	2	0.28	0.75	56	0.25	<0.10	<0.10	--	<0.10	0.19	
			ANSC-3	3	0.43	0.80	51	0.23	<0.10	<0.10	--	<0.10	0.19	
			Average Concentration (mg/L)		0.33	0.77	53	0.24	ND	ND	--	ND	0.19	
			Standard Deviation (mmoles)		1.3E-04	5.0E-05	6.2E-03	3.2E-05	0.0E+00	0.0E+00	--	0.0E+00	2.2E-04	
			Average Total mmoles		**0.0005**	**0.0013**	**0.12**	**0.0005**	**ND**	**ND**	**1.2E-01**	**ND**	**0.019**	
Anaerobic Active Control	29-Jan-14	-2												Amended first replicate with 100 ÕL resazurin.
	30-Jan-14	-1												Spiked with cDCE and PCE to a target concentrations of 50 mg/L and 1.0 mg/L, respectively.
	31-Jan-14	0	ANAC-1	4	0.55	0.91	56	0.27	<0.10	<0.10	--	<0.10	0.22	
			ANAC-2	5	0.61	0.87	48	0.23	<0.10	<0.10	--	<0.10	0.22	
			ANAC-3	6	0.23	0.68	44	0.19	<0.10	<0.10	--	<0.10	0.23	
			Average Concentration (mg/L)		0.46	0.82	49	0.23	ND	ND	--	ND	0.22	
			Standard Deviation (mmoles)		3.0E-04	2.1E-04	1.4E-02	8.5E-05	0.0E+00	0.0E+00	--	0.0E+00	5.0E-04	
			Average Total mmoles		**0.00069**	**0.0014**	**0.11**	**0.0005**	**ND**	**ND**	**1.1E-01**	**ND**	**0.021**	
	14-Feb-14	14	ANAC-1	4	0.77	1.0	53	0.25	<0.10	<0.10	--	<0.10	0.25	
			ANAC-2	5	0.92	1.3	64	0.32	<0.10	<0.10	--	<0.10	0.23	
			ANAC-3	6	0.56	1.2	58	0.27	<0.10	<0.10	--	<0.10	0.23	
			Average Concentration (mg/L)		0.75	1.2	58	0.28	ND	ND	--	ND	0.24	
			Standard Deviation (mmoles)		2.7E-04	2.7E-04	1.3E-02	7.8E-05	0.0E+00	0.0E+00	--	0.0E+00	1.4E-03	
			Average Total mmoles		**0.0011**	**0.002**	**0.13**	**0.0006**	**ND**	**ND**	**1.3E-01**	**ND**	**0.023**	
	28-Feb-14	28	ANAC-1	4	0.88	1.2	52	0.25	<0.10	<0.10	--	<0.10	0.25	
			ANAC-2	5	0.59	0.84	55	0.26	<0.10	<0.10	--	<0.10	0.24	
			ANAC-3	6	0.13	0.71	46	0.20	<0.10	<0.10	--	<0.10	0.24	
			Average Concentration (mg/L)		0.53	0.9	51	0.24	ND	ND	--	ND	0.24	
			Standard Deviation (mmoles)		5.7E-04	3.9E-04	9.3E-03	7.7E-05	0.0E+00	0.0E+00	--	0.0E+00	7.1E-04	
			Average Total mmoles		**0.00079**	**0.0015**	**0.11**	**0.0005**	**ND**	**ND**	**1.1E-01**	**ND**	**0.024**	
	14-Mar-14	42	ANAC-1	4	0.31	0.54	50	0.22	<0.10	<0.10	--	<0.10	0.21	
			ANAC-2	5	0.20	0.24	55	0.24	<0.10	<0.10	--	<0.10	0.21	
			ANAC-3	6	0.15	0.55	37	0.17	<0.10	<0.10	--	<0.10	0.20	
			Average Concentration (mg/L)		0.22	0.44	47	0.21	ND	ND	--	ND	0.21	
			Standard Deviation (mmoles)		1.2E-04	3.0E-04	2.0E-02	8.7E-05	0.0E+00	0.0E+00	--	0.0E+00	3.4E-04	
			Average Total mmoles		**0.00033**	**0.00076**	**0.1**	**0.0005**	**ND**	**ND**	**1.0E-01**	**ND**	**0.02**	
	15-Jul-14	165	ANAC-1	4	<0.10	<0.10	54	0.25	<0.10	<0.10	--	<0.10	0.19	
			ANAC-2	5	<0.10	0.24	56	0.22	<0.10	<0.10	--	<0.10	0.16	
			ANAC-3	6	<0.10	0.15	51	0.19	<0.10	<0.10	--	<0.10	0.16	
			Average Concentration (mg/L)		ND	0.13	54	0.22	ND	ND	--	ND	0.17	
			Standard Deviation (mmoles)		0.0E+00	2.1E-04	5.7E-03	6.2E-05	0.0E+00	0.0E+00	--	0.0E+00	1.6E-03	
			Average Total mmoles		**ND**	**0.00023**	**0.12**	**0.0005**	**ND**	**ND**	**1.2E-01**	**ND**	**0.017**	

TABLE 2: SUMMARY OF MICROCOSM CHLORINATED VOC AND DHG RESULTS
Park Euclid Site, Phoenix, Arizona

Treatment	Date	Day	Replicate	Bottle	Chlorinated Ethenes							Chlorinated Ethanes	Methane and Electron Donors	Comment
					PCE	TCE	cDCE	tDCE	VC	Ethene	Total Ethenes	Ethane	Methane	
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mmol/bottle	mg/L	mg/L	
Lactate	29-Jan-14	-2												Amended first replicate with 100 ÕL resazurin.
	30-Jan-14	-1												Spiked with cDCE and PCE to a target concentrations of 50 mg/L and 1.0 mg/L, respectively.
	31-Jan-14	0												Amended with 60% Lactate solution to a target concentration of 366 mg/L.
			LAC-1	7	0.78	1.2	69	0.31	<0.10	<0.10	--	<0.10	0.22	
			LAC-2	8	0.97	1.3	54	0.26	<0.10	<0.10	--	<0.10	0.22	
			LAC-3	9	0.69	1.1	62	0.29	<0.10	<0.10	--	<0.10	0.22	
			Average Concentration (mg/L)		0.81	1.2	62	0.29	ND	ND	--	ND	0.22	
			Standard Deviation (mmoles)		2.1E-04	1.7E-04	1.7E-02	6.5E-05	0.0E+00	0.0E+00	--	0.0E+00	2.6E-04	
			Average Total mmoles		**0.0012**	**0.002**	**0.14**	**0.0006**	**ND**	**ND**	**1.4E-01**	**ND**	**0.021**	
	14-Feb-14	14	LAC-1	7	0.39	0.98	57	0.27	<0.10	<0.10	--	<0.10	0.21	
			LAC-2	8	0.33	0.85	51	0.25	<0.10	<0.10	--	<0.10	0.21	
			LAC-3	9	1.4	1.7	69	0.38	<0.10	<0.10	--	<0.10	0.22	
			Average Concentration (mg/L)		0.71	1.2	59	0.3	ND	ND	--	ND	0.21	
			Standard Deviation (mmoles)		8.9E-04	7.8E-04	2.1E-02	1.5E-04	0.0E+00	0.0E+00	--	0.0E+00	3.4E-04	
			Average Total mmoles		**0.0011**	**0.002**	**0.13**	**0.0007**	**ND**	**ND**	**1.3E-01**	**ND**	**0.021**	
	28-Feb-14	28	LAC-1	7	0.72	1.4	54	0.27	<0.10	<0.10	--	<0.10	0.25	
			LAC-2	8	1.7	2.0	57	0.29	<0.10	<0.10	--	<0.10	0.24	
			LAC-3	9	0.28	1.1	53	0.24	<0.10	<0.10	--	<0.10	0.23	
			Average Concentration (mg/L)		0.89	1.5	55	0.27	ND	ND	--	ND	0.24	
			Standard Deviation (mmoles)		1.1E-03	8.0E-04	4.6E-03	4.5E-05	0.0E+00	0.0E+00	--	0.0E+00	1.0E-03	
			Average Total mmoles		**0.0013**	**0.0026**	**0.12**	**0.0006**	**ND**	**ND**	**1.2E-01**	**ND**	**0.023**	
	14-Mar-14	42	LAC-1	7	0.11	0.93	54	0.25	<0.10	<0.10	--	<0.10	0.20	
			LAC-2	8	0.13	0.97	48	0.24	<0.10	<0.10	--	<0.10	0.20	
			LAC-3	9	<0.10	1.3	53	0.28	<0.10	<0.10	--	<0.10	0.20	
			Average Concentration (mg/L)		0.079	1.1	52	0.25	ND	ND	--	ND	0.20	
			Standard Deviation (mmoles)		1.0E-04	3.5E-04	6.6E-03	4.4E-05	0.0E+00	0.0E+00	--	0.0E+00	1.7E-04	
			Average Total mmoles		**0.00012**	**0.0018**	**0.11**	**0.0006**	**ND**	**ND**	**1.1E-01**	**ND**	**0.019**	
	16-Apr-14	75	LAC-1	7	<0.10	1.4	58	0.27	<0.10	<0.10	--	<0.10	0.22	
			LAC-2	8	<0.10	1.2	52	0.23	<0.10	<0.10	--	<0.10	0.21	
			LAC-3	9	<0.10	1.3	59	0.28	<0.10	<0.10	--	<0.10	0.22	
			Average Concentration (mg/L)		ND	1.3	56	0.26	ND	ND	--	ND	0.22	
			Standard Deviation (mmoles)		0.0E+00	1.9E-04	8.1E-03	5.3E-05	0.0E+00	0.0E+00	--	0.0E+00	1.9E-04	
			Average Total mmoles		**ND**	**0.0022**	**0.13**	**0.0006**	**ND**	**ND**	**1.3E-01**	**ND**	**0.021**	
	08-May-14	97												Amended with lactate to a target concentration of 366 mg/L.
			LAC-1	7	<0.10	1.0	53	0.23	<0.10	<0.10	--	<0.10	0.19	
			LAC-2	8	0.10	1.2	49	0.22	<0.10	<0.10	--	<0.10	0.20	
			LAC-3	9	<0.10	1.3	55	0.25	<0.10	<0.10	--	<0.10	0.20	
			Average Concentration (mg/L)		0.034	1.2	52	0.24	ND	ND	--	ND	0.20	
			Standard Deviation (mmoles)		8.8E-05	2.3E-04	7.3E-03	3.7E-05	0.0E+00	0.0E+00	--	0.0E+00	3.6E-04	
			Average Total mmoles		**5.1E-05**	**0.002**	**0.12**	**0.0005**	**ND**	**ND**	**1.2E-01**	**ND**	**0.019**	
	22-May-14	111	LAC-1	7	<0.10	1.2	56	0.27	0.13	<0.10	--	<0.10	0.19	
			LAC-2	8	0.15	1.4	52	<0.10	<0.10	<0.10	--	<0.10	0.19	
			LAC-3	9	<0.10	1.4	60	0.32	<0.10	<0.10	--	<0.10	0.20	
			Average Concentration (mg/L)		0.049	1.3	56	0.2	0.044	ND	--	ND	0.19	
			Standard Deviation (mmoles)		1.3E-04	2.4E-04	9.1E-03	3.8E-04	3.0E-04	0.0E+00	--	0.0E+00	2.8E-04	
			Average Total mmoles		**7.2E-05**	**0.0023**	**0.12**	**0.0004**	**0.00017**	**ND**	**1.2E-01**	**ND**	**0.019**	
	03-Jul-14	153												Amended with lactate to a target concentration of 366 mg/L.
	15-Jul-14	165	LAC-1	7	0.31	1.6	59	0.27	<0.10	<0.10	--	<0.10	0.19	
			LAC-2	8	0.28	1.6	54	0.24	<0.10	<0.10	--	<0.10	0.19	
			LAC-3	9	0.19	1.5	58	0.27	<0.10	<0.10	--	<0.10	0.19	
			Average Concentration (mg/L)		0.26	1.6	57	0.26	ND	ND	--	ND	0.19	
			Standard Deviation (mmoles)		8.9E-05	1.3E-04	6.5E-03	3.1E-05	0.0E+00	0.0E+00	--	0.0E+00	8.5E-05	
			Average Total mmoles		**0.00039**	**0.0027**	**0.13**	**0.0006**	**ND**	**ND**	**1.3E-01**	**ND**	**0.018**	
Lactate and KB-1	29-Jan-14	-2												Amended first replicate with 100 ÕL resazurin.
	30-Jan-14	-1												Spiked with cDCE and PCE to a target concentrations of 50 mg/L and 1.0 mg/L, respectively.
	31-Jan-14	0												Amended with 60% Lactate solution to a target concentration of 366 mg/L.
			LAC+KB-1-1	10	1.0	1.5	66	0.33	<0.10	<0.10	--	<0.10	0.21	
			LAC+KB-1-2	11	0.66	0.97	60	0.31	<0.10	<0.10	--	<0.10	0.21	
			LAC+KB-1-3	12	0.67	1.1	60	0.28	<0.10	<0.10	--	<0.10	0.22	
			Average Concentration (mg/L)		0.78	1.2	62	0.31	ND	ND	--	ND	0.22	
			Standard Deviation (mmoles)		3.1E-04	5.1E-04	7.7E-03	5.5E-05	0.0E+00	0.0E+00	--	0.0E+00	1.8E-04	
			Average Total mmoles		**0.0012**	**0.002**	**0.14**	**0.0007**	**ND**	**ND**	**1.4E-01**	**ND**	**0.021**	
	14-Feb-14	14	LAC+KB-1-1	10	0.37	0.87	59	0.26	<0.10	<0.10	--	<0.10	0.22	
			LAC+KB-1-2	11	0.27	1.1	61	0.30	<0.10	<0.10	--	<0.10	0.22	
			LAC+KB-1-3	12	0.36	0.88	54	0.26	<0.10	<0.10	--	<0.10	0.22	
			Average Concentration (mg/L)		0.34	0.95	58	0.28	ND	ND	--	ND	0.22	
			Standard Deviation (mmoles)		8.2E-05	2.2E-04	8.5E-03	5.6E-05	0.0E+00	0.0E+00	--	0.0E+00	2.7E-04	
			Average Total mmoles		**0.0005**	**0.0016**	**0.13**	**0.0006**	**ND**	**ND**	**1.3E-01**	**ND**	**0.021**	
	28-Feb-14	28												Bioaugmented with KB-1
			LAC+KB-1-1	10	1.7	2.2	64	0.34	<0.10	<0.10	--	<0.10	0.23	
			LAC+KB-1-2	11	0.53	2.1	56	0.28	<0.10	<0.10	--	<0.10	0.23	
			LAC+KB-1-3	12	2.0	2.7	65	0.36	<0.10	<0.10	--	<0.10	0.24	

TABLE 2: SUMMARY OF MICROCOSM CHLORINATED VOC AND DHG RESULTS
Park Euclid Site, Phoenix, Arizona

Treatment	Date	Day	Replicate	Bottle	Chlorinated Ethenes							Chlorinated Ethanes	Methane and Electron Donors	Comment
					PCE	TCE	cDCE	tDCE	VC	Ethene	Total Ethenes	Ethane	Methane	
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mmol/bottle	mg/L	mg/L	
Lactate and KB-1			**Average Concentration (mg/L)**		1.4	2.3	62	0.33	ND	ND	--	ND	0.23	
			Standard Deviation (mmoles)		1.2E-03	5.2E-04	1.0E-02	8.9E-05	0.0E+00	0.0E+00	--	0.0E+00	7.8E-04	
			Average Total mmoles		**0.0021**	**0.004**	**0.14**	**0.0007**	**ND**	**ND**	**1.5E-01**	**ND**	**0.023**	
	14-Mar-14	42	LAC+KB-1-1	10	<0.10	0.43	53	0.27	0.43	<0.10	--	<0.10	0.22	
			LAC+KB-1-2	11	<0.10	0.22	54	0.26	0.66	<0.10	--	<0.10	0.21	
			LAC+KB-1-3	12	<0.10	0.37	52	0.26	0.61	<0.10	--	<0.10	0.22	
			Average Concentration (mg/L)		ND	0.34	53	0.26	0.57	ND	--	ND	0.21	
			Standard Deviation (mmoles)		0.0E+00	1.9E-04	2.2E-03	8.0E-06	4.7E-04	0.0E+00	--	0.0E+00	2.3E-04	
			Average Total mmoles		**ND**	**0.00058**	**0.12**	**0.0006**	**0.0022**	**ND**	**1.2E-01**	**ND**	**0.021**	
	28-Mar-14	56	LAC+KB-1-1	10	<0.10	0.26	55	0.25	0.77	<0.10	--	<0.10	<0.10	
			LAC+KB-1-2	11	<0.10	<0.10	54	0.25	1.3	<0.10	--	<0.10	0.23	
			LAC+KB-1-3	12	<0.10	<0.10	49	0.23	1.1	<0.10	--	<0.10	0.22	
			Average Concentration (mg/L)		ND	0.09	53	0.24	1.1	ND	--	ND	0.15	
			Standard Deviation (mmoles)		0.0E+00	2.6E-04	7.4E-03	2.4E-05	1.1E-03	0.0E+00	--	0.0E+00	1.3E-02	
			Average Total mmoles		**ND**	**0.00015**	**0.12**	**0.0005**	**0.0043**	**ND**	**1.2E-01**	**ND**	**0.015**	
	16-Apr-14	75	LAC+KB-1-1	10	<0.10	<0.10	55	0.25	1.1	<0.10	--	<0.10	<0.10	
			LAC+KB-1-2	11	<0.10	<0.10	57	0.27	2.1	<0.10	--	<0.10	0.26	
			LAC+KB-1-3	12	<0.10	<0.10	56	0.26	2.0	<0.10	--	<0.10	<0.10	
			Average Concentration (mg/L)		ND	ND	56	0.26	1.7	ND	--	ND	0.09	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	2.8E-03	1.5E-05	2.2E-03	0.0E+00	--	0.0E+00	1.5E-02	
			Average Total mmoles		**ND**	**ND**	**0.12**	**0.0006**	**0.0068**	**ND**	**1.3E-01**	**ND**	**0.0084**	
	08-May-14	97												Amended with lactate to a target concentration of 366 mg/L.
			LAC+KB-1-1	10	<0.10	<0.10	54	0.24	1.3	<0.10	--	<0.10	0.27	
			LAC+KB-1-2	11	<0.10	<0.10	55	0.27	2.6	<0.10	--	<0.10	0.27	
			LAC+KB-1-3	12	<0.10	<0.10	55	0.27	2.4	<0.10	--	<0.10	0.32	
			Average Concentration (mg/L)		ND	ND	55	0.26	2.1	ND	--	ND	0.29	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	1.1E-03	3.6E-05	2.8E-03	0.0E+00	--	0.0E+00	2.7E-03	
			Average Total mmoles		**ND**	**ND**	**0.12**	**0.0006**	**0.0082**	**ND**	**1.3E-01**	**ND**	**0.028**	
	22-May-14	111	LAC+KB-1-1	10	<0.10	<0.10	56	0.26	1.5	<0.10	--	<0.10	0.31	
			LAC+KB-1-2	11	<0.10	<0.10	56	0.26	3.5	<0.10	--	<0.10	<0.10	
			LAC+KB-1-3	12	<0.10	<0.10	57	0.27	3.0	<0.10	--	<0.10	<0.10	
			Average Concentration (mg/L)		ND	ND	57	0.26	2.7	ND	--	ND	0.10	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	1.4E-03	1.1E-05	4.1E-03	0.0E+00	--	0.0E+00	1.7E-02	
			Average Total mmoles		**ND**	**ND**	**0.13**	**0.0006**	**0.011**	**ND**	**1.4E-01**	**ND**	**0.01**	
	30-May-14	119												Bioaugmented with KB-1.
	13-Jun-14	133	LAC+KB-1-1	10	<0.10	<0.10	55	0.29	2.6	<0.10	--	<0.10	0.39	
			LAC+KB-1-2	11	<0.10	<0.10	58	0.33	6.3	<0.10	--	<0.10	0.46	
			LAC+KB-1-3	12	<0.10	0.26	52	0.25	4.6	<0.10	--	<0.10	0.42	
			Average Concentration (mg/L)		ND	0.09	55	0.29	4.5	ND	--	ND	0.42	
			Standard Deviation (mmoles)		0.0E+00	2.6E-04	6.8E-03	8.8E-05	7.5E-03	0.0E+00	--	0.0E+00	3.4E-03	
			Average Total mmoles		**ND**	**0.00015**	**0.12**	**0.0006**	**0.018**	**ND**	**1.4E-01**	**ND**	**0.041**	
	03-Jul-14	153												Amended with lactate to a target concentration of 366 mg/L.
	15-Jul-14	165	LAC+KB-1-1	10	<0.10	<0.10	56	0.29	4.7	<0.10	--	<0.10	0.42	
			LAC+KB-1-2	11	<0.10	<0.10	43	0.26	15	<0.10	--	<0.10	0.38	
			LAC+KB-1-3	12	<0.10	<0.10	46	0.24	7.7	<0.10	--	<0.10	0.38	
			Average Concentration (mg/L)		ND	ND	49	0.26	9.2	ND	--	ND	0.40	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	1.5E-02	5.3E-05	2.1E-02	0.0E+00	--	0.0E+00	2.3E-03	
			Average Total mmoles		**ND**	**ND**	**0.11**	**0.0006**	**0.036**	**ND**	**1.5E-01**	**ND**	**0.038**	
KB1	29-Jan-14	-2												Amended first replicate with 100 ŐL resazurin.
	30-Jan-14	-1												Spiked with cDCE and PCE to a target concentrations of 50 mg/L and 1.0 mg/L, respectively.
	31-Jan-14	0	KB1-1	13	0.63	1.1	73	0.32	<0.10	<0.10	--	<0.10	0.20	
			KB1-2	14	0.32	0.91	54	0.25	<0.10	<0.10	--	<0.10	0.23	
			KB1-3	15	0.20	0.84	56	0.25	<0.10	<0.10	--	<0.10	0.23	
			Average Concentration (mg/L)		0.38	0.96	61	0.27	ND	ND	--	ND	0.22	
			Standard Deviation (mmoles)		3.3E-04	2.6E-04	2.3E-02	9.7E-05	0.0E+00	0.0E+00	--	0.0E+00	1.5E-03	
			Average Total mmoles		**0.00057**	**0.0016**	**0.14**	**0.0006**	**ND**	**ND**	**1.4E-01**	**ND**	**0.021**	
	14-Feb-14	14	KB1-1	13	1.5	1.4	41	0.24	<0.10	<0.10	--	<0.10	0.22	
			KB1-2	14	0.95	1.5	58	0.27	<0.10	<0.10	--	<0.10	0.22	
			KB1-3	15	0.15	0.84	55	0.25	<0.10	<0.10	--	<0.10	0.23	
			Average Concentration (mg/L)		0.85	1.2	52	0.25	ND	ND	--	ND	0.22	
			Standard Deviation (mmoles)		9.8E-04	6.1E-04	2.0E-02	3.5E-05	0.0E+00	0.0E+00	--	0.0E+00	5.4E-04	
			Average Total mmoles		**0.0013**	**0.0021**	**0.11**	**0.0006**	**ND**	**ND**	**1.1E-01**	**ND**	**0.022**	
	28-Feb-14	28												Bioaugmented with KB-1.
			KB1-1	13	2.3	2.8	69	0.35	<0.10	<0.10	--	<0.10	0.25	
			KB1-2	14	0.46	0.98	51	0.27	<0.10	<0.10	--	<0.10	0.26	
			KB1-3	15	0.36	1.9	53	0.25	<0.10	<0.10	--	<0.10	0.25	
			Average Concentration (mg/L)		1.0	1.9	57	0.29	ND	ND	--	ND	0.25	
			Standard Deviation (mmoles)		1.6E-03	1.6E-03	2.2E-02	1.3E-04	0.0E+00	0.0E+00	--	0.0E+00	2.7E-04	
			Average Total mmoles		**0.0015**	**0.0032**	**0.13**	**0.0006**	**ND**	**ND**	**1.4E-01**	**ND**	**0.025**	

TABLE 2: SUMMARY OF MICROCOSM CHLORINATED VOC AND DHG RESULTS
Park Euclid Site, Phoenix, Arizona

Treatment	Date	Day	Replicate	Bottle	Chlorinated Ethenes							Chlorinated Ethanes	Methane and Electron Donors	Comment
					PCE	TCE	cDCE	tDCE	VC	Ethene	Total Ethenes	Ethane	Methane	
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mmol/bottle	mg/L	mg/L	
KB1	14-Mar-14	42	KB1-1	13	0.24	0.11	57	0.25	0.13	<0.10	--	<0.10	0.21	
			KB1-2	14	0.16	<0.10	52	0.23	<0.10	<0.10	--	<0.10	<0.10	
			KB1-3	15	0.16	0.13	56	0.25	0.21	<0.10	--	<0.10	0.21	
			Average Concentration (mg/L)		0.19	0.08	55	0.24	0.11	ND	--	ND	0.14	
			Standard Deviation (mmoles)		7.0E-05	1.2E-04	5.4E-03	2.5E-05	4.2E-04	0.0E+00	--	0.0E+00	1.2E-02	
			Average Total mmoles		**0.00028**	**0.00014**	**0.12**	**0.0005**	**0.00045**	**ND**	**1.2E-01**	**ND**	**0.014**	
	28-Mar-14	56	KB1-1	13	<0.10	<0.10	57	0.23	0.20	<0.10	--	<0.10	0.21	
			KB1-2	14	<0.10	<0.10	57	0.24	0.25	<0.10	--	<0.10	0.21	
			KB1-3	15	0.12	<0.10	62	0.26	0.33	<0.10	--	<0.10	0.21	
			Average Concentration (mg/L)		0.04	ND	59	0.25	0.26	ND	--	ND	0.21	
			Standard Deviation (mmoles)		1.0E-04	0.0E+00	6.3E-03	3.2E-05	2.7E-04	0.0E+00	--	0.0E+00	3.9E-05	
			Average Total mmoles		**5.9E-05**	**ND**	**0.13**	**0.0005**	**0.001**	**ND**	**1.3E-01**	**ND**	**0.021**	
	16-Apr-14	75	KB1-1	13	<0.10	<0.10	57	0.24	0.29	<0.10	--	<0.10	0.22	
			KB1-2	14	<0.10	<0.10	60	0.24	0.35	<0.10	--	<0.10	0.18	
			KB1-3	15	<0.10	<0.10	60	0.26	0.47	<0.10	--	<0.10	0.22	
			Average Concentration (mg/L)		ND	ND	59	0.25	0.37	ND	--	ND	0.21	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	4.6E-03	1.6E-05	3.6E-04	0.0E+00	--	0.0E+00	2.1E-03	
			Average Total mmoles		**ND**	**ND**	**0.13**	**0.0006**	**0.0015**	**ND**	**1.3E-01**	**ND**	**0.02**	
	22-May-14	111	KB1-1	13	0.11	<0.10	54	0.24	0.40	<0.10	--	<0.10	0.20	
			KB1-2	14	<0.10	<0.10	59	0.25	0.49	<0.10	--	<0.10	0.21	
			KB1-3	15	<0.10	<0.10	46	0.19	0.46	<0.10	--	<0.10	0.20	
			Average Concentration (mg/L)		0.04	ND	53	0.23	0.45	ND	--	ND	0.20	
			Standard Deviation (mmoles)		9.3E-05	0.0E+00	1.5E-02	7.1E-05	1.8E-04	0.0E+00	--	0.0E+00	4.2E-04	
			Average Total mmoles		**5.4E-05**	**ND**	**0.12**	**0.0005**	**0.0018**	**ND**	**1.2E-01**	**ND**	**0.02**	
	30-May-14	119												Bioaugmented with KB-1.
	13-Jun-14	133	KB1-1	13	0.70	0.31	72	0.36	0.75	<0.10	--	<0.10	0.22	
			KB1-2	14	0.48	0.17	60	0.25	0.76	<0.10	--	<0.10	0.22	
			KB1-3	15	0.53	<0.10	64	0.28	0.97	<0.10	--	<0.10	0.21	
			Average Concentration (mg/L)		0.57	0.16	65	0.30	0.83	ND	--	ND	0.22	
			Standard Deviation (mmoles)		1.7E-04	2.6E-04	1.4E-02	1.2E-04	5.1E-04	0.0E+00	--	0.0E+00	1.6E-04	
			Average Total mmoles		**0.00084**	**0.00027**	**0.15**	**0.0007**	**0.0033**	**ND**	**1.6E-01**	**ND**	**0.021**	
	15-Jul-14	165	KB1-1	13	<0.10	<0.10	58	0.26	0.81	<0.10	--	<0.10	0.20	
			KB1-2	14	<0.10	<0.10	56	0.24	0.92	<0.10	--	<0.10	0.20	
			KB1-3	15	<0.10	<0.10	51	0.27	1.0	<0.10	--	<0.10	0.20	
			Average Concentration (mg/L)		ND	ND	55	0.26	0.92	ND	--	ND	0.20	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	8.0E-03	3.4E-05	4.5E-04	0.0E+00	--	0.0E+00	1.7E-04	
			Average Total mmoles		**ND**	**ND**	**0.12**	**0.0006**	**0.0036**	**ND**	**1.2E-01**	**ND**	**0.019**	

Notes:

-- - not analyzed
% - percent
< - compound not detected, the associated value is the detection limit
ANSC - anaerobic sterile control
ANAC - anaerobic active control
cDCE - cis-1,2-dichloroethene
LAC - lactate
mg/L - milligrams per liter
mmoles - millimoles
mmoles/bottle - millimoles per bottle
ND - not detected
TCE - trichloroethene
tDCE - trans-1,2-dichloroethene
PCE -tetrachloroethene
VC - vinyl chloride
µL - microliters

TABLE 3: SUMMARY OF MICROCOSM ANION RESULTS

Park Euclid Site, Phoenix, Arizona

Treatment	Date	Day	Bottle	Treatment Replicate	Total VFAs	Chloride	Nitrite-N	Nitrate-N	Sulfate	Phosphate
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Anaerobic Sterile Control	31-Jan-14	0	1	ANSC-1	5.9	288	<0.09	<0.09	201	0.11
			2	ANSC-2	4.5	324	<0.09	<0.09	221	0.15
			3	ANSC-3	6.4	290	<0.09	<0.09	203	0.09
				Average Concentration	**5.6**	**301**	**ND**	**ND**	**208**	**0.12**
	14-Feb-14	14	1	ANSC-1	3.3	252	<0.09	0.19	181	0.63
			2	ANSC-2	4.7	266	<0.09	0.12	184	0.28
			3	ANSC-3	4.4	273	<0.09	0.19	191	1.2
				Average Concentration	**4.2**	**264**	**ND**	**0.16**	**185**	**0.70**
	15-Jul-14	165	1	ANSC-1	19	268	<0.09	0.12	189	<0.07
			2	ANSC-2	20	283	<0.09	<0.09	204	<0.07
			3	ANSC-3	20	278	<0.09	<0.09	205	<0.07
				Average Concentration	**19**	**277**	**ND**	**0.04**	**200**	**ND**
Anaerobic Active Control	31-Jan-14	0	4	ANAC-1	4.5	196	<0.09	0.10	198	0.12
			5	ANAC-2	5.1	206	<0.09	0.39	208	0.11
			6	ANAC-3	3.5	231	<0.09	0.19	237	<0.07
				Average Concentration	**4.4**	**211**	**ND**	**0.23**	**215**	**0.08**
	14-Feb-14	14	4	ANAC-1	2.0	209	<0.09	0.17	206	<0.07
			5	ANAC-2	3.3	188	<0.09	0.50	183	<0.07
			6	ANAC-3	2.8	185	<0.09	0.29	186	<0.07
				Average Concentration	**2.7**	**194**	**ND**	**0.32**	**192**	**ND**
	15-Jul-14	165	4	ANAC-1	18	203	<0.09	0.10	171	<0.07
			5	ANAC-2	17	193	<0.09	0.36	169	<0.07
			6	ANAC-3	20	194	<0.09	0.51	187	<0.07
				Average Concentration	**18**	**197**	**ND**	**0.32**	**176**	**ND**
Lactate	31-Jan-14	0	7	LAC-1	552	226	<0.09	0.12	231	0.21
			8	LAC-2	537	210	<0.09	0.14	217	<0.07
			9	LAC-3	506	199	<0.09	0.09	204	<0.07
				Average Concentration	**532**	**212**	**ND**	**0.11**	**217**	**0.07**
	14-Feb-14	14	7	LAC-1	502	205	<0.09	0.95	201	<0.07
			8	LAC-2	473	202	<0.09	0.23	184	<0.07
			9	LAC-3	466	182	<0.09	0.33	181	<0.07
				Average Concentration	**480**	**196**	**ND**	**0.51**	**189**	**ND**
	8-May-14	97	7	LAC-1	456	204	<0.09	0.16	144	0.39
			8	LAC-2	470	210	<0.09	0.15	144	0.21
			9	LAC-3	505	227	<0.09	0.09	154	0.62
				Average Concentration	**477**	**214**	**ND**	**0.13**	**147**	**0.41**
	15-Jul-14	165	7	LAC-1	1125	194	<0.09	0.27	88	<0.07
			8	LAC-2	1120	194	<0.09	0.33	91	<0.07
			9	LAC-3	1066	183	<0.09	0.16	72	<0.07
				Average Concentration	**1104**	**190**	**ND**	**0.25**	**84**	**ND**
Lactate and KB-1	31-Jan-14	0	10	LAC+KB-1-1	472	173	<0.09	0.09	180	<0.07
			11	LAC+KB-1-2	542	199	<0.09	0.11	206	<0.07
			12	LAC+KB-1-3	498	204	<0.09	0.52	207	0.15
				Average Concentration	**504**	**192**	**ND**	**0.24**	**198**	**0.05**
	14-Feb-14	14	10	LAC+KB-1-1	519	198	<0.09	0.25	201	<0.07
			11	LAC+KB-1-2	443	170	<0.09	0.64	167	<0.07
			12	LAC+KB-1-3	409	161	<0.09	0.53	160	<0.07
				Average Concentration	**457**	**176**	**ND**	**0.47**	**176**	**ND**
	8-May-14	97	10	LAC+KB-1-1	308	205	<0.09	<0.09	13	0.12
			11	LAC+KB-1-2	307	215	<0.09	0.69	11	1.9
			12	LAC+KB-1-3	304	213	<0.09	0.13	9.4	0.15
				Average Concentration	**306**	**211**	**ND**	**0.27**	**11**	**0.71**
	15-Jul-14	165	10	LAC+KB-1-1	729	195	<0.09	<0.09	4.6	<0.07
			11	LAC+KB-1-2	840	195	<0.09	<0.09	8.3	<0.07
			12	LAC+KB-1-3	734	208	<0.09	<0.09	7.1	<0.07
				Average Concentration	**768**	**199**	**ND**	**ND**	**6.7**	**ND**
KB-1	31-Jan-14	0	13	KB-1-1	5.4	204	<0.09	0.12	204	<0.07
			14	KB-1-2	3.1	193	<0.09	0.12	192	<0.07
			15	KB-1-3	3.3	205	<0.09	0.14	212	0.47
				Average Concentration	**3.9**	**201**	**ND**	**0.13**	**203**	**0.16**
	14-Feb-14	14	13	KB-1-1	2.5	160	<0.09	0.72	159	<0.07
			14	KB-1-2	2.4	170	<0.09	1.0	168	<0.07
			15	KB-1-3	2.5	175	<0.09	0.15	176	<0.07
				Average Concentration	**2.5**	**168**	**ND**	**0.62**	**168**	**ND**
	15-Jul-14	165	13	KB-1-1	23	191	<0.09	<0.09	111	<0.07
			14	KB-1-2	17	186	<0.09	<0.09	108	<0.07
			15	KB-1-3	24	192	<0.09	<0.09	121	<0.07
				Average Concentration	**21**	**190**	**ND**	**ND**	**113**	**ND**

Notes:

LAC - lactate
ANAC - anaerobic active control
ANSC - anaerobic sterile control
ND - not detected
mg/L - milligrams per liter
VFAs - total volatile fatty acids, calibrated as lactate but may include other VFAs such as formate, acetate, propionate, pyruvate and butyrate
< - compound not detected, the associated value is the detection limit

TABLE 4: SUMMARY OF MICROCOSM VFA RESULTS
Park Euclid Site, Phoenix, Arizona

Treatment	Date	Day	Bottle	Treatment Replicate	Lactate	Acetate	Propionate	Formate	Butyrate	Pyruvate
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Lactate	31-Jan-14	0	7	LAC-1	600	<0.54	0.36	1.3	<0.41	<0.69
			8	LAC-2	640	<0.54	0.38	1.4	<0.41	<0.69
			9	LAC-3	611	<0.54	0.36	1.5	<0.41	<0.69
				Average Concentration	**617**	**ND**	**0.36**	**1.4**	**ND**	**ND**
	8-May-14	97	7	LAC-1	351	42	1.6	<0.22	0.41	1.3
			8	LAC-2	353	41	1.5	<0.22	0.41	1.3
			9	LAC-3	363	52	1.8	<0.22	0.46	1.3
				Average Concentration	**356**	**45**	**1.6**	**ND**	**0.43**	**1.3**
	15-Jul-14	165	7	LAC-1	818	23	2.1	0.51	0.54	<0.69
			8	LAC-2	832	21	2.3	0.61	0.48	<0.69
			9	LAC-3	809	27	4.9	24	0.66	<0.69
				Average Concentration	**820**	**24**	**3.1**	**8.3**	**0.56**	**ND**
Lactate and KB-1	31-Jan-14	0	10	LAC+KB-1-1	632	<0.54	0.33	1.3	<0.41	<0.69
			11	LAC+KB-1-2	641	<0.54	0.40	1.6	<0.41	<0.69
			12	LAC+KB-1-3	564	<0.54	0.36	1.2	<0.41	<0.69
				Average Concentration	**613**	**ND**	**0.36**	**1.4**	**ND**	**ND**
	8-May-14	97	10	LAC+KB-1-1	0.52	344	92	<0.22	1.5	<0.69
			11	LAC+KB-1-2	1.1	362	84	<0.22	1.4	<0.69
			12	LAC+KB-1-3	<0.39	334	68	<0.22	1.4	<0.69
				Average Concentration	**0.53**	**347**	**81**	**ND**	**1.4**	**ND**
	15-Jul-14	165	10	LAC+KB-1-1	11	764	86	1.4	2.0	<0.69
			11	LAC+KB-1-2	154	519	78	2.0	1.9	1.1
			12	LAC+KB-1-3	58	591	72	1.5	1.9	0.81
				Average Concentration	**74**	**625**	**79**	**1.6**	**1.9**	**0.64**
KB-1	31-Jan-14	0	13	KB-1-1	0.55	1.8	<0.31	0.67	<0.41	<0.69
			14	KB-1-2	0.49	2.1	<0.31	0.49	<0.41	<0.69
			15	KB-1-3	0.68	2.0	<0.31	0.58	<0.41	<0.69
				Average Concentration	**0.57**	**2.0**	**ND**	**0.58**	**ND**	**ND**
	15-Jul-14	165	13	KB-1-1	<0.39	2.7	<0.31	2.0	<0.41	<0.69
			14	KB-1-2	<0.39	4.1	<0.31	0.56	<0.41	<0.69
			15	KB-1-3	<0.39	3.2	<0.31	0.47	<0.41	<0.69
				Average Concentration	**ND**	**3.3**	**ND**	**1.0**	**ND**	**ND**

Notes:

ANAC - anaerobic active control
ANSC - anaerobic sterile control
mg/L - milligrams per liter
LAC - lactate
ND - not detected
< - compound not detected, the associated value is the detection limit

TABLE 5: SUMMARY OF MICROCOSM pH RESULTS
Park Euclid Site, Phoenix, Arizona

Treatment	Date	Day	Bottle	Treatment Replicate	pH
Anaerobic Sterile Control	31-Jan-14	0	1	ANSC-1	6.90
			2	ANSC-2	6.95
			3	ANSC-3	6.97
				Average Concentration	**6.94**
	14-Feb-14	14	1	ANSC-1	6.45
			2	ANSC-2	6.60
			3	ANSC-3	6.60
				Average Concentration	**6.55**
	28-Feb-14	28	1	ANSC-1	6.55
			2	ANSC-2	6.76
			3	ANSC-3	6.67
				Average Concentration	**6.66**
	14-Mar-14	42	1	ANSC-1	6.69
			2	ANSC-2	6.78
			3	ANSC-3	6.65
				Average Concentration	**6.71**
	15-Jul-14	165	1	ANSC-1	7.01
			2	ANSC-2	7.02
			3	ANSC-3	6.97
				Average Concentration	**7.00**
Anaerobic Active Control	31-Jan-14	0	4	ANAC-1	6.86
			5	ANAC-2	6.88
			6	ANAC-3	6.83
				Average Concentration	**6.86**
	14-Feb-14	14	4	ANAC-1	6.64
			5	ANAC-2	6.64
			6	ANAC-3	6.54
				Average Concentration	**6.61**
	28-Feb-14	28	4	ANAC-1	6.36
			5	ANAC-2	6.53
			6	ANAC-3	6.68
				Average Concentration	**6.52**
	14-Mar-14	42	4	ANAC-1	6.54
			5	ANAC-2	6.60
			6	ANAC-3	6.60
				Average Concentration	**6.58**
	15-Jul-14	165	4	ANAC-1	7.13
			5	ANAC-2	7.03
			6	ANAC-3	6.97
				Average Concentration	**7.04**
Lactate	31-Jan-14	0	7	LAC-1	6.81
			8	LAC-2	6.86
			9	LAC-3	6.87
				Average Concentration	**6.85**
	14-Feb-14	14	7	LAC-1	6.64
			8	LAC-2	6.67
			9	LAC-3	6.69
				Average Concentration	**6.67**
	28-Feb-14	28	7	LAC-1	6.67
			8	LAC-2	6.68
			9	LAC-3	6.67
				Average Concentration	**6.67**
	14-Mar-14	42	7	LAC-1	6.63
			8	LAC-2	6.64
			9	LAC-3	6.64
				Average Concentration	**6.64**
	16-Apr-14	75	7	LAC-1	6.68
			8	LAC-2	6.78
			9	LAC-3	6.68
				Average Concentration	**6.71**
	8-May-14	97	7	LAC-1	6.68
			8	LAC-2	6.88
			9	LAC-3	6.95
				Average Concentration	**6.84**
	22-May-14	111	7	LAC-1	6.57
			8	LAC-2	6.67
			9	LAC-3	6.64
				Average Concentration	**6.63**
	15-Jul-14	165	7	LAC-1	6.68
			8	LAC-2	6.71
			9	LAC-3	6.72
				Average Concentration	**6.70**
Lactate and KB-1	31-Jan-14	0	10	LAC+KB-1-1	6.89
			11	LAC+KB-1-2	6.84
			12	LAC+KB-1-3	6.84
				Average Concentration	**6.86**
	14-Feb-14	14	10	LAC+KB-1-1	6.61
			11	LAC+KB-1-2	6.68
			12	LAC+KB-1-3	6.67
				Average Concentration	**6.65**
	28-Feb-14	28	10	LAC+KB-1-1	6.75
			11	LAC+KB-1-2	6.71
			12	LAC+KB-1-3	6.94
				Average Concentration	**6.80**
	14-Mar-14	42	10	LAC+KB-1-1	6.79
			11	LAC+KB-1-2	6.69
			12	LAC+KB-1-3	6.72
				Average Concentration	**6.73**

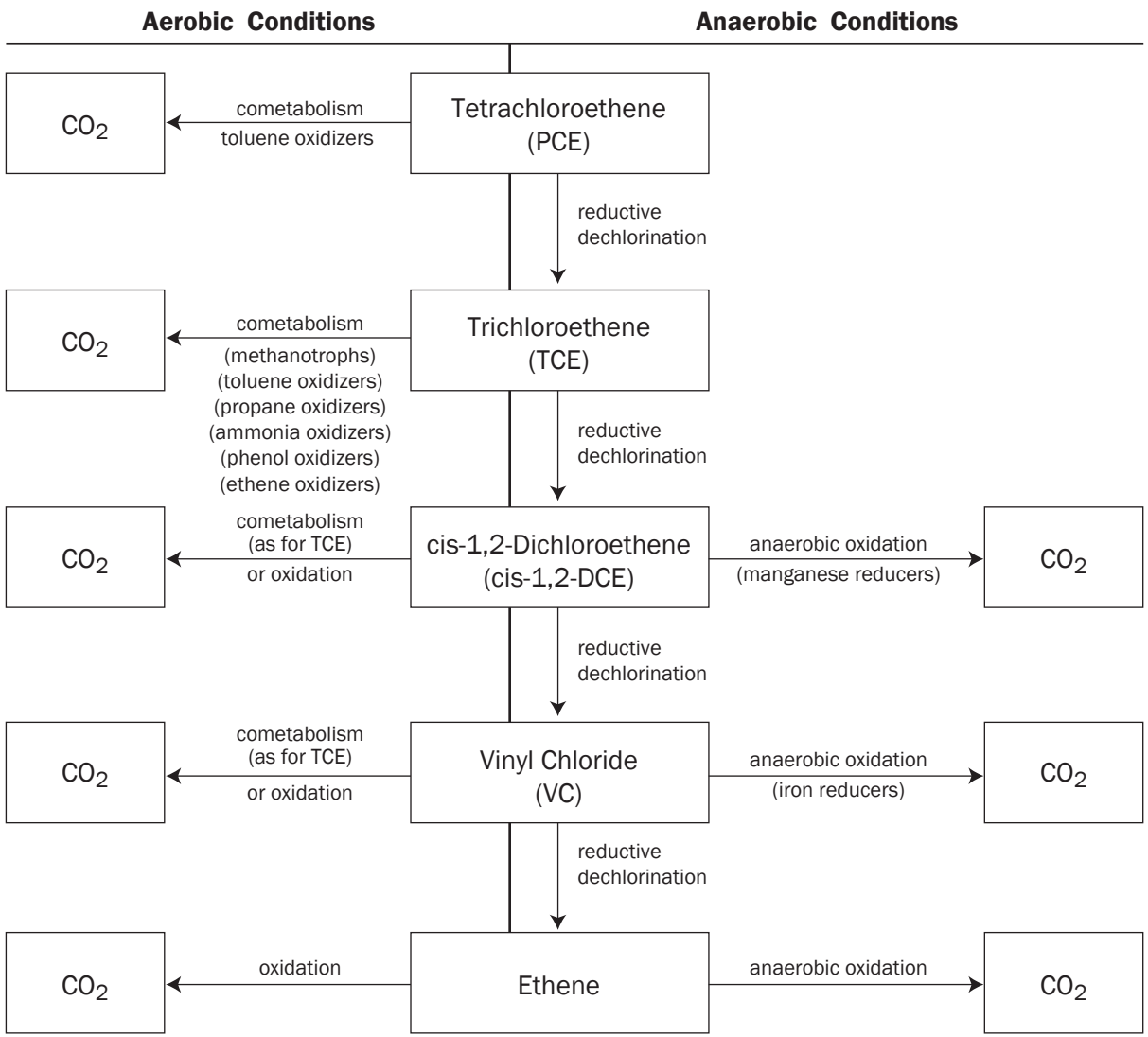
TABLE 5: SUMMARY OF MICROCOSM pH RESULTS
Park Euclid Site, Phoenix, Arizona

Treatment	Date	Day	Bottle	Treatment Replicate	pH
Lactate and KB-1	28-Mar-14	56	10	LAC+KB-1-1	6.86
			11	LAC+KB-1-2	6.83
			12	LAC+KB-1-3	6.86
				Average Concentration	**6.85**
	16-Apr-14	75	10	LAC+KB-1-1	6.58
			11	LAC+KB-1-2	6.61
			12	LAC+KB-1-3	6.70
				Average Concentration	**6.63**
	8-May-14	97	10	LAC+KB-1-1	6.93
			11	LAC+KB-1-2	6.77
			12	LAC+KB-1-3	6.84
				Average Concentration	**6.85**
	22-May-14	111	10	LAC+KB-1-1	6.52
			11	LAC+KB-1-2	6.51
			12	LAC+KB-1-3	6.55
				Average Concentration	**6.53**
	13-Jun-14	133	10	LAC+KB-1-1	6.58
			11	LAC+KB-1-2	6.54
			12	LAC+KB-1-3	6.56
				Average Concentration	**6.56**
	15-Jul-14	165	10	LAC+KB-1-1	6.42
			11	LAC+KB-1-2	6.51
			12	LAC+KB-1-3	6.53
				Average Concentration	**6.49**
KB-1	31-Jan-14	0	13	KB-1-1	6.88
			14	KB-1-2	6.82
			15	KB-1-3	6.86
				Average Concentration	**6.85**
	14-Feb-14	14	13	KB-1-1	6.73
			14	KB-1-2	6.79
			15	KB-1-3	6.69
				Average Concentration	**6.74**
	28-Feb-14	28	13	KB-1-1	6.66
			14	KB-1-2	6.80
			15	KB-1-3	6.74
				Average Concentration	**6.73**
	14-Mar-14	42	13	KB-1-1	6.73
			14	KB-1-2	6.76
			15	KB-1-3	6.74
				Average Concentration	**6.74**
	28-Mar-14	56	13	KB-1-1	6.82
			14	KB-1-2	6.83
			15	KB-1-3	6.97
				Average Concentration	**6.87**
	16-Apr-14	75	13	KB-1-1	6.82
			14	KB-1-2	6.80
			15	KB-1-3	6.84
				Average Concentration	**6.82**
	22-May-14	111	13	KB-1-1	6.67
			14	KB-1-2	6.70
			15	KB-1-3	6.73
				Average Concentration	**6.70**
	13-Jun-14	133	13	KB-1-1	6.60
			14	KB-1-2	6.60
			15	KB-1-3	6.57
				Average Concentration	**6.59**
	15-Jul-14	165	13	KB-1-1	6.72
			14	KB-1-2	6.81
			15	KB-1-3	6.86
				Average Concentration	**6.80**

Notes:

ANAC - anaerobic active control
ANSC - anaerobic sterile control
LAC - lactate

FIGURES



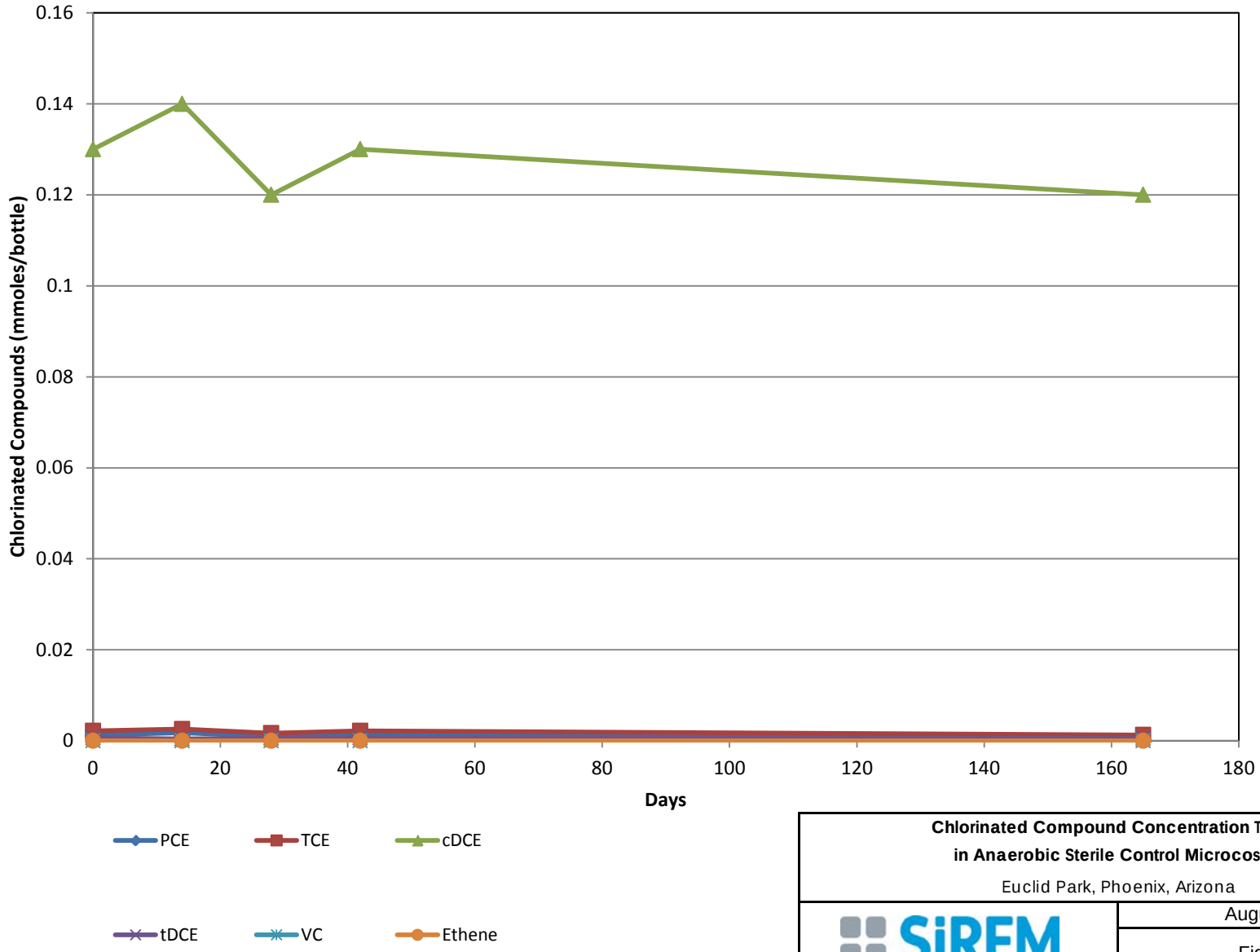
Pathways for the Degradation of Chlorinated Ethenes

SiREM

June 2012

Figure: **1**

pathways_chlorinated ethenes.ai



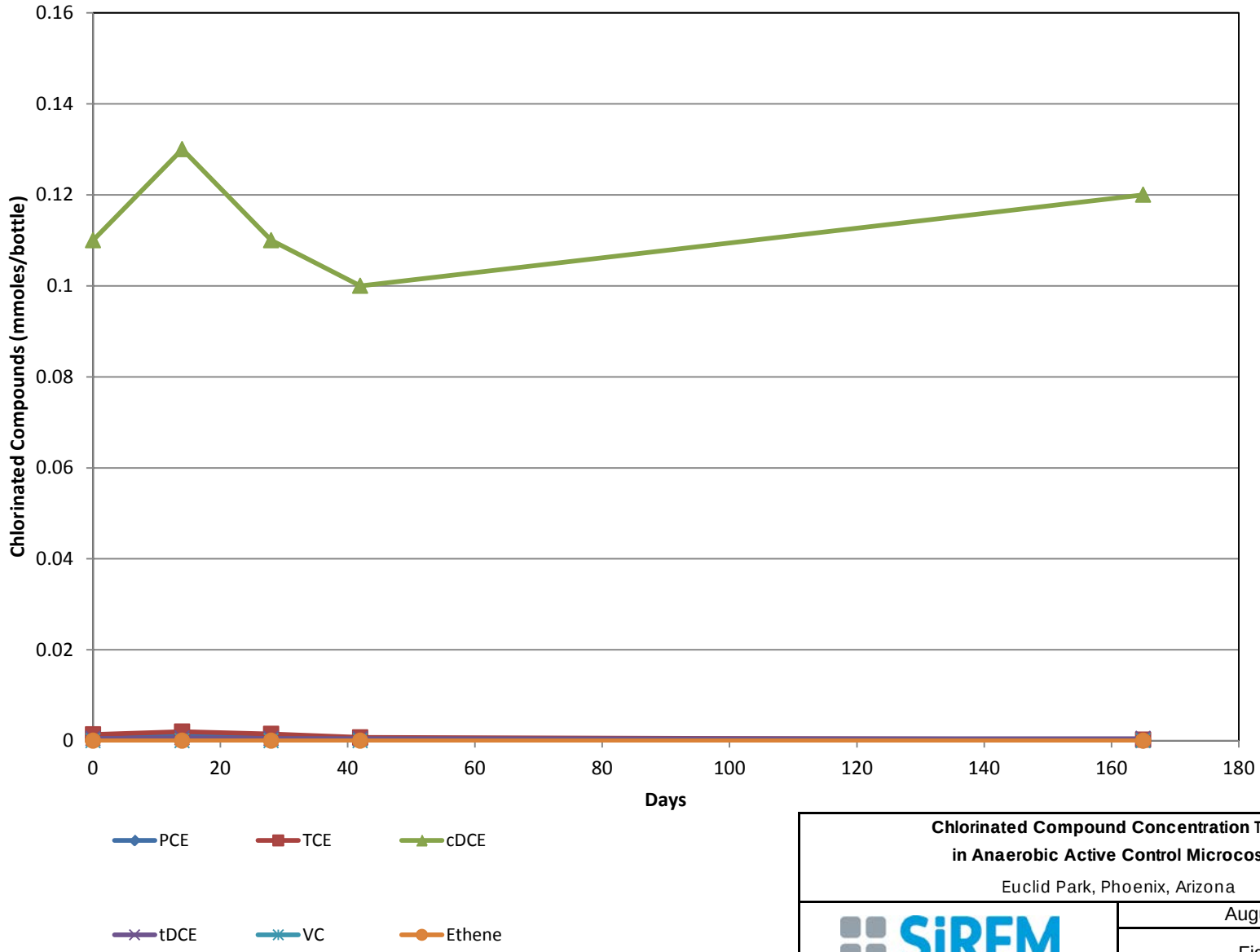
Chlorinated Compound Concentration Trends in Anaerobic Sterile Control Microcosms

Euclid Park, Phoenix, Arizona

SiREM

August 2014

Figure: **2**



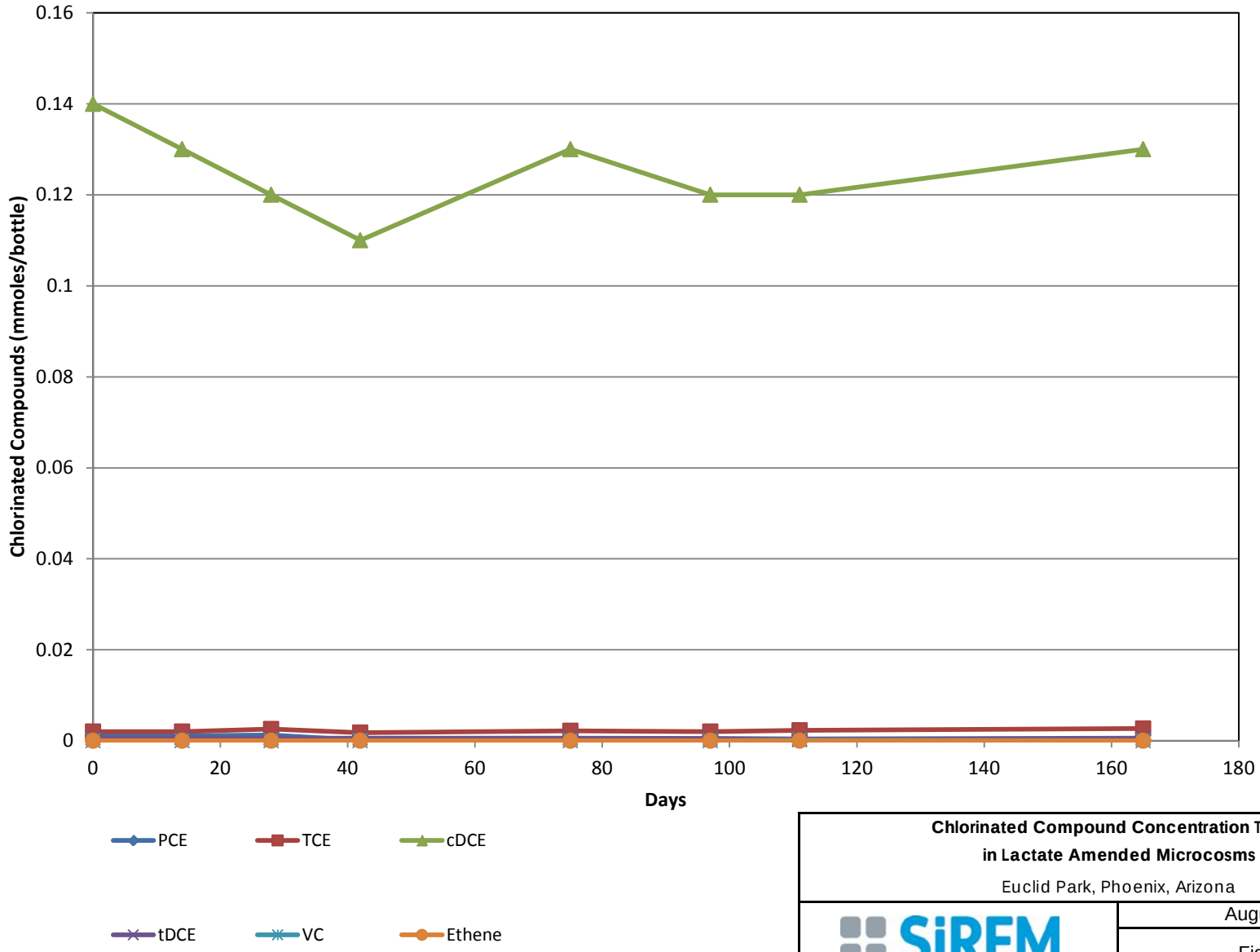
Chlorinated Compound Concentration Trends in Anaerobic Active Control Microcosms

Euclid Park, Phoenix, Arizona

SiREM

August 2014

Figure: **3**



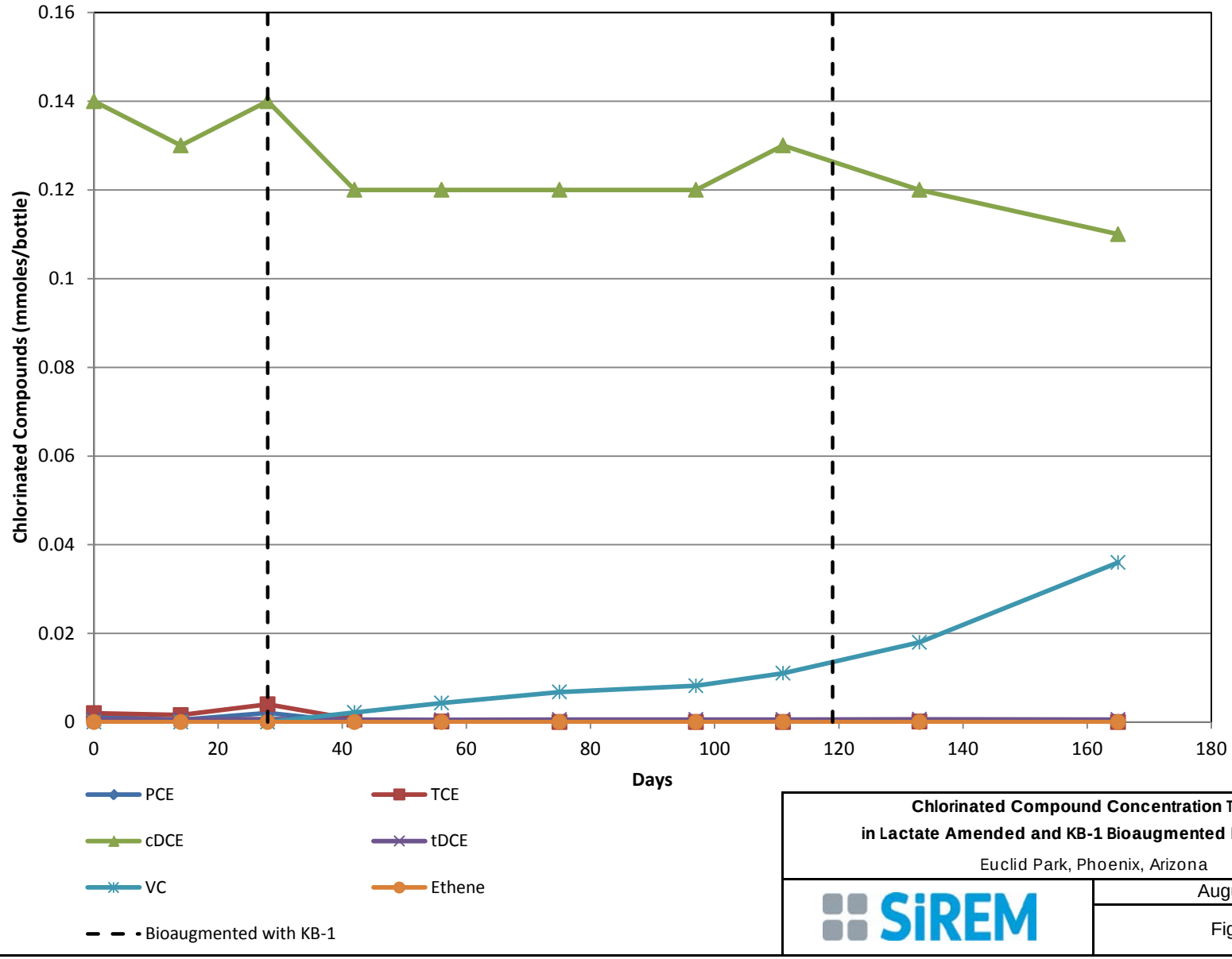
Chlorinated Compound Concentration Trends in Lactate Amended Microcosms

Euclid Park, Phoenix, Arizona

SiREM

August 2014

Figure: **4**



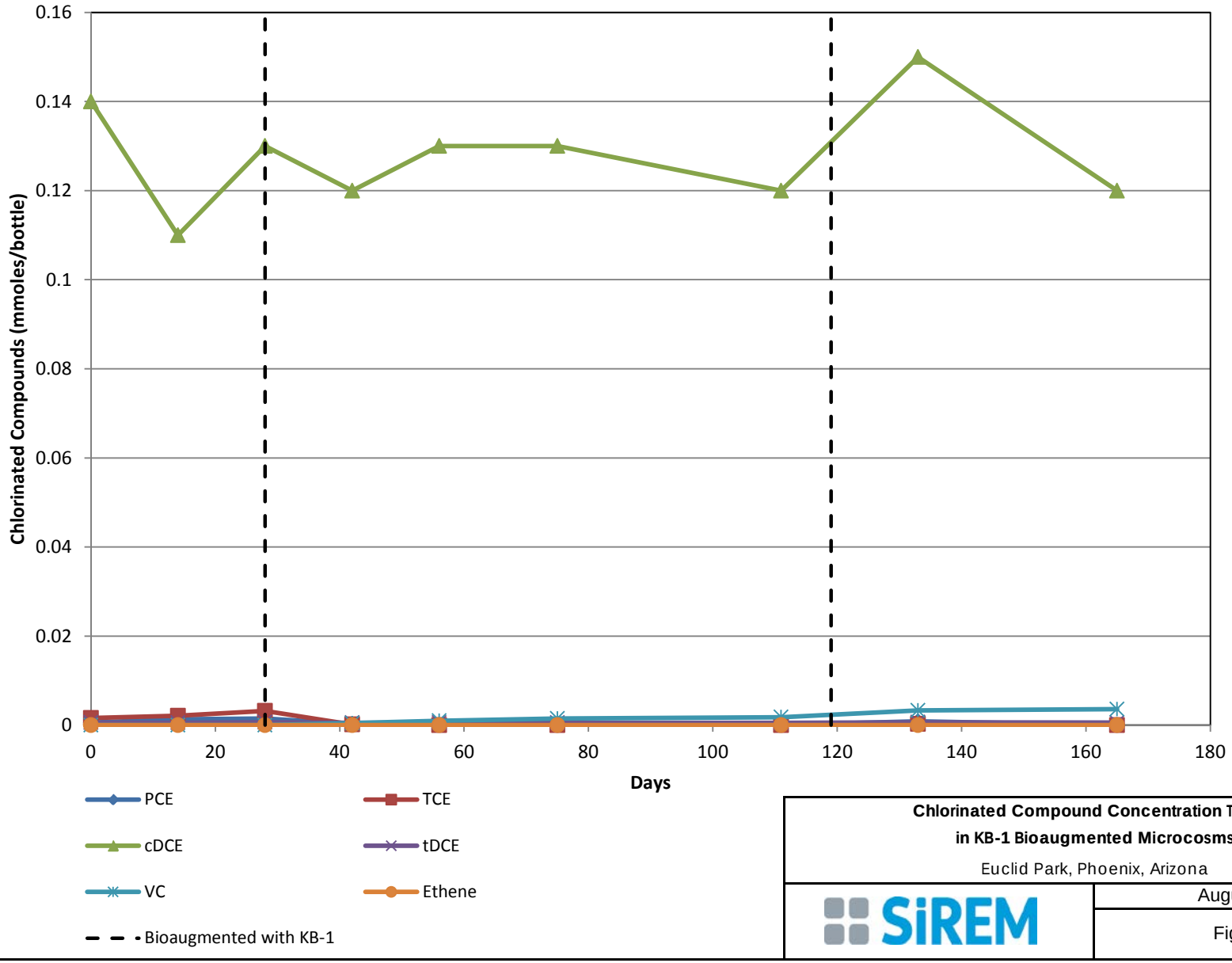
Chlorinated Compound Concentration Trends
in Lactate Amended and KB-1 Bioaugmented Microcosms

Euclid Park, Phoenix, Arizona

SiREM

August 2014

Figure: **5**



Chlorinated Compound Concentration Trends in KB-1 Bioaugmented Microcosms

Euclid Park, Phoenix, Arizona

SiREM

August 2014

Figure: **6**

APPENDIX A: Chain of Custody Documentation

copy -> 2 coolers

SiREM
Leading Science · Lasting Solutions

Chain-of-Custody Form

130 Research Lane, Suite 2 · Guelph, Ontario, Canada N1G 5G3 · Phone (519) 822-2265 or toll free 1-866-251-1747 Fax (519) 822-3151
www.siremlab.com

№ 3589

Page 1 of 1

Lab # S-3081

Project Name	Park / Euclid
Project #	22241866
Project Manager	Janet Workman
Email Address	Janet.workman@urs.com
Company	URS Corp.
Address	Phoenix AZ office
Phone #	1-602-861-7494
Fax #	
Sampler's Signature	
Sampler's Printed Name	Oscar Skinner

Analysis

Preservative	0	0		0							
	Gene-Trac Dhc	Gene-Trac VC	Gene-Trac Dhb	Bench Scale testing							

Preservative Key
0. None
1. HCl
2. Other _____
3. Other _____

Customer Sample ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac Dhc	Gene-Trac VC	Gene-Trac Dhb	Bench Scale testing								Other Information
MPE-2GPT-012214	1/22/14	1015	GW	1	X	X										
MPE-3GPT-012214	1/22/14	1100	GW	1	X	X										
SVE-103GPT-012214	1/22/14	1200	GW	1	X	X										
MPF-1GPT-012214	1/22/14	1230	GW	1	X	X										
MPM-1GPT-012214	1/22/14	1245	GW	1	X	X										
SVE-104GPT-012214	1/22/14	1445	GW	1	X	X										
MPE-1GPT-012214	1/22/14	1530	GW	2			X									2- one gallon containers
PEP-8GPT-012214	1/22/14	1620	GW	1	X	X										
PEP-10GPT-012214	1/22/14	1645	GW	1	X	X										
PEP-9GPT-012214	1/22/14	1705	GW	1	X	X										

Sample Receipt	
Cooler Condition:	good
Cooler Temperature:	5°C
Custody Seals:	Yes ☒ No ☐

Billing Information	
P.O. #	22241866-011514-SiREM
Bill To:	

Turnaround Time Requested
Normal ☒
Rush ☐

For Lab Use Only
Proposal #: _____

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	Signature	Signature	Signature	Signature	Signature
Printed Name Armando Jimenez	Printed Name Ben Reside	Printed Name	Printed Name	Printed Name	Printed Name
Firm URS	Firm SiREM	Firm	Firm	Firm	Firm
Date/Time 1-23-14 1340	Date/Time 1-24-14 13:50	Date/Time	Date/Time	Date/Time	Date/Time

Distribution: White - Return to Originator: Yellow - Lab Copy: Pink - Retained by Client

SiREM
Leading Science · Lasting Solutions

Chain-of-Custody Form

130 Research Lane, Suite 2 · Guelph, Ontario, Canada N1G 5G3 · Phone (519) 822-2265 or toll free 1-866-251-1747 Fax (519) 822-3151
www.siremlab.com

3589

Page 1 of 1

Lab # S-3082.

Project Name	Park / Euclid
Project #	22241866
Project Manager	Janet Workman
Email Address	Janet.workman@urs.com
Company	URS Corp.
Address	Phoenix AZ office
Phone #	1-602-861-7494
Fax #	
Sampler's Signature	Oscar S
Sampler's Printed Name	Oscar Skinner

Analysis

Customer Sample ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac Dhc	Gene-Trac VC ver A	Gene-Trac Dhb	Bench Scale testing	Other Information
Preservative					0	0		0	
MPE-2GPT-012214	1/22/14	1015	GW	1	X	X			
MPE-3GPT-012214	1/22/14	1100	GW	1	X	X			
SVE-103GPT-012214	1/22/14	1200	GW	1	X	X			
MPE-1GPT-012214	1/22/14	1230	GW	1	X	X			
MPM-1GPT-012214	1/22/14	1245	GW	1	X	X			
SVE-104GPT-012214	1/22/14	1445	GW	1	X	X			
MPE-1GPT-012214	1/22/14	1530	GW	2			X		2- one gallon containers
PEP-8GPT-012214	1/22/14	1620	GW	1	X	X			
PEP-10GPT-012214	1/22/14	1645	GW	1	X	X			MPE-1 & MPE-2 GPT-012214 may
PEP-9GPT-012214	1/22/14	1705	GW	1	X	X			not have diesel.

Preservative Key
0. None
1. HCl
2. Other _____
3. Other _____

Sample Receipt
Cooler Condition: Good.
Cooler Temperature: 4° C
Custody Seals: Yes ☒ No ☐

Billing Information
P.O. # 22241866-011514-SiREM
Bill To:

Turnaround Time Requested
Normal ☒
Rush ☐

For Lab Use Only
Received highlighted missing samples from S-3081 (Jan 24 '14)
Proposal #: _____

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature: A. S	Signature: Zespoli	Signature:	Signature:	Signature:	Signature:
Printed Name: Armando Jimenez	Printed Name: D. Zespoli	Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: URS	Firm: SiREM.	Firm:	Firm:	Firm:	Firm:
Date/Time: 1-23-14 1340	Date/Time: Jan 27 '14 1pm.	Date/Time:	Date/Time:	Date/Time:	Date/Time:

Distribution: White - Return to Originator: Yellow - Lab Copy: Pink - Retained by Client

APPENDIX B: Henry's Law Calculation

The following Henry's Law calculation was used to convert aqueous concentrations (Table 2) to total mmoles of each analyte per microcosm bottle (Figures 2 to 6):

$$\text{Total mmoles} = \frac{C_{liq} \times (V_{liq} + H \times V_{gas})}{\text{Molecular Weight (mg/mmol)}}$$

Where

C_{liq} = liquid concentration (mg/L)
V_{liq} = liquid volume (0.225 L) per bottle
V_{gas} = headspace volume (0.025 L) per bottle
H = Henry's Law constant (dimensionless)

The Henry's Law constants used are summarized in the table below.

Analyte	Henry's Law Constant [a] (dimensionless)
Tetrachloroethene	0.60
Trichloroethene	0.42
cis-1,2-dichloroethene	0.18
Vinyl chloride	1.08
Ethene	8.78
Methane	27.3

[a] Source: Montgomery, J.H. 2000. *Groundwater Chemicals Desk Reference, Third Edition.* CRC Press LLC, Boca Raton, FL.

APPENDIX C: ALS External Analysis Report

SIREM
ATTN: Sandra Dworatzek/Michael Healey
130 Research Lane
Suite 2
Guelph ON N1G 5G3

Date Received: 03-FEB-14
Report Date: 06-FEB-14 10:31 (MT)
Version: FINAL

Client Phone: 519-822-2265

Certificate of Analysis

Lab Work Order #: L1418278

Project P.O. #: NOT SUBMITTED
Job Reference: S-3081
C of C Numbers:
Legal Site Desc:

Lindsay D. Zuiker
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1418278-1 S-3081-1 (1,2,3) Sampled By: MICHAEL HEALEY on 31-JAN-14 Matrix: WATER							
Volatile Organic Compounds							
Benzene	0.84		0.50	ug/L		05-FEB-14	R2786067
Ethyl Benzene	11.3		0.50	ug/L		05-FEB-14	R2786067
Toluene	<0.50		0.50	ug/L		05-FEB-14	R2786067
o-Xylene	9.06		0.30	ug/L		05-FEB-14	R2786067
m+p-Xylenes	1.34		0.40	ug/L		05-FEB-14	R2786067
Xylenes (Total)	10.4		0.50	ug/L		05-FEB-14	
Surrogate: 4-Bromofluorobenzene	117.2		70-130	%		05-FEB-14	R2786067
Surrogate: 1,4-Difluorobenzene	102.3		70-130	%		05-FEB-14	R2786067
Hydrocarbons							
F1 (C6-C10)	2030		25	ug/L		05-FEB-14	R2786067
F1-BTEX	2010		25	ug/L		05-FEB-14	
F2 (C10-C16)	1560000	DLA	4500	ug/L	05-FEB-14	05-FEB-14	R2786373
F3 (C16-C34)	1850000	DLA	11000	ug/L	05-FEB-14	05-FEB-14	R2786373
F4 (C34-C50)	1300	DLIS	1100	ug/L	05-FEB-14	05-FEB-14	R2786373
Total Hydrocarbons (C6-C50)	3410000		12000	ug/L		05-FEB-14	
Chrom. to baseline at nC50	YES				05-FEB-14	05-FEB-14	R2786373
Surrogate: 2-Bromobenzotrifluoride	N/A	SMI	60-140	%	05-FEB-14	05-FEB-14	R2786373
Surrogate: 3,4-Dichlorotoluene	103.3		60-140	%		05-FEB-14	R2786067
L1418278-2 S-3081-2 (1,2,3) Sampled By: MICHAEL HEALEY on 31-JAN-14 Matrix: WATER							
Volatile Organic Compounds							
Benzene	1.28		0.50	ug/L		05-FEB-14	R2786067
Ethyl Benzene	20.4		0.50	ug/L		05-FEB-14	R2786067
Toluene	<0.50		0.50	ug/L		05-FEB-14	R2786067
o-Xylene	13.9		0.30	ug/L		05-FEB-14	R2786067
m+p-Xylenes	1.70		0.40	ug/L		05-FEB-14	R2786067
Xylenes (Total)	15.6		0.50	ug/L		05-FEB-14	
Surrogate: 4-Bromofluorobenzene	89.1		70-130	%		05-FEB-14	R2786067
Surrogate: 1,4-Difluorobenzene	101.0		70-130	%		05-FEB-14	R2786067
Hydrocarbons							
F1 (C6-C10)	6680	DLA	50	ug/L		06-FEB-14	R2786067
F1-BTEX	6640		50	ug/L		06-FEB-14	
F2 (C10-C16)	2550000	DLA	4500	ug/L	05-FEB-14	05-FEB-14	R2786373
F3 (C16-C34)	3190000	DLA	11000	ug/L	05-FEB-14	05-FEB-14	R2786373
F4 (C34-C50)	26000	DLA	11000	ug/L	05-FEB-14	05-FEB-14	R2786373
Total Hydrocarbons (C6-C50)	5770000		17000	ug/L		06-FEB-14	
Chrom. to baseline at nC50	YES				05-FEB-14	05-FEB-14	R2786373
Surrogate: 2-Bromobenzotrifluoride	N/A	SMI	60-140	%	05-FEB-14	05-FEB-14	R2786373
Surrogate: 3,4-Dichlorotoluene	103.0		60-140	%		06-FEB-14	R2786067
L1418278-3 S-3081-3 (1,2,3) Sampled By: MICHAEL HEALEY on 31-JAN-14							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1418278-3 S-3081-3 (1,2,3) Sampled By: MICHAEL HEALEY on 31-JAN-14 Matrix: WATER							
Volatile Organic Compounds							
Benzene	0.83		0.50	ug/L		05-FEB-14	R2786067
Ethyl Benzene	9.01		0.50	ug/L		05-FEB-14	R2786067
Toluene	<0.50		0.50	ug/L		05-FEB-14	R2786067
o-Xylene	8.13		0.30	ug/L		05-FEB-14	R2786067
m+p-Xylenes	1.22		0.40	ug/L		05-FEB-14	R2786067
Xylenes (Total)	9.35		0.50	ug/L		05-FEB-14	
Surrogate: 4-Bromofluorobenzene	117.1		70-130	%		05-FEB-14	R2786067
Surrogate: 1,4-Difluorobenzene	99.6		70-130	%		05-FEB-14	R2786067
Hydrocarbons							
F1 (C6-C10)	1860		25	ug/L		05-FEB-14	R2786067
F1-BTEX	1840		25	ug/L		05-FEB-14	
F2 (C10-C16)	1420000	DLA	4500	ug/L	05-FEB-14	05-FEB-14	R2786373
F3 (C16-C34)	1640000	DLA	11000	ug/L	05-FEB-14	05-FEB-14	R2786373
F4 (C34-C50)	1200	DLIS	1100	ug/L	05-FEB-14	05-FEB-14	R2786373
Total Hydrocarbons (C6-C50)	3060000		12000	ug/L		05-FEB-14	
Chrom. to baseline at nC50	YES				05-FEB-14	05-FEB-14	R2786373
Surrogate: 2-Bromobenzotrifluoride	N/A	SMI	60-140	%	05-FEB-14	05-FEB-14	R2786373
Surrogate: 3,4-Dichlorotoluene	88.7		60-140	%		05-FEB-14	R2786067

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLIS	Detection Limit Adjusted: Insufficient Sample
SMI	Surrogate recovery could not be measured due to sample matrix interference.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BTX-511-HS-WT	Water	BTEX by Headspace	SW846 8260 (511)

BTX is determined by analyzing by headspace-GC/MS.

F1-F4-511-CALC-WT	Water	F1-F4 Hydrocarbon Calculated Parameters	CCME CWS-PHC DEC-2000 - PUB# 1310-L

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F1-HS-511-WT	Water	F1-O.Reg 153/04 (July 2011)	E3398/CCME TIER 1-HS

Fraction F1 is determined by analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F2-F4-511-WT	Water	F2-F4-O.Reg 153/04 (July 2011)	MOE DECPH-E3398/CCME TIER 1

Fractions F2, F3 and F4 are determined by liquid/liquid extraction with a solvent. The solvent recovered from the extracted sample is dried and treated to remove polar material. The extract is then analyzed by GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

XYLENES-SUM-CALC-WT	Water	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1418278 Report Date: 06-FEB-14

Client: SIREM
130 Research Lane Suite 2
Guelph ON N1G 5G3

Contact: Sandra Dworatzek/Michael Healey

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX-511-HS-WT	**Water**							
Batch R2786067								
WG1825583-1 CVS								
Benzene			102.4		%		75-125	05-FEB-14
Ethyl Benzene			119.2		%		70-130	05-FEB-14
m+p-Xylenes			111.8		%		75-125	05-FEB-14
o-Xylene			118.7		%		70-130	05-FEB-14
Toluene			105.3		%		75-125	05-FEB-14
WG1825583-4 DUP		**WG1825583-3**						
Benzene		8.60	8.65		ug/L	0.6	30	05-FEB-14
Ethyl Benzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	05-FEB-14
m+p-Xylenes		<0.40	<0.40	RPD-NA	ug/L	N/A	30	05-FEB-14
o-Xylene		<0.30	<0.30	RPD-NA	ug/L	N/A	30	05-FEB-14
Toluene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	05-FEB-14
WG1825583-2 MB								
Benzene			<0.50		ug/L		0.5	05-FEB-14
Ethyl Benzene			<0.50		ug/L		0.5	05-FEB-14
m+p-Xylenes			<0.40		ug/L		0.4	05-FEB-14
o-Xylene			<0.30		ug/L		0.3	05-FEB-14
Toluene			<0.50		ug/L		0.5	05-FEB-14
Surrogate: 1,4-Difluorobenzene			103.6		%		70-130	05-FEB-14
Surrogate: 4-Bromofluorobenzene			97.4		%		70-130	05-FEB-14
WG1825583-5 MS		**L1417937-17**						
Benzene			110.1		%		50-150	05-FEB-14
Ethyl Benzene			91.3		%		50-150	05-FEB-14
m+p-Xylenes			104.4		%		50-150	05-FEB-14
o-Xylene			101.9		%		50-150	05-FEB-14
Toluene			105.6		%		50-150	05-FEB-14
F1-HS-511-WT	**Water**							
Batch R2786067								
WG1825583-1 CVS								
F1 (C6-C10)			96.5		%		80-120	05-FEB-14
WG1825583-4 DUP		**WG1825583-3**						
F1 (C6-C10)		38	34		ug/L	9.6	30	05-FEB-14
WG1825583-2 MB								
F1 (C6-C10)			<25		ug/L		25	05-FEB-14
Surrogate: 3,4-Dichlorotoluene			101.1		%		60-140	05-FEB-14
WG1825583-5 MS		**L1417937-17**						

Quality Control Report

Workorder: L1418278 Report Date: 06-FEB-14

Client: SIREM
130 Research Lane Suite 2
Guelph ON N1G 5G3

Contact: Sandra Dworatzek/Michael Healey

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F1-HS-511-WT	**Water**							
Batch R2786067								
WG1825583-5 MS		**L1417937-17**						
F1 (C6-C10)			70.7		%		60-140	05-FEB-14
F2-F4-511-WT	**Water**							
Batch R2786373								
WG1826838-1 CVS								
F2 (C10-C16)			102.0		%		65-135	05-FEB-14
F3 (C16-C34)			102.6		%		65-135	05-FEB-14
F4 (C34-C50)			101.3		%		65-135	05-FEB-14
WG1826475-2 LCS								
F2 (C10-C16)			81.5		%		65-135	05-FEB-14
F3 (C16-C34)			87.0		%		65-135	05-FEB-14
F4 (C34-C50)			83.0		%		65-135	05-FEB-14
WG1826475-3 LCSD		**WG1826475-2**						
F2 (C10-C16)		81.5	86.3		%	5.6	50	05-FEB-14
F3 (C16-C34)		87.0	93.4		%	7.1	50	05-FEB-14
F4 (C34-C50)		83.0	138.0		%	50	50	05-FEB-14
WG1826475-1 MB								
F2 (C10-C16)			<100		ug/L		100	05-FEB-14
F3 (C16-C34)			<250		ug/L		250	05-FEB-14
F4 (C34-C50)			<250		ug/L		250	05-FEB-14
Surrogate: 2-Bromobenzotrifluoride			64.9		%		60-140	05-FEB-14

Quality Control Report

Workorder: L1418278 Report Date: 06-FEB-14

Client: SIREM
130 Research Lane Suite 2
Guelph ON N1G 5G3
Contact: Sandra Dworatzek/Michael Healey

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

C of C #

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

Page 1 of 1

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Specify date required	Service requested			
	5 day (regular)		2 day TAT (50%)	
	3-4 day (25%)		Next day TAT (100%)	
			Same day TAT (200%)	

COMPANY NAME: SiREM
OFFICE:
PROJECT MANAGER: Sandra Dworatzek / Michael Healey
PROJECT #: S-3081
PHONE: (519) 515-0839
FAX: (519) 822-3151
ACCOUNT #:
QUOTATION #:
PO #:

CRITERIA — Criteria on report YES___ NO___
Reg 153/04 Reg 511/09
Table 1 2 3
TCLP _____ MISA _____ PWQO _____
ODWS _____ OTHER _____

REPORT FORMAT/DISTRIBUTION
EMAIL _____ FAX _____ BOTH _____
SELECT: PDF _____ DIGITAL _____ BOTH _____
EMAIL 1 _____
EMAIL 2 _____

ANALYSIS REQUEST — PLEASE INDICATE FILTERED, PRESERVED OR BOTH <----- (F, P, F/P)

SUBMISSION #: L1418278
ENTERED BY: RH
DATE/TIME ENTERED: 3-Feb-14
BIN #: 348

SAMPLING INFORMATION

Date (dd-mm-yy)	Time (24hr) (hh:mm)	COMP	GRAB	WATER	SOIL	OTHER	SAMPLE DESCRIPTION TO APPEAR ON REPORT	NUMBER OF CONTAINERS	Hydrocarbons (F2-F4)	Hydrocarbons (F1)	BTEX	COMMENTS	LAB ID
31-Jan-14				X			S-3081-1-1	1	X				1
				X			S-3081-1-2	1		X			
				X			S-3081-1-3	1			X		
				X			S-3081-2-1	1	X				2
				X			S-3081-2-2	1		X			
				X			S-3081-2-3	1			X		
				X			S-3081-3-1	1	X				3
				X			S-3081-3-2	1		X			
				X			S-3081-3-3	1			X		

L1418278-COFC

SPECIAL INSTRUCTIONS/COMMENTS

THE QUESTIONS BELOW MUST BE ANSWERED FORWATER SAMPLES (CHECK Yes OR No)
Are any samples taken from a regulated DW System? Yes ___ No ___
If yes, an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ___ No ___

SAMPLE CONDITION
___ FROZEN
___ COLD
___ COOLING INITIATED
___ AMBIENT
MEAN TEMP: 4.8

SAMPLED BY: Michael Healey	DATE & TIME: 31 Jan 14	RECEIVED BY:	DATE & TIME
RELINQUISHED BY: Michael Healey	DATE & TIME: 3 Feb 14	RECEIVED AT LAB BY: RH	DATE & TIME: 3 Feb 14 1630

OBSERVATIONS Yes___ No ___ If yes add SIF
INIT: RH

Notes

1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

Attachment B
Field Documentation

January 2014 – Bioaugmentation Testing Baseline Sampling Event

2014-01-BIO

URS Corporation
8181 East Tufts Avenue
Denver, Colorado 80237

URS

Robert Boudra
Phone: 303.740.3841

PARK EUCLID
Water Level Measurement Form

Instrument Type: Interphase
Instrument Number: 59681
Sampler's Name: Fernando Jimenez / Oscar Sikinnen
Date(s): 1-22-14

Project Name: Park Euclid - Bioaugmentation Study
Project Number: 22241866
Weather: 50's - clear / Sunny
Event: ~~Semiannual~~ Bioaugmentation

AQ	Well ID	Screened Interval	PDS Depth	Method (I,T,P)	Date	Time	Product (ft btoc)	Groundwater (ft btoc)	Comment
Perched Aquifer	ADOT-1	75-95	91'	—	—	—	9999	9999	Not part of work plan
	MLS-12	90-105	NA						
	MLS-13	90-105							
	MLS-4	75-105							
	MLS-5	73.5-103.5							
	MLS-6	75-105	100'						
	PEP-10	84-94	92'	I	1-22-14	810	~~90.59~~ 91.67	96.38	tried it several times — Sounding
	PEP-11	85-95	93'	—	—	—	9999	9999	Not part of work plan
	PEP-18	86-96	93'						
	PEP-19	87.5-97.5	95'						
	PEP-24	83.5-93.5	NA						
	PEP-8	90-100		I	1-22-14	820	94.64	97.65	—
	PEP-9	90-100		I	1-22-14	825	94.94	97.14	—
	WR-345A	69-99	98'	—	—	—	9999	9999	not part of work plan
	WR-347A	79.5-109.5	NA	—	—	—	9999	9999	
	SVE-101	27-97		I	1-22-14	903	91.77	94.50	
	SVE-103	30-100		I	1-22-14	903	~~-7777~~	92.24	PDL = 92.21
	SVE-104	30-100		I	1-22-14	917	92.13	94.18	
	MPE-1	90-100		I	1-22-14	8:35	92.75	98.05	System is off
	MPE-2	86-96		I	1-22-14	851	~~-7777~~	90.03	91.39 = PDL
	MPE-3	86-96		I	1-22-14	856	89.79	90.20	" "
	MPE-4	85-95		—	—	—	9999	9999	Not part of work plan
	MPE-5	86-96		—	—	—			
	MPE-6	98.5-99.5		—	—	—			
	MRM-1	85-95		I	1-22-14	840	94.65	95.13	—

Notes: Method: Interface Probe (I), water level tape (T), or pressure transducer (P)

if free product was not observed enter "**-7777**" in product field; if no attempt to measure free product was made, enter "**-5555**" in product field; if unable to distinguish interface between GW and product, enter "**-1111**" in groundwater column; if well is dry enter "**-4444**" in groundwater field; if location cannot be accessed or a measurement can not be attempted enter "**-9999**" and write explanatory comment

@ PEP-10 - PDL = 91.77, SWL = 90.45 TD = 95.6, after tripping out PDBag

MPE-2 - ~~TD~~ = PDL = 91.39, SWL = 90.03 - Tried several times
TD = 93.75, Tip had minor product

1410: 93.97 after 4 bails (not full)
TD: 95.21 @ SVE 104

URS Corporation
8181 East Tufts Avenue
Denver, Colorado 80237

URS

Robert Boudra
Phone: 303.740.3841

PARK EUCLID
Perched Aquifer Sample Documentation Form

Project Name: Bioaugmentation
Sampler's Name: Armando Jimenez & Oscar Skinner
Date(s): 1-22-14

Project Number: 22241866
Weather: 42°, Partly Sunny / Cloudy
Event: ~~Semiannual~~ 2Q

Well Information			Groundwater Sample Information						Product Samples						Comment
			Parent Sample			Containers			Sample Information			Containers			
AQ	Well ID	Type	Date	Time	Sample ID	#	type	pres	Date	Time	Sample ID	#	type	pres	(QC, odor, staining, not sampled, etc)
Perched Aquifer	ADOT-1	PDS	—	—	—	—	VOAs	HCL					VOAs	None	
	MLS-12	Bailer	—	—	—	—	VOAs	HCL	Even if product is present at MLS-12 and MLS-13, these locations are to be sampled for water matrix only.						
	MLS-13		—	—	—	—	VOAs	HCL							
	MLS-4		—	—	—	—	VOAs	HCL					VOAs	None	
	MLS-5		—	—	—	—	VOAs	HCL					VOAs	None	
	MLS-6	PDS	—	—	—	—	VOAs	HCL					VOAs	None	
	PEP-10	PDS	1-22-14	1645	PEP-10-GPT-012214	3	VOAs	HCL					VOAs	None	
	PEP-11	PDS	—	—	—		VOAs	HCL					VOAs	None	
	PEP-18	PDS	—	—	—		VOAs	HCL					VOAs	None	
	PEP-19	PDS	See Note (A)		—		VOAs	HCL					VOAs	None	
	PEP-24	Bailer	—	—	—		VOAs	HCL					VOAs	None	
	PEP-8		1-22-14	1620	PEP-8-GPT-012214	6	VOAs	HCL					VOAs	None	
	PEP-9		1-22-14	1705	PEP-9-GPT-012214	6	VOAs	HCL					VOAs	None	
	WR-345A	PDS	See Note (A)		—		VOAs	HCL					VOAs	None	
	WR-347A	Bailer	—	—	—		VOAs	HCL					VOAs	None	
	SVE-101		—	—	—		VOAs	HCL					VOAs	None	
	SVE-103		1-22-14	1200	SVE-103-GPT-012214	6	VOAs	HCL					VOAs	None	
	SVE-104		1-22-14	1445	SVE-104-GPT-012214	6	VOAs	HCL					VOAs	None	
	MPE-1		1-22-14	1235	MPE-1-GPT-012214	6	VOAs	HCL					VOAs	None	
	MPE-2		1-22-14	1015	MPE-2-GPT-012214	6	VOAs	HCL					VOAs	None	
	MPE-3		1-22-14	1100	MPE-3-GP-012214	6	VOAs	HCL					VOAs	None	
	MPE-4		—	—	—		VOAs	HCL					VOAs	None	
	MPE-5		—	—	—		VOAs	HCL					VOAs	None	
	MPE-6		—	—	—		VOAs	HCL					VOAs	None	
	MPM-1		1-22-14	1245	MPM-1-GPT-012214	6	VOAs	HCL					VOAs	None	

Additional General Notes:
(A) PEP-19 and WR-345A are sampled biannually (every other year or one out of every four semiannual events). Therefore, sample these wells during the second semiannual event of even years (next in second half of 2014)

Sampler Signature

Date/Time of Completion: 1-22-14 ~~1645~~ 1705

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF CUSTODY FORM

[ ] Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, AZ 85040 (602) 437-3340 FAX (602) 454-9303
[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (520) 807-3801 FAX (520) 807-3803
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-1264

Page 1 of 1

Client Name/Address: URS Corp. 333 E. Wetmore Rd #400 Tucson, AZ 85705

Project/PO Number: Park/Euclid 22241866

Project Manager: Janet Workman

Phone Number: 602 861 7494

Sampler: A. Jimenez / D. Skinner

Fax Number:

Analysis Required: 8260B, RSK 175

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	8260B	RSK 175								Special Instructions
MPE-2GPT-012214	GW	40mL	5	1/22/14	1015	HCL	X	X								
MPE-3GPT-012214	GW	40mL	5	1/22/14	1100	HCL	X	X								
SVE-103GPT-012214	GW	40mL	5	1/22/14	1200	HCL	X	X								
MPE-1GPT-012214	GW	40mL	5	1/22/14	1230	HCL	X	X								
MPM-1GPT-012214	GW	40mL	5	1/22/14	1245	HCL	X	X								
SVE-104GPT-012214	GW	40mL	5	1/22/14	1445	HCL	X	X								
PEP-8GPT-012214	GW	40mL	5	1/22/14	1620	HCL	X	X								
PEP-10GPT-012214	GW	40mL	5	1/22/14	1645	HCL	X	X								
PEP-9GPT-012214	GW	40mL	5	1/22/14	1705	HCL	X	X								
GTT-012214TB	W	40mL	2			HCL	X									

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
A. J	1-23-14 1055	[signature]	1-23-14 1055	same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal X
Relinquished By:	Date/Time:	Received in Lab By:	Date/Time:	Sample Integrity: (Check)
				intact X on ice X

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

1.8

3589

SIREM Site Recovery & Management

Chain-of-Custody Form

130 Research Lane, Suite 2 Guelph, Ontario, Canada N1G 5G3 Phone (519) 822-2265 or toll free 1-866-251-1747 Fax (519) 822-3151

www.siremlab.com

Page 1 of 1

Lab #

Project Name: Park / Euclid	Project #: 22241866
Project Manager: Janet Workman	
Email Address: JaneT.workman@urs.com	
Company: URS Corp.	
Address: Phoenix AZ office	
Phone #: 1-602-861-7494	Fax #:
Sampler's Signature:	Sampler's Printed Name: Oscar Skinner

Analysis

Preservative Key
0. None
1. HCl
2. Other _____
3. Other _____

Customer Sample ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac Dhc	Gene-Trac VC	Gene-Trac Dhb	Other Information
MPE-2GPT-012214	1/22/14	1015	GW	1	X	X		
MPE-3GPT-012214	1/22/14	1100	GW	1	X	X		
SVE-103GPT-012214	1/22/14	1200	GW	1	X	X		
MPF-1GPT-012214	1/22/14	1230	GW	1	X	X		
MPN-1GPT-012214	1/22/14	1245	GW	1	X	X		
SVE-104GPT-012214	1/22/14	1445	GW	1	X	X		
MPE-1GPT-012214	1/22/14	1530	GW	2			X	2 - one gallon containers
PEP-8GPT-012214	1/22/14	1620	GW	1	X	X		
PEP-10GPT-012214	1/22/14	1645	GW	1	X	X		MPE-1 & MPE-2 GPT-012214 may
PEP-9GPT-012214	1/22/14	1705	GW	1	X	X		not have diesel.

Sample Receipt	Billing Information	Turnaround Time Requested	For Lab Use Only
Cooler Condition:	P.O. # 22241866-011514-SIREM	Normal ☒	
Cooler Temperature:	Bill To:	Rush ☐	
Custody Seals: Yes ☐ No ☐			Proposal #: _____

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature:	Signature:	Signature:	Signature:	Signature:	Signature:
Printed Name: Alexander Lemarz	Printed Name:	Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: URS	Firm:	Firm:	Firm:	Firm:	Firm:
Date/Time: 1-23-14 1340	Date/Time:	Date/Time:	Date/Time:	Date/Time:	Date/Time:

Distribution: White - Return to Originator: Yellow - Lab Copy: Pink - Retained by Client

Wednesday, Bioaugmentation Study 1-22-14

0715 AS and OS onsite
- 42° degrees, partly sunny / Partly cloudy
- Tail gate safety meeting → Vehicular traffic is crucial
- Tasks for Day: round of water / product levels on ten perched wells, see Water level Measurement form. 2nd. collect GW samples for Test America & SiRem.

0805 start collect SWL's & PDL's, will start @ PEP-10
Please see Water level measurement.

0810 - @ PEP-10, several attempts / confirmations on Interphase PDL: 91.07 & SWL: 90.38, tripped out PDBag PDL: 91.77 & SWL: 90.45, water was tagged first or heard first then product, several confirmations were made. ~~tip~~ ~~At~~ sounder ~~was~~ At had product sheen.

0935 came back to MPE-2, thought we had to bail 3 well volumes. Lowered interphase to tag TD, Encountered product tone, tried several times, confirmed tone (steady), tripped Interphase, probe had sheen as well / mild odor. No purging needed.
- well prep to start collecting samples.

1015 collect MPE-2 GPT-012214 - 6 containers (5 for TestAmer & 1 SiRem)
1100 collect MPE-3 GPT-012214 - 6 containers " "
1135 after several attempts to collect sample @ SVE-101, unsuccessful, not enough water, SWL = 94.50, TD = 94.61 → According to Monitor well Sampling Details - Table 2
1200 collect SVE-103 GPT-012214 - 6 containers, 1-liter sample very "dirty water".
1235 collect MPE-1 GPT-012214 - 6 containers
- note: for MPE wells, stingers were removed prior to lowering bailers.
1245 collect MPM-1-GPT-012214 - 6 containers
1340 @ SVE-104
1410 after 4 bails, ~~SWL~~ PDL: 93.97 TD: ~95.21, maybe 1/3 full of "water" in 1-Liter container. ~5 (1/2 gallon) of product.
1445 collect SVE-104-GPT 012214 - 6 containers only not enough water for 2-1 gallon containers
1530 collect 2 one gallon containers, ID: MPE-1-GPT 012214
Per Janet's recommendation per conversation between Oskar Skinner and JW conversation

Scale: 1 square =

Wednesday Bioaugmentation Study 1-22-14

1620 collect PEP-8 GPT-012214 - 6 containers

1645 collect PEP-10 GPT-012214 -

1705 collect PEP-9 GPT-012214

- Start cleaning up

1720 AJ and OS offsite

AJ 1-22-14

"Rite in the Rain" ALL WEATHER WRITING PAPER

Scale: 1 square = _____

Attachment C
Laboratory Analytical Data Reports

SiREM
Leading Science · Lasting Solutions

130 Research Lane, Ste 2
Guelph ON N1G 5G3
(519) 822-2265

Certificate of Analysis: Gene-Trac® *Dehalococcoides* Assay

Customer: Janet Workman, URS Corporation
Project: Park/Euclid
Customer Reference: 22241866

SiREM Reference: S-3081, S-3082
Report Date: 7-Feb-14
Data Files: iQ5-DHC-QPCR-1080
iQ5-DHC-QPCR-1082
iQ5-DB-DHC-QPCR-0441
iQ5-DB-DHC-QPCR-0442
iQ5-TBA-QPCR-0026

Table 1a: Test Results

Customer Sample ID	SiREM Sample ID	Sample Collection Date	Sample Matrix	Percent Dhc *	*Dehalococcoides* Enumeration/Liter **
MPE-2GPT-012214	DHC-9994	22-Jan-14	Groundwater	NA	3×10^3 U
MPE-3GPT-012214	DHC-9995	22-Jan-14	Groundwater	NA	6×10^3 U
SVE-103GPT-012214	DHC-9996	22-Jan-14	Groundwater	72 - 100 %	6×10^9
MPM-1GPT-012214	DHC-9997	22-Jan-14	Groundwater	NA	1×10^4 U
SVE-104GPT-012214	DHC-9998	22-Jan-14	Groundwater	0.0004 - 0.001 %	4×10^4 J
PEP-8GPT-012214	DHC-10015	22-Jan-14	Groundwater	0.00002 - 0.00007 %	9×10^3 J
PEP-10GPT-012214	DHC-10000	22-Jan-14	Groundwater	0.06 - 0.2 %	1×10^6
PEP-9GPT-012214	DHC-10001	22-Jan-14	Groundwater	0.08 - 0.2 %	2×10^6
MPE-1GPT-012214	DHC-10002	22-Jan-14	Groundwater	NA	6×10^4 U

Notes:

* Percent *Dehalococcoides* (Dhc) in microbial population. This value is calculated by dividing the number of Dhc 16S ribosomal ribonucleic acid (rRNA) gene copies by the total number of bacteria as estimated by the mass of DNA extracted from the sample. Range represents normal variation in Dhc enumeration.

** Based on quantification of Dhc 16S rRNA gene copies. Dhc are generally reported to contain one 16S rRNA gene copy per cell; therefore, this number is often interpreted to represent the number of Dhc cells present in the sample.

J The associated value is an estimated quantity between the method detection limit and quantitation limit.
U Not detected, associated value is the quantification limit.
B Analyte was also detected in the method blank.
NA Not applicable as *Dehalococcoides* not detected and/or quantifiable DNA not extracted from the sample.
I Sample inhibited the test reaction based on inability to PCR amplify extracted DNA with universal primers.
E Extracted genomic DNA was not detected in sample.

Analyst: J. Wilkinson
Jennifer Wilkinson
Senior Laboratory Technician

Approved: Ximena Druar
Ximena Druar, B.Sc.
Genetic Testing Coordinator

SiREM
Leading Science · Lasting Solutions

130 Research Lane, Ste 2
Guelph ON N1G 5G3
(519) 822-2265

Certificate of Analysis: Gene-Trac® VC, Vinyl Chloride Reductase (*vcrA*) Assay

Customer: Janet Workman, URS Corporation

Project: Park/Euclid

Customer Reference: 22241866

SiREM Reference: S-3081, S-3082

Report Date: 7-Feb-14

Data Files: MyiQ-VC-QPCR-0617
MyiQ-VC-QPCR-0619
MyiQ-DB-VC-QPCR-0342
MyiQ-DB-VC-QPCR-0343
VC-QPCR-check-gel-0630
VC-QPCR-check-gel-0632

Table 1b: Test Results

Customer Sample ID	SiREM Sample ID	Sample Collection Date	Sample Matrix	Percent *vcrA* *	Vinyl Chloride Reductase (*vcrA*) Gene Copies/Liter
SVE-103GPT-012214	VCR-4449	22-Jan-14	Groundwater	23 - 54 %	1×10^9
SVE-104GPT-012214	VCR-4450	22-Jan-14	Groundwater	0.0004 - 0.001 %	4×10^4 J
PEP-8GPT-012214	VCR-4462	22-Jan-14	Groundwater	NA	6×10^4 U
PEP-10GPT-012214	VCR-4451	22-Jan-14	Groundwater	0.008 - 0.02 %	1×10^5
PEP-9GPT-012214	VCR-4452	22-Jan-14	Groundwater	0.01 - 0.04 %	3×10^5

Notes:

* Percent *vcrA* in microbial population. This value is calculated by dividing the number of vinyl chloride reductase A (*vcrA*) gene copies quantified by the total number of bacteria estimated to be in the sample based on the mass of DNA extracted from the sample. Range represents normal variation in enumeration of *vcrA*.

J The associated value is an estimated quantity between the method detection limit and quantitation limit.
U Not detected, associated value is the quantification limit.
B Analyte was also detected in the method blank.
NA Not applicable as *vcrA* not detected and/or quantifiable DNA not extracted from the sample.
I Sample inhibited the test reaction based on inability to PCR amplify extracted DNA with universal primers.
C Correction factor applied to correct for non-specific PCR amplification products, value is an estimated quantity.

Analyst: J. Wilkinson
Jennifer Wilkinson
Senior Laboratory Technician

Approved: Ximena Druar
Ximena Druar, B.Sc.
Genetic Testing Coordinator

Table 2.1: Detailed Test Parameters, Gene-Trac Test Reference S-3081, S-3082

Customer Sample ID	MPE-2GPT-012214	MPE-3GPT-012214	SVE-103GPT-012214	MPM-1GPT-012214	SVE-104GPT-012214
SiREM Dhc Sample ID	DHC-9994	DHC-9995	DHC-9996	DHC-9997	DHC-9998
SiREM *vcrA* Sample ID	NA	NA	VCR-4449	NA	VCR-4450
Date Received	24-Jan-14	24-Jan-14	24-Jan-14	24-Jan-14	24-Jan-14
Sample Temperature	5 ºC	5 ºC	5 ºC	5 ºC	5 ºC
Filtration Date	28-Jan-14	28-Jan-14	28-Jan-14	28-Jan-14	28-Jan-14
Volume Used for DNA Extraction	500 mL	200 mL	10 mL	100 mL	10 mL
DNA Extraction Date	29-Jan-14	29-Jan-14	29-Jan-14	29-Jan-14	29-Jan-14
DNA Concentration in Sample (extractable)	17213 ng/L	15653 ng/L	9628 ng/L	4718 ng/L	19860 ng/L
PCR Amplifiable DNA	Detected	Detected	Detected	Detected	Detected
Dhc qPCR Date Analyzed	29-Jan-14	29-Jan-14	29-Jan-14	29-Jan-14	29-Jan-14
***vcrA* qPCR Date Analyzed**	NA	NA	30-Jan-14	NA	30-Jan-14
Laboratory Controls (see Tables 3 & 4)	Passed	Passed	Passed	Passed	Passed
Comments	- -	- -	- -	- -	- -

Notes:

Refer to Tables 3 & 4 for detailed results of controls.
°C = degrees Celsius
DNA = Deoxyribonucleic acid
PCR = polymerase chain reaction
qPCR = quantitative PCR
Dhc = *Dehalococcoides*
ng/L = nanograms per liter
mL = milliliters
vcrA = vinyl chloride reductase

Table 2.2: Detailed Test Parameters, Gene-Trac Test Reference S-3081, S-3082

Customer Sample ID	PEP-8GPT-012214	PEP-10GPT-012214	PEP-9GPT-012214	MPE-1GPT-012214
SiREM Dhc Sample ID	DHC-10015	DHC-10000	DHC-10001	DHC-10002
SiREM *vcrA* Sample ID	VCR-4462	VCR-4451	VCR-4452	NA
Date Received	24-Jan-14	24-Jan-14	24-Jan-14	27-Jan-14
Sample Temperature	5 ºC	5 ºC	5 ºC	4 ºC
Filtration Date	3-Feb-14	28-Jan-14	28-Jan-14	28-Jan-14
Volume Used for DNA Extraction	20 mL	200 mL	100 mL	20 mL
DNA Extraction Date	3-Feb-14	29-Jan-14	29-Jan-14	29-Jan-14
DNA Concentration in Sample (extractable)	81000 ng/L	2994 ng/L	5048 ng/L	3915 ng/L
PCR Amplifiable DNA	Detected	Detected	Detected	Detected
Dhc qPCR Date Analyzed	5-Feb-14	29-Jan-14	29-Jan-14	29-Jan-14
***vcrA* qPCR Date Analyzed**	6-Feb-14	30-Jan-14	30-Jan-14	NA
Laboratory Controls (see Tables 3 & 4)	Passed	Passed	Passed	Passed
Comments	- -	- -	- -	- -

Notes:

Refer to Tables 3 & 4 for detailed results of controls.
°C = degrees Celsius
DNA = Deoxyribonucleic acid
PCR = polymerase chain reaction
qPCR = quantitative PCR
Dhc = *Dehalococcoides*
ng/L = nanograms per liter
mL = milliliters
vcrA = vinyl chloride reductase

Table 3: Gene-Trac Dhc Control Results, Test Reference S-3081, S-3082

Laboratory Control	Analysis Date	Control Description	Spiked Dhc 16S rRNA Gene Copies per Liter	Recovered Dhc 16S rRNA Gene Copies per Liter	Comments
Positive Control Low Concentration	29-Jan-14	qPCR with KB1 genomic DNA (CSLD-0718)	1.1×10^5	1.3×10^5	--
Positive Control High Concentration	29-Jan-14	qPCR with KB1 genomic DNA (CSHD-0718)	1.4×10^7	1.8×10^7	--
DNA Extraction Blank	29-Jan-14	DNA extraction sterile water (FB-2114)	0	1.8×10^3 J	See Note 1
Negative Control	29-Jan-14	Tris Reagent Blank (TBD-0677)	0	2.6×10^3 U	--
Positive Control Low Concentration	5-Feb-14	qPCR with KB1 genomic DNA (CSLD-0720)	1.1×10^5	1.2×10^5	--
Positive Control High Concentration	5-Feb-14	qPCR with KB1 genomic DNA (CSHD-0720)	1.4×10^7	1.9×10^7	--
DNA Extraction Blank	5-Feb-14	DNA extraction sterile water (FB-2116)	0	2.6×10^3 U	--
Negative Control	5-Feb-14	Tris Reagent Blank (TBD-0679)	0	2.6×10^3 U	--

Notes:

Dhc = *Dehalococcoides*

DNA = Deoxyribonucleic acid

qPCR = quantitative PCR

16S rRNA = 16S ribosomal ribonucleic acid

U Not detected, associated value is the quantification limit.

[1]Acceptable as test results for relevant samples are greater than 1 order of magnitude above DNA Extraction Blank test result.

Table 4: Gene-Trac VC Control Results, Test Reference S-3081, S-3082

Laboratory Control	Analysis Date	Control Description	Spiked *vcrA* reductase Gene Copies per Liter	Recovered *vcrA* reductase Gene Copies per Liter	Comments
Positive Control Low Concentration	30-Jan-14	qPCR with KB1 genomic DNA (CSLV-0485)	7.5×10^4	6.0×10^4	--
Positive Control High Concentration	30-Jan-14	qPCR with KB1 genomic DNA (CSHV-0485)	1.2×10^7	9.0×10^6	--
DNA Extraction Blank	30-Jan-14	DNA extraction sterile water (FB-2114)	0	2.6×10^3 U	--
Negative Control	30-Jan-14	Tris Reagent Blank (TBV-0456)	0	2.6×10^3 U	--
Positive Control Low Concentration	6-Feb-14	qPCR with KB1 genomic DNA (CSLV-0487)	7.5×10^4	6.6×10^4	--
Positive Control High Concentration	6-Feb-14	qPCR with KB1 genomic DNA (CSHV-0487)	1.2×10^7	9.0×10^6	--
DNA Extraction Blank	6-Feb-14	DNA extraction sterile water (FB-2116)	0	2.6×10^3 U	--
Negative Control	6-Feb-14	Tris Reagent Blank (TBV-0458)	0	2.6×10^3 U	--

Notes:

DNA = Deoxyribonucleic acid

qPCR = quantitative PCR

16S rRNA = 16S ribosomal ribonucleic acid

U Not detected, associated value is the quantification limit.

vcrA = vinyl chloride reductase

copy -> 2 coolers

SiREM
Leading Science · Lasting Solutions

Chain-of-Custody Form

130 Research Lane, Suite 2 · Guelph, Ontario, Canada N1G 5G3 · Phone (519) 822-2265 or toll free 1-866-251-1747 Fax (519) 822-3151
www.siremlab.com

№ 3589

Page 1 of 1

Lab # S-3081

Project Name	Park / Euclid
Project #	22241866
Project Manager	Janet Workman
Email Address	Janet.workman@urs.com
Company	URS Corp.
Address	Phoenix AZ office
Phone #	1-602-861-7494
Fax #	
Sampler's Signature	
Sampler's Printed Name	Oscar Skinner

Analysis

Preservative	0	0		0							
	Gene-Trac Dhc	Gene-Trac VC	Gene-Trac Dhb	Bench Scale testing							

Preservative Key
0. None
1. HCl
2. Other _____
3. Other _____

Customer Sample ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac Dhc	Gene-Trac VC	Gene-Trac Dhb	Bench Scale testing								Other Information
MPE-2GPT-012214	1/22/14	1015	GW	1	X	X										
MPE-3GPT-012214	1/22/14	1100	GW	1	X	X										
SVE-103GPT-012214	1/22/14	1200	GW	1	X	X										
MPF-1GPT-012214	1/22/14	1230	GW	1	X	X										
MPM-1GPT-012214	1/22/14	1245	GW	1	X	X										
SVE-104GPT-012214	1/22/14	1445	GW	1	X	X										
MPE-1GPT-012214	1/22/14	1530	GW	2			X									2- one gallon containers
PEP-8GPT-012214	1/22/14	1620	GW	1	X	X										
PEP-10GPT-012214	1/22/14	1645	GW	1	X	X										
PEP-9GPT-012214	1/22/14	1705	GW	1	X	X										

Sample Receipt	
Cooler Condition:	good
Cooler Temperature:	5°C
Custody Seals:	Yes ☒ No ☐

Billing Information	
P.O. #	22241866-011514-SiREM
Bill To:	

Turnaround Time Requested
Normal ☒
Rush ☐

For Lab Use Only
Proposal #: _____

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	Signature	Signature	Signature	Signature	Signature
Printed Name Armando Jimenez	Printed Name Ben Reside	Printed Name	Printed Name	Printed Name	Printed Name
Firm URS	Firm SiREM	Firm	Firm	Firm	Firm
Date/Time 1-23-14 1340	Date/Time 1-24-14 13:50	Date/Time	Date/Time	Date/Time	Date/Time

Distribution: White - Return to Originator: Yellow - Lab Copy: Pink - Retained by Client

SiREM
Leading Science · Lasting Solutions

Chain-of-Custody Form

130 Research Lane, Suite 2 · Guelph, Ontario, Canada N1G 5G3 · Phone (519) 822-2265 or toll free 1-866-251-1747 Fax (519) 822-3151
www.siremlab.com

3589

Page 1 of 1

Lab # S-3082.

Project Name	Park / Euclid
Project #	22241866
Project Manager	Janet Workman
Email Address	Janet.workman@urs.com
Company	URS Corp.
Address	Phoenix AZ office
Phone #	1-602-861-7494
Fax #	
Sampler's Signature	Oscar S
Sampler's Printed Name	Oscar Skinner

Analysis

Customer Sample ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac Dhc	Gene-Trac VC ver A	Gene-Trac Dhb	Bench Scale testing	Other Information
Preservative					0	0		0	
MPE-2GPT-012214	1/22/14	1015	GW	1	X	X			
MPE-3GPT-012214	1/22/14	1100	GW	1	X	X			
SVE-103GPT-012214	1/22/14	1200	GW	1	X	X			
MPE-1GPT-012214	1/22/14	1230	GW	1	X	X			
MPM-1GPT-012214	1/22/14	1245	GW	1	X	X			
SVE-104GPT-012214	1/22/14	1445	GW	1	X	X			
MPE-1GPT-012214	1/22/14	1530	GW	2			X		2- one gallon containers
PEP-8GPT-012214	1/22/14	1620	GW	1	X	X			
PEP-10GPT-012214	1/22/14	1645	GW	1	X	X			MPE-1 & MPE-2 GPT-012214 may
PEP-9GPT-012214	1/22/14	1705	GW	1	X	X			not have diesel.

Preservative Key
0. None
1. HCl
2. Other _____
3. Other _____

Sample Receipt
Cooler Condition: Good.
Cooler Temperature: 4° C
Custody Seals: Yes ☒ No ☐

Billing Information
P.O. # 22241866-011514-SiREM
Bill To:

Turnaround Time Requested
Normal ☒
Rush ☐

For Lab Use Only
Received highlighted missing samples from S-3081 (Jan 24 '14)
Proposal #: _____

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature: A. S	Signature: Zespoli	Signature:	Signature:	Signature:	Signature:
Printed Name: Armando Jimenez	Printed Name: D. Zespoli	Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: URS	Firm: SiREM.	Firm:	Firm:	Firm:	Firm:
Date/Time: 1-23-14 1340	Date/Time: Jan 27 '14 1pm.	Date/Time:	Date/Time:	Date/Time:	Date/Time:

Distribution: White - Return to Originator: Yellow - Lab Copy: Pink - Retained by Client

SiREM
Leading Science · Lasting Solutions

130 Research Lane, Ste 2
Guelph ON N1G 5G3
(519) 822-2265

SiREM Technical Note 1.5:

Guidelines for Interpretation of Gene-Trac® Test Results

This document provides technical background information and guidelines for interpreting the results for the following Gene-Trac® assays:

(1) Gene-Trac® Dhc
(2) Gene-Trac® VC
(3) Gene-Trac® Dhb

SiREM Technical Note 1.4 - *Quantitative Gene-Trac® Assay Test Procedure and Reporting Overview* provides detailed information on Gene-Trac® test procedures and reporting. Explanation of data qualifiers and commonly used notes is provided as Appendix A. Table 1 provides a brief interpretation for some common scenarios, more detailed interpretation information is provided in the following sections.

Table 1: Common Gene-Trac® Test Result Scenarios and Interpretation

Gene-Trac® Dhc (*Dehalococcoides*)	Gene-Trac® VC (*vcrA*)	Gene-Trac® Dhb (*Dehalobacter*)	Interpretation
>1 x10^7/L	**>1 x10^7/L**	Not Analyzed	Complete dechlorination to ethene likely as Dhc high and *vcrA* high
1 x10^7/L	**Not Detected**	Not Analyzed	VC accumulation possible as *vcrA* negative
Not Detected	**Not Detected**	Not Analyzed	Dhc negative/ lack of dechlorination or *cis*-DCE accumulation likely
Not Analyzed	Not Analyzed	**1 x10^6/L**	Dhb positive,potential for biodegradation of 1,1,1-TCA, 1,2-DCA, carbon tetrachloride and chloroform, PCE and TCE to *cis*-DCE
Not Analyzed	Not Analyzed	**Not Detected**	Biodegradation of 1,1,1-TCA, carbon tetrachloride and chloroform not expected as Dhb negative

Gene-Trac® Dhc -Total *Dehalococcoides* Test

Background:

Gene-Trac® Dhc is a quantitative PCR (qPCR) test for total *Dehalococcoides* (Dhc) microbes that targets Dhc specific sequences of the 16S ribosomal ribonucleic acid (rRNA) gene, a gene commonly used to indentify microbes. Dhc are the only known microorganisms capable of complete dechlorination of chloroethenes (i.e., tetrachloroethene, trichloroethene, cis-1,2-dichloroethene [cis-DCE] and vinyl chloride) to non-toxic ethene. Gene-Trac® Dhc may also be used to assess the in situ growth of Dhc containing bioaugmentation cultures such as KB-1®.

Negative Gene-Trac® Dhc Test Results (U qualified)

A non-detect in the Gene-Trac® Dhc assay (e.g., 4,000U) indicates that Dhc were not detected in the sample. The absence of Dhc is frequently associated with a lack of complete dechlorination or incomplete dechlorination of chlorinated ethenes. Where Dhc are absent the accumulation of cis-DCE is commonly observed, particularly after addition of electron donors. Bioaugmentation with Dhc containing cultures, such as KB-1®, is commonly used to improve bioremediation performance at sites that lack an indigenous Dhc population.

Positive Gene-Trac® Dhc Test Results

The detection of Dhc has been correlated with the complete biological dechlorination of chlorinated ethenes to ethene at contaminated sites (Hendrickson et al., 2002). A positive Gene-Trac® Dhc test indicates that Dhc DNA was detected in the sample and is encouraging for dechlorination of chlorinated ethenes to ethene. Note not all Dhc are capable of conversion of vinyl chloride to ethene; this capability can be determined by the Gene-Trac® VC test (see Section 2) which is commonly performed as a follow-on analysis after positive Gene-Trac® Dhc tests. In most cases Dhc must be present at sufficient concentrations in order for significant dechlorination to be observed, guidelines for expected impacts at various Dhc concentrations are indicated below.

Values of 10^4 Dhc gene copies per liter (or lower): indicates that the sample contains low concentrations of Dhc which may indicate that site conditions are suboptimal for high rates of dechlorination. Increases in Dhc concentrations at the site may be possible if conditions are optimized (e.g., electron donor addition).

Values of 10^5-10^6 Dhc gene copies per liter: indicates the sample contains moderate concentrations of Dhc which may, or may not, be associated with observable dechlorination activity (i.e., detectable ethene).

Values at or above 10^7 Dhc gene copies per liter: indicates that the sample contains high concentrations of Dhc that are often associated with high rates of dechlorination (Lu et al., 2006) and the production of ethene.

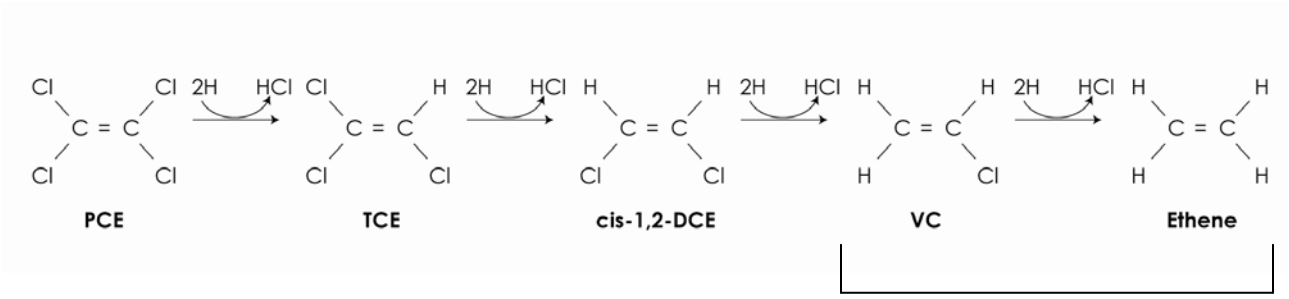
Values of 10^9 Dhc gene copies per liter are generally the highest observed for groundwater samples with rare exceptions.

Gene-Trac® VC- Vinyl Chloride Reductase (*vcrA*) Test

Background

Gene-Trac® VC is a qPCR test for the vinyl chloride reductase (*vcrA*) gene that codes for a Dhc enzyme that converts (VC) to ethene, a critical step in reductive dechlorination of chlorinated ethenes. Gene-Trac® VC is commonly used where Gene-Trac® Dhc test results are positive to confirm that the Dhc detected are capable of complete dechlorination to ethene.#

The vinyl chloride reductase gene (*vcrA)* (Müller et al., 2004) produces an enzyme that is found in many (but not all) Dhc and is reported to be the most common identified VC reductase in the environment (van der Zaan et al., 2010).



Key activity of vinyl chloride reductase vcrA gene/enzyme

Interpretation of Gene-Trac® VC Results

Detect in Gene-Trac® VC Test

A detect in the Gene-Trac® VC test indicates that a Dhc population has the *vcrA* gene and the prospects for complete dechlorination to ethene are good. As a minimal requirement, *vcrA* copies exceeding 10^5/L combined with observed increases over time (i.e., cell growth) are required for robust VC dechlorination (van der Zaan et al., 2010). Also the guidelines for detection of ethene provided under Gene-Trac® Dhc are conservative for interpretation of Gene-Trac® VC (i.e., > 1 x10^7 gene copies/L indicate a high likelihood of detection of ethene). In one study, more than 90% of samples where *vcrA* enumeration exceeded 1 x10^7 gene copies/L had detectable ethene (Dennis, 2009). In cases where *vcrA* gene copies are lower the likelihood of detectable ethene decreases.

Non-Detect in Gene-Trac® VC Test (U qualified)

A non-detect in the Gene-Trac® VC test indicates that *vcrA* gene sequences in the sample are below the detection limit of the assay (typically 4 x 10^3 *vcrA* gene copies/L). This indicates VC accumulation (VC stall) is possible. Note negative Gene-Trac® VC test results do not indicate with 100% certainty that a VC-stall will occur as there are other vinyl chloride reductase genes, such as *bvcA* (van der Zaan et al., 2010) that also convert VC to ethene.

Comparing Gene-Trac® VC and Gene-Trac® Dhc Test Results

Sites may contain different types of Dhc populations. At some sites the Dhc population is homogenous while other sites have Dhc populations that are mixtures of different types of Dhc. This can lead to differing results for Gene-Trac® Dhc and Gene-Trac® VC.

In many cases, the numerical results of Gene-Trac® VC test are identical to those obtained in the Gene-Trac® Dhc test, indicating that the entire Dhc population contains the *vcrA* gene. In other cases, Gene-Trac® VC results may differ significantly (i.e., more than an order or magnitude) from the total Dhc for a number of reasons.

Table 3 provides some common scenarios for Gene-Trac® VC and Gene-Trac® Dhc test results. In general, where Gene-Trac® VC results are non-detect, or significantly lower than Gene-Trac® Dhc, accumulation of VC is more likely.

Table 2: Interpretation of Gene-Trac® VC in Relation to Gene-Trac® Dhc

Gene-Trac® Dhc (16S rRNA gene copies/ L)	Gene-Trac® VC (*vcr*A gene copies/L)	Results Summary	Interpretation	Potential Site Implications
2×10^8 /L	3×10^8/L	Total Dhc and *vcrA* are ~the same (within 3-fold)	Entire Dhc population has *vcrA* gene	Potential for complete dechlorination high. VC stall unlikely-sites with *vcr*A above 1×10^7/L typically have detectable ethene
1×10^8/L	Non-detect	Total Dhc high; *vcrA* non-detect	High concentration of Dhc and entire population lacks the *vcrA* gene	Likelihood for VC accumulation high as *vcrA* non-detect
1×10^8/L	1×10^6 /L	Total Dhc is significantly higher (100 fold) than *vcrA*	*Dhc* population consists of different types, some with the *vcrA* gene (~1%) and some without (~99%)	VC-accumulation possible; Dhc/*vcrA* proportions may change over course of remediation
1×10^6/L	1×10^8/L	*vcrA* orders of magnitude higher than Dhc	Significantly higher *vcrA* may indicate the presence of populations of non-Dhc microorganisms with *vcrA* like genes	Potential for VC-stall likely low

Gene-Trac® Dhb-Total *Dehalobacter* Test

Gene-Trac® Dhb is a qPCR test targeting the 16S rRNA gene sequences unique to *Dehalobacter* (Dhb). Dhb are implicated in the biodegradation of 1,1,1-trichloroethane (to chloroethane), 1,1,2-trichloroethane and 1,2-dichloroethane to ethene (Grostern and Edwards, 2006) and chloroform (to dichloromethane) (Grostern et al., 2010) as well as incomplete dechlorination of PCE and TCE to cis-DCE (Holliger et al.,1998). Gene-Trac® Dhb may also be used as a tool to assess the impact of bioaugmentation with the KB-1® Plus cultures which contain high concentrations of Dhb.

Positive Gene-Trac® Dhb Test Results (Detects)

A positive Gene-Trac® Dhb indicates that a member of the *Dehalobacter* (Dhb) genus was detected in the sample. The detection of Dhb indicates that some or all of the dechlorination activities attributed to Dhb may be present at the subject site. Increasing concentrations of Dhb are indicative of increased potential to degrade some or all of these compounds.

Note: the Gene-Trac® Dhb test will not differentiate the type of Dhb; therefore, observations of the specific biodegradation pathways and end products based on chemical analytical methods in conjunction with Gene-Trac® Dhb will increase the interpretability of Gene-Trac® Dhb results.

Note: Dhb have been reported to contain multiple copies (up to 4 per cell) of the 16S rRNA gene (Grostern and Edwards, 2008). This means that, unlike Dhc, there is not a 1:1 ratio between the 16S rRNA gene copy and the number of Dhb cells in a sample. Calculating the number of Dhb cells requires dividing the Gene-Trac® Dhb test result by the 16S rRNA gene copy number (often 3-4 copies/cell).

Non-detect Gene-Trac® Dhb Results (U qualified)

In cases where Gene-Trac® Dhb is not detected (e.g., 4,000U) this indicates that *Dehalobacter* species were not identified in the sample and that anaerobic reductive dechlorination of 1,1,1-TCA, 1,1,2-TCA, 1,2-DCA or chloroform, which are dechlorinated by *Dehalobacter*, may not be observed. This activity can be introduced at sites through the addition of bioaugmentation cultures containing *Dehalobacter* such as KB-1® Plus.

Key Elements of Gene-Trac® Data

Gene-Trac® test results include two key values (a) Target Gene Enumeration, an enumeration of target gene sequence by quantitative PCR (e.g. "Dhc Enumeration" "Dhb 16S Gene Copies" or "*vcrA* gene copies") and (b) Target gene percent (e.g. "Percent Dhc"), an estimated percentage of the microbial population comprised by microbes harboring the target gene and other microbes present in sample. Further explanation of these values is provided below.

a) Target Gene Enumeration

This value is the concentration of Dhc or Dhb 16S rRNA or *vcrA* gene copies detected in the sample. Results may be reported as either gene copies per liter (for groundwater) or per gram (for soil). In general, the greater the number of gene copies in a sample the greater the likelihood of related dechlorination activity. Dhc 16S gene copies are typically equivalent to the number of Dhc as they have 1 gene copy per cell this is not necessarily true for Dhb or *vcrA* which have the potential be present in multiple gene copies per cell. Guidelines for relating target gene presence and concentration to observable dechlorination activity for groundwater samples are provided below in previous sections.

b) Target Gene Percent (%Dhc, %Dhb, %*vcrA*)

This value estimates the percentage of the target gene (e.g., %Dhc) relative to other microorganisms in the sample based on the formulas/assumptions presented below. For example, %Dhc is a measure of the predominance of Dhc and, in general, the higher this percentage the better.

$$\%Dhc = \frac{\text{Number Dhc}}{\text{Number Dhc} + \text{Number other Bacteria}}$$

Where:

$$\text{Number other Bacteria} = \frac{\text{Total DNA in sample (ng)} - \text{DNA attributed to Dhc (ng)}}{*4.0 \times 10^{-6} \text{ ng DNA per bacterial cell}}$$

*Paul and Clark, (1996).

Percent Dhc (and % *vcrA*) values can range from very low fractions of percentages, in samples with low numbers of Dhc and a high number of other bacteria (incompletely colonized by Dhc), to greater than 50% in Dhc enriched locations (highly colonized by Dhc).

In addition to determining the predominance of the target gene target gene percent is also useful for interpretation of Dhc counts from different sampling locations, or the same location over time. For example, the %Dhc value can be used to correct Dhc counts where samples are biased due to non-representative sampling. Example 1 illustrates a hypothetical scenario where the %Dhc value improved data interpretation.

Example 1, use of %Dhc to interpret enumeration data

Table 2 presents results from MW-1 sampled in April, May and June. Based on the Dhc enumeration alone one would conclude that the concentration of Dhc held steady between April and May; however, the %Dhc indicates the proportion of Dhc actually increased from April to May and the unchanged count in May could be a case of low biomass recovery during sampling or other losses such as sample degradation in transit. The higher raw count and the higher percentage of Dhc in June confirm the trend of increasing Dhc concentrations over time.

Table 3: Use of % Dhc* Value to Diagnose Sampling Bias

Sample	Dhc Enumeration	%Dhc	Interpretation Based on %Dhc
MW-1, April	1.0×10^5/Liter	0.1%	Dhc is a low proportion of total microbial population
MW-1, May	1.0×10^5/Liter	1%	Dhc <u>proportion</u> increased 10-fold from April. Dhc enumeration was unchanged possibly due to low biomass recovery from monitoring well, non-biased sample would be $[(1.0/0.1) \times 1.0 \times 10^5] = 1.0 \times 10^6$/Liter
MW-1, June	1.0×10^7/Liter	10%	Dhc has increased 100-fold from April and confirms May sample was likely low biased

**Note: the above approach is also applicable to the "%vcrA" and "%Dhb" values provided on their respective test certificates*

References

Dennis, P., X.M. Druar, A. Waller and E. Edwards, 2006. Advantages of Vinyl Chloride Reductase Gene Testing in Bioremediation. Abstract and platform presentation, Presented at Fifth International Conference on Remediation of Chlorinated & Recalcitrant Compounds, Monterey, California May 22-25, 2006.

Dennis, P**.,** 2009. Lessons Learned from Interpreting the Quantification of *Dehalococcoides* - Platform Presentation-Clemson Hydrogeology Symposium, Clemson University, Clemson, South Carolina, April 2, 2009.

Grostern, A. and E.A. Edwards, 2006. Growth of *Dehalobacter* and *Dehalococcoides* spp. during Degradation of Chlorinated Ethanes. *Appl. Environ. Microbiol*. 72: 428–436.

Grostern, A. and E.A. Edwards, 2008. Characterization of a *Dehalobacter* Coculture that Dechlorinates 1,2-Dichloroethane to Ethene and Identification of the Putative Reductive Dehalogenase Gene. *Appl. Environ. Microbiol*. 75: 2684–2693.

Grostern, A., M. Duhamel, S. Dworatzek and E.A. Edwards, 2010. Chloroform respiration to dichloromethane by a *Dehalobacter* population. *Environmental Microbiology* 12(4) 1053-1060.

Holliger, C., D. Hahn, H. Harmsen, W. Ludwig, W. Schumacher, B. Tindall, F. Vazquez, N. Weiss, and A.J.B. Zehnder, 1998. Dehalobacter restrictus gen. nov. and sp. nov.,a strictly anaerobic bacterium that reductively dechlorinates tetraandtrichloroethene in an anaerobic respiration *Arch Microbiol* (1998) 169 : 313–321.

Krajmalnik-Brown, R., T. Hölscher, I.N. Thomson, F.M. Saunders, K.M. Ritalahti, and F.E. Löffler, 2004. Genetic Identification of a Putative Vinyl Chloride Reductase in *Dehalococcoides* sp. Strain BAV1. *Appl. Environ. Microbiol.* 70: 6347–6351.

Lu, X., J.T. Wilson, D.H. Kampbell, 2006. Relationship between *Dehalococcoides* DNA in ground water and rates of reductive dechlorination at field scale. *Water Res.* 40: 3131- 3140.

Paul, E.A. and F.E. Clark, 1996. *Soil Microbiology and Biochemistry* Academic Press, Inc., San Diego, CA.

Müller, J.A., B.M. Rosner, G. von Abendroth, G. Meshulam-Simon, P.L. McCarty, and A.M. Spormann, 2004. Molecular Identification of the Catabolic Vinyl Chloride Reductase from *Dehalococcoides* sp. Strain VS and Its Environmental Distribution. A*pplied and Environmental Microbiology* 2004 August; 70(8): 4880–4888.

van der Zaan, B. , F. Hannes, N. Hoekstra, H. Rijnaarts, W.M. de Vos, H. Smidt, and J. Gerritse, 2010. Correlation of Dehalococcoides 16S rRNA and Chloroethene-Reductive Dehalogenase Genes with Geochemical Conditions in Chloroethene-Contaminated Groundwater. *Appl. Environ. Microbiol*. 76(3) 843–850.

Appendix A: Data Qualifiers

Data Qualification

Data qualifiers and notes are used to clarify Gene-Trac® test results. Additional explanation beyond that provided on the test certificate is provided below.

"**U" Not detected, associated value is the quantitation limit.** Indicates that the target gene (microbe) was not detected in the sample above the quantitation limit of the assay. Note the quantitation limit value can change between samples as the volume filtered can vary; thus, a sample in which 100 ml was tested would have a 5–fold higher quantification limit compared with a sample in which 500 ml was tested.

"J" The associated value is an estimated quantity between the method detection limit and quantitation limit. Indicates that the target gene was conclusively detected but the concentration is below the quantitation limit where it cannot be accurately quantified.

"I" Sample inhibited the test reaction. This means universal primers were incapable of amplifying DNA from this sample. The inability to amplify with universal primers suggests that the sample may be imparting matrix interference. Matrix interference is commonly attributed to humic compounds, polyphenols and metals. Non-detects with an "I" qualifier are more likely to be false negative.

"B" Analyte was also detected in the method blank. Indicates that DNA was detected in a method blank or negative control; detectable contamination of the blanks with microbes or DNA containing the gene of interest is not uncommon as the test reaction is extremely sensitive. In most cases, blank contamination is at a very low level relative to test results (often orders of magnitude lower). In these cases, blank contamination is not relevant to interpretation of test results. The potential of test samples being contaminated (i.e. false positives) should be considered in cases where blank results are within 1 order of magnitude of test results.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Phoenix
4625 East Cotton Ctr Blvd
Suite 189
Phoenix, AZ 85040
Tel: (602)437-3340

TestAmerica Job ID: 550-18305-1
TestAmerica Sample Delivery Group: 22241866
Client Project/Site: Park Euclid
Revision: 1

For:
URS Corporation
7720 North 16th Street
Suite 100
Phoenix, Arizona 85020

Attn: Janet Workman

Authorized for release by:
2/12/2014 1:47:53 PM

Carlene McCutcheon, Project Manager II
(602)659-7612
carlene.mccutcheon@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Cover Page 1
Table of Contents 2
Definitions/Glossary 3
Case Narrative 4
Sample Summary 5
Detection Summary 6
Client Sample Results 8
Surrogate Summary 13
QC Sample Results 14
QC Association Summary 21
Lab Chronicle 23
Certification Summary 25
Method Summary 26
Chain of Custody 27
Receipt Checklists 28

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
N1	See case narrative.
Q2	Sample received with headspace.
Q4	Sample received and analyzed with improper chemical preservation.

GC VOA

Qualifier	Qualifier Description
D2	Sample required dilution due to high concentration of analyte.
Q2	Sample received with headspace.
C8	Sample RPD between the primary and confirmatory analysis exceeded 40% Per EPA Method 8000C, the lower value was reported as there was no evidence of chromatographic problems.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 550-18305-1

Laboratory: TestAmerica Phoenix

Narrative

Job Narrative
550-18305-1

Comments
No additional comments.

Receipt
The samples were received on 1/24/2014 9:50 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 1.8º C.

Except:

A trip blank was submitted for analysis with these samples; however, it was not listed on the Chain of Custody (COC). A trip blank sample was not logged for analysis.RSK175

The following sample:550-18305-06, was observed to have headspace and the two containers had very different media from each other.

GC/MS VOA
Method(s) 8260B: The initial calibration verification (ICV) for analytical batch 26355 was higher than control criteria for Trichlorofluoromethane. This analyte was not detected in the associated samples; therefore, the data is not impacted. The data have been qualified with N1 and reported.

Method(s) 8260B: The laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD); as well as, the matrix spike (MS) and/or matrix spike duplicate (MSD) for batch 26355 recovered outside control limits for the following analytes: Vinyl chloride. This analyte was biased high in the LCS/ LCSD/ MS and/or MSD and was not detected in the associated samples; therefore, the data has been reported, the MS and/ or MSD will be flagged with an N1 qualifier. See batch 26355.

No other analytical or quality issues were noted.

GC VOA
Method(s) RSK-175: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with RSK-175 batch 210347.

Method(s) RSK-175: The %RPD between the primary and confirmation column exceeded 40% for Ethene (Ethylene) for the following sample(s): PEP-9GPT-012214 (550-18305-9). This is the result of matrix interference on the primary column. Data has been reported from the confirmation column, which was unaffected by the matrix interference. The data was qualified with a C8 flag, which is the closest thing available in the Arizona Flagging Suite, however that flag specifies that the lower result was reported which is not the case in this instance. The higher value has been reported and qualified in accordance with the laboratory's SOP.
RSK-175 batch 210544

Method(s) RSK-175: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with RSK-175 batch 210544.

Method(s) RSK-175: The following sample was improperly preserved in the field: (280-51538-1), (280-51538-1 DU). Method RSK-175 indicates that samples should be fixed with 1:1 hydrochloric acid to a pH less than 2 or with 1% trisodium phosphate before they are capped. The sample had a pH of 6-7 and the vial had no indication of preservative.
Batch 210544

No other analytical or quality issues were noted.

VOA Prep
No analytical or quality issues were noted.

REVISED Report: Please note that this report has been revised to report data with a corrected dilution factor (550-18305-02).

Sample Summary

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
550-18305-1	MPE-2GPT-012214	Water	01/22/14 10:15	01/24/14 09:50
550-18305-2	MPE-3GPT-012214	Water	01/22/14 11:00	01/24/14 09:50
550-18305-3	SVE-103GPT-012214	Water	01/22/14 12:00	01/24/14 09:50
550-18305-4	MPE-1GPT-012214	Water	01/22/14 12:30	01/24/14 09:50
550-18305-5	MPM-1GPT-012214	Water	01/22/14 12:45	01/24/14 09:50
550-18305-6	SVE-104GPT-012214	Water	01/22/14 14:45	01/24/14 09:50
550-18305-7	PEP-8GPT-012214	Water	01/22/14 16:20	01/24/14 09:50
550-18305-8	PEP-10GPT-012214	Water	01/22/14 16:45	01/24/14 09:50
550-18305-9	PEP-9GPT-012214	Water	01/22/14 17:05	01/24/14 09:50
550-18305-10	GTT-012214TB	Water	01/22/14 10:15	01/24/14 09:50

Detection Summary

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Client Sample ID: MPE-2GPT-012214 — Lab Sample ID: 550-18305-1

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	190		0.50	ug/L	1		8260B	Total/NA
trans-1,2-Dichloroethene	30		0.50	ug/L	1		8260B	Total/NA
Vinyl chloride	1.7		0.50	ug/L	1		8260B	Total/NA
cis-1,2-Dichloroethene - DL	9900		50	ug/L	100		8260B	Total/NA
Trichloroethene - DL	340		50	ug/L	100		8260B	Total/NA
Methane	460		5.0	ug/L	1		RSK-175	Total/NA

Client Sample ID: MPE-3GPT-012214 — Lab Sample ID: 550-18305-2

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	18000		500	ug/L	1000		8260B	Total/NA
trans-1,2-Dichloroethene	170		50	ug/L	100		8260B	Total/NA
Trichloroethene	170		50	ug/L	100		8260B	Total/NA

Client Sample ID: SVE-103GPT-012214 — Lab Sample ID: 550-18305-3

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	2800		500	ug/L	1000		8260B	Total/NA
Vinyl chloride	9500		500	ug/L	1000		8260B	Total/NA
Methane - DL	4900	D2	90	ug/L	18		RSK-175	Total/NA
Ethene - DL	4100	D2	90	ug/L	18		RSK-175	Total/NA

Client Sample ID: MPE-1GPT-012214 — Lab Sample ID: 550-18305-4

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	11000		50	ug/L	100		8260B	Total/NA
Trichloroethene	390		50	ug/L	100		8260B	Total/NA
Methane	130		5.0	ug/L	1		RSK-175	Total/NA

Client Sample ID: MPM-1GPT-012214 — Lab Sample ID: 550-18305-5

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
trans-1,2-Dichloroethene	210		50	ug/L	100		8260B	Total/NA
Trichloroethene	180		50	ug/L	100		8260B	Total/NA
cis-1,2-Dichloroethene - DL	75000		1000	ug/L	2000		8260B	Total/NA
Methane	11		5.0	ug/L	1		RSK-175	Total/NA

Client Sample ID: SVE-104GPT-012214 — Lab Sample ID: 550-18305-6

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
trans-1,2-Dichloroethene	1700	Q2 Q4	50	ug/L	100		8260B	Total/NA
Trichloroethene	170	Q2 Q4	50	ug/L	100		8260B	Total/NA
Vinyl chloride	2000	Q2 Q4	50	ug/L	100		8260B	Total/NA
cis-1,2-Dichloroethene - DL	120000	Q2 Q4	1000	ug/L	2000		8260B	Total/NA
Methane	100	Q2	5.0	ug/L	1		RSK-175	Total/NA
Ethene	15	Q2	5.0	ug/L	1		RSK-175	Total/NA

Client Sample ID: PEP-8GPT-012214 — Lab Sample ID: 550-18305-7

This Detection Summary does not include radiochemical test results.

Detection Summary

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Client Sample ID: PEP-8GPT-012214 (Continued) — Lab Sample ID: 550-18305-7

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	60		25	ug/L	50		8260B	Total/NA
Methane	7500		5.0	ug/L	1		RSK-175	Total/NA

Client Sample ID: PEP-10GPT-012214 — Lab Sample ID: 550-18305-8

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	2.4		0.50	ug/L	1		8260B	Total/NA
trans-1,2-Dichloroethene	1.2		0.50	ug/L	1		8260B	Total/NA
Vinyl chloride	26		0.50	ug/L	1		8260B	Total/NA
Methane	3500		5.0	ug/L	1		RSK-175	Total/NA
Ethene	14		5.0	ug/L	1		RSK-175	Total/NA

Client Sample ID: PEP-9GPT-012214 — Lab Sample ID: 550-18305-9

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	8200		100	ug/L	200		8260B	Total/NA
Vinyl chloride	140		100	ug/L	200		8260B	Total/NA
Methane	190		5.0	ug/L	1		RSK-175	Total/NA
Ethene	17	C8	5.0	ug/L	1		RSK-175	Total/NA

Client Sample ID: GTT-012214TB — Lab Sample ID: 550-18305-10

No Detections.

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Client Sample ID: MPE-2GPT-012214

Lab Sample ID: 550-18305-1

Date Collected: 01/22/14 10:15
Matrix: Water
Date Received: 01/24/14 09:50

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	**190**		0.50	ug/L			01/28/14 16:30	1
trans-1,2-Dichloroethene	**30**		0.50	ug/L			01/28/14 16:30	1
Vinyl chloride	**1.7**		0.50	ug/L			01/28/14 16:30	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*118*		*70 - 130*		*01/28/14 16:30*	*1*
Toluene-d8 (Surr)	*105*		*70 - 130*		*01/28/14 16:30*	*1*
4-Bromofluorobenzene (Surr)	*92*		*70 - 130*		*01/28/14 16:30*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**9900**		50	ug/L			01/29/14 11:22	100
Trichloroethene	**340**		50	ug/L			01/29/14 11:22	100

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*100*		*70 - 130*		*01/29/14 11:22*	*100*
Toluene-d8 (Surr)	*96*		*70 - 130*		*01/29/14 11:22*	*100*
4-Bromofluorobenzene (Surr)	*91*		*70 - 130*		*01/29/14 11:22*	*100*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**460**		5.0	ug/L			01/28/14 15:05	1
Ethene	ND		5.0	ug/L			01/28/14 15:05	1
Ethane	ND		5.0	ug/L			01/28/14 15:05	1

Client Sample ID: MPE-3GPT-012214

Lab Sample ID: 550-18305-2

Date Collected: 01/22/14 11:00
Matrix: Water
Date Received: 01/24/14 09:50

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**18000**		500	ug/L			01/29/14 11:55	1000
Tetrachloroethene	ND		50	ug/L			01/28/14 17:20	100
trans-1,2-Dichloroethene	**170**		50	ug/L			01/28/14 17:20	100
Trichloroethene	**170**		50	ug/L			01/28/14 17:20	100
Vinyl chloride	ND		50	ug/L			01/28/14 17:20	100

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*93*		*70 - 130*		*01/28/14 17:20*	*100*
Dibromofluoromethane (Surr)	*97*		*70 - 130*		*01/29/14 11:55*	*1000*
Toluene-d8 (Surr)	*100*		*70 - 130*		*01/28/14 17:20*	*100*
Toluene-d8 (Surr)	*96*		*70 - 130*		*01/29/14 11:55*	*1000*
4-Bromofluorobenzene (Surr)	*95*		*70 - 130*		*01/28/14 17:20*	*100*
4-Bromofluorobenzene (Surr)	*99*		*70 - 130*		*01/29/14 11:55*	*1000*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	ND		5.0	ug/L			01/28/14 15:09	1
Ethene	ND		5.0	ug/L			01/28/14 15:09	1
Ethane	ND		5.0	ug/L			01/28/14 15:09	1

Client Sample Results

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Client Sample ID: SVE-103GPT-012214

Lab Sample ID: 550-18305-3
Date Collected: 01/22/14 12:00
Matrix: Water
Date Received: 01/24/14 09:50

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**2800**		500	ug/L			01/28/14 17:52	1000
Tetrachloroethene	ND		500	ug/L			01/28/14 17:52	1000
trans-1,2-Dichloroethene	ND		500	ug/L			01/28/14 17:52	1000
Trichloroethene	ND		500	ug/L			01/28/14 17:52	1000
Vinyl chloride	**9500**		500	ug/L			01/28/14 17:52	1000

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*100*		*70 - 130*		*01/28/14 17:52*	*1000*
Toluene-d8 (Surr)	*99*		*70 - 130*		*01/28/14 17:52*	*1000*
4-Bromofluorobenzene (Surr)	*95*		*70 - 130*		*01/28/14 17:52*	*1000*

Method: RSK-175 - Dissolved Gases (GC) - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**4900**	**D2**	90	ug/L			01/28/14 17:37	18
Ethene	**4100**	**D2**	90	ug/L			01/28/14 17:37	18
Ethane	ND	D2	90	ug/L			01/28/14 17:37	18

Client Sample ID: MPE-1GPT-012214

Lab Sample ID: 550-18305-4
Date Collected: 01/22/14 12:30
Matrix: Water
Date Received: 01/24/14 09:50

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**11000**		50	ug/L			01/28/14 18:25	100
Tetrachloroethene	ND		50	ug/L			01/28/14 18:25	100
trans-1,2-Dichloroethene	ND		50	ug/L			01/28/14 18:25	100
Trichloroethene	**390**		50	ug/L			01/28/14 18:25	100
Vinyl chloride	ND		50	ug/L			01/28/14 18:25	100

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*102*		*70 - 130*		*01/28/14 18:25*	*100*
Toluene-d8 (Surr)	*105*		*70 - 130*		*01/28/14 18:25*	*100*
4-Bromofluorobenzene (Surr)	*94*		*70 - 130*		*01/28/14 18:25*	*100*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**130**		5.0	ug/L			01/28/14 15:29	1
Ethene	ND		5.0	ug/L			01/28/14 15:29	1
Ethane	ND		5.0	ug/L			01/28/14 15:29	1

Client Sample ID: MPM-1GPT-012214

Lab Sample ID: 550-18305-5
Date Collected: 01/22/14 12:45
Matrix: Water
Date Received: 01/24/14 09:50

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	ND		50	ug/L			01/28/14 18:58	100
trans-1,2-Dichloroethene	**210**		50	ug/L			01/28/14 18:58	100
Trichloroethene	**180**		50	ug/L			01/28/14 18:58	100
Vinyl chloride	ND		50	ug/L			01/28/14 18:58	100

Client Sample ID: MPM-1GPT-012214

Lab Sample ID: 550-18305-5

Date Collected: 01/22/14 12:45

Matrix: Water

Date Received: 01/24/14 09:50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*101*		*70 - 130*		*01/28/14 18:58*	*100*
Toluene-d8 (Surr)	*97*		*70 - 130*		*01/28/14 18:58*	*100*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*01/28/14 18:58*	*100*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**75000**		1000	ug/L			01/29/14 12:27	2000

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*104*		*70 - 130*		*01/29/14 12:27*	*2000*
Toluene-d8 (Surr)	*93*		*70 - 130*		*01/29/14 12:27*	*2000*
4-Bromofluorobenzene (Surr)	*99*		*70 - 130*		*01/29/14 12:27*	*2000*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**11**		5.0	ug/L			01/28/14 16:15	1
Ethene	ND		5.0	ug/L			01/28/14 16:15	1
Ethane	ND		5.0	ug/L			01/28/14 16:15	1

Client Sample ID: SVE-104GPT-012214

Lab Sample ID: 550-18305-6

Date Collected: 01/22/14 14:45

Matrix: Water

Date Received: 01/24/14 09:50

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	ND	Q2 Q4	50	ug/L			01/28/14 19:31	100
trans-1,2-Dichloroethene	**1700**	**Q2 Q4**	50	ug/L			01/28/14 19:31	100
Trichloroethene	**170**	**Q2 Q4**	50	ug/L			01/28/14 19:31	100
Vinyl chloride	**2000**	**Q2 Q4**	50	ug/L			01/28/14 19:31	100

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*102*		*70 - 130*		*01/28/14 19:31*	*100*
Toluene-d8 (Surr)	*97*		*70 - 130*		*01/28/14 19:31*	*100*
4-Bromofluorobenzene (Surr)	*97*		*70 - 130*		*01/28/14 19:31*	*100*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**120000**	**Q2 Q4**	1000	ug/L			01/29/14 13:00	2000

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*102*		*70 - 130*		*01/29/14 13:00*	*2000*
Toluene-d8 (Surr)	*98*		*70 - 130*		*01/29/14 13:00*	*2000*
4-Bromofluorobenzene (Surr)	*99*		*70 - 130*		*01/29/14 13:00*	*2000*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**100**	**Q2**	5.0	ug/L			01/28/14 16:20	1
Ethene	**15**	**Q2**	5.0	ug/L			01/28/14 16:20	1
Ethane	ND	Q2	5.0	ug/L			01/28/14 16:20	1

Client Sample Results

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Client Sample ID: PEP-8GPT-012214

Lab Sample ID: 550-18305-7
Date Collected: 01/22/14 16:20
Matrix: Water
Date Received: 01/24/14 09:50

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**60**		25	ug/L			01/29/14 15:09	50
Tetrachloroethene	ND		25	ug/L			01/29/14 15:09	50
trans-1,2-Dichloroethene	ND		25	ug/L			01/29/14 15:09	50
Trichloroethene	ND		25	ug/L			01/29/14 15:09	50
Vinyl chloride	ND		25	ug/L			01/29/14 15:09	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*94*		*70 - 130*		*01/29/14 15:09*	*50*
Toluene-d8 (Surr)	*97*		*70 - 130*		*01/29/14 15:09*	*50*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*		*01/29/14 15:09*	*50*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**7500**		5.0	ug/L			01/28/14 16:24	1
Ethene	ND		5.0	ug/L			01/28/14 16:24	1
Ethane	ND		5.0	ug/L			01/28/14 16:24	1

Client Sample ID: PEP-10GPT-012214

Lab Sample ID: 550-18305-8
Date Collected: 01/22/14 16:45
Matrix: Water
Date Received: 01/24/14 09:50

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**2.4**		0.50	ug/L			01/29/14 15:42	1
Tetrachloroethene	ND		0.50	ug/L			01/29/14 15:42	1
trans-1,2-Dichloroethene	**1.2**		0.50	ug/L			01/29/14 15:42	1
Trichloroethene	ND		0.50	ug/L			01/29/14 15:42	1
Vinyl chloride	**26**		0.50	ug/L			01/29/14 15:42	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*94*		*70 - 130*		*01/29/14 15:42*	*1*
Toluene-d8 (Surr)	*93*		*70 - 130*		*01/29/14 15:42*	*1*
4-Bromofluorobenzene (Surr)	*98*		*70 - 130*		*01/29/14 15:42*	*1*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**3500**		5.0	ug/L			01/29/14 18:31	1
Ethene	**14**		5.0	ug/L			01/29/14 18:31	1
Ethane	ND		5.0	ug/L			01/29/14 18:31	1

Client Sample ID: PEP-9GPT-012214

Lab Sample ID: 550-18305-9
Date Collected: 01/22/14 17:05
Matrix: Water
Date Received: 01/24/14 09:50

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**8200**		100	ug/L			01/29/14 14:37	200
Tetrachloroethene	ND		100	ug/L			01/29/14 14:37	200
trans-1,2-Dichloroethene	ND		100	ug/L			01/29/14 14:37	200
Trichloroethene	ND		100	ug/L			01/29/14 14:37	200
Vinyl chloride	**140**		100	ug/L			01/29/14 14:37	200

Client Sample Results

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Client Sample ID: PEP-9GPT-012214

Lab Sample ID: 550-18305-9

Date Collected: 01/22/14 17:05
Matrix: Water
Date Received: 01/24/14 09:50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*95*		*70 - 130*		*01/29/14 14:37*	*200*
Toluene-d8 (Surr)	*99*		*70 - 130*		*01/29/14 14:37*	*200*
4-Bromofluorobenzene (Surr)	*100*		*70 - 130*		*01/29/14 14:37*	*200*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**190**		5.0	ug/L			01/29/14 19:03	1
Ethene	**17**	**C8**	5.0	ug/L			01/29/14 19:03	1
Ethane	ND		5.0	ug/L			01/29/14 19:03	1

Client Sample ID: GTT-012214TB

Lab Sample ID: 550-18305-10

Date Collected: 01/22/14 10:15
Matrix: Water
Date Received: 01/24/14 09:50

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.50	ug/L			01/28/14 10:45	1
Tetrachloroethene	ND		0.50	ug/L			01/28/14 10:45	1
trans-1,2-Dichloroethene	ND		0.50	ug/L			01/28/14 10:45	1
Trichloroethene	ND		0.50	ug/L			01/28/14 10:45	1
Vinyl chloride	ND		0.50	ug/L			01/28/14 10:45	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*98*		*70 - 130*		*01/28/14 10:45*	*1*
Toluene-d8 (Surr)	*100*		*70 - 130*		*01/28/14 10:45*	*1*
4-Bromofluorobenzene (Surr)	*97*		*70 - 130*		*01/28/14 10:45*	*1*

Surrogate Summary

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Method: 8260B - Volatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		DBFM	TOL	BFB
Lab Sample ID	Client Sample ID	(70-130)	(70-130)	(70-130)
550-18097-D-6 MS	Matrix Spike	124	114	107
550-18097-D-6 MSD	Matrix Spike Duplicate	116	107	102
550-18262-A-1 MS	Matrix Spike	93	97	93
550-18262-A-1 MSD	Matrix Spike Duplicate	98	105	97
550-18305-1	MPE-2GPT-012214	118	105	92
550-18305-1 - DL	MPE-2GPT-012214	100	96	91
550-18305-2	MPE-3GPT-012214	93	100	95
550-18305-2	MPE-3GPT-012214	97	96	99
550-18305-3	SVE-103GPT-012214	100	99	95
550-18305-4	MPE-1GPT-012214	102	105	94
550-18305-5	MPM-1GPT-012214	101	97	96
550-18305-5 - DL	MPM-1GPT-012214	104	93	99
550-18305-6	SVE-104GPT-012214	102	97	97
550-18305-6 - DL	SVE-104GPT-012214	102	98	99
550-18305-7	PEP-8GPT-012214	94	97	105
550-18305-8	PEP-10GPT-012214	94	93	98
550-18305-9	PEP-9GPT-012214	95	99	100
550-18305-10	GTT-012214TB	98	100	97
550-18318-B-19 MS	Matrix Spike	98	100	96
550-18318-B-19 MSD	Matrix Spike Duplicate	95	98	97
LCS 550-26334/3	Lab Control Sample	121	110	105
LCS 550-26355/3	Lab Control Sample	95	95	97
LCS 550-26451/3	Lab Control Sample	95	95	94
LCSD 550-26334/4	Lab Control Sample Dup	115	108	104
LCSD 550-26355/4	Lab Control Sample Dup	102	97	96
LCSD 550-26451/4	Lab Control Sample Dup	99	95	94
MB 550-26334/5	Method Blank	108	105	92
MB 550-26355/5	Method Blank	97	97	94
MB 550-26451/5	Method Blank	99	97	96

Surrogate Legend

DBFM = Dibromofluoromethane (Surr)
TOL = Toluene-d8 (Surr)
BFB = 4-Bromofluorobenzene (Surr)

Method: 8260B - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 550-26334/5 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26334

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.50	ug/L			01/28/14 07:01	1
Tetrachloroethene	ND		0.50	ug/L			01/28/14 07:01	1
trans-1,2-Dichloroethene	ND		0.50	ug/L			01/28/14 07:01	1
Trichloroethene	ND		0.50	ug/L			01/28/14 07:01	1
Vinyl chloride	ND		0.50	ug/L			01/28/14 07:01	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*108*		*70 - 130*		*01/28/14 07:01*	*1*
Toluene-d8 (Surr)	*105*		*70 - 130*		*01/28/14 07:01*	*1*
4-Bromofluorobenzene (Surr)	*92*		*70 - 130*		*01/28/14 07:01*	*1*

Lab Sample ID: LCS 550-26334/3 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26334

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	25.0	26.4		ug/L		105	70 - 130
Tetrachloroethene	25.0	23.5		ug/L		94	70 - 130
trans-1,2-Dichloroethene	25.0	24.8		ug/L		99	69 - 127
Trichloroethene	25.0	25.1		ug/L		101	70 - 130
Vinyl chloride	25.0	26.7		ug/L		107	65 - 137

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*121*		*70 - 130*
Toluene-d8 (Surr)	*110*		*70 - 130*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*

Lab Sample ID: LCSD 550-26334/4 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26334

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene	25.0	26.0		ug/L		104	70 - 130	1	20
Tetrachloroethene	25.0	24.2		ug/L		97	70 - 130	3	20
trans-1,2-Dichloroethene	25.0	25.5		ug/L		102	69 - 127	3	20
Trichloroethene	25.0	25.5		ug/L		102	70 - 130	1	20
Vinyl chloride	25.0	26.7		ug/L		107	65 - 137	0	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*115*		*70 - 130*
Toluene-d8 (Surr)	*108*		*70 - 130*
4-Bromofluorobenzene (Surr)	*104*		*70 - 130*

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 550-18097-D-6 MS
Matrix: Water
Analysis Batch: 26334

Client Sample ID: Matrix Spike
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	ND		25.0	28.3		ug/L		113	65 - 127
Tetrachloroethene	ND		25.0	24.6		ug/L		98	67 - 131
trans-1,2-Dichloroethene	ND		25.0	27.0		ug/L		108	62 - 131
Trichloroethene	ND		25.0	26.6		ug/L		106	66 - 132
Vinyl chloride	ND		25.0	28.3		ug/L		113	55 - 146

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*124*		*70 - 130*
Toluene-d8 (Surr)	*114*		*70 - 130*
4-Bromofluorobenzene (Surr)	*107*		*70 - 130*

Lab Sample ID: 550-18097-D-6 MSD
Matrix: Water
Analysis Batch: 26334

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene	ND		25.0	26.5		ug/L		106	65 - 127	7	34
Tetrachloroethene	ND		25.0	23.7		ug/L		95	67 - 131	4	31
trans-1,2-Dichloroethene	ND		25.0	26.1		ug/L		104	62 - 131	3	35
Trichloroethene	ND		25.0	25.6		ug/L		102	66 - 132	4	29
Vinyl chloride	ND		25.0	28.4		ug/L		114	55 - 146	1	35

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*116*		*70 - 130*
Toluene-d8 (Surr)	*107*		*70 - 130*
4-Bromofluorobenzene (Surr)	*102*		*70 - 130*

Lab Sample ID: MB 550-26355/5
Matrix: Water
Analysis Batch: 26355

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.50	ug/L			01/28/14 10:12	1
Tetrachloroethene	ND		0.50	ug/L			01/28/14 10:12	1
trans-1,2-Dichloroethene	ND		0.50	ug/L			01/28/14 10:12	1
Trichloroethene	ND		0.50	ug/L			01/28/14 10:12	1
Vinyl chloride	ND		0.50	ug/L			01/28/14 10:12	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*97*		*70 - 130*		*01/28/14 10:12*	*1*
Toluene-d8 (Surr)	*97*		*70 - 130*		*01/28/14 10:12*	*1*
4-Bromofluorobenzene (Surr)	*94*		*70 - 130*		*01/28/14 10:12*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 550-26355/3 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26355

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	25.0	22.5		ug/L		90	70 - 130
Tetrachloroethene	25.0	26.9		ug/L		108	70 - 130
trans-1,2-Dichloroethene	25.0	22.9		ug/L		92	69 - 127
Trichloroethene	25.0	24.3		ug/L		97	70 - 130
Vinyl chloride	25.0	24.1		ug/L		96	65 - 137

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*95*		*70 - 130*
Toluene-d8 (Surr)	*95*		*70 - 130*
4-Bromofluorobenzene (Surr)	*97*		*70 - 130*

Lab Sample ID: LCSD 550-26355/4 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26355

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene	25.0	25.6		ug/L		102	70 - 130	13	20
Tetrachloroethene	25.0	27.4		ug/L		110	70 - 130	2	20
trans-1,2-Dichloroethene	25.0	24.6		ug/L		98	69 - 127	7	20
Trichloroethene	25.0	25.2		ug/L		101	70 - 130	4	20
Vinyl chloride	25.0	26.0		ug/L		104	65 - 137	8	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*102*		*70 - 130*
Toluene-d8 (Surr)	*97*		*70 - 130*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*

Lab Sample ID: 550-18262-A-1 MS — **Client Sample ID: Matrix Spike**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26355

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	ND		25.0	24.2		ug/L		97	65 - 127
Tetrachloroethene	19		25.0	43.3		ug/L		98	67 - 131
trans-1,2-Dichloroethene	ND		25.0	23.2		ug/L		93	62 - 131
Trichloroethene	ND		25.0	27.0		ug/L		108	66 - 132
Vinyl chloride	ND	N1	25.0	24.3	N1	ug/L		97	55 - 146

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*93*		*70 - 130*
Toluene-d8 (Surr)	*97*		*70 - 130*
4-Bromofluorobenzene (Surr)	*93*		*70 - 130*

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 550-18262-A-1 MSD — **Client Sample ID: Matrix Spike Duplicate**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26355

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene	ND		25.0	24.2		ug/L		97	65 - 127	0	34
Tetrachloroethene	19		25.0	43.1		ug/L		97	67 - 131	0	31
trans-1,2-Dichloroethene	ND		25.0	23.9		ug/L		96	62 - 131	3	35
Trichloroethene	ND		25.0	27.6		ug/L		110	66 - 132	2	29
Vinyl chloride	ND	N1	25.0	24.5	N1	ug/L		98	55 - 146	1	35

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*98*		*70 - 130*
Toluene-d8 (Surr)	*105*		*70 - 130*
4-Bromofluorobenzene (Surr)	*97*		*70 - 130*

Lab Sample ID: MB 550-26451/5 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26451

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.50	ug/L			01/29/14 08:40	1
Tetrachloroethene	ND		0.50	ug/L			01/29/14 08:40	1
trans-1,2-Dichloroethene	ND		0.50	ug/L			01/29/14 08:40	1
Trichloroethene	ND		0.50	ug/L			01/29/14 08:40	1
Vinyl chloride	ND		0.50	ug/L			01/29/14 08:40	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*99*		*70 - 130*		*01/29/14 08:40*	*1*
Toluene-d8 (Surr)	*97*		*70 - 130*		*01/29/14 08:40*	*1*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*01/29/14 08:40*	*1*

Lab Sample ID: LCS 550-26451/3 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26451

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	25.0	21.5		ug/L		86	70 - 130
Tetrachloroethene	25.0	26.5		ug/L		106	70 - 130
trans-1,2-Dichloroethene	25.0	19.9		ug/L		80	69 - 127
Trichloroethene	25.0	24.4		ug/L		98	70 - 130
Vinyl chloride	25.0	24.6		ug/L		98	65 - 137

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*95*		*70 - 130*
Toluene-d8 (Surr)	*95*		*70 - 130*
4-Bromofluorobenzene (Surr)	*94*		*70 - 130*

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCSD 550-26451/4 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26451

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene			25.0	21.1		ug/L		84	70 - 130	2	20
Tetrachloroethene			25.0	25.8		ug/L		103	70 - 130	3	20
trans-1,2-Dichloroethene			25.0	19.9		ug/L		80	69 - 127	0	20
Trichloroethene			25.0	24.4		ug/L		97	70 - 130	0	20
Vinyl chloride			25.0	23.6		ug/L		95	65 - 137	4	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*99*		*70 - 130*
Toluene-d8 (Surr)	*95*		*70 - 130*
4-Bromofluorobenzene (Surr)	*94*		*70 - 130*

Lab Sample ID: 550-18318-B-19 MS — **Client Sample ID: Matrix Spike**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26451

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
cis-1,2-Dichloroethene	ND		250	225		ug/L		90	65 - 127		
Tetrachloroethene	ND		250	244		ug/L		97	67 - 131		
trans-1,2-Dichloroethene	ND		250	205		ug/L		82	62 - 131		
Trichloroethene	230		250	496		ug/L		106	66 - 132		
Vinyl chloride	ND		250	234		ug/L		94	55 - 146		

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*98*		*70 - 130*
Toluene-d8 (Surr)	*100*		*70 - 130*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*

Lab Sample ID: 550-18318-B-19 MSD — **Client Sample ID: Matrix Spike Duplicate**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 26451

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene	ND		250	212		ug/L		85	65 - 127	6	34
Tetrachloroethene	ND		250	265		ug/L		106	67 - 131	8	31
trans-1,2-Dichloroethene	ND		250	203		ug/L		81	62 - 131	1	35
Trichloroethene	230		250	500		ug/L		108	66 - 132	1	29
Vinyl chloride	ND		250	227		ug/L		91	55 - 146	3	35

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*95*		*70 - 130*
Toluene-d8 (Surr)	*98*		*70 - 130*
4-Bromofluorobenzene (Surr)	*97*		*70 - 130*

Method: RSK-175 - Dissolved Gases (GC)

Lab Sample ID: MB 280-210347/7 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 210347

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Methane	ND		5.0		ug/L			01/28/14 14:43	1
Ethene	ND		5.0		ug/L			01/28/14 14:43	1
Ethane	ND		5.0		ug/L			01/28/14 14:43	1

Lab Sample ID: LCS 280-210347/5 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 210347

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Methane			146	159		ug/L		109	75 - 125		
Ethene			255	247		ug/L		97	75 - 125		
Ethane			274	274		ug/L		100	75 - 125		

Lab Sample ID: LCSD 280-210347/6 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 210347

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Methane			146	157		ug/L		107	75 - 125	1	20
Ethene			255	246		ug/L		96	75 - 125	0	20
Ethane			274	273		ug/L		100	75 - 125	0	20

Lab Sample ID: 280-51433-J-1 DU — **Client Sample ID: Duplicate**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 210347

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Methane	9.7			9.73		ug/L				0.09	20
Ethene	ND			ND		ug/L				NC	20
Ethane	ND			ND		ug/L				NC	20

Lab Sample ID: MB 280-210544/7 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 210544

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Methane	ND		5.0		ug/L			01/29/14 14:44	1
Ethene	ND		5.0		ug/L			01/29/14 14:44	1
Ethane	ND		5.0		ug/L			01/29/14 14:44	1

Lab Sample ID: LCS 280-210544/5 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 210544

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Methane			146	154		ug/L		106	75 - 125		
Ethene			255	242		ug/L		95	75 - 125		
Ethane			274	266		ug/L		97	75 - 125		

Method: RSK-175 - Dissolved Gases (GC) (Continued)

Lab Sample ID: LCSD 280-210544/6
Matrix: Water
Analysis Batch: 210544

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Methane			146	143		ug/L		98	75 - 125	7	20
Ethene			255	229		ug/L		90	75 - 125	6	20
Ethane			274	249		ug/L		91	75 - 125	6	20

QC Association Summary

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

GC/MS VOA

Analysis Batch: 26334

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-18097-D-6 MS	Matrix Spike	Total/NA	Water	8260B	
550-18097-D-6 MSD	Matrix Spike Duplicate	Total/NA	Water	8260B	
550-18305-1	MPE-2GPT-012214	Total/NA	Water	8260B	
LCS 550-26334/3	Lab Control Sample	Total/NA	Water	8260B	
LCSD 550-26334/4	Lab Control Sample Dup	Total/NA	Water	8260B	
MB 550-26334/5	Method Blank	Total/NA	Water	8260B	

Analysis Batch: 26355

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-18262-A-1 MS	Matrix Spike	Total/NA	Water	8260B	
550-18262-A-1 MSD	Matrix Spike Duplicate	Total/NA	Water	8260B	
550-18305-2	MPE-3GPT-012214	Total/NA	Water	8260B	
550-18305-3	SVE-103GPT-012214	Total/NA	Water	8260B	
550-18305-4	MPE-1GPT-012214	Total/NA	Water	8260B	
550-18305-5	MPM-1GPT-012214	Total/NA	Water	8260B	
550-18305-6	SVE-104GPT-012214	Total/NA	Water	8260B	
550-18305-10	GTT-012214TB	Total/NA	Water	8260B	
LCS 550-26355/3	Lab Control Sample	Total/NA	Water	8260B	
LCSD 550-26355/4	Lab Control Sample Dup	Total/NA	Water	8260B	
MB 550-26355/5	Method Blank	Total/NA	Water	8260B	

Analysis Batch: 26451

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-18305-1 - DL	MPE-2GPT-012214	Total/NA	Water	8260B	
550-18305-2	MPE-3GPT-012214	Total/NA	Water	8260B	
550-18305-5 - DL	MPM-1GPT-012214	Total/NA	Water	8260B	
550-18305-6 - DL	SVE-104GPT-012214	Total/NA	Water	8260B	
550-18305-7	PEP-8GPT-012214	Total/NA	Water	8260B	
550-18305-8	PEP-10GPT-012214	Total/NA	Water	8260B	
550-18305-9	PEP-9GPT-012214	Total/NA	Water	8260B	
550-18318-B-19 MS	Matrix Spike	Total/NA	Water	8260B	
550-18318-B-19 MSD	Matrix Spike Duplicate	Total/NA	Water	8260B	
LCS 550-26451/3	Lab Control Sample	Total/NA	Water	8260B	
LCSD 550-26451/4	Lab Control Sample Dup	Total/NA	Water	8260B	
MB 550-26451/5	Method Blank	Total/NA	Water	8260B	

GC VOA

Analysis Batch: 210347

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-51433-J-1 DU	Duplicate	Total/NA	Water	RSK-175	
550-18305-1	MPE-2GPT-012214	Total/NA	Water	RSK-175	
550-18305-2	MPE-3GPT-012214	Total/NA	Water	RSK-175	
550-18305-3 - DL	SVE-103GPT-012214	Total/NA	Water	RSK-175	
550-18305-4	MPE-1GPT-012214	Total/NA	Water	RSK-175	
550-18305-5	MPM-1GPT-012214	Total/NA	Water	RSK-175	
550-18305-6	SVE-104GPT-012214	Total/NA	Water	RSK-175	
550-18305-7	PEP-8GPT-012214	Total/NA	Water	RSK-175	
LCS 280-210347/5	Lab Control Sample	Total/NA	Water	RSK-175	
LCSD 280-210347/6	Lab Control Sample Dup	Total/NA	Water	RSK-175	

GC VOA (Continued)

Analysis Batch: 210347 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 280-210347/7	Method Blank	Total/NA	Water	RSK-175	

Analysis Batch: 210544

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-18305-8	PEP-10GPT-012214	Total/NA	Water	RSK-175	
550-18305-9	PEP-9GPT-012214	Total/NA	Water	RSK-175	
LCS 280-210544/5	Lab Control Sample	Total/NA	Water	RSK-175	
LCSD 280-210544/6	Lab Control Sample Dup	Total/NA	Water	RSK-175	
MB 280-210544/7	Method Blank	Total/NA	Water	RSK-175	

Lab Chronicle

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Client Sample ID: MPE-2GPT-012214 — Lab Sample ID: 550-18305-1

Date Collected: 01/22/14 10:15 — **Matrix: Water**
Date Received: 01/24/14 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	26334	01/28/14 16:30	KMA	TAL PHX
Total/NA	Analysis	8260B	DL	100	26451	01/29/14 11:22	KMA	TAL PHX
Total/NA	Analysis	RSK-175		1	210347	01/28/14 15:05	MPS	TAL DEN

Client Sample ID: MPE-3GPT-012214 — Lab Sample ID: 550-18305-2

Date Collected: 01/22/14 11:00 — **Matrix: Water**
Date Received: 01/24/14 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		100	26355	01/28/14 17:20	EMA	TAL PHX
Total/NA	Analysis	8260B		1000	26451	01/29/14 11:55	KMA	TAL PHX
Total/NA	Analysis	RSK-175		1	210347	01/28/14 15:09	MPS	TAL DEN

Client Sample ID: SVE-103GPT-012214 — Lab Sample ID: 550-18305-3

Date Collected: 01/22/14 12:00 — **Matrix: Water**
Date Received: 01/24/14 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1000	26355	01/28/14 17:52	EMA	TAL PHX
Total/NA	Analysis	RSK-175	DL	18	210347	01/28/14 17:37	MPS	TAL DEN

Client Sample ID: MPE-1GPT-012214 — Lab Sample ID: 550-18305-4

Date Collected: 01/22/14 12:30 — **Matrix: Water**
Date Received: 01/24/14 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		100	26355	01/28/14 18:25	EMA	TAL PHX
Total/NA	Analysis	RSK-175		1	210347	01/28/14 15:29	MPS	TAL DEN

Client Sample ID: MPM-1GPT-012214 — Lab Sample ID: 550-18305-5

Date Collected: 01/22/14 12:45 — **Matrix: Water**
Date Received: 01/24/14 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		100	26355	01/28/14 18:58	EMA	TAL PHX
Total/NA	Analysis	8260B	DL	2000	26451	01/29/14 12:27	KMA	TAL PHX
Total/NA	Analysis	RSK-175		1	210347	01/28/14 16:15	MPS	TAL DEN

Lab Chronicle

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Client Sample ID: SVE-104GPT-012214 — Lab Sample ID: 550-18305-6

Date Collected: 01/22/14 14:45 — **Matrix: Water**
Date Received: 01/24/14 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		100	26355	01/28/14 19:31	EMA	TAL PHX
Total/NA	Analysis	8260B	DL	2000	26451	01/29/14 13:00	KMA	TAL PHX
Total/NA	Analysis	RSK-175		1	210347	01/28/14 16:20	MPS	TAL DEN

Client Sample ID: PEP-8GPT-012214 — Lab Sample ID: 550-18305-7

Date Collected: 01/22/14 16:20 — **Matrix: Water**
Date Received: 01/24/14 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		50	26451	01/29/14 15:09	KMA	TAL PHX
Total/NA	Analysis	RSK-175		1	210347	01/28/14 16:24	MPS	TAL DEN

Client Sample ID: PEP-10GPT-012214 — Lab Sample ID: 550-18305-8

Date Collected: 01/22/14 16:45 — **Matrix: Water**
Date Received: 01/24/14 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	26451	01/29/14 15:42	KMA	TAL PHX
Total/NA	Analysis	RSK-175		1	210544	01/29/14 18:31	MPS	TAL DEN

Client Sample ID: PEP-9GPT-012214 — Lab Sample ID: 550-18305-9

Date Collected: 01/22/14 17:05 — **Matrix: Water**
Date Received: 01/24/14 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		200	26451	01/29/14 14:37	KMA	TAL PHX
Total/NA	Analysis	RSK-175		1	210544	01/29/14 19:03	MPS	TAL DEN

Client Sample ID: GTT-012214TB — Lab Sample ID: 550-18305-10

Date Collected: 01/22/14 10:15 — **Matrix: Water**
Date Received: 01/24/14 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	26355	01/28/14 10:45	EMA	TAL PHX

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

TAL PHX = TestAmerica Phoenix, 4625 East Cotton Ctr Blvd, Suite 189, Phoenix, AZ 85040, TEL (602)437-3340

Certification Summary

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Laboratory: TestAmerica Phoenix

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
AIHA	IHLAP		154268	07-01-15
Arizona	State Program	9	AZ0728	06-09-14
California	NELAP	9	01109CA	11-30-14
Nevada	State Program	9	AZ01030	07-31-14
New York	NELAP	2	11898	04-01-14
Oregon	NELAP	10	AZ100001	03-09-14
USDA	Federal		P330-09-00024	06-09-15

Laboratory: TestAmerica Denver

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-15
A2LA	ISO/IEC 17025		2907.01	10-31-15
Alabama	State Program	4	40730	09-30-12 *
Alaska (UST)	State Program	10	UST-30	04-05-14
Arizona	State Program	9	AZ0713	12-19-14
Arkansas DEQ	State Program	6	88-0687	06-01-14
California	ELAP	9	2513	08-31-14
Colorado	State Program	8	N/A	09-30-14
Connecticut	State Program	1	PH-0686	09-30-14
Florida	NELAP	4	E87667	06-30-14
Illinois	NELAP	5	200017	04-30-14
Iowa	State Program	7	370	12-01-14
Kansas	NELAP	7	E-10166	04-30-14
Louisiana	NELAP	6	30785	06-30-14 *
Maine	State Program	1	CO0002	03-03-15
Maryland	State Program	3	268	03-31-14
Minnesota	NELAP	5	8-999-405	12-31-14
Nevada	State Program	9	CO0026	07-31-14
New Hampshire	NELAP	1	205310	04-28-14
New Jersey	NELAP	2	CO004	06-30-14
New Mexico	State Program	6	CO00026	06-30-14
New York	NELAP	2	11964	04-01-14
North Carolina DENR	State Program	4	358	12-31-14
North Dakota	State Program	8	R-034	06-30-14
Oklahoma	State Program	6	8614	08-31-14
Oregon	NELAP	10	CO200001	01-09-15
Pennsylvania	NELAP	3	68-00664	07-30-14 *
South Carolina	State Program	4	72002	06-30-14
Texas	NELAP	6	T104704183-08-TX	10-01-14
USDA	Federal		P330-13-00202	07-02-16
Utah	NELAP	8	CO000262012-4	07-31-14
Virginia	NELAP	3	460232	06-14-14
Washington	State Program	10	C583	08-03-14
West Virginia DEP	State Program	3	354	11-30-14
Wisconsin	State Program	5	999615430	08-31-14
Wyoming (UST)	A2LA	8	2907.01	10-31-15

* Expired certification is currently pending renewal and is considered valid.

Method Summary

Client: URS Corporation
Project/Site: Park Euclid

TestAmerica Job ID: 550-18305-1
SDG: 22241866

Method	Method Description	Protocol	Laboratory
8260B	Volatile Organic Compounds (GC/MS)	SW846	TAL PHX
RSK-175	Dissolved Gases (GC)	RSK	TAL DEN

Protocol References:

RSK = Sample Prep And Calculations For Dissolved Gas Analysis In Water Samples Using A GC Headspace Equilibration Technique, RSKSOP-175, Rev. 0, 8/11/94, USEPA Research Lab
SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

TAL PHX = TestAmerica Phoenix, 4625 East Cotton Ctr Blvd, Suite 189, Phoenix, AZ 85040, TEL (602)437-3340

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

550-18305

CHAIN OF CUSTODY FORM

[ ] Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, AZ 85040 (602) 437-3340 FAX (602) 454-9303
[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (520) 807-3801 FAX (520) 807-3803
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-1264

Page 1 of 1

2/12/2014

Client Name/Address: URS Corp. 333 E. Wetmore Rd #400 Tucson, AZ. 85705

Project/PO Number: Park/Euclid 22241866

Project Manager: Janet Workman

Phone Number: 602 861 7494

Sampler: A. Jimenez / O. Skinner

Fax Number:

Analysis Required: 8260B, RSK 175

550-18305 Chain of Custody

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	8260B	RSK 175								Special Instructions
MPE-2GPT-012214	GW	40mL	5	1/22/14	1015	HCL	X	X								-1
MPE-3GPT-012214	GW	40mL	5	1/22/14	1100	HCL	X	X								-2
SVE-103GPT-012214	GW	40mL	5	1/22/14	1200	HCL	X	X								-3
MPE-1GPT-012214	GW	40mL	5	1/22/14	1230	HCL	X	X								-4
MPM-1GPT-012214	GW	40mL	5	1/22/14	1245	HCL	X	X								-5
SVE-104GPT-012214	GW	40mL	5	1/22/14	1445	HCL	X	X								-6
PEP-8GPT-012214	GW	40mL	5	1/22/14	1620	HCL	X	X								-7
PEP-10GPT-012214	GW	40mL	5	1/22/14	1645	HCL	X	X								-8
PEP-9GPT-012214	GW	40mL	5	1/22/14	1705	HCL	X	X								-9
GTT-012214TB	W	40mL	2			HCL	X									-10

Relinquished By:	Date/Time:	Received By:	Date/Time:
[signature]	1-23-14 1055	[signature]	1-23-14 1055
[signature]	1-23-14 1515	[signature]	
		Received in Lab By: [signature]	1/24/14 0950

Turnaround Time: (Check)
same day ____ 72 hours ____
24 hours ____ 5 days ____
48 hours ____ normal X

Sample Integrity: (Check)
intact X on ice X

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

1.8 C512

Login Sample Receipt Checklist

Client: URS Corporation

Job Number: 550-18305-1
SDG Number: 22241866

Login Number: 18305
List Number: 1
Creator: Shoemaker, Cory M

List Source: TestAmerica Phoenix

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	False	Check done at department level as required.

Login Sample Receipt Checklist

Client: URS Corporation

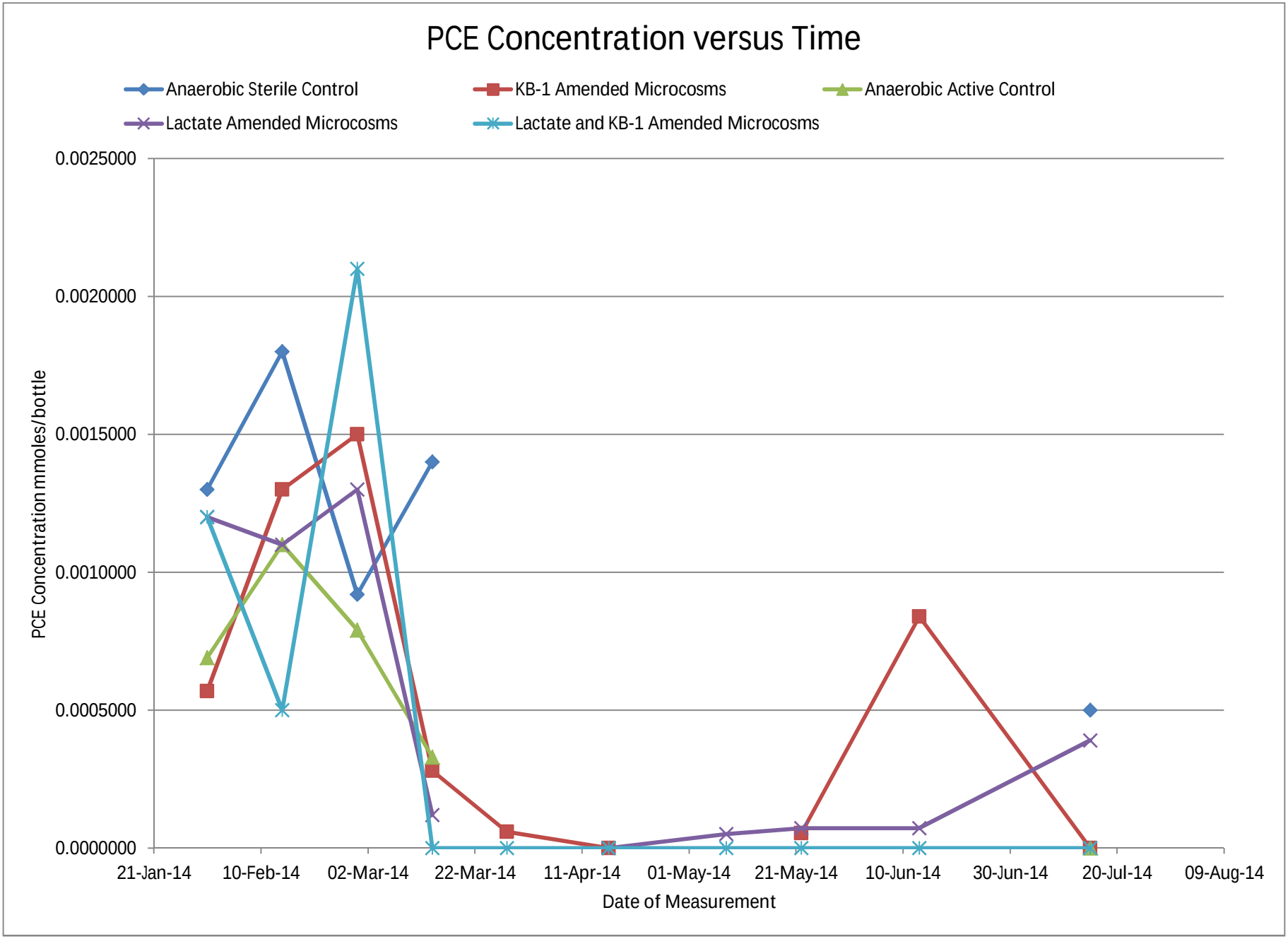
Job Number: 550-18305-1
SDG Number: 22241866

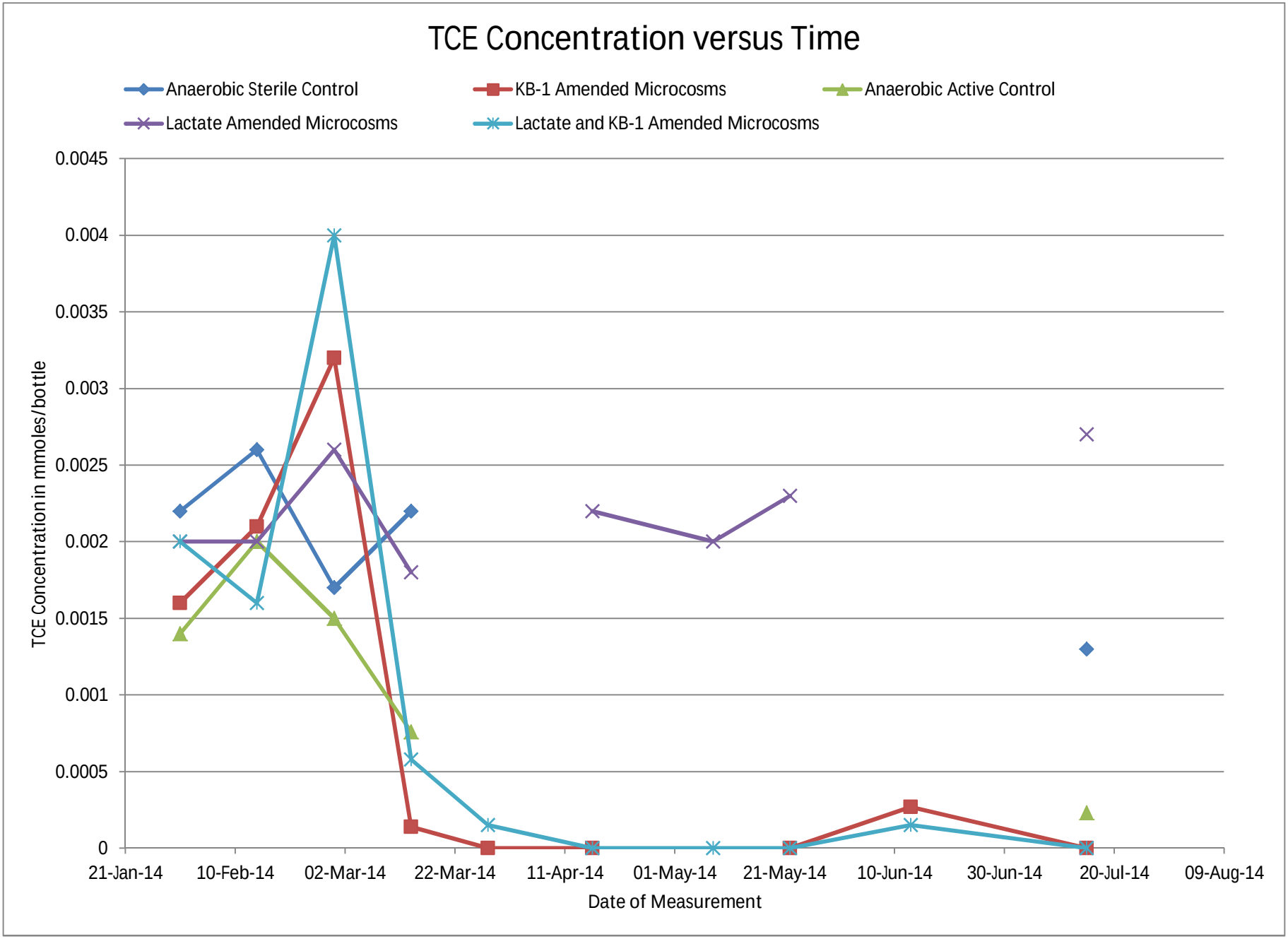
Login Number: 18305
List Number: 1
Creator: Broander, Laura L

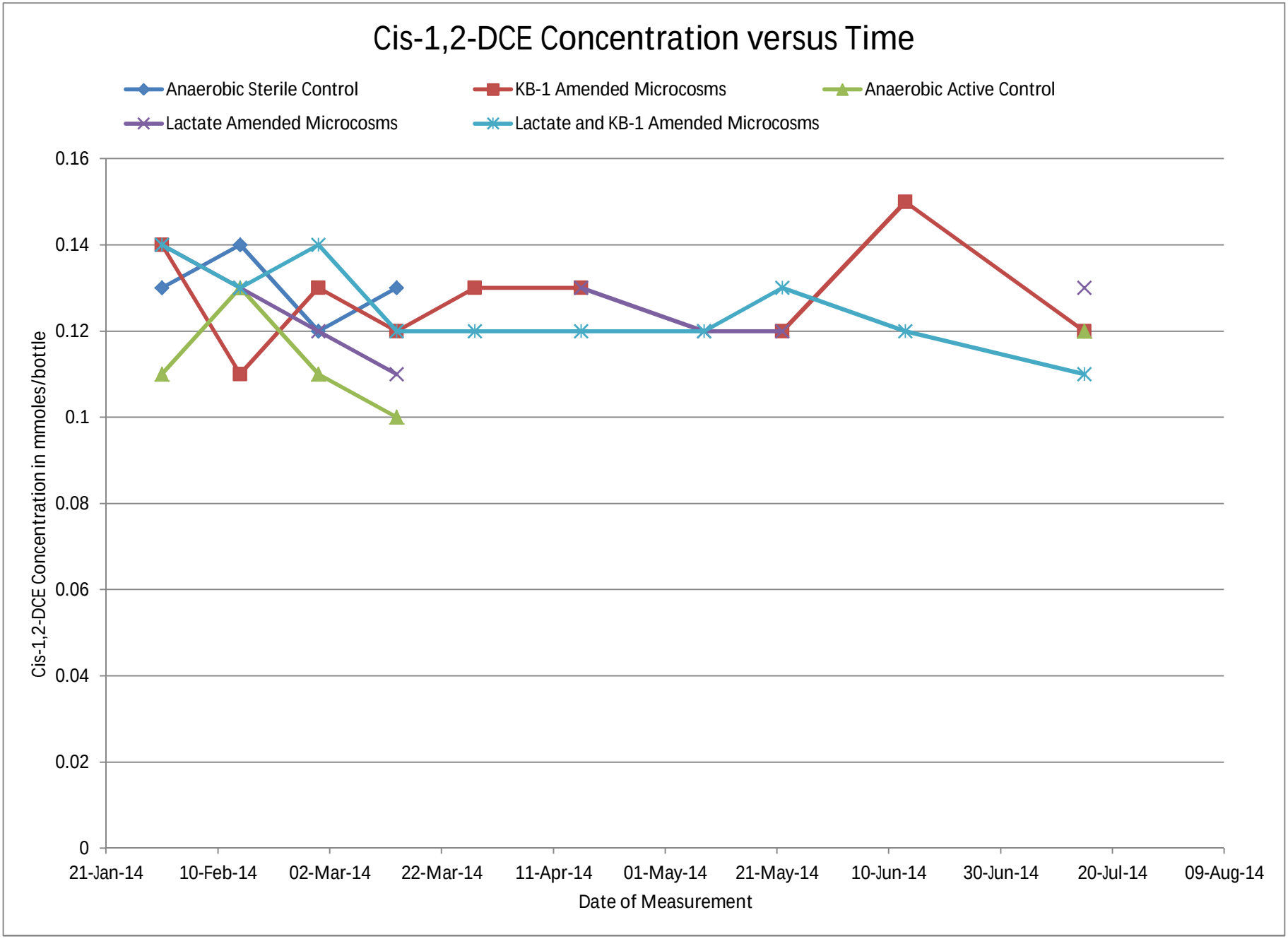
List Source: TestAmerica Denver
List Creation: 01/27/14 04:33 PM

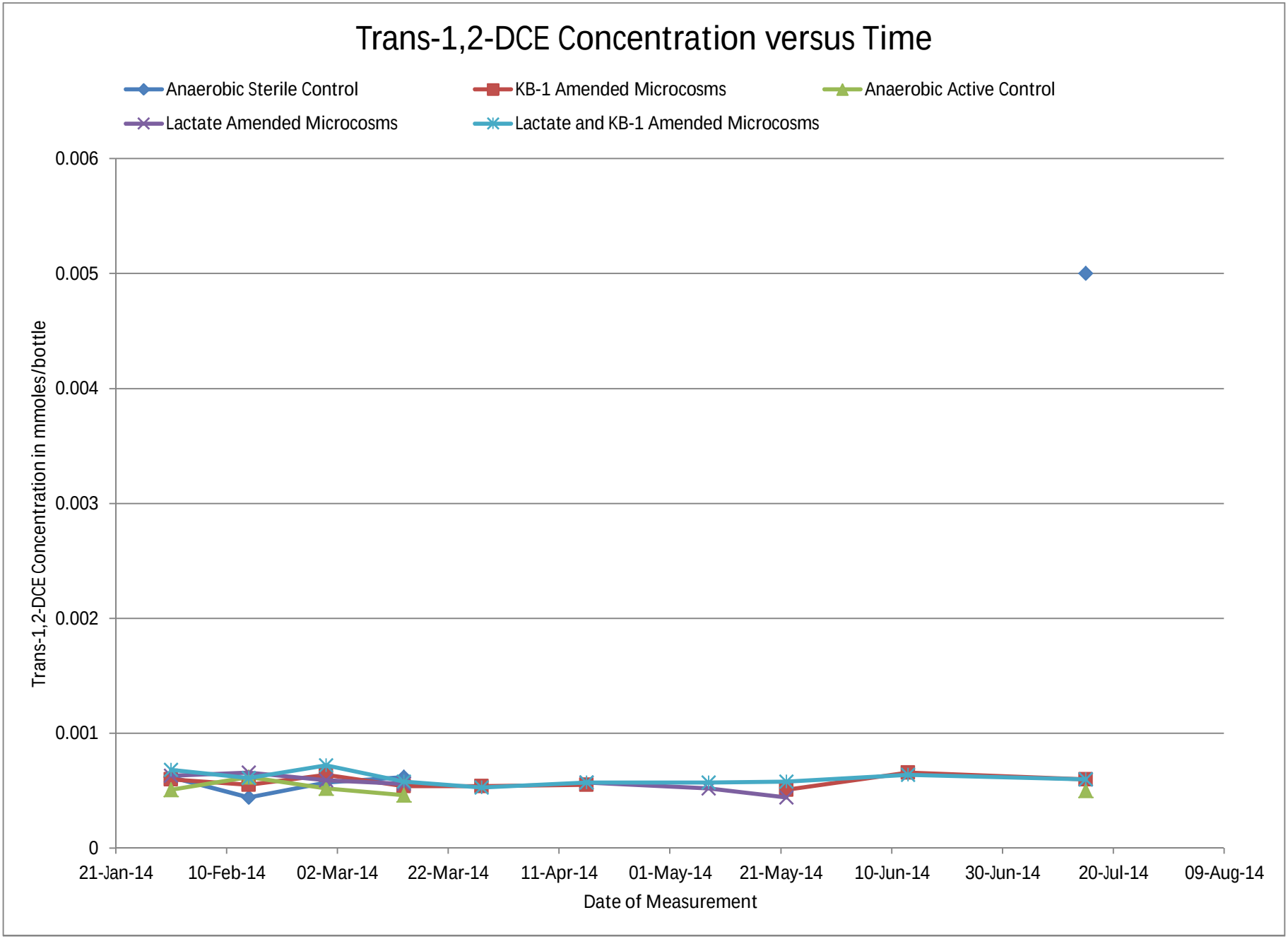
Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	Received project as a subcontract.
There are no discrepancies between the containers received and the COC.	False	Received Trip Blank(s) not listed on COC.
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	False	Headspace larger than 1/4".
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

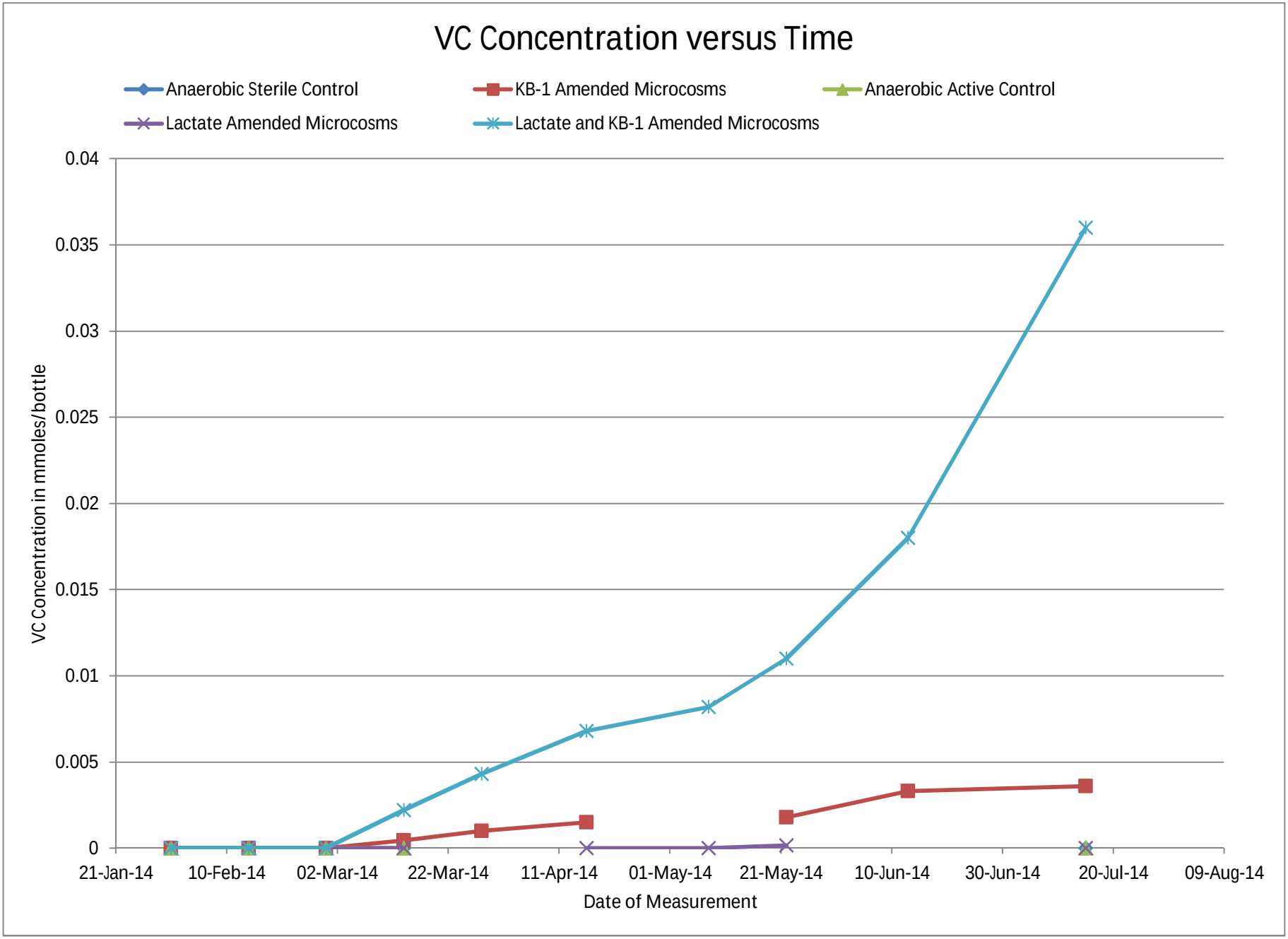
Attachment D
Concentration Time-Series Charts


PCE Concentration versus Time
Anaerobic Sterile Control
KB-1 Amended Microcosms
Anaerobic Active Control
Lactate Amended Microcosms
Lactate and KB-1 Amended Microcosms
0.0025000
0.0020000
0.0015000
0.0010000
0.0005000
0.0000000
PCE Concentration mmoles/bottle
21-Jan-14
10-Feb-14
02-Mar-14
22-Mar-14
11-Apr-14
01-May-14
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
09-Aug-14
Date of Measurement


TCE Concentration versus Time
Anaerobic Sterile Control
KB-1 Amended Microcosms
Anaerobic Active Control
Lactate Amended Microcosms
Lactate and KB-1 Amended Microcosms
TCE Concentration in mmoles/bottle
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
21-Jan-14
10-Feb-14
02-Mar-14
22-Mar-14
11-Apr-14
01-May-14
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
09-Aug-14
Date of Measurement


Cis-1,2-DCE Concentration versus Time
Anaerobic Sterile Control
KB-1 Amended Microcosms
Anaerobic Active Control
Lactate Amended Microcosms
Lactate and KB-1 Amended Microcosms
Cis-1,2-DCE Concentration in mmoles/bottle
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
21-Jan-14
10-Feb-14
02-Mar-14
22-Mar-14
11-Apr-14
01-May-14
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
09-Aug-14
Date of Measurement


Trans-1,2-DCE Concentration versus Time
Anaerobic Sterile Control
KB-1 Amended Microcosms
Anaerobic Active Control
Lactate Amended Microcosms
Lactate and KB-1 Amended Microcosms
Trans-1,2-DCE Concentration in mmoles/bottle
0.006
0.005
0.004
0.003
0.002
0.001
0
21-Jan-14
10-Feb-14
02-Mar-14
22-Mar-14
11-Apr-14
01-May-14
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
09-Aug-14
Date of Measurement


VC Concentration versus Time
Anaerobic Sterile Control
KB-1 Amended Microcosms
Anaerobic Active Control
Lactate Amended Microcosms
Lactate and KB-1 Amended Microcosms
VC Concentration in mmoles/bottle
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
21-Jan-14
10-Feb-14
02-Mar-14
22-Mar-14
11-Apr-14
01-May-14
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
09-Aug-14
Date of Measurement

Appendix D

Vapor Intrusion HHRA Evaluation

D-1 Vapor Intrusion HHRA Tech Memo

D-2 Vapor Intrusion HHRA Addendum

TECHNICAL MEMORANDUM

HUMAN HEALTH RISK ASSESSMENT FOR THE FEASIBILITY STUDY AND ASSOCIATED ACTIVITIES

PARK-EUCLID WQARF SITE TUCSON, ARIZONA

Prepared for

Park-Euclid Group

November 17, 2014

URS

URS Corporation
8181 E. Tufts Avenue
Denver, CO 80237

Project No. 22241866

TABLE OF CONTENTS

Section 1 Introduction 1-1

1.1 Background 1-1
1.2 Rationale for Vapor Intrusion Risk Assessment 1-1

Section 2 Vapor Intrusion Risk Assessment 2-1

2.1 Soil Vapor Sampling Plan 2-1
2.2 Data Evaluation 2-1
2.2.1 Data Treatment 2-1
2.3 Selection of Chemicals of Potential Concern 2-2
2.3.1 Screening Level Analysis of Soil Gas Concentrations 2-2
2.3.2 Screening Level Analysis of Predicted Indoor Air Concentrations 2-2
2.4 Uncertainty in the Risk Assessment 2-4
2.4.1 Lack of Published Screening Levels 2-4
2.4.2 Potential Impact of the Multi-Phase Extraction System on Vapor Concentrations 2-4
2.5 Conclusions 2-5

Section 3 References 3-1

List of Tables

Table 1 Screening Level Analysis of Soil Gas Concentrations

Table 2 Summary of Results from Target VOC Analyses

Table 3 Comparison of Predicted Concentrations of PCE and TCE in Indoor Air to RSLs for Residential Indoor Air

List of Figures

Figure 1 Site Location

Figure 2 Soil Gas Sample Locations

List of Appendices

Appendix A Screening Level Analysis of Predicted Indoor Air Concentrations

Appendix A.1 Tetrachloroethene (PCE) Johnson & Ettinger Model

Appendix A.2 Trichloroethene (TCE) Johnson & Ettinger Model

Appendix B Laboratory Reports

List of Acronyms

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
CalEPA	California Environmental Protection Agency
cm	centimeter
cm^3/cm^3	cubic centimeters per cubic centimeter
COC	contaminant of concern
COPC	chemical of potential concern
CR	cancer risk
CVOC	chlorinated volatile organic compound
EPC	exposure point concentration
FS	Feasibility Study
g/cm^3	grams per cubic centimeter
$g/cm\text{-}s^2$	grams per centimeter seconds squared
the Group	The Park – Euclid Group
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
J&E	Johnson & Ettinger
mg/m^3	milligrams per cubic meter
MPE	multi-phase extraction
MRL	maximum risk level
PCE	tetrachloroethene
QC	quality control
RL	reporting limit
RSL	Regional Screening Level
Site	Park-Euclid WQARF Site
TCE	trichloroethene
URS Corporation	URS
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WQARF	Water Quality Assurance Revolving Fund

1.1 BACKGROUND

This Technical Memorandum describes the vapor intrusion human health risk assessment (HHRA) conducted in support of the Feasibility Study (FS) and associated activities for the Park-Euclid Water Quality Assurance Revolving Fund (WQARF) Site (the Site) in Tucson, Arizona (Figure 1). This memorandum was developed in accordance with the requirements of the Arizona Administrative Code (AAC) Title 18, Chapter 16, Section 407. This work is being performed by URS Corporation (URS) on behalf of the Park – Euclid Group (the Group) under an Agreement to Conduct Work between the Group and the Arizona Department of Environmental Quality (ADEQ) dated July 16, 2010.

The Site is located east of downtown Tucson, Arizona and is bounded approximately by 7th Street on the north, Cherry Avenue on the east, 14th Street on the south, and Tyndall Avenue on the west. The Site encompasses soil and groundwater that have been impacted by chlorinated volatile organic compounds (CVOCs). The contaminants of concern (COCs) related to the Site are the dry cleaning chemical tetrachloroethene (PCE) and its biological breakdown products trichloroethene (TCE), dichloroethene (1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene), and vinyl chloride. Additional site background, FS, and associated activities details are provided in the *Feasibility Study and Associated Activities Work Plan* (URS 2013).

1.2 RATIONALE FOR VAPOR INTRUSION RISK ASSESSMENT

An HHRA was performed to evaluate current or potential future threats to human health from volatile organic compounds (VOCs) in soil and groundwater at the Site under existing or anticipated future conditions. The HHRA is limited to evaluating potential exposure of residents and commercial/industrial workers to VOCs in indoor air via vapor intrusion from soil and groundwater. Soil gas concentrations were used with the United States Environmental Protection Agency's (USEPA's 2004) SG-ADV-Feb 04 Johnson and Ettinger (J&E) model to predict indoor air concentrations.

2.1 SOIL VAPOR SAMPLING PLAN

Two sources of data were used to evaluate the potential for vapor intrusion to indoor air and potential risk to human health:

- Soil vapor data collected from a depth of 5 feet below ground surface (bgs) at seven permanent soil vapor monitoring points VW-1 through VW-7 (Figure 2). Samples from these wells are currently being collected on an annual basis under the long-term monitoring program for the Site. The most recent sampling results from the permanent soil vapor monitoring points (collected on April 22, 2014 for sampling locations VW-01-05, VW-02-05, and VW-07-05 and on April 21, 2014 for sampling locations VW-03-05 to VW-06-05) were used in the HHRA.
- Soil vapor data collected a depth of 5 feet bgs at six temporary soil gas probes (Figure 2). Soil gas samples were collected from the VW-8 to VW-12 sampling locations (including a field duplicate at VW-11) on June 25, 2014. A soil gas sample was collected from the VW-13 sampling location on July 9, 2014.

2.2 DATA EVALUATION

The first step in the HHRA process is the identification of representative data for quantitative evaluation. Soil gas samples were collected for potential evaluation in the HHRA. Sample locations and analytical methods were specifically chosen to characterize the nature and extent of contamination, based on Site history, and to provide representative data for the purposes of HHRA. Analytical data were evaluated and organized into a form appropriate for baseline risk assessment. A primary purpose of the evaluation of data usability is to select analytical results that are of adequate quality for use in quantifying risks.

2.2.1 Data Treatment

Data determined to be acceptable for use in the HHRA were treated or modified according to the rules listed below. Treatment may relate to detected or non-detected analytes, data qualifiers, and duplicate sample results.

<u>Qualified Data</u>

Data were reviewed for usability in the HHRA. At times, problems are identified in laboratory analytical results. It is not uncommon to identify problems associated with the chemical concentration, the chemical identity, interference from other analytes, and/or matrix interferences (USEPA 1989). In such cases, analytes may be assigned a data qualifier.

Data flagged as estimated ("J" qualified), indicating that the analyte was positively identified but the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control (QC) criteria, were treated the same as unqualified data.

<u>Non-Detect Data</u>

When an analyte was not detected in a sample, the value reported was the reporting limit (RL). All non-detect values were included in the data evaluation for the HHRA. Non-detect data were included in the risk analyses without adjustments (such as using 1/2 the RL as a surrogate).

Treatment of Duplicate Samples

A field duplicate sample, which is a QC sample collected to provide a measure of the contribution of field-related sources to overall variability, was collected at VW-11. In the two screening steps in the HHRA, the field duplicate results were treated the same as the other results.

2.3 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Chemicals of potential concern (COPCs) are defined as chemicals for which cancer risks and non-cancer hazard indices are calculated in a quantitative HHRA.

2.3.1 Screening Level Analysis of Soil Gas Concentrations

Maximum detected concentrations of VOCs in soil gas across the entire Site were multiplied by an attenuation factor of 0.01 as a conservative approach to account for the estimated decrease in concentrations of VOCs in soil gas versus the concentrations in indoor air. In this screening level analysis, the attenuated values were compared to USEPA Regional Screening Levels (RSLs) for residential indoor air protective to a hazard quotient (HQ) of 0.1 or a cancer risk (CR) of 1×10^{-6},whichever is more protective (USEPA 2014a) (Table 1). The target HQ of 0.1 is used in the initial screening level analysis to minimize the likelihood of eliminating chemicals as COPCs whose cumulative non-cancer hazard index (HI) may add up to more than 1.0. It is common to use conservative assumptions (such as an HQ of 0.1) in the derivation of initial screening levels, because the exceedance of a screening level does not indicate that the chemicals pose an unacceptable risk. Rather, the exceedance of a screening level indicates that further evaluation of the chemical is necessary. Table 2 provides a summary of results from all VOC analyses used in the soil gas screening level risk assessment. Attenuated concentrations of TCE and PCE exceeded their respective RSLs for residential indoor air; therefore, TCE and PCE were evaluated further in site-specific screening described in Section 2.3.2. cis-1,2-Dichloroethene was detected, but was not evaluated further in the HHRA because the USEPA RSL tables do not have RSLs for indoor air for cis-1,2-dichloroethene. Neither trans-1,2-dichloroethene or vinyl chloride were detected at any of the sampling locations, and therefore, these compounds were also not evaluated further in the site-specific screening.

2.3.2 Screening Level Analysis of Predicted Indoor Air Concentrations

Maximum site-wide detected concentrations of PCE and TCE in soil gas that were selected for further evaluation (see Section 2.3.1) were used with the J&E model to predict maximum concentrations of VOCs in residential indoor air across the entire Site. In this analysis, less conservative (more realistic) site-specific values are used to calculate CR and HQ. Because this second level screening was based on site-specific conditions and because only two compounds were carried forward to this secondary screening, predicted indoor air concentrations were compared to USEPA (2014b) RSLs for residential indoor air protective to a CR of 1×10^{-6} and more realistic HQ of 1.

Modeling of Soil Gas Transport to Indoor Air

The following site-specific information was used in the J&E model for the residential scenario (Appendix A):

- Maximum detected site-wide soil gas concentrations for PCE and TCE of 6.375 and 0.0699 milligrams per cubic meter (mg/m^3), respectively.
- Soil gas sampling depth below grade of 5 feet.
- Average soil temperature of 75 degrees Fahrenheit (°F) (based on the average soil temperature at 20 inches bgs during the month of June).
- Site-specific soil type – Clay loam for sampling location VW-07 (the sampling location with the maximum detected site-wide soil gas concentrations for PCE and TCE).

The following default values were used for the residential scenario:

- Depth below grade to bottom of enclosed space floor: 15 centimeters (cm), based on USEPA (2004) default value for slab-on-grade buildings.
- Based on soil type of clay loam: dry bulk density of 1.48 grams per cubic centimeter (g/cm^3).
- Based on soil type of clay loam: total porosity of 0.442 (unitless).
- Based on soil type of clay loam: water-filled porosity of 0.168 cubic centimeters per cubic centimeter (cm^3/cm^3).
- Enclosed space floor thickness: 10 cm, based on USEPA (2004) default value.
- Soil-building pressure differential: 40 grams per centimeter seconds squared ($g/cm\text{-}s^2$), based on USEPA (2004) default value.
- Enclosed space floor length: 1,000 cm, based on USEPA (2004) default value.
- Enclosed space floor width: 1,000 cm, based on USEPA (2004) default value.
- Enclosed space height: 366 cm, based on USEPA (2004) default value for residences.
- Floor-wall seam crack width: 0.1 cm, based on USEPA (2004) default value.
- Indoor air exchange rate: 0.25 exchange per hour, based on USEPA (2004) default value for residences.
- Average vapor flow rate into building: 5 liters per minute, based on USEPA (2004) default value.

The J&E model predicted that, based on a maximum detected site-wide concentration of PCE in soil gas of 6.375 mg/m^3, the concentration of PCE in indoor air would be 0.00656 mg/m^3 (Appendix A). This indoor air concentration is less than the USEPA RSL for PCE in residential indoor air of 0.011 mg/m^3. This residential RSL for PCE in indoor air of 0.011 mg/m^3 is protective to an HQ of 1 and a CR of 1×10^{-6}. The predicted concentration of PCE in indoor air of 0.00656 mg/m^3 is also well below the USEPA RSL for PCE in industrial indoor air of 0.047 mg/m^3. The J&E model predicted that, based on a maximum detected site-wide concentration of TCE in soil gas of 0.0699 mg/m^3, the concentration of TCE in indoor air would be 0.000077 mg/m^3 (Appendix A). This indoor air concentration is well below the USEPA RSL for TCE in residential indoor air of 0.048 mg/m^3. This RSL for TCE in indoor air of 0.048 mg/m^3 is protective to an HQ of 1 and a CR of 1×10^{-6}. The predicted concentration of TCE in indoor air

of 0.000077 mg/m^3 is also well below the USEPA RSL for TCE in industrial indoor air of 0.003 mg/m^3. Therefore, PCE and TCE were not selected as COPCs to be evaluated further in the HHRA. trans-1,2-Dichloroethene and vinyl chloride were not selected as COPCs, because those VOCs were not detected in any soil gas samples collected at the Site. cis-1,2-Dichloroethene was detected, but was not selected as a COPC because the USEPA RSL tables do not have RSLs for indoor air for cis-1,2-dichloroethene. Therefore, no COPCs were selected at the Site based on the screening level analysis of soil gas concentrations and the screening level analysis of predicted indoor air concentrations. Because no COPCs were selected, it was not necessary to perform quantitative estimates of CR and HI for residents and commercial/industrial workers exposed to indoor air impacted by VOCs in soil and groundwater at the Site.

2.4 UNCERTAINTY IN THE RISK ASSESSMENT

The most significant uncertainties associated with the HHRA are related to the lack of published screening levels for compounds detected in samples from soil gas samples and potential rebound in vapor concentrations following shutdown of the multi-phase extraction (MPE) system at the Site. These topics are addressed below.

2.4.1 Lack of Published Screening Levels

One source of uncertainty in the HHRA is that detected levels of cis-1,2-dichloroethene were not evaluated in the screening level analysis of soil gas concentrations or the screening level analysis of predicted indoor air concentrations. Toxicity values for inhalation of cis-1,2-dichloroethene are not available from USEPA sources (USEPA 1997; 2014b,c,d) or from other traditional sources of toxicity values such as California Environmental Protection Agency (CalEPA 2014) and Agency for Toxic Substances and Disease Registry (ATDSR 2014). An intermediate (subchronic duration) minimum risk level (MRL) of 7.9 mg/m^3 is available for trans-1,2-dichloroethene (ATSDR 2014). The maximum site-wide attenuated soil gas concentration for cis-1,2-dichloroethene of 0.00103 mg/m^3 is more than 7,000-times lower than the ATSDR MRL for trans-1,2-dichloroethene of 7.9 mg/m^3.

2.4.2 Potential Impact of the Multi-Phase Extraction System on Vapor Concentrations

The Group has operated a MPE system as an Early Response Action for removal of contaminated vapors, water, and petroleum product containing dissolved VOCs from the surface of the Perched Aquifer at the Site for several years (URS 2010). The primary goal of this system was to remove as much contaminant mass from the Perched Aquifer as practical, and because most of the VOC mass in the Perched Aquifer is believed to occur in the dissolved phase in the product, the MPE system was optimized to remove as much product as practical. However, this system had the added benefit of also extracting contaminated vapors from the upper vadose zone near its interface with the Perched Aquifer, and therefore, concentrations of VOCs have also declined significantly in the upper vadose zone as a result of MPE. This system was shut down on April 11, 2014 pending further evaluation in the FS as a potential component of the final remedy for the Perched Aquifer as PCE concentrations in the Perched Aquifer have decreased significantly.

When a system extracting VOC vapors from the subsurface is shut down, some rebound in vapor phase VOC concentrations is normally expected, as remaining sorbed phase VOCs equilibrate with the surrounding vapors in the soil matrix. However, because extraction at the MPE system

targets remediation of the Perched Aquifer and upper vadose zone at a depth of about 90 feet bgs, the least impact from MPE (and therefore the least rebound) would be expected at the 5-foot depth where samples were collected for the HHRA. Also, if occurring, concentration rebound from sorbed phase VOCs in the vadose zone would be expected to be at a maximum shortly after shutdown of the MPE system, and therefore, the results from samples collected from the shallow vapor wells about 10 days after shutdown of MPE would not be expected to show as significant an impact as they would if the samples were collected during operation or shortly after system shutdown.

Samples from the temporary vapor wells adjacent to commercial and residential offsite properties (VW-08 through VW-13, Figure 2) used in the risk assessment were collected in late June 2014, over 2 months after shutdown of the MPE system on April 11, 2014. Further, these locations are far enough away from the MPE extraction wells to be outside the anticipated zone of influence of vapor extraction from the MPE system, and therefore, significant rebound is not expected in these wells following shutdown of the MPE system. No additional evaluation of the impact of MPE shutdown on vapor concentrations at these locations with respect to this HHRA is recommended.

Because of the proximity of the permanent vapor wells (VW-01 through VW-07, Figure 2) to the MPE extraction wells and the shorter time period between the MPE system shutdown and collection of the samples used in this HHRA, a contingency will be included in the FS to periodically review the results from long term monitoring of the permanent vapor wells beneath the source area. Should J&E modeling based on these data predict that commercial RSLs beneath the source area would be exceeded (HQ > 1; CR > 1 x 10^{-6}), additional assessment of vapor intrusion risk may be recommended.

2.5 CONCLUSIONS

Soil gas collected at 13 locations (with an additional field duplicate collected at VW-11) was analyzed for PCE, TCE, cis-1,2-dichlorethene, trans-1,2-dichloroethene, and vinyl chloride. In the first step of selection of COPCs (screening level analysis of soil gas concentrations), maximum detected concentrations of VOCs in soil gas across the entire Site were multiplied by an attenuation factor of 0.01 for comparison to USEPA RSLs for residential indoor air protective to an HQ of 0.1 and a CR of 1 x 10^{-6} (USEPA 2014a). trans-1,2-Dichloroethene and vinyl chloride were not detected at any sampling locations at the Site, and therefore, were not evaluated further in the HHRA. cis-1,2-Dichloroethene was detected in 50% of the samples. However, there are no toxicity values or screening levels for inhalation of cis-1,2-dichloroethene in air. Therefore, cis-1,2-dichloroethene could not be evaluated in the screening level analysis of soil gas concentrations.

Attenuated concentrations of TCE and PCE exceeded their respective RSLs for indoor air protective to an HQ of 0.1 and a CR of 1 x 10^{-6} (USEPA 2014a); therefore, PCE and TCE were evaluated further in the HHRA. In the next step of the selection of COPCs (screening level analysis of predicted indoor air concentrations), indoor air concentrations of PCE and TCE were predicted using the maximum detected site-wide concentrations with the J&E model. The predicted indoor air concentrations of PCE and TCE were each less than USEPA RSLs for residential indoor air protective to an HQ of 1 and a CR of 1 x 10^{-6} (USEPA 2014b). Therefore, no COPCs were selected at the Site based on the screening level analysis of soil gas concentrations and the screening level analysis of predicted indoor air concentrations. Because

no COPCs were selected, it was not necessary to perform quantitative estimates of CR and HI for residents and commercial/industrial workers exposed to indoor air impacted by VOCs in soil and groundwater at the Site.

Based on the soil gas sampling results and HHRA performed at the Site, potential exposure of residents or commercial/industrial workers to trans-1,2-dichloroethene (not detected), vinyl chloride (not detected), TCE (predicted indoor air concentration less than residential RSL), and PCE (predicted indoor air concentration less than residential RSL) would not pose an unacceptable threat to human health. There is uncertainty associated with potential impacts from human exposure to cis-1,2-dichloroethene in indoor air impacted by groundwater and soil at the Site.

Agency for Toxic Substances and Disease Registry (ATSDR). 2014. Minimum Risk Levels (MRLs) for Hazardous Substances. December. Accessed online at http://www.atsdr.cdc.gov/mrls/index.asp.

California Environmental Protection Agency (CalEPA). 2014. Toxicity Criteria Database, Office of Environmental Health Hazard Assessment. Accessed online at http://www.oehha.ca.gov/risk/ChemicalDB/index.asp.

URS Corporation (URS). 2010. Work Plan, Multi-Phase Extraction System Early Response Action, Park-Euclid WQARF Site, Tucson, Arizona. Prepared for the Park-Euclid RP Group. October 15.

URS. 2013. Feasibility Study and Associated Activities Work Plan, Park-Euclid WQARF Site, Tucson, Arizona. Prepared for Park-Euclid Responsible Parties. June 21.

U.S. Environmental Protection Agency (USEPA). 1989. Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual, Part A. Interim Final. Office of Emergency and Remedial Response, Washington, D.C. December.

USEPA. 1997. Health Effects Assessment Summary Tables. FY 1997 Update. EPA-540-R-97-036. July.

USEPA. 2004 Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings. Version SG-ADV-04. Accessed online at http://www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm.

USEPA. 2014a. USEPA Master Regional Screening Level (RSL) Table. May. (TR=1E-6, HQ=0.1).

USEPA. 2014b. USEPA Master Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1). May.

USEPA. 2014c. Integrated Risk Information System (IRIS). Accessed online at http://www.epa.gov/iris.

USEPA. 2014d. Provisional Peer Reviewed Toxicity Values for Superfund (PPRTV). PPRTV Assessments Electronic Library. Accessed online at http://hhpprtv.ornl.gov/index.html.

Table 1
Screening Level Analysis of Soil Gas Concentrations

Analyte	CAS Number	Number of Samples	Number of Detections	Frequency of Detection	Maximum Detected Concentration (mg/m^3)	Maximum Detected Concentration with Attenuation Factor of 0.01 Applied (mg/m^3)[1]	Residential Indoor Air RSL (USEPA 2014) (mg/m^3)[2]	Basis for RSL	Maximum Detected Concentration > RSL?
cis-1,2-Dichloroethene	156-59-2	14	7	50%	0.103	0.00103	NV	-	NV
Tetrachloroethene	127-18-4	14	14	100%	6.38	0.0638	0.00420	HQ of 0.1	**Yes**
trans-1,2-Dichloroethene	156-60-5	14	0	0%	ND	ND	NV	-	ND
Trichloroethene	79-01-6	14	6	43%	0.0699	0.000699	0.000210	HQ of 0.1	**Yes**
Vinyl chloride	75-01-4	14	0	0%	ND	ND	0.000170	CR of 1×10^{-6}	ND

[1] An attentuation factor of 0.01 is a conservative approach to account for the potential decrease in concentrations of VOCs in soil gas versus the concentrations in indoor air.
[2] RSLs are based on a target HQ of 0.1 for non-carcinogens or a target CR of 1×10^{-6}. For chemicals that had RSLs both for an HQ of 0.1 and a CR of 1×10^{-6}, the lower of the two resulting RSLs was selected.

Notes:
Includes field duplicate for sample location VW-11.

Acronyms:
CR - cancer risk
HQ - hazard quotient
mg/m^3 - milligrams per cubic meter
ND - not detected (at the site)
NV - no value (no Residential Indoor Air RSL for this analyte)
RSL - Regional Screening Level
USEPA - U.S. Environmental Protection Agency
VOC - volatile organic compound

References:
U.S. Environmental Protection Agency (USEPA). 2014. USEPA Master Regional Screening Level (RSL) Table. May.

Table 2
Summary of Results from Target VOC Analyses
Vapor Intrusion Risk Assessment
Park - Euclid WQARF Site, Tucson, Arizona

Location ID	Type	Sample Date	c-1,2-DCE V mg/m3	PCE V mg/m3	t-1,2-DCE V mg/m3	TCE V mg/m3	VC V mg/m3
		Analyte Fraction Units					
VW-01-05	SA	04/22/2014	<0.0068	0.88	<0.0067	<0.0091	<0.0043
VW-02-05	SA	04/22/2014	<0.0016	0.0095	<0.0016	<0.0021	<0.0010
VW-03-05	SA	04/21/2014	<0.0016	0.022	<0.0016	<0.0021	<0.0010
VW-04-05	SA	04/21/2014	<0.0016	0.38	<0.0016	<0.0021	<0.0010
VW-05-05	SA	04/21/2014	<0.0016	0.18	<0.0016	<0.0021	<0.0010
VW-06-05	SA	04/21/2014	<0.0016	0.0059	<0.0016	<0.0021	<0.0010
VW-07-05	SA	04/22/2014	0.10	6.4	<0.044	0.070	<0.028
VW-08	SA	06/25/2014	0.0034	0.26	<0.0016	0.0038	<0.0010
VW-09	SA	06/25/2014	0.0035	0.31	<0.0016	0.0040	<0.0010
VW-10	SA	06/25/2014	<0.018	0.39	<0.017	<0.024	<0.011
VW-11	SA	06/25/2014	0.0020	0.15	<0.0016	0.0023	<0.0010
VW-11	FD	06/25/2014	0.0026	0.18	<0.0016	0.0030	<0.0010
VW-12	SA	06/25/2014	0.0017	0.13	<0.0016	<0.0021	<0.0010
VW-13	SA	07/09/2014	0.0068	0.40	<0.0016	0.0059	<0.0010

SA - Field Original, FD - Field Duplicate
V - Vapor, mg/m3 - milligrams per cubic meter
< 0.0016 - Not detected at or above the reporting limit.

Table 3
Comparison of Predicted Concentrations of PCE and TCE in Indoor Air to RSLs for Residential Indoor Air

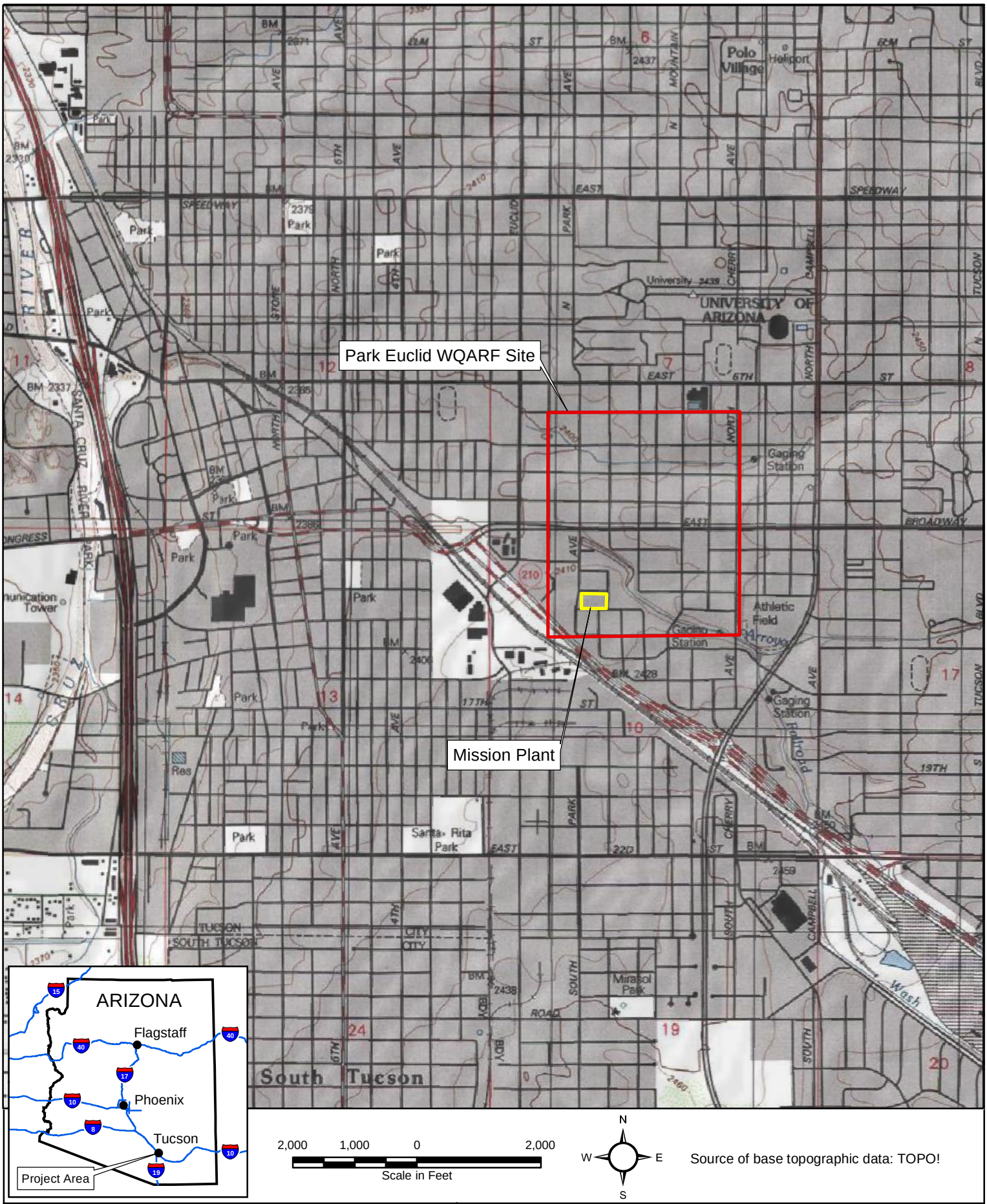
Analyte	CAS Number	Maximum Detected Concentration in Soil Gas (mg/m^3)	Predicted Concentration in Indoor Air (mg/m^3)	Residential Indoor Air RSL (USEPA 2014) (mg/m^3)[1]	Basis for Residential Indoor Air RSL?	Predicted Indoor Air Concentration > Residential Indoor Air RSL?
Tetrachloroethene	127-18-4	6.38	0.00656	0.0110	CR = 1×10^{-6}	No
Trichloroethene	79-01-6	0.0699	0.000077	0.00048	CR = 1×10^{-6}	No

[1] RSLs are based on a target HQ of 1 for non-carcinogens or a target CR of 1×10^{-6}. For chemicals that had RSLs both for an HQ of 1 and a CR of 1×10^{-6}, the lower of the two resulting RSLs was selected.

Notes:
Includes field duplicate for sample location VW-11.

Acronyms:
CR - cancer risk
mg/m^3 - milligrams per cubic meter
PCE - tetrachloroethene
RSL - Regional Screening Level
TCE - trichloroethene
USEPA - U.S. Environmental Protection Agency

References:
U.S. Environmental Protection Agency (USEPA). 2014. USEPA Master Regional Screening Level (RSL) Table. May.



Source of base topographic data: TOPO!

URS

Project Name: Park-Euclid WQARF Site

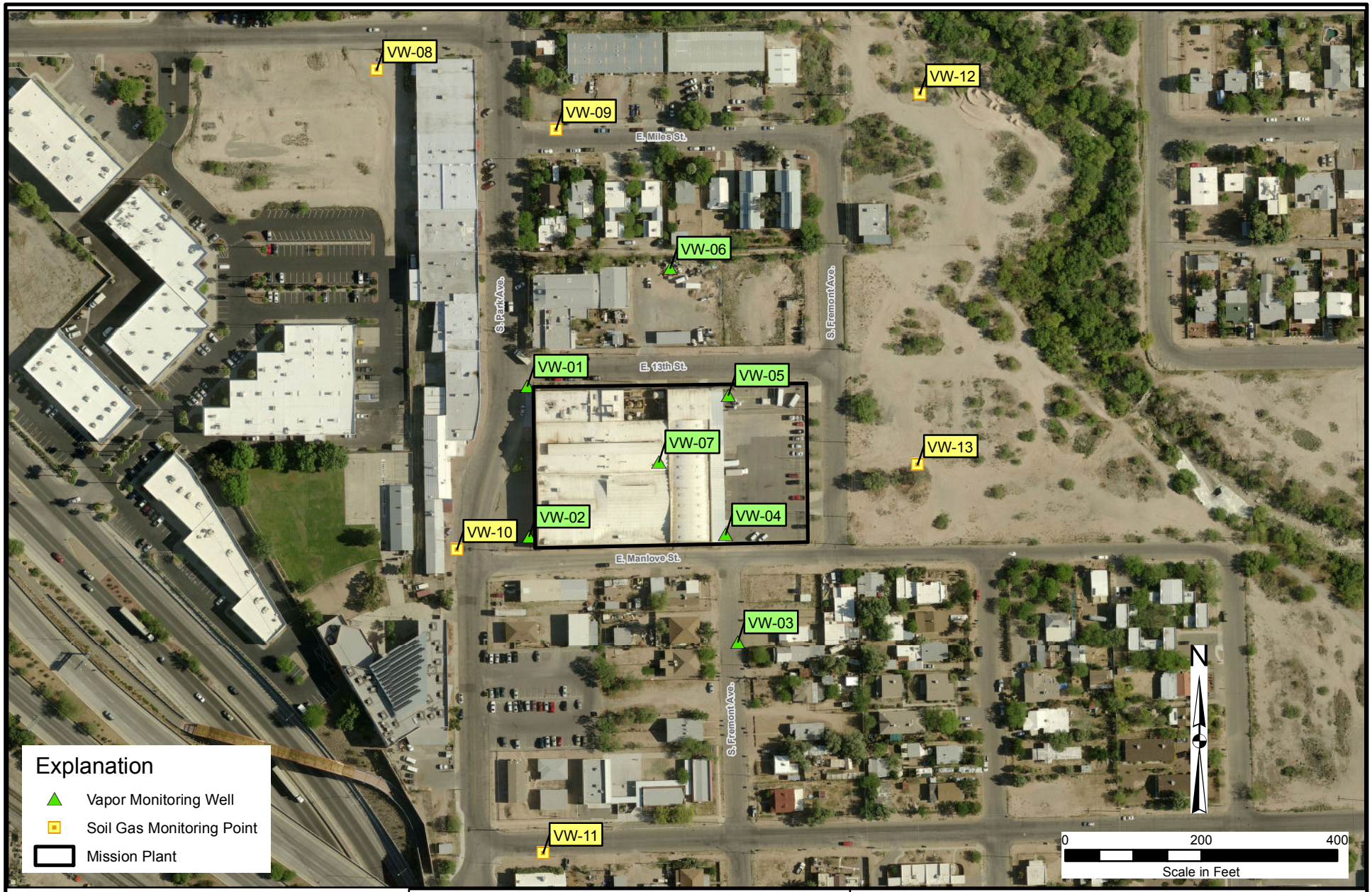
Job No: 22241866

Date: January 2013

SITE LOCATION
PARK-EUCLID WQARF SITE
301 SOUTH PARK AVENUE
TUCSON, ARIZONA

Y:/GIS/Projects/Mission/Park_Euclid/Proj13/FS_Final/Fig1_SiteLocation.mxd

Figure 1



Aerial Photography Source: Pima County, Arizona GIS 2010

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

Date: September 2014

SOIL GAS SAMPLE LOCATIONS

PARK-EUCLID WQARF SITE
301 SOUTH PARK AVENUE
TUCSON, ARIZONA

P_E/Projects14/HHRA_Tech_Memo/Fig2_Soil_Gas_Locs.mxd

Figure 2

Appendix A

Screening Level Analysis of Predicted Indoor Air Concentrations

Appendix A
Screening Level Analysis of Predicted Indoor Air Concentrations

Appendix A.1

Tetrachloroethene (PCE) Johnson & Ettinger Model

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	6.375E+03			Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	152.4	23.89	152.4	0	0	CL		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
CL	1.48	0.442	0.168								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	6.0E-01

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	137.4	0.274	ERROR	ERROR	0.245	1.29E-09	0.865	1.12E-09	4,000	6.38E+03	2.54E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	9,411	1.73E-02	7.10E-01	1.80E-04	4.95E-03	0.00E+00	0.00E+00	4.95E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	6.38E+03	0.10	8.33E+01	4.95E-03	4.00E+02	8.91E+182	1.03E-03	**6.56E+00**	5.9E-06	6.0E-01

END

Appendix A.2

Trichloroethene (TCE) Johnson & Ettinger Model

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
79016	6.99E+01			Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	152.4	23.89	152.4			CL		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
CL	1.48	0.442	0.168								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	137.4	0.274	ERROR	ERROR	0.245	1.29E-09	0.865	1.12E-09	4,000	6.99E+01	2.54E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	8,384	9.74E-03	4.00E-01	1.80E-04	5.43E-03	0.00E+00	0.00E+00	5.43E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	6.99E+01	0.10	8.33E+01	5.43E-03	4.00E+02	5.43E+166	1.10E-03	**7.66E-02**	1.1E-04	4.0E-02

END

Appendix B
Laboratory Reports

Appendix B
Laboratory Reports

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Tel: (916)373-5600

TestAmerica Job ID: 320-7188-1
Client Project/Site: Park-Euclid WQARF Site

For:
URS Corporation
8181 East Tufts Ave.
Denver, Colorado 80237

Attn: Mr. Robert Boudra

Authorized for release by:
5/14/2014 1:07:08 PM

Laura Turpen, Project Manager I
(916)373-5600
laura.turpen@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Cover Page 1
Table of Contents 2
Definitions/Glossary 3
Case Narrative 4
Detection Summary 5
Client Sample Results 13
Surrogate Summary 33
QC Sample Results 35
QC Association Summary 41
Lab Chronicle 43
Certification Summary 50
Method Summary 51
Sample Summary 52
Chain of Custody 53
Field Data Sheets 58
Receipt Checklists 98
Clean Canister Certification 99
    Pre-Ship Certification 99
    Clean Canister Data 105

Qualifiers

Air - GC/MS VOA

Qualifier	Qualifier Description
X	Surrogate is outside control limits
E6	Concentration estimated. Internal standard recoveries did not meet method acceptance criteria.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 320-7188-1

Laboratory: TestAmerica Sacramento

Narrative

Receipt
The samples were received on 4/25/2014 9:10 AM; the samples arrived in good condition.

Except:

The container label for the following sample(s) did not match the information listed on the Chain-of-Custody (COC): .
VW-06-85-VPT-042114 can is 34001709, coc lists 34001790.
VML-02-190-VPT-042314 is labeled VML-02-85-VPT-042314.
VML-02-130-VPT-042414 is labeled VML-02-130-VPT-042314.

The client confirmed the sample IDs as VML-02-190-VPT-042314 and VML-02-130-VPT-042414and the canitser ID as 34001709.

Air - GC/MS VOA
Method(s) TO-15: Surrogate recovery for the following sample was outside control limits: VW-01-85-VPT-042214 (320-7188-21). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) TO-15: The following sample was diluted due to the abundance of non-target analytes: VW-01-55-VPT-042214 (320-7188-20). Elevated reporting limits (RLs) are provided.

Method(s) TO-15: Surrogate recovery for the following sample was outside control limits: VW-01-85-VDT-042214 (320-7188-22). Re-extraction and/or re-analysis was performed with concurring results. The original analysis has been reported.

Method(s) TO-15: Internal standard (ISTD) response for the following sample was outside control limits: VW-01-85-VDT-042214 (320-7188-22). The sample was re-extracted and/or re-analyzed with concurring results, and the original set of data has been reported.

No other analytical or quality issues were noted.

VOA Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Detection Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Client Sample ID: VW-03-05-VPT-042114 — Lab Sample ID: 320-7188-1

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	3.2		0.40	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	22		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-03-30-VPT-042114 — Lab Sample ID: 320-7188-2

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	1.3		0.40	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	9.1		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-03-55-VPT-042114 — Lab Sample ID: 320-7188-3

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	2.7		0.40	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	19		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-03-85-VPT-042114 — Lab Sample ID: 320-7188-4

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	1.6		0.40	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	11		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-04-05-VPT-042114 — Lab Sample ID: 320-7188-5

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	56		0.40	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	380		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-04-30-VPT-042114 — Lab Sample ID: 320-7188-6

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	130		2.4	ppb v/v	5.98		TO-15	Total/NA
Tetrachloroethene	900		16	ug/m3	5.98		TO-15	Total/NA

Client Sample ID: VW-04-55-VPT-042114 — Lab Sample ID: 320-7188-7

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	120		2.0	ppb v/v	4.93		TO-15	Total/NA
Tetrachloroethene	820		13	ug/m3	4.93		TO-15	Total/NA

Client Sample ID: VW-04-85-VPT-042114 — Lab Sample ID: 320-7188-8

This Detection Summary does not include radiochemical test results.

Client Sample ID: VW-04-85-VPT-042114 (Continued) — Lab Sample ID: 320-7188-8

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	300		3.3	ppb v/v	8.31		TO-15	Total/NA
Tetrachloroethene	90		3.3	ppb v/v	8.31		TO-15	Total/NA
Trichloroethene	24		3.3	ppb v/v	8.31		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1200		13	ug/m3	8.31		TO-15	Total/NA
Tetrachloroethene	610		23	ug/m3	8.31		TO-15	Total/NA
Trichloroethene	130		18	ug/m3	8.31		TO-15	Total/NA

Client Sample ID: VW-04-85-VDT-042114 — Lab Sample ID: 320-7188-9

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	170		2.3	ppb v/v	5.73		TO-15	Total/NA
Tetrachloroethene	130		2.3	ppb v/v	5.73		TO-15	Total/NA
Trichloroethene	19		2.3	ppb v/v	5.73		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	680		9.1	ug/m3	5.73		TO-15	Total/NA
Tetrachloroethene	860		16	ug/m3	5.73		TO-15	Total/NA
Trichloroethene	100		12	ug/m3	5.73		TO-15	Total/NA

Client Sample ID: VW-05-05-VPT-042114 — Lab Sample ID: 320-7188-10

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	27		0.40	ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	190		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-05-30-VPT-042114 — Lab Sample ID: 320-7188-11

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	850		12	ppb v/v	29.3		TO-15	Total/NA
Trichloroethene	12		12	ppb v/v	29.3		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	5700		79	ug/m3	29.3		TO-15	Total/NA
Trichloroethene	62		63	ug/m3	29.3		TO-15	Total/NA

Client Sample ID: VW-05-55-VPT-042114 — Lab Sample ID: 320-7188-12

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	44		1.7	ppb v/v	4.16		TO-15	Total/NA
Tetrachloroethene	150		1.7	ppb v/v	4.16		TO-15	Total/NA
Trichloroethene	37		1.7	ppb v/v	4.16		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	170		6.6	ug/m3	4.16		TO-15	Total/NA
Tetrachloroethene	1000		11	ug/m3	4.16		TO-15	Total/NA
Trichloroethene	200		8.9	ug/m3	4.16		TO-15	Total/NA

Client Sample ID: VW-05-85-VPT-042114 — Lab Sample ID: 320-7188-13

This Detection Summary does not include radiochemical test results.

Client Sample ID: VW-05-85-VPT-042114 (Continued) — Lab Sample ID: 320-7188-13

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1800		29	ppb v/v	73.4		TO-15	Total/NA
Tetrachloroethene	550		29	ppb v/v	73.4		TO-15	Total/NA
Trichloroethene	980		29	ppb v/v	73.4		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	7100		120	ug/m3	73.4		TO-15	Total/NA
Tetrachloroethene	3700		200	ug/m3	73.4		TO-15	Total/NA
Trichloroethene	5300		160	ug/m3	73.4		TO-15	Total/NA

Client Sample ID: VW-06-05-VPT-042114 — Lab Sample ID: 320-7188-14

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	0.87		0.40	ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	5.9		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-06-30-VPT-042114 — Lab Sample ID: 320-7188-15

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	10		0.40	ppb v/v	1		TO-15	Total/NA
Trichloroethene	0.42		0.40	ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	68		2.7	ug/m3	1		TO-15	Total/NA
Trichloroethene	2.3		2.1	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-06-55-VPT-042114 — Lab Sample ID: 320-7188-16

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	0.47		0.40	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	14		0.40	ppb v/v	1		TO-15	Total/NA
Trichloroethene	1.1		0.40	ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1.9		1.6	ug/m3	1		TO-15	Total/NA
Tetrachloroethene	95		2.7	ug/m3	1		TO-15	Total/NA
Trichloroethene	5.8		2.1	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-06-85-VPT-042114 — Lab Sample ID: 320-7188-17

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	46		0.40	ppb v/v	1		TO-15	Total/NA
trans-1,2-Dichloroethene	1.2		0.40	ppb v/v	1		TO-15	Total/NA
Vinyl chloride	1.4		0.40	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene - DL	69		2.4	ppb v/v	5.9		TO-15	Total/NA
Trichloroethene - DL	140		2.4	ppb v/v	5.9		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	180		1.6	ug/m3	1		TO-15	Total/NA
trans-1,2-Dichloroethene	4.6		1.6	ug/m3	1		TO-15	Total/NA
Vinyl chloride	3.5		1.0	ug/m3	1		TO-15	Total/NA
Tetrachloroethene - DL	470		16	ug/m3	5.9		TO-15	Total/NA
Trichloroethene - DL	730		13	ug/m3	5.9		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Detection Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Client Sample ID: VW-01-05-VPT-042214 — Lab Sample ID: 320-7188-18

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	130		1.7	ppb v/v	4.16		TO-15	Total/NA
Analyte	**Result**	**Qualifier**	**RL**	**Unit**	**Dil Fac**	**D**	**Method**	**Prep Type**
Tetrachloroethene	850		11	ug/m3	4.16		TO-15	Total/NA

Client Sample ID: VW-01-30-VPT-042214 — Lab Sample ID: 320-7188-19

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	330		4.0	ppb v/v	9.98		TO-15	Total/NA
Analyte	**Result**	**Qualifier**	**RL**	**Unit**	**Dil Fac**	**D**	**Method**	**Prep Type**
Tetrachloroethene	2200		27	ug/m3	9.98		TO-15	Total/NA

Client Sample ID: VW-01-55-VPT-042214 — Lab Sample ID: 320-7188-20

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	8.6		1.8	ppb v/v	4.43		TO-15	Total/NA
Analyte	**Result**	**Qualifier**	**RL**	**Unit**	**Dil Fac**	**D**	**Method**	**Prep Type**
Tetrachloroethene	59		12	ug/m3	4.43		TO-15	Total/NA

Client Sample ID: VW-01-85-VPT-042214 — Lab Sample ID: 320-7188-21

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	15		0.40	ppb v/v	1		TO-15	Total/NA
Analyte	**Result**	**Qualifier**	**RL**	**Unit**	**Dil Fac**	**D**	**Method**	**Prep Type**
Tetrachloroethene	98		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-01-85-VDT-042214 — Lab Sample ID: 320-7188-22

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	12	E6	0.40	ppb v/v	1		TO-15	Total/NA
Analyte	**Result**	**Qualifier**	**RL**	**Unit**	**Dil Fac**	**D**	**Method**	**Prep Type**
Tetrachloroethene	81	E6	2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-02-05-VPT-042214 — Lab Sample ID: 320-7188-23

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	1.4		0.40	ppb v/v	1		TO-15	Total/NA
Analyte	**Result**	**Qualifier**	**RL**	**Unit**	**Dil Fac**	**D**	**Method**	**Prep Type**
Tetrachloroethene	9.5		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-02-30-VPT-042214 — Lab Sample ID: 320-7188-24

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	4.7		0.40	ppb v/v	1		TO-15	Total/NA
Analyte	**Result**	**Qualifier**	**RL**	**Unit**	**Dil Fac**	**D**	**Method**	**Prep Type**
Tetrachloroethene	32		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-02-55-VPT-042214 — Lab Sample ID: 320-7188-25

This Detection Summary does not include radiochemical test results.

Client Sample ID: VW-02-55-VPT-042214 (Continued) — Lab Sample ID: 320-7188-25

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	4.4		0.40	ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	30		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-02-85-VPT-042214 — Lab Sample ID: 320-7188-26

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	7.6		0.40	ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	52		2.7	ug/m3	1		TO-15	Total/NA

Client Sample ID: VW-07-05-VPT-042214 — Lab Sample ID: 320-7188-27

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	26		11	ppb v/v	27.9		TO-15	Total/NA
Tetrachloroethene	940		11	ppb v/v	27.9		TO-15	Total/NA
Trichloroethene	13		11	ppb v/v	27.9		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	100		44	ug/m3	27.9		TO-15	Total/NA
Tetrachloroethene	6400		76	ug/m3	27.9		TO-15	Total/NA
Trichloroethene	70		60	ug/m3	27.9		TO-15	Total/NA

Client Sample ID: VW-07-30-VPT-042214 — Lab Sample ID: 320-7188-28

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	56		44	ppb v/v	110		TO-15	Total/NA
Tetrachloroethene	2600		44	ppb v/v	110		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	220		170	ug/m3	110		TO-15	Total/NA
Tetrachloroethene	18000		300	ug/m3	110		TO-15	Total/NA

Client Sample ID: VW-07-55-VPT-042214 — Lab Sample ID: 320-7188-29

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	23000		590	ppb v/v	1470		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	160000		4000	ug/m3	1470		TO-15	Total/NA

Client Sample ID: VW-07-85-VPT-042214 — Lab Sample ID: 320-7188-30

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	11000		220	ppb v/v	556		TO-15	Total/NA
Tetrachloroethene	7900		220	ppb v/v	556		TO-15	Total/NA
Trichloroethene	10000		220	ppb v/v	556		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	44000		880	ug/m3	556		TO-15	Total/NA
Tetrachloroethene	54000		1500	ug/m3	556		TO-15	Total/NA
Trichloroethene	54000		1200	ug/m3	556		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Detection Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Client Sample ID: VML-01-190-VPT-042314 — Lab Sample ID: 320-7188-31

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	730		77	ppb v/v	193		TO-15	Total/NA
Trichloroethene	1000		77	ppb v/v	193		TO-15	Total/NA
Tetrachloroethene - DL	24000		190	ppb v/v	483		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	2900		310	ug/m3	193		TO-15	Total/NA
Trichloroethene	5500		410	ug/m3	193		TO-15	Total/NA
Tetrachloroethene - DL	160000		1300	ug/m3	483		TO-15	Total/NA

Client Sample ID: VML-01-170-VPT-042314 — Lab Sample ID: 320-7188-32

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1700		1000	ppb v/v	2620		TO-15	Total/NA
Tetrachloroethene	42000		1000	ppb v/v	2620		TO-15	Total/NA
Trichloroethene	3100		1000	ppb v/v	2620		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	6700		4200	ug/m3	2620		TO-15	Total/NA
Tetrachloroethene	290000		7100	ug/m3	2620		TO-15	Total/NA
Trichloroethene	17000		5600	ug/m3	2620		TO-15	Total/NA

Client Sample ID: VML-01-170-VDT-042314 — Lab Sample ID: 320-7188-33

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1800		1200	ppb v/v	3040		TO-15	Total/NA
Tetrachloroethene	44000		1200	ppb v/v	3040		TO-15	Total/NA
Trichloroethene	3300		1200	ppb v/v	3040		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	7200		4800	ug/m3	3040		TO-15	Total/NA
Tetrachloroethene	300000		8200	ug/m3	3040		TO-15	Total/NA
Trichloroethene	18000		6500	ug/m3	3040		TO-15	Total/NA

Client Sample ID: VML-01-150-VPT-042314 — Lab Sample ID: 320-7188-34

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	830		380	ppb v/v	961		TO-15	Total/NA
Tetrachloroethene	15000		380	ppb v/v	961		TO-15	Total/NA
Trichloroethene	830		380	ppb v/v	961		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	3300		1500	ug/m3	961		TO-15	Total/NA
Tetrachloroethene	100000		2600	ug/m3	961		TO-15	Total/NA
Trichloroethene	4400		2100	ug/m3	961		TO-15	Total/NA

Client Sample ID: VML-01-130-VPT-042314 — Lab Sample ID: 320-7188-35

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1100		11	ppb v/v	27.5		TO-15	Total/NA
Trichloroethene	68		11	ppb v/v	27.5		TO-15	Total/NA
Tetrachloroethene - DL	1200		22	ppb v/v	55.1		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	4300		44	ug/m3	27.5		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: VML-01-130-VPT-042314 (Continued) — Lab Sample ID: 320-7188-35

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Trichloroethene	360		59		ug/m3	27.5		TO-15	Total/NA
Tetrachloroethene - DL	8200		150		ug/m3	55.1		TO-15	Total/NA

Client Sample ID: VML-02-190-VPT-042314 — Lab Sample ID: 320-7188-36

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	260000		4400		ppb v/v	11000		TO-15	Total/NA
Tetrachloroethene	240000		4400		ppb v/v	11000		TO-15	Total/NA
Trichloroethene	29000		4400		ppb v/v	11000		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1000000		17000		ug/m3	11000		TO-15	Total/NA
Tetrachloroethene	1600000		30000		ug/m3	11000		TO-15	Total/NA
Trichloroethene	150000		24000		ug/m3	11000		TO-15	Total/NA

Client Sample ID: VML-02-170-VPT-042414 — Lab Sample ID: 320-7188-37

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	230000		4000		ppb v/v	10000		TO-15	Total/NA
Trichloroethene	53000		4000		ppb v/v	10000		TO-15	Total/NA
Tetrachloroethene - DL	690000		5000		ppb v/v	12500		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	910000		16000		ug/m3	10000		TO-15	Total/NA
Trichloroethene	290000		21000		ug/m3	10000		TO-15	Total/NA
Tetrachloroethene - DL	4700000		34000		ug/m3	12500		TO-15	Total/NA

Client Sample ID: VML-02-150-VPT-042414 — Lab Sample ID: 320-7188-38

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	100000		2000		ppb v/v	4950		TO-15	Total/NA
Tetrachloroethene	180000		2000		ppb v/v	4950		TO-15	Total/NA
Trichloroethene	13000		2000		ppb v/v	4950		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	400000		7900		ug/m3	4950		TO-15	Total/NA
Tetrachloroethene	1200000		13000		ug/m3	4950		TO-15	Total/NA
Trichloroethene	70000		11000		ug/m3	4950		TO-15	Total/NA

Client Sample ID: VML-02-130-VPT-042414 — Lab Sample ID: 320-7188-39

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	3400		1000		ppb v/v	2510		TO-15	Total/NA
Tetrachloroethene	36000		1000		ppb v/v	2510		TO-15	Total/NA
Trichloroethene	1900		1000		ppb v/v	2510		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	14000		4000		ug/m3	2510		TO-15	Total/NA
Tetrachloroethene	240000		6800		ug/m3	2510		TO-15	Total/NA
Trichloroethene	10000		5400		ug/m3	2510		TO-15	Total/NA

Client Sample ID: VML-02-130-VDT-042414 — Lab Sample ID: 320-7188-40

This Detection Summary does not include radiochemical test results.

Client Sample ID: VML-02-130-VDT-042414 (Continued)

Lab Sample ID: 320-7188-40

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	160		110		ppb v/v	283		TO-15	Total/NA
Tetrachloroethene	3800		110		ppb v/v	283		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	640		450		ug/m3	283		TO-15	Total/NA
Tetrachloroethene	26000		770		ug/m3	283		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: VW-03-05-VPT-042114

Lab Sample ID: 320-7188-1

Date Collected: 04/21/14 11:16
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 00:52	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 00:52	1
Tetrachloroethene	**3.2**		0.40	ppb v/v			05/07/14 00:52	1
Trichloroethene	ND		0.40	ppb v/v			05/07/14 00:52	1
Vinyl chloride	ND		0.40	ppb v/v			05/07/14 00:52	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 00:52	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 00:52	1
Tetrachloroethene	**22**		2.7	ug/m3			05/07/14 00:52	1
Trichloroethene	ND		2.1	ug/m3			05/07/14 00:52	1
Vinyl chloride	ND		1.0	ug/m3			05/07/14 00:52	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*		*05/07/14 00:52*	*1*
1,2-Dichloroethane-d4 (Surr)	*91*		*70 - 130*		*05/07/14 00:52*	*1*
Toluene-d8 (Surr)	*100*		*70 - 130*		*05/07/14 00:52*	*1*

Client Sample ID: VW-03-30-VPT-042114

Lab Sample ID: 320-7188-2

Date Collected: 04/21/14 11:07
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 01:50	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 01:50	1
Tetrachloroethene	**1.3**		0.40	ppb v/v			05/07/14 01:50	1
Trichloroethene	ND		0.40	ppb v/v			05/07/14 01:50	1
Vinyl chloride	ND		0.40	ppb v/v			05/07/14 01:50	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 01:50	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 01:50	1
Tetrachloroethene	**9.1**		2.7	ug/m3			05/07/14 01:50	1
Trichloroethene	ND		2.1	ug/m3			05/07/14 01:50	1
Vinyl chloride	ND		1.0	ug/m3			05/07/14 01:50	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*101*		*70 - 130*		*05/07/14 01:50*	*1*
1,2-Dichloroethane-d4 (Surr)	*89*		*70 - 130*		*05/07/14 01:50*	*1*
Toluene-d8 (Surr)	*100*		*70 - 130*		*05/07/14 01:50*	*1*

Client Sample ID: VW-03-55-VPT-042114

Lab Sample ID: 320-7188-3

Date Collected: 04/21/14 10:56
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 02:45	1

Client Sample ID: VW-03-55-VPT-042114 — Lab Sample ID: 320-7188-3

Date Collected: 04/21/14 10:56 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 02:45	1
Tetrachloroethene	**2.7**		0.40	ppb v/v			05/07/14 02:45	1
Trichloroethene	ND		0.40	ppb v/v			05/07/14 02:45	1
Vinyl chloride	ND		0.40	ppb v/v			05/07/14 02:45	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 02:45	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 02:45	1
Tetrachloroethene	**19**		2.7	ug/m3			05/07/14 02:45	1
Trichloroethene	ND		2.1	ug/m3			05/07/14 02:45	1
Vinyl chloride	ND		1.0	ug/m3			05/07/14 02:45	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*103*		*70 - 130*		*05/07/14 02:45*	*1*
1,2-Dichloroethane-d4 (Surr)	*88*		*70 - 130*		*05/07/14 02:45*	*1*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/07/14 02:45*	*1*

Client Sample ID: VW-03-85-VPT-042114 — Lab Sample ID: 320-7188-4

Date Collected: 04/21/14 10:41 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 03:41	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 03:41	1
Tetrachloroethene	**1.6**		0.40	ppb v/v			05/07/14 03:41	1
Trichloroethene	ND		0.40	ppb v/v			05/07/14 03:41	1
Vinyl chloride	ND		0.40	ppb v/v			05/07/14 03:41	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 03:41	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 03:41	1
Tetrachloroethene	**11**		2.7	ug/m3			05/07/14 03:41	1
Trichloroethene	ND		2.1	ug/m3			05/07/14 03:41	1
Vinyl chloride	ND		1.0	ug/m3			05/07/14 03:41	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*94*		*70 - 130*		*05/07/14 03:41*	*1*
1,2-Dichloroethane-d4 (Surr)	*87*		*70 - 130*		*05/07/14 03:41*	*1*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/07/14 03:41*	*1*

Client Sample ID: VW-04-05-VPT-042114 — Lab Sample ID: 320-7188-5

Date Collected: 04/21/14 14:05 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 04:38	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 04:38	1

Client Sample ID: VW-04-05-VPT-042114 — Lab Sample ID: 320-7188-5

Date Collected: 04/21/14 14:05
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	**56**		0.40	ppb v/v			05/07/14 04:38	1
Trichloroethene	ND		0.40	ppb v/v			05/07/14 04:38	1
Vinyl chloride	ND		0.40	ppb v/v			05/07/14 04:38	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 04:38	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 04:38	1
Tetrachloroethene	**380**		2.7	ug/m3			05/07/14 04:38	1
Trichloroethene	ND		2.1	ug/m3			05/07/14 04:38	1
Vinyl chloride	ND		1.0	ug/m3			05/07/14 04:38	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*98*		*70 - 130*		*05/07/14 04:38*	*1*
1,2-Dichloroethane-d4 (Surr)	*88*		*70 - 130*		*05/07/14 04:38*	*1*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/07/14 04:38*	*1*

Client Sample ID: VW-04-30-VPT-042114 — Lab Sample ID: 320-7188-6

Date Collected: 04/21/14 13:41
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		2.4	ppb v/v			05/07/14 05:29	5.98
trans-1,2-Dichloroethene	ND		2.4	ppb v/v			05/07/14 05:29	5.98
Tetrachloroethene	**130**		2.4	ppb v/v			05/07/14 05:29	5.98
Trichloroethene	ND		2.4	ppb v/v			05/07/14 05:29	5.98
Vinyl chloride	ND		2.4	ppb v/v			05/07/14 05:29	5.98

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		9.5	ug/m3			05/07/14 05:29	5.98
trans-1,2-Dichloroethene	ND		9.5	ug/m3			05/07/14 05:29	5.98
Tetrachloroethene	**900**		16	ug/m3			05/07/14 05:29	5.98
Trichloroethene	ND		13	ug/m3			05/07/14 05:29	5.98
Vinyl chloride	ND		6.1	ug/m3			05/07/14 05:29	5.98

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*92*		*70 - 130*		*05/07/14 05:29*	*5.98*
1,2-Dichloroethane-d4 (Surr)	*88*		*70 - 130*		*05/07/14 05:29*	*5.98*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/07/14 05:29*	*5.98*

Client Sample ID: VW-04-55-VPT-042114 — Lab Sample ID: 320-7188-7

Date Collected: 04/21/14 13:29
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		2.0	ppb v/v			05/07/14 06:19	4.93
trans-1,2-Dichloroethene	ND		2.0	ppb v/v			05/07/14 06:19	4.93
Tetrachloroethene	**120**		2.0	ppb v/v			05/07/14 06:19	4.93

Client Sample ID: VW-04-55-VPT-042114 — Lab Sample ID: 320-7188-7

Date Collected: 04/21/14 13:29 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethene	ND		2.0	ppb v/v			05/07/14 06:19	4.93
Vinyl chloride	ND		2.0	ppb v/v			05/07/14 06:19	4.93

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		7.8	ug/m3			05/07/14 06:19	4.93
trans-1,2-Dichloroethene	ND		7.8	ug/m3			05/07/14 06:19	4.93
Tetrachloroethene	**820**		13	ug/m3			05/07/14 06:19	4.93
Trichloroethene	ND		11	ug/m3			05/07/14 06:19	4.93
Vinyl chloride	ND		5.0	ug/m3			05/07/14 06:19	4.93

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*92*		*70 - 130*		*05/07/14 06:19*	*4.93*
1,2-Dichloroethane-d4 (Surr)	*89*		*70 - 130*		*05/07/14 06:19*	*4.93*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/07/14 06:19*	*4.93*

Client Sample ID: VW-04-85-VPT-042114 — Lab Sample ID: 320-7188-8

Date Collected: 04/21/14 13:11 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**300**		3.3	ppb v/v			05/07/14 07:09	8.31
trans-1,2-Dichloroethene	ND		3.3	ppb v/v			05/07/14 07:09	8.31
Tetrachloroethene	**90**		3.3	ppb v/v			05/07/14 07:09	8.31
Trichloroethene	**24**		3.3	ppb v/v			05/07/14 07:09	8.31
Vinyl chloride	ND		3.3	ppb v/v			05/07/14 07:09	8.31

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**1200**		13	ug/m3			05/07/14 07:09	8.31
trans-1,2-Dichloroethene	ND		13	ug/m3			05/07/14 07:09	8.31
Tetrachloroethene	**610**		23	ug/m3			05/07/14 07:09	8.31
Trichloroethene	**130**		18	ug/m3			05/07/14 07:09	8.31
Vinyl chloride	ND		8.5	ug/m3			05/07/14 07:09	8.31

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*91*		*70 - 130*		*05/07/14 07:09*	*8.31*
1,2-Dichloroethane-d4 (Surr)	*90*		*70 - 130*		*05/07/14 07:09*	*8.31*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/07/14 07:09*	*8.31*

Client Sample ID: VW-04-85-VDT-042114 — Lab Sample ID: 320-7188-9

Date Collected: 04/21/14 13:17 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**170**		2.3	ppb v/v			05/07/14 08:01	5.73
trans-1,2-Dichloroethene	ND		2.3	ppb v/v			05/07/14 08:01	5.73
Tetrachloroethene	**130**		2.3	ppb v/v			05/07/14 08:01	5.73
Trichloroethene	**19**		2.3	ppb v/v			05/07/14 08:01	5.73

Client Sample ID: VW-04-85-VDT-042114 — Lab Sample ID: 320-7188-9

Date Collected: 04/21/14 13:17 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Vinyl chloride	ND		2.3	ppb v/v			05/07/14 08:01	5.73

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**680**		9.1	ug/m3			05/07/14 08:01	5.73
trans-1,2-Dichloroethene	ND		9.1	ug/m3			05/07/14 08:01	5.73
Tetrachloroethene	**860**		16	ug/m3			05/07/14 08:01	5.73
Trichloroethene	**100**		12	ug/m3			05/07/14 08:01	5.73
Vinyl chloride	ND		5.9	ug/m3			05/07/14 08:01	5.73

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*98*		*70 - 130*		*05/07/14 08:01*	*5.73*
1,2-Dichloroethane-d4 (Surr)	*90*		*70 - 130*		*05/07/14 08:01*	*5.73*
Toluene-d8 (Surr)	*100*		*70 - 130*		*05/07/14 08:01*	*5.73*

Client Sample ID: VW-05-05-VPT-042114 — Lab Sample ID: 320-7188-10

Date Collected: 04/21/14 15:43 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 08:57	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/07/14 08:57	1
Tetrachloroethene	**27**		0.40	ppb v/v			05/07/14 08:57	1
Trichloroethene	ND		0.40	ppb v/v			05/07/14 08:57	1
Vinyl chloride	ND		0.40	ppb v/v			05/07/14 08:57	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 08:57	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/07/14 08:57	1
Tetrachloroethene	**190**		2.7	ug/m3			05/07/14 08:57	1
Trichloroethene	ND		2.1	ug/m3			05/07/14 08:57	1
Vinyl chloride	ND		1.0	ug/m3			05/07/14 08:57	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*98*		*70 - 130*		*05/07/14 08:57*	*1*
1,2-Dichloroethane-d4 (Surr)	*90*		*70 - 130*		*05/07/14 08:57*	*1*
Toluene-d8 (Surr)	*101*		*70 - 130*		*05/07/14 08:57*	*1*

Client Sample ID: VW-05-30-VPT-042114 — Lab Sample ID: 320-7188-11

Date Collected: 04/21/14 15:26 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		12	ppb v/v			05/07/14 09:46	29.3
trans-1,2-Dichloroethene	ND		12	ppb v/v			05/07/14 09:46	29.3
Tetrachloroethene	**850**		12	ppb v/v			05/07/14 09:46	29.3
Trichloroethene	**12**		12	ppb v/v			05/07/14 09:46	29.3
Vinyl chloride	ND		12	ppb v/v			05/07/14 09:46	29.3

Client Sample ID: VW-05-30-VPT-042114 — Lab Sample ID: 320-7188-11

Date Collected: 04/21/14 15:26 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		46	ug/m3			05/07/14 09:46	29.3
trans-1,2-Dichloroethene	ND		46	ug/m3			05/07/14 09:46	29.3
Tetrachloroethene	**5700**		79	ug/m3			05/07/14 09:46	29.3
Trichloroethene	**62**		63	ug/m3			05/07/14 09:46	29.3
Vinyl chloride	ND		30	ug/m3			05/07/14 09:46	29.3

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*92*		*70 - 130*		*05/07/14 09:46*	*29.3*
1,2-Dichloroethane-d4 (Surr)	*90*		*70 - 130*		*05/07/14 09:46*	*29.3*
Toluene-d8 (Surr)	*102*		*70 - 130*		*05/07/14 09:46*	*29.3*

Client Sample ID: VW-05-55-VPT-042114 — Lab Sample ID: 320-7188-12

Date Collected: 04/21/14 15:16 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**44**		1.7	ppb v/v			05/08/14 00:37	4.16
trans-1,2-Dichloroethene	ND		1.7	ppb v/v			05/08/14 00:37	4.16
Tetrachloroethene	**150**		1.7	ppb v/v			05/08/14 00:37	4.16
Trichloroethene	**37**		1.7	ppb v/v			05/08/14 00:37	4.16
Vinyl chloride	ND		1.7	ppb v/v			05/08/14 00:37	4.16

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**170**		6.6	ug/m3			05/08/14 00:37	4.16
trans-1,2-Dichloroethene	ND		6.6	ug/m3			05/08/14 00:37	4.16
Tetrachloroethene	**1000**		11	ug/m3			05/08/14 00:37	4.16
Trichloroethene	**200**		8.9	ug/m3			05/08/14 00:37	4.16
Vinyl chloride	ND		4.3	ug/m3			05/08/14 00:37	4.16

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*92*		*70 - 130*		*05/08/14 00:37*	*4.16*
1,2-Dichloroethane-d4 (Surr)	*93*		*70 - 130*		*05/08/14 00:37*	*4.16*
Toluene-d8 (Surr)	*100*		*70 - 130*		*05/08/14 00:37*	*4.16*

Client Sample ID: VW-05-85-VPT-042114 — Lab Sample ID: 320-7188-13

Date Collected: 04/21/14 14:57 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**1800**		29	ppb v/v			05/08/14 01:28	73.4
trans-1,2-Dichloroethene	ND		29	ppb v/v			05/08/14 01:28	73.4
Tetrachloroethene	**550**		29	ppb v/v			05/08/14 01:28	73.4
Trichloroethene	**980**		29	ppb v/v			05/08/14 01:28	73.4
Vinyl chloride	ND		29	ppb v/v			05/08/14 01:28	73.4

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**7100**		120	ug/m3			05/08/14 01:28	73.4
trans-1,2-Dichloroethene	ND		120	ug/m3			05/08/14 01:28	73.4

Client Sample ID: VW-05-85-VPT-042114 — Lab Sample ID: 320-7188-13

Date Collected: 04/21/14 14:57
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	**3700**		200	ug/m3			05/08/14 01:28	73.4
Trichloroethene	**5300**		160	ug/m3			05/08/14 01:28	73.4
Vinyl chloride	ND		75	ug/m3			05/08/14 01:28	73.4

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*99*		*70 - 130*		*05/08/14 01:28*	*73.4*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*05/08/14 01:28*	*73.4*
Toluene-d8 (Surr)	*100*		*70 - 130*		*05/08/14 01:28*	*73.4*

Client Sample ID: VW-06-05-VPT-042114 — Lab Sample ID: 320-7188-14

Date Collected: 04/21/14 10:00
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 02:25	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 02:25	1
Tetrachloroethene	**0.87**		0.40	ppb v/v			05/08/14 02:25	1
Trichloroethene	ND		0.40	ppb v/v			05/08/14 02:25	1
Vinyl chloride	ND		0.40	ppb v/v			05/08/14 02:25	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 02:25	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 02:25	1
Tetrachloroethene	**5.9**		2.7	ug/m3			05/08/14 02:25	1
Trichloroethene	ND		2.1	ug/m3			05/08/14 02:25	1
Vinyl chloride	ND		1.0	ug/m3			05/08/14 02:25	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*101*		*70 - 130*		*05/08/14 02:25*	*1*
1,2-Dichloroethane-d4 (Surr)	*90*		*70 - 130*		*05/08/14 02:25*	*1*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/08/14 02:25*	*1*

Client Sample ID: VW-06-30-VPT-042114 — Lab Sample ID: 320-7188-15

Date Collected: 04/21/14 09:52
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 11:23	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 11:23	1
Tetrachloroethene	**10**		0.40	ppb v/v			05/08/14 11:23	1
Trichloroethene	**0.42**		0.40	ppb v/v			05/08/14 11:23	1
Vinyl chloride	ND		0.40	ppb v/v			05/08/14 11:23	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 11:23	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 11:23	1
Tetrachloroethene	**68**		2.7	ug/m3			05/08/14 11:23	1

Client Sample ID: VW-06-30-VPT-042114

Lab Sample ID: 320-7188-15

Date Collected: 04/21/14 09:52
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethene	2.3		2.1	ug/m3			05/08/14 11:23	1
Vinyl chloride	ND		1.0	ug/m3			05/08/14 11:23	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*05/08/14 11:23*	*1*
1,2-Dichloroethane-d4 (Surr)	*90*		*70 - 130*		*05/08/14 11:23*	*1*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/08/14 11:23*	*1*

Client Sample ID: VW-06-55-VPT-042114

Lab Sample ID: 320-7188-16

Date Collected: 04/21/14 09:41
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	0.47		0.40	ppb v/v			05/08/14 04:10	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 04:10	1
Tetrachloroethene	14		0.40	ppb v/v			05/08/14 04:10	1
Trichloroethene	1.1		0.40	ppb v/v			05/08/14 04:10	1
Vinyl chloride	ND		0.40	ppb v/v			05/08/14 04:10	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	1.9		1.6	ug/m3			05/08/14 04:10	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 04:10	1
Tetrachloroethene	95		2.7	ug/m3			05/08/14 04:10	1
Trichloroethene	5.8		2.1	ug/m3			05/08/14 04:10	1
Vinyl chloride	ND		1.0	ug/m3			05/08/14 04:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*98*		*70 - 130*		*05/08/14 04:10*	*1*
1,2-Dichloroethane-d4 (Surr)	*91*		*70 - 130*		*05/08/14 04:10*	*1*
Toluene-d8 (Surr)	*101*		*70 - 130*		*05/08/14 04:10*	*1*

Client Sample ID: VW-06-85-VPT-042114

Lab Sample ID: 320-7188-17

Date Collected: 04/21/14 09:28
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	46		0.40	ppb v/v			05/08/14 05:05	1
trans-1,2-Dichloroethene	1.2		0.40	ppb v/v			05/08/14 05:05	1
Vinyl chloride	1.4		0.40	ppb v/v			05/08/14 05:05	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	180		1.6	ug/m3			05/08/14 05:05	1
trans-1,2-Dichloroethene	4.6		1.6	ug/m3			05/08/14 05:05	1
Vinyl chloride	3.5		1.0	ug/m3			05/08/14 05:05	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*94*		*70 - 130*		*05/08/14 05:05*	*1*

Client Sample ID: VW-06-85-VPT-042114 — Lab Sample ID: 320-7188-17

Date Collected: 04/21/14 09:28 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	91		70 - 130		05/08/14 05:05	1
Toluene-d8 (Surr)	99		70 - 130		05/08/14 05:05	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	**69**		2.4	ppb v/v			05/13/14 09:45	5.9
Trichloroethene	**140**		2.4	ppb v/v			05/13/14 09:45	5.9

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	**470**		16	ug/m3			05/13/14 09:45	5.9
Trichloroethene	**730**		13	ug/m3			05/13/14 09:45	5.9

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	96		70 - 130		05/13/14 09:45	5.9
1,2-Dichloroethane-d4 (Surr)	95		70 - 130		05/13/14 09:45	5.9
Toluene-d8 (Surr)	99		70 - 130		05/13/14 09:45	5.9

Client Sample ID: VW-01-05-VPT-042214 — Lab Sample ID: 320-7188-18

Date Collected: 04/22/14 17:14 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.7	ppb v/v			05/08/14 05:56	4.16
trans-1,2-Dichloroethene	ND		1.7	ppb v/v			05/08/14 05:56	4.16
Tetrachloroethene	**130**		1.7	ppb v/v			05/08/14 05:56	4.16
Trichloroethene	ND		1.7	ppb v/v			05/08/14 05:56	4.16
Vinyl chloride	ND		1.7	ppb v/v			05/08/14 05:56	4.16

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		6.6	ug/m3			05/08/14 05:56	4.16
trans-1,2-Dichloroethene	ND		6.6	ug/m3			05/08/14 05:56	4.16
Tetrachloroethene	**850**		11	ug/m3			05/08/14 05:56	4.16
Trichloroethene	ND		8.9	ug/m3			05/08/14 05:56	4.16
Vinyl chloride	ND		4.3	ug/m3			05/08/14 05:56	4.16

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	94		70 - 130		05/08/14 05:56	4.16
1,2-Dichloroethane-d4 (Surr)	91		70 - 130		05/08/14 05:56	4.16
Toluene-d8 (Surr)	99		70 - 130		05/08/14 05:56	4.16

Client Sample ID: VW-01-30-VPT-042214 — Lab Sample ID: 320-7188-19

Date Collected: 04/22/14 17:02 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		4.0	ppb v/v			05/08/14 06:47	9.98
trans-1,2-Dichloroethene	ND		4.0	ppb v/v			05/08/14 06:47	9.98

Client Sample ID: VW-01-30-VPT-042214 — Lab Sample ID: 320-7188-19

Date Collected: 04/22/14 17:02 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	**330**		4.0	ppb v/v			05/08/14 06:47	9.98
Trichloroethene	ND		4.0	ppb v/v			05/08/14 06:47	9.98
Vinyl chloride	ND		4.0	ppb v/v			05/08/14 06:47	9.98

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		16	ug/m3			05/08/14 06:47	9.98
trans-1,2-Dichloroethene	ND		16	ug/m3			05/08/14 06:47	9.98
Tetrachloroethene	**2200**		27	ug/m3			05/08/14 06:47	9.98
Trichloroethene	ND		21	ug/m3			05/08/14 06:47	9.98
Vinyl chloride	ND		10	ug/m3			05/08/14 06:47	9.98

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*91*		*70 - 130*		*05/08/14 06:47*	*9.98*
1,2-Dichloroethane-d4 (Surr)	*91*		*70 - 130*		*05/08/14 06:47*	*9.98*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/08/14 06:47*	*9.98*

Client Sample ID: VW-01-55-VPT-042214 — Lab Sample ID: 320-7188-20

Date Collected: 04/22/14 16:48 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.8	ppb v/v			05/08/14 19:14	4.43
trans-1,2-Dichloroethene	ND		1.8	ppb v/v			05/08/14 19:14	4.43
Tetrachloroethene	**8.6**		1.8	ppb v/v			05/08/14 19:14	4.43
Trichloroethene	ND		1.8	ppb v/v			05/08/14 19:14	4.43
Vinyl chloride	ND		1.8	ppb v/v			05/08/14 19:14	4.43

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		7.0	ug/m3			05/08/14 19:14	4.43
trans-1,2-Dichloroethene	ND		7.0	ug/m3			05/08/14 19:14	4.43
Tetrachloroethene	**59**		12	ug/m3			05/08/14 19:14	4.43
Trichloroethene	ND		9.5	ug/m3			05/08/14 19:14	4.43
Vinyl chloride	ND		4.5	ug/m3			05/08/14 19:14	4.43

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*05/08/14 19:14*	*4.43*
1,2-Dichloroethane-d4 (Surr)	*91*		*70 - 130*		*05/08/14 19:14*	*4.43*
Toluene-d8 (Surr)	*98*		*70 - 130*		*05/08/14 19:14*	*4.43*

Client Sample ID: VW-01-85-VPT-042214 — Lab Sample ID: 320-7188-21

Date Collected: 04/22/14 16:26 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 08:35	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 08:35	1
Tetrachloroethene	**15**		0.40	ppb v/v			05/08/14 08:35	1

Client Sample ID: VW-01-85-VPT-042214 — Lab Sample ID: 320-7188-21

Date Collected: 04/22/14 16:26 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethene	ND		0.40	ppb v/v			05/08/14 08:35	1
Vinyl chloride	ND		0.40	ppb v/v			05/08/14 08:35	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 08:35	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 08:35	1
Tetrachloroethene	**98**		2.7	ug/m3			05/08/14 08:35	1
Trichloroethene	ND		2.1	ug/m3			05/08/14 08:35	1
Vinyl chloride	ND		1.0	ug/m3			05/08/14 08:35	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*92*		*70 - 130*		*05/08/14 08:35*	*1*
1,2-Dichloroethane-d4 (Surr)	*157*	*X*	*70 - 130*		*05/08/14 08:35*	*1*
Toluene-d8 (Surr)	*109*		*70 - 130*		*05/08/14 08:35*	*1*

Client Sample ID: VW-01-85-VDT-042214 — Lab Sample ID: 320-7188-22

Date Collected: 04/22/14 16:33 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 09:29	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 09:29	1
Tetrachloroethene	**12**	**E6**	0.40	ppb v/v			05/08/14 09:29	1
Trichloroethene	ND		0.40	ppb v/v			05/08/14 09:29	1
Vinyl chloride	ND		0.40	ppb v/v			05/08/14 09:29	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 09:29	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 09:29	1
Tetrachloroethene	**81**	**E6**	2.7	ug/m3			05/08/14 09:29	1
Trichloroethene	ND		2.1	ug/m3			05/08/14 09:29	1
Vinyl chloride	ND		1.0	ug/m3			05/08/14 09:29	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*112*	*E6*	*70 - 130*		*05/08/14 09:29*	*1*
4-Bromofluorobenzene (Surr)	*105*	*E6*	*70 - 130*		*05/09/14 12:41*	*1.51*
1,2-Dichloroethane-d4 (Surr)	*143*	*X*	*70 - 130*		*05/08/14 09:29*	*1*
1,2-Dichloroethane-d4 (Surr)	*134*	*X*	*70 - 130*		*05/09/14 12:41*	*1.51*
Toluene-d8 (Surr)	*109*		*70 - 130*		*05/08/14 09:29*	*1*
Toluene-d8 (Surr)	*108*		*70 - 130*		*05/09/14 12:41*	*1.51*

Client Sample ID: VW-02-05-VPT-042214 — Lab Sample ID: 320-7188-23

Date Collected: 04/22/14 11:08 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 20:10	1

Client Sample ID: VW-02-05-VPT-042214 — Lab Sample ID: 320-7188-23

Date Collected: 04/22/14 11:08 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 20:10	1
Tetrachloroethene	**1.4**		0.40	ppb v/v			05/08/14 20:10	1
Trichloroethene	ND		0.40	ppb v/v			05/08/14 20:10	1
Vinyl chloride	ND		0.40	ppb v/v			05/08/14 20:10	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 20:10	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 20:10	1
Tetrachloroethene	**9.5**		2.7	ug/m3			05/08/14 20:10	1
Trichloroethene	ND		2.1	ug/m3			05/08/14 20:10	1
Vinyl chloride	ND		1.0	ug/m3			05/08/14 20:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*05/08/14 20:10*	*1*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*05/08/14 20:10*	*1*
Toluene-d8 (Surr)	*101*		*70 - 130*		*05/08/14 20:10*	*1*

Client Sample ID: VW-02-30-VPT-042214 — Lab Sample ID: 320-7188-24

Date Collected: 04/22/14 10:58 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 21:07	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 21:07	1
Tetrachloroethene	**4.7**		0.40	ppb v/v			05/08/14 21:07	1
Trichloroethene	ND		0.40	ppb v/v			05/08/14 21:07	1
Vinyl chloride	ND		0.40	ppb v/v			05/08/14 21:07	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 21:07	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 21:07	1
Tetrachloroethene	**32**		2.7	ug/m3			05/08/14 21:07	1
Trichloroethene	ND		2.1	ug/m3			05/08/14 21:07	1
Vinyl chloride	ND		1.0	ug/m3			05/08/14 21:07	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*05/08/14 21:07*	*1*
1,2-Dichloroethane-d4 (Surr)	*93*		*70 - 130*		*05/08/14 21:07*	*1*
Toluene-d8 (Surr)	*98*		*70 - 130*		*05/08/14 21:07*	*1*

Client Sample ID: VW-02-55-VPT-042214 — Lab Sample ID: 320-7188-25

Date Collected: 04/22/14 10:38 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 23:06	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 23:06	1

Client Sample ID: VW-02-55-VPT-042214 — Lab Sample ID: 320-7188-25

Date Collected: 04/22/14 10:38 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	**4.4**		0.40	ppb v/v			05/08/14 23:06	1
Trichloroethene	ND		0.40	ppb v/v			05/08/14 23:06	1
Vinyl chloride	ND		0.40	ppb v/v			05/08/14 23:06	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 23:06	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/08/14 23:06	1
Tetrachloroethene	**30**		2.7	ug/m3			05/08/14 23:06	1
Trichloroethene	ND		2.1	ug/m3			05/08/14 23:06	1
Vinyl chloride	ND		1.0	ug/m3			05/08/14 23:06	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*94*		*70 - 130*		*05/08/14 23:06*	*1*
1,2-Dichloroethane-d4 (Surr)	*91*		*70 - 130*		*05/08/14 23:06*	*1*
Toluene-d8 (Surr)	*98*		*70 - 130*		*05/08/14 23:06*	*1*

Client Sample ID: VW-02-85-VPT-042214 — Lab Sample ID: 320-7188-26

Date Collected: 04/22/14 10:27 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/09/14 00:00	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/09/14 00:00	1
Tetrachloroethene	**7.6**		0.40	ppb v/v			05/09/14 00:00	1
Trichloroethene	ND		0.40	ppb v/v			05/09/14 00:00	1
Vinyl chloride	ND		0.40	ppb v/v			05/09/14 00:00	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			05/09/14 00:00	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			05/09/14 00:00	1
Tetrachloroethene	**52**		2.7	ug/m3			05/09/14 00:00	1
Trichloroethene	ND		2.1	ug/m3			05/09/14 00:00	1
Vinyl chloride	ND		1.0	ug/m3			05/09/14 00:00	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*98*		*70 - 130*		*05/09/14 00:00*	*1*
1,2-Dichloroethane-d4 (Surr)	*90*		*70 - 130*		*05/09/14 00:00*	*1*
Toluene-d8 (Surr)	*98*		*70 - 130*		*05/09/14 00:00*	*1*

Client Sample ID: VW-07-05-VPT-042214 — Lab Sample ID: 320-7188-27

Date Collected: 04/22/14 15:38 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**26**		11	ppb v/v			05/09/14 00:50	27.9
trans-1,2-Dichloroethene	ND		11	ppb v/v			05/09/14 00:50	27.9
Tetrachloroethene	**940**		11	ppb v/v			05/09/14 00:50	27.9

Client Sample ID: VW-07-05-VPT-042214 — Lab Sample ID: 320-7188-27

Date Collected: 04/22/14 15:38 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethene	**13**		11	ppb v/v			05/09/14 00:50	27.9
Vinyl chloride	ND		11	ppb v/v			05/09/14 00:50	27.9

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**100**		44	ug/m3			05/09/14 00:50	27.9
trans-1,2-Dichloroethene	ND		44	ug/m3			05/09/14 00:50	27.9
Tetrachloroethene	**6400**		76	ug/m3			05/09/14 00:50	27.9
Trichloroethene	**70**		60	ug/m3			05/09/14 00:50	27.9
Vinyl chloride	ND		29	ug/m3			05/09/14 00:50	27.9

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*89*		*70 - 130*		*05/09/14 00:50*	*27.9*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*05/09/14 00:50*	*27.9*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/09/14 00:50*	*27.9*

Client Sample ID: VW-07-30-VPT-042214 — Lab Sample ID: 320-7188-28

Date Collected: 04/22/14 15:28 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**56**		44	ppb v/v			05/09/14 01:41	110
trans-1,2-Dichloroethene	ND		44	ppb v/v			05/09/14 01:41	110
Tetrachloroethene	**2600**		44	ppb v/v			05/09/14 01:41	110
Trichloroethene	ND		44	ppb v/v			05/09/14 01:41	110
Vinyl chloride	ND		44	ppb v/v			05/09/14 01:41	110

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**220**		170	ug/m3			05/09/14 01:41	110
trans-1,2-Dichloroethene	ND		170	ug/m3			05/09/14 01:41	110
Tetrachloroethene	**18000**		300	ug/m3			05/09/14 01:41	110
Trichloroethene	ND		240	ug/m3			05/09/14 01:41	110
Vinyl chloride	ND		110	ug/m3			05/09/14 01:41	110

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*05/09/14 01:41*	*110*
1,2-Dichloroethane-d4 (Surr)	*91*		*70 - 130*		*05/09/14 01:41*	*110*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/09/14 01:41*	*110*

Client Sample ID: VW-07-55-VPT-042214 — Lab Sample ID: 320-7188-29

Date Collected: 04/22/14 15:16 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		590	ppb v/v			05/09/14 02:31	1470
trans-1,2-Dichloroethene	ND		590	ppb v/v			05/09/14 02:31	1470
Tetrachloroethene	**23000**		590	ppb v/v			05/09/14 02:31	1470
Trichloroethene	ND		590	ppb v/v			05/09/14 02:31	1470

Client Sample ID: VW-07-55-VPT-042214 — Lab Sample ID: 320-7188-29

Date Collected: 04/22/14 15:16 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Vinyl chloride	ND		590	ppb v/v			05/09/14 02:31	1470

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		2300	ug/m3			05/09/14 02:31	1470
trans-1,2-Dichloroethene	ND		2300	ug/m3			05/09/14 02:31	1470
Tetrachloroethene	**160000**		4000	ug/m3			05/09/14 02:31	1470
Trichloroethene	ND		3200	ug/m3			05/09/14 02:31	1470
Vinyl chloride	ND		1500	ug/m3			05/09/14 02:31	1470

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*05/09/14 02:31*	*1470*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*05/09/14 02:31*	*1470*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/09/14 02:31*	*1470*

Client Sample ID: VW-07-85-VPT-042214 — Lab Sample ID: 320-7188-30

Date Collected: 04/22/14 15:01 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**11000**		220	ppb v/v			05/09/14 03:20	556
trans-1,2-Dichloroethene	ND		220	ppb v/v			05/09/14 03:20	556
Tetrachloroethene	**7900**		220	ppb v/v			05/09/14 03:20	556
Trichloroethene	**10000**		220	ppb v/v			05/09/14 03:20	556
Vinyl chloride	ND		220	ppb v/v			05/09/14 03:20	556

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**44000**		880	ug/m3			05/09/14 03:20	556
trans-1,2-Dichloroethene	ND		880	ug/m3			05/09/14 03:20	556
Tetrachloroethene	**54000**		1500	ug/m3			05/09/14 03:20	556
Trichloroethene	**54000**		1200	ug/m3			05/09/14 03:20	556
Vinyl chloride	ND		570	ug/m3			05/09/14 03:20	556

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*95*		*70 - 130*		*05/09/14 03:20*	*556*
1,2-Dichloroethane-d4 (Surr)	*93*		*70 - 130*		*05/09/14 03:20*	*556*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/09/14 03:20*	*556*

Client Sample ID: VML-01-190-VPT-042314 — Lab Sample ID: 320-7188-31

Date Collected: 04/23/14 09:43 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**730**		77	ppb v/v			05/09/14 04:11	193
trans-1,2-Dichloroethene	ND		77	ppb v/v			05/09/14 04:11	193
Trichloroethene	**1000**		77	ppb v/v			05/09/14 04:11	193
Vinyl chloride	ND		77	ppb v/v			05/09/14 04:11	193

Client Sample ID: VML-01-190-VPT-042314

Lab Sample ID: 320-7188-31

Date Collected: 04/23/14 09:43
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	2900		310	ug/m3			05/09/14 04:11	193
trans-1,2-Dichloroethene	ND		310	ug/m3			05/09/14 04:11	193
Trichloroethene	5500		410	ug/m3			05/09/14 04:11	193
Vinyl chloride	ND		200	ug/m3			05/09/14 04:11	193

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*05/09/14 04:11*	*193*
1,2-Dichloroethane-d4 (Surr)	*91*		*70 - 130*		*05/09/14 04:11*	*193*
Toluene-d8 (Surr)	*96*		*70 - 130*		*05/09/14 04:11*	*193*

Method: TO-15 - Volatile Organic Compounds in Ambient Air - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	24000		190	ppb v/v			05/13/14 04:36	483

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	160000		1300	ug/m3			05/13/14 04:36	483

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*101*		*70 - 130*		*05/13/14 04:36*	*483*
1,2-Dichloroethane-d4 (Surr)	*95*		*70 - 130*		*05/13/14 04:36*	*483*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/13/14 04:36*	*483*

Client Sample ID: VML-01-170-VPT-042314

Lab Sample ID: 320-7188-32

Date Collected: 04/23/14 10:22
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	1700		1000	ppb v/v			05/09/14 05:01	2620
trans-1,2-Dichloroethene	ND		1000	ppb v/v			05/09/14 05:01	2620
Tetrachloroethene	42000		1000	ppb v/v			05/09/14 05:01	2620
Trichloroethene	3100		1000	ppb v/v			05/09/14 05:01	2620
Vinyl chloride	ND		1000	ppb v/v			05/09/14 05:01	2620

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	6700		4200	ug/m3			05/09/14 05:01	2620
trans-1,2-Dichloroethene	ND		4200	ug/m3			05/09/14 05:01	2620
Tetrachloroethene	290000		7100	ug/m3			05/09/14 05:01	2620
Trichloroethene	17000		5600	ug/m3			05/09/14 05:01	2620
Vinyl chloride	ND		2700	ug/m3			05/09/14 05:01	2620

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*05/09/14 05:01*	*2620*
1,2-Dichloroethane-d4 (Surr)	*91*		*70 - 130*		*05/09/14 05:01*	*2620*
Toluene-d8 (Surr)	*97*		*70 - 130*		*05/09/14 05:01*	*2620*

Client Sample ID: VML-01-170-VDT-042314 — Lab Sample ID: 320-7188-33

Date Collected: 04/23/14 10:27 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	1800		1200	ppb v/v			05/09/14 05:51	3040
trans-1,2-Dichloroethene	ND		1200	ppb v/v			05/09/14 05:51	3040
Tetrachloroethene	44000		1200	ppb v/v			05/09/14 05:51	3040
Trichloroethene	3300		1200	ppb v/v			05/09/14 05:51	3040
Vinyl chloride	ND		1200	ppb v/v			05/09/14 05:51	3040

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	7200		4800	ug/m3			05/09/14 05:51	3040
trans-1,2-Dichloroethene	ND		4800	ug/m3			05/09/14 05:51	3040
Tetrachloroethene	300000		8200	ug/m3			05/09/14 05:51	3040
Trichloroethene	18000		6500	ug/m3			05/09/14 05:51	3040
Vinyl chloride	ND		3100	ug/m3			05/09/14 05:51	3040

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*05/09/14 05:51*	*3040*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*05/09/14 05:51*	*3040*
Toluene-d8 (Surr)	*100*		*70 - 130*		*05/09/14 05:51*	*3040*

Client Sample ID: VML-01-150-VPT-042314 — Lab Sample ID: 320-7188-34

Date Collected: 04/23/14 14:43 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	830		380	ppb v/v			05/09/14 06:43	961
trans-1,2-Dichloroethene	ND		380	ppb v/v			05/09/14 06:43	961
Tetrachloroethene	15000		380	ppb v/v			05/09/14 06:43	961
Trichloroethene	830		380	ppb v/v			05/09/14 06:43	961
Vinyl chloride	ND		380	ppb v/v			05/09/14 06:43	961

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	3300		1500	ug/m3			05/09/14 06:43	961
trans-1,2-Dichloroethene	ND		1500	ug/m3			05/09/14 06:43	961
Tetrachloroethene	100000		2600	ug/m3			05/09/14 06:43	961
Trichloroethene	4400		2100	ug/m3			05/09/14 06:43	961
Vinyl chloride	ND		980	ug/m3			05/09/14 06:43	961

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*99*		*70 - 130*		*05/09/14 06:43*	*961*
1,2-Dichloroethane-d4 (Surr)	*93*		*70 - 130*		*05/09/14 06:43*	*961*
Toluene-d8 (Surr)	*100*		*70 - 130*		*05/09/14 06:43*	*961*

Client Sample ID: VML-01-130-VPT-042314 — Lab Sample ID: 320-7188-35

Date Collected: 04/23/14 15:16 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	1100		11	ppb v/v			05/09/14 07:33	27.5

Client Sample ID: VML-01-130-VPT-042314

Lab Sample ID: 320-7188-35

Date Collected: 04/23/14 15:16
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,2-Dichloroethene	ND		11	ppb v/v			05/09/14 07:33	27.5
Trichloroethene	**68**		11	ppb v/v			05/09/14 07:33	27.5
Vinyl chloride	ND		11	ppb v/v			05/09/14 07:33	27.5

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**4300**		44	ug/m3			05/09/14 07:33	27.5
trans-1,2-Dichloroethene	ND		44	ug/m3			05/09/14 07:33	27.5
Trichloroethene	**360**		59	ug/m3			05/09/14 07:33	27.5
Vinyl chloride	ND		28	ug/m3			05/09/14 07:33	27.5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*91*		*70 - 130*		*05/09/14 07:33*	*27.5*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*05/09/14 07:33*	*27.5*
Toluene-d8 (Surr)	*98*		*70 - 130*		*05/09/14 07:33*	*27.5*

Method: TO-15 - Volatile Organic Compounds in Ambient Air - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	**1200**		22	ppb v/v			05/13/14 05:27	55.1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	**8200**		150	ug/m3			05/13/14 05:27	55.1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*104*		*70 - 130*		*05/13/14 05:27*	*55.1*
1,2-Dichloroethane-d4 (Surr)	*95*		*70 - 130*		*05/13/14 05:27*	*55.1*
Toluene-d8 (Surr)	*100*		*70 - 130*		*05/13/14 05:27*	*55.1*

Client Sample ID: VML-02-190-VPT-042314

Lab Sample ID: 320-7188-36

Date Collected: 04/23/14 16:04
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**260000**		4400	ppb v/v			05/09/14 08:24	11000
trans-1,2-Dichloroethene	ND		4400	ppb v/v			05/09/14 08:24	11000
Tetrachloroethene	**240000**		4400	ppb v/v			05/09/14 08:24	11000
Trichloroethene	**29000**		4400	ppb v/v			05/09/14 08:24	11000
Vinyl chloride	ND		4400	ppb v/v			05/09/14 08:24	11000

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**1000000**		17000	ug/m3			05/09/14 08:24	11000
trans-1,2-Dichloroethene	ND		17000	ug/m3			05/09/14 08:24	11000
Tetrachloroethene	**1600000**		30000	ug/m3			05/09/14 08:24	11000
Trichloroethene	**150000**		24000	ug/m3			05/09/14 08:24	11000
Vinyl chloride	ND		11000	ug/m3			05/09/14 08:24	11000

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*97*		*70 - 130*		*05/09/14 08:24*	*11000*
1,2-Dichloroethane-d4 (Surr)	*94*		*70 - 130*		*05/09/14 08:24*	*11000*
Toluene-d8 (Surr)	*98*		*70 - 130*		*05/09/14 08:24*	*11000*

Client Sample ID: VML-02-170-VPT-042414 — Lab Sample ID: 320-7188-37

Date Collected: 04/24/14 09:15 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	230000		4000	ppb v/v			05/09/14 09:13	10000
trans-1,2-Dichloroethene	ND		4000	ppb v/v			05/09/14 09:13	10000
Trichloroethene	53000		4000	ppb v/v			05/09/14 09:13	10000
Vinyl chloride	ND		4000	ppb v/v			05/09/14 09:13	10000

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	910000		16000	ug/m3			05/09/14 09:13	10000
trans-1,2-Dichloroethene	ND		16000	ug/m3			05/09/14 09:13	10000
Trichloroethene	290000		21000	ug/m3			05/09/14 09:13	10000
Vinyl chloride	ND		10000	ug/m3			05/09/14 09:13	10000

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*05/09/14 09:13*	*10000*
1,2-Dichloroethane-d4 (Surr)	*93*		*70 - 130*		*05/09/14 09:13*	*10000*
Toluene-d8 (Surr)	*96*		*70 - 130*		*05/09/14 09:13*	*10000*

Method: TO-15 - Volatile Organic Compounds in Ambient Air - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	690000		5000	ppb v/v			05/13/14 06:16	12500

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	4700000		34000	ug/m3			05/13/14 06:16	12500

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*98*		*70 - 130*		*05/13/14 06:16*	*12500*
1,2-Dichloroethane-d4 (Surr)	*96*		*70 - 130*		*05/13/14 06:16*	*12500*
Toluene-d8 (Surr)	*103*		*70 - 130*		*05/13/14 06:16*	*12500*

Client Sample ID: VML-02-150-VPT-042414 — Lab Sample ID: 320-7188-38

Date Collected: 04/24/14 09:49 — **Matrix: Air**
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	100000		2000	ppb v/v			05/09/14 10:03	4950
trans-1,2-Dichloroethene	ND		2000	ppb v/v			05/09/14 10:03	4950
Tetrachloroethene	180000		2000	ppb v/v			05/09/14 10:03	4950
Trichloroethene	13000		2000	ppb v/v			05/09/14 10:03	4950
Vinyl chloride	ND		2000	ppb v/v			05/09/14 10:03	4950

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	400000		7900	ug/m3			05/09/14 10:03	4950
trans-1,2-Dichloroethene	ND		7900	ug/m3			05/09/14 10:03	4950
Tetrachloroethene	1200000		13000	ug/m3			05/09/14 10:03	4950
Trichloroethene	70000		11000	ug/m3			05/09/14 10:03	4950
Vinyl chloride	ND		5100	ug/m3			05/09/14 10:03	4950

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*97*		*70 - 130*		*05/09/14 10:03*	*4950*
1,2-Dichloroethane-d4 (Surr)	*93*		*70 - 130*		*05/09/14 10:03*	*4950*
Toluene-d8 (Surr)	*100*		*70 - 130*		*05/09/14 10:03*	*4950*

Client Sample ID: VML-02-130-VPT-042414

Lab Sample ID: 320-7188-39

Date Collected: 04/24/14 10:21
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	3400		1000	ppb v/v			05/09/14 10:54	2510
trans-1,2-Dichloroethene	ND		1000	ppb v/v			05/09/14 10:54	2510
Tetrachloroethene	36000		1000	ppb v/v			05/09/14 10:54	2510
Trichloroethene	1900		1000	ppb v/v			05/09/14 10:54	2510
Vinyl chloride	ND		1000	ppb v/v			05/09/14 10:54	2510

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	14000		4000	ug/m3			05/09/14 10:54	2510
trans-1,2-Dichloroethene	ND		4000	ug/m3			05/09/14 10:54	2510
Tetrachloroethene	240000		6800	ug/m3			05/09/14 10:54	2510
Trichloroethene	10000		5400	ug/m3			05/09/14 10:54	2510
Vinyl chloride	ND		2600	ug/m3			05/09/14 10:54	2510

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*		*05/09/14 10:54*	*2510*
1,2-Dichloroethane-d4 (Surr)	*95*		*70 - 130*		*05/09/14 10:54*	*2510*
Toluene-d8 (Surr)	*101*		*70 - 130*		*05/09/14 10:54*	*2510*

Client Sample ID: VML-02-130-VDT-042414

Lab Sample ID: 320-7188-40

Date Collected: 04/24/14 10:27
Matrix: Air
Date Received: 04/25/14 09:10
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	160		110	ppb v/v			05/09/14 11:45	283
trans-1,2-Dichloroethene	ND		110	ppb v/v			05/09/14 11:45	283
Tetrachloroethene	3800		110	ppb v/v			05/09/14 11:45	283
Trichloroethene	ND		110	ppb v/v			05/09/14 11:45	283
Vinyl chloride	ND		110	ppb v/v			05/09/14 11:45	283

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	640		450	ug/m3			05/09/14 11:45	283
trans-1,2-Dichloroethene	ND		450	ug/m3			05/09/14 11:45	283
Tetrachloroethene	26000		770	ug/m3			05/09/14 11:45	283
Trichloroethene	ND		610	ug/m3			05/09/14 11:45	283
Vinyl chloride	ND		290	ug/m3			05/09/14 11:45	283

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*100*		*70 - 130*		*05/09/14 11:45*	*283*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*05/09/14 11:45*	*283*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/09/14 11:45*	*283*

Surrogate Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Matrix: Air **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)							
		BFB	12DCE	TOL					
Lab Sample ID	Client Sample ID	(70-130)	(70-130)	(70-130)					
320-7188-1	VW-03-05-VPT-042114	105	91	100					
320-7188-2	VW-03-30-VPT-042114	101	89	100					
320-7188-3	VW-03-55-VPT-042114	103	88	99					
320-7188-4	VW-03-85-VPT-042114	94	87	99					
320-7188-5	VW-04-05-VPT-042114	98	88	99					
320-7188-6	VW-04-30-VPT-042114	92	88	99					
320-7188-7	VW-04-55-VPT-042114	92	89	99					
320-7188-8	VW-04-85-VPT-042114	91	90	99					
320-7188-9	VW-04-85-VDT-042114	98	90	100					
320-7188-10	VW-05-05-VPT-042114	98	90	101					
320-7188-11	VW-05-30-VPT-042114	92	90	102					
320-7188-12	VW-05-55-VPT-042114	92	93	100					
320-7188-13	VW-05-85-VPT-042114	99	92	100					
320-7188-14	VW-06-05-VPT-042114	101	90	99					
320-7188-15	VW-06-30-VPT-042114	96	90	99					
320-7188-16	VW-06-55-VPT-042114	98	91	101					
320-7188-17	VW-06-85-VPT-042114	94	91	99					
320-7188-17 - DL	VW-06-85-VPT-042114	96	95	99					
320-7188-18	VW-01-05-VPT-042214	94	91	99					
320-7188-19	VW-01-30-VPT-042214	91	91	99					
320-7188-20	VW-01-55-VPT-042214	96	91	98					
320-7188-21	VW-01-85-VPT-042214	92	157 X	109					
320-7188-22	VW-01-85-VDT-042214	112 E6	143 X	109					
320-7188-22	VW-01-85-VDT-042214	105 E6	134 X	108					
320-7188-23	VW-02-05-VPT-042214	96	92	101					
320-7188-24	VW-02-30-VPT-042214	96	93	98					
320-7188-25	VW-02-55-VPT-042214	94	91	98					
320-7188-26	VW-02-85-VPT-042214	98	90	98					
320-7188-27	VW-07-05-VPT-042214	89	92	99					
320-7188-28	VW-07-30-VPT-042214	96	91	99					
320-7188-29	VW-07-55-VPT-042214	96	92	99					
320-7188-30	VW-07-85-VPT-042214	95	93	99					
320-7188-31	VML-01-190-VPT-042314	96	91	96					
320-7188-31 - DL	VML-01-190-VPT-042314	101	95	99					
320-7188-32	VML-01-170-VPT-042314	96	91	97					
320-7188-33	VML-01-170-VDT-042314	96	92	100					
320-7188-34	VML-01-150-VPT-042314	99	93	100					
320-7188-35	VML-01-130-VPT-042314	91	92	98					
320-7188-35 - DL	VML-01-130-VPT-042314	104	95	100					
320-7188-36	VML-02-190-VPT-042314	97	94	98					
320-7188-37	VML-02-170-VPT-042414	96	93	96					
320-7188-37 - DL	VML-02-170-VPT-042414	98	96	103					
320-7188-38	VML-02-150-VPT-042414	97	93	100					
320-7188-39	VML-02-130-VPT-042414	105	95	101					
320-7188-40	VML-02-130-VDT-042414	100	92	99					
LCS 320-41830/5	Lab Control Sample	102	99	103					
LCS 320-41910/5	Lab Control Sample	105	96	102					
LCS 320-42000/4	Lab Control Sample	102	98	102					
LCS 320-42186/4	Lab Control Sample	106	99	101					

Surrogate Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Matrix: Air **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		BFB	12DCE	TOL
Lab Sample ID	Client Sample ID	(70-130)	(70-130)	(70-130)
LCSD 320-41830/19	Lab Control Sample Dup	105	96	101
LCSD 320-41910/24	Lab Control Sample Dup	106	98	101
LCSD 320-42000/5	Lab Control Sample Dup	106	98	103
LCSD 320-42186/5	Lab Control Sample Dup	106	100	101
MB 320-41830/7	Method Blank	83	92	97
MB 320-41910/7	Method Blank	90	90	98
MB 320-42000/7	Method Blank	91	91	99
MB 320-42186/7	Method Blank	89	94	98

Surrogate Legend

BFB = 4-Bromofluorobenzene (Surr)

12DCE = 1,2-Dichloroethane-d4 (Surr)

TOL = Toluene-d8 (Surr)

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Lab Sample ID: MB 320-41830/7 — **Client Sample ID: Method Blank**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 41830

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40		ppb v/v			05/06/14 17:47	1
trans-1,2-Dichloroethene	ND		0.40		ppb v/v			05/06/14 17:47	1
Tetrachloroethene	ND		0.40		ppb v/v			05/06/14 17:47	1
Trichloroethene	ND		0.40		ppb v/v			05/06/14 17:47	1
Vinyl chloride	ND		0.40		ppb v/v			05/06/14 17:47	1

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6		ug/m3			05/06/14 17:47	1
trans-1,2-Dichloroethene	ND		1.6		ug/m3			05/06/14 17:47	1
Tetrachloroethene	ND		2.7		ug/m3			05/06/14 17:47	1
Trichloroethene	ND		2.1		ug/m3			05/06/14 17:47	1
Vinyl chloride	ND		1.0		ug/m3			05/06/14 17:47	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*83*		*70 - 130*		*05/06/14 17:47*	*1*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*05/06/14 17:47*	*1*
Toluene-d8 (Surr)	*97*		*70 - 130*		*05/06/14 17:47*	*1*

Lab Sample ID: LCS 320-41830/5 — **Client Sample ID: Lab Control Sample**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 41830

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
cis-1,2-Dichloroethene			20.4	22.7		ppb v/v		112	70 - 130		
trans-1,2-Dichloroethene			20.2	21.8		ppb v/v		108	70 - 130		
Tetrachloroethene			19.6	23.6		ppb v/v		120	70 - 130		
Trichloroethene			20.4	23.6		ppb v/v		116	70 - 130		
Vinyl chloride			20.4	19.8		ppb v/v		97	70 - 130		

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
cis-1,2-Dichloroethene			81	90.2		ug/m3		112	70 - 130		
trans-1,2-Dichloroethene			80	86.6		ug/m3		108	70 - 130		
Tetrachloroethene			130	160		ug/m3		120	70 - 130		
Trichloroethene			110	127		ug/m3		116	70 - 130		
Vinyl chloride			52	50.6		ug/m3		97	70 - 130		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*102*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*99*		*70 - 130*
Toluene-d8 (Surr)	*103*		*70 - 130*

Lab Sample ID: LCSD 320-41830/19 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 41830

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene			20.4	21.3		ppb v/v		104	70 - 130	7	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-41830/19 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 41830

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
trans-1,2-Dichloroethene			20.2	20.4		ppb v/v		101	70 - 130	7	25
Tetrachloroethene			19.6	22.6		ppb v/v		115	70 - 130	4	25
Trichloroethene			20.4	22.0		ppb v/v		108	70 - 130	7	25
Vinyl chloride			20.4	16.6		ppb v/v		81	70 - 130	18	25

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene			81	84.4		ug/m3		104	70 - 130	7	25
trans-1,2-Dichloroethene			80	81.0		ug/m3		101	70 - 130	7	25
Tetrachloroethene			130	153		ug/m3		115	70 - 130	4	25
Trichloroethene			110	118		ug/m3		108	70 - 130	7	25
Vinyl chloride			52	42.4		ug/m3		81	70 - 130	18	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*96*		*70 - 130*
Toluene-d8 (Surr)	*101*		*70 - 130*

Lab Sample ID: MB 320-41910/7 — **Client Sample ID: Method Blank**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 41910

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40		ppb v/v			05/07/14 19:25	1
trans-1,2-Dichloroethene	ND		0.40		ppb v/v			05/07/14 19:25	1
Tetrachloroethene	ND		0.40		ppb v/v			05/07/14 19:25	1
Trichloroethene	ND		0.40		ppb v/v			05/07/14 19:25	1
Vinyl chloride	ND		0.40		ppb v/v			05/07/14 19:25	1

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6		ug/m3			05/07/14 19:25	1
trans-1,2-Dichloroethene	ND		1.6		ug/m3			05/07/14 19:25	1
Tetrachloroethene	ND		2.7		ug/m3			05/07/14 19:25	1
Trichloroethene	ND		2.1		ug/m3			05/07/14 19:25	1
Vinyl chloride	ND		1.0		ug/m3			05/07/14 19:25	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*90*		*70 - 130*		*05/07/14 19:25*	*1*
1,2-Dichloroethane-d4 (Surr)	*90*		*70 - 130*		*05/07/14 19:25*	*1*
Toluene-d8 (Surr)	*98*		*70 - 130*		*05/07/14 19:25*	*1*

Lab Sample ID: LCS 320-41910/5 — **Client Sample ID: Lab Control Sample**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 41910

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
cis-1,2-Dichloroethene			20.4	22.6		ppb v/v		111	70 - 130		
trans-1,2-Dichloroethene			20.2	21.5		ppb v/v		107	70 - 130		
Tetrachloroethene			19.6	23.9		ppb v/v		122	70 - 130		

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-41910/5
Matrix: Air
Analysis Batch: 41910

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Trichloroethene	20.4	23.4		ppb v/v		114	70 - 130
Vinyl chloride	20.4	18.1		ppb v/v		89	70 - 130

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	81	89.8		ug/m3		111	70 - 130
trans-1,2-Dichloroethene	80	85.4		ug/m3		107	70 - 130
Tetrachloroethene	130	162		ug/m3		122	70 - 130
Trichloroethene	110	125		ug/m3		114	70 - 130
Vinyl chloride	52	46.2		ug/m3		89	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*96*		*70 - 130*
Toluene-d8 (Surr)	*102*		*70 - 130*

Lab Sample ID: LCSD 320-41910/24
Matrix: Air
Analysis Batch: 41910

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene	20.4	22.2		ppb v/v		109	70 - 130	2	25
trans-1,2-Dichloroethene	20.2	21.4		ppb v/v		106	70 - 130	1	25
Tetrachloroethene	19.6	23.9		ppb v/v		122	70 - 130	0	25
Trichloroethene	20.4	23.2		ppb v/v		114	70 - 130	1	25
Vinyl chloride	20.4	19.2		ppb v/v		94	70 - 130	6	25

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene	81	88.2		ug/m3		109	70 - 130	2	25
trans-1,2-Dichloroethene	80	84.7		ug/m3		106	70 - 130	1	25
Tetrachloroethene	130	162		ug/m3		122	70 - 130	0	25
Trichloroethene	110	125		ug/m3		114	70 - 130	1	25
Vinyl chloride	52	49.2		ug/m3		94	70 - 130	6	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*106*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*98*		*70 - 130*
Toluene-d8 (Surr)	*101*		*70 - 130*

Lab Sample ID: MB 320-42000/7
Matrix: Air
Analysis Batch: 42000

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 18:23	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			05/08/14 18:23	1
Tetrachloroethene	ND		0.40	ppb v/v			05/08/14 18:23	1
Trichloroethene	ND		0.40	ppb v/v			05/08/14 18:23	1
Vinyl chloride	ND		0.40	ppb v/v			05/08/14 18:23	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-42000/7
Matrix: Air
Analysis Batch: 42000

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6		ug/m3			05/08/14 18:23	1
trans-1,2-Dichloroethene	ND		1.6		ug/m3			05/08/14 18:23	1
Tetrachloroethene	ND		2.7		ug/m3			05/08/14 18:23	1
Trichloroethene	ND		2.1		ug/m3			05/08/14 18:23	1
Vinyl chloride	ND		1.0		ug/m3			05/08/14 18:23	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*91*		*70 - 130*		*05/08/14 18:23*	*1*
1,2-Dichloroethane-d4 (Surr)	*91*		*70 - 130*		*05/08/14 18:23*	*1*
Toluene-d8 (Surr)	*99*		*70 - 130*		*05/08/14 18:23*	*1*

Lab Sample ID: LCS 320-42000/4
Matrix: Air
Analysis Batch: 42000

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
cis-1,2-Dichloroethene			20.4	22.5		ppb v/v		110	70 - 130		
trans-1,2-Dichloroethene			20.2	21.4		ppb v/v		106	70 - 130		
Tetrachloroethene			19.6	23.7		ppb v/v		121	70 - 130		
Trichloroethene			20.4	23.5		ppb v/v		115	70 - 130		
Vinyl chloride			20.4	18.6		ppb v/v		91	70 - 130		
Analyte			**Spike Added**	**LCS Result**	**LCS Qualifier**	**Unit**	**D**	**%Rec**	**%Rec. Limits**		
cis-1,2-Dichloroethene			81	89.3		ug/m3		110	70 - 130		
trans-1,2-Dichloroethene			80	85.0		ug/m3		106	70 - 130		
Tetrachloroethene			130	161		ug/m3		121	70 - 130		
Trichloroethene			110	126		ug/m3		115	70 - 130		
Vinyl chloride			52	47.4		ug/m3		91	70 - 130		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*102*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*98*		*70 - 130*
Toluene-d8 (Surr)	*102*		*70 - 130*

Lab Sample ID: LCSD 320-42000/5
Matrix: Air
Analysis Batch: 42000

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene			20.4	23.6		ppb v/v		115	70 - 130	5	25
trans-1,2-Dichloroethene			20.2	22.1		ppb v/v		110	70 - 130	3	25
Tetrachloroethene			19.6	25.0		ppb v/v		127	70 - 130	5	25
Trichloroethene			20.4	26.2		ppb v/v		128	70 - 130	11	25
Vinyl chloride			20.4	18.9		ppb v/v		93	70 - 130	2	25
Analyte			**Spike Added**	**LCSD Result**	**LCSD Qualifier**	**Unit**	**D**	**%Rec**	**%Rec. Limits**	**RPD**	**RPD Limit**
cis-1,2-Dichloroethene			81	93.4		ug/m3		115	70 - 130	5	25
trans-1,2-Dichloroethene			80	87.8		ug/m3		110	70 - 130	3	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-42000/5 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 42000

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Tetrachloroethene			130	169		ug/m3		127	70 - 130	5	25
Trichloroethene			110	141		ug/m3		128	70 - 130	11	25
Vinyl chloride			52	48.4		ug/m3		93	70 - 130	2	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*106*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*98*		*70 - 130*
Toluene-d8 (Surr)	*103*		*70 - 130*

Lab Sample ID: MB 320-42186/7 — **Client Sample ID: Method Blank**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 42186

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40		ppb v/v			05/12/14 23:17	1
trans-1,2-Dichloroethene	ND		0.40		ppb v/v			05/12/14 23:17	1
Tetrachloroethene	ND		0.40		ppb v/v			05/12/14 23:17	1
Trichloroethene	ND		0.40		ppb v/v			05/12/14 23:17	1
Vinyl chloride	ND		0.40		ppb v/v			05/12/14 23:17	1

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6		ug/m3			05/12/14 23:17	1
trans-1,2-Dichloroethene	ND		1.6		ug/m3			05/12/14 23:17	1
Tetrachloroethene	ND		2.7		ug/m3			05/12/14 23:17	1
Trichloroethene	ND		2.1		ug/m3			05/12/14 23:17	1
Vinyl chloride	ND		1.0		ug/m3			05/12/14 23:17	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*89*		*70 - 130*		*05/12/14 23:17*	*1*
1,2-Dichloroethane-d4 (Surr)	*94*		*70 - 130*		*05/12/14 23:17*	*1*
Toluene-d8 (Surr)	*98*		*70 - 130*		*05/12/14 23:17*	*1*

Lab Sample ID: LCS 320-42186/4 — **Client Sample ID: Lab Control Sample**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 42186

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
cis-1,2-Dichloroethene			20.4	22.5		ppb v/v		110	70 - 130		
trans-1,2-Dichloroethene			20.2	21.6		ppb v/v		107	70 - 130		
Tetrachloroethene			19.6	22.9		ppb v/v		117	70 - 130		
Trichloroethene			20.4	22.6		ppb v/v		111	70 - 130		
Vinyl chloride			20.4	19.5		ppb v/v		96	70 - 130		

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
cis-1,2-Dichloroethene			81	89.1		ug/m3		110	70 - 130		
trans-1,2-Dichloroethene			80	85.8		ug/m3		107	70 - 130		
Tetrachloroethene			130	155		ug/m3		117	70 - 130		
Trichloroethene			110	121		ug/m3		111	70 - 130		

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-42186/4
Matrix: Air
Analysis Batch: 42186

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Vinyl chloride			52	49.9		ug/m3		96	70 - 130		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*106*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*99*		*70 - 130*
Toluene-d8 (Surr)	*101*		*70 - 130*

Lab Sample ID: LCSD 320-42186/5
Matrix: Air
Analysis Batch: 42186

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene			20.4	22.2		ppb v/v		109	70 - 130	1	25
trans-1,2-Dichloroethene			20.2	21.3		ppb v/v		105	70 - 130	2	25
Tetrachloroethene			19.6	23.0		ppb v/v		117	70 - 130	1	25
Trichloroethene			20.4	22.8		ppb v/v		112	70 - 130	1	25
Vinyl chloride			20.4	18.6		ppb v/v		91	70 - 130	5	25
Analyte			**Spike Added**	**LCSD Result**	**LCSD Qualifier**	**Unit**	**D**	**%Rec**	**%Rec. Limits**	**RPD**	**RPD Limit**
cis-1,2-Dichloroethene			81	88.0		ug/m3		109	70 - 130	1	25
trans-1,2-Dichloroethene			80	84.4		ug/m3		105	70 - 130	2	25
Tetrachloroethene			130	156		ug/m3		117	70 - 130	1	25
Trichloroethene			110	122		ug/m3		112	70 - 130	1	25
Vinyl chloride			52	47.5		ug/m3		91	70 - 130	5	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*106*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*
Toluene-d8 (Surr)	*101*		*70 - 130*

Air - GC/MS VOA

Analysis Batch: 41830

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-7188-1	VW-03-05-VPT-042114	Total/NA	Air	TO-15	
320-7188-2	VW-03-30-VPT-042114	Total/NA	Air	TO-15	
320-7188-3	VW-03-55-VPT-042114	Total/NA	Air	TO-15	
320-7188-4	VW-03-85-VPT-042114	Total/NA	Air	TO-15	
320-7188-5	VW-04-05-VPT-042114	Total/NA	Air	TO-15	
320-7188-6	VW-04-30-VPT-042114	Total/NA	Air	TO-15	
320-7188-7	VW-04-55-VPT-042114	Total/NA	Air	TO-15	
320-7188-8	VW-04-85-VPT-042114	Total/NA	Air	TO-15	
320-7188-9	VW-04-85-VDT-042114	Total/NA	Air	TO-15	
320-7188-10	VW-05-05-VPT-042114	Total/NA	Air	TO-15	
320-7188-11	VW-05-30-VPT-042114	Total/NA	Air	TO-15	
LCS 320-41830/5	Lab Control Sample	Total/NA	Air	TO-15	
LCSD 320-41830/19	Lab Control Sample Dup	Total/NA	Air	TO-15	
MB 320-41830/7	Method Blank	Total/NA	Air	TO-15	

Analysis Batch: 41910

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-7188-12	VW-05-55-VPT-042114	Total/NA	Air	TO-15	
320-7188-13	VW-05-85-VPT-042114	Total/NA	Air	TO-15	
320-7188-14	VW-06-05-VPT-042114	Total/NA	Air	TO-15	
320-7188-15	VW-06-30-VPT-042114	Total/NA	Air	TO-15	
320-7188-16	VW-06-55-VPT-042114	Total/NA	Air	TO-15	
320-7188-17	VW-06-85-VPT-042114	Total/NA	Air	TO-15	
320-7188-18	VW-01-05-VPT-042214	Total/NA	Air	TO-15	
320-7188-19	VW-01-30-VPT-042214	Total/NA	Air	TO-15	
320-7188-21	VW-01-85-VPT-042214	Total/NA	Air	TO-15	
320-7188-22	VW-01-85-VDT-042214	Total/NA	Air	TO-15	
LCS 320-41910/5	Lab Control Sample	Total/NA	Air	TO-15	
LCSD 320-41910/24	Lab Control Sample Dup	Total/NA	Air	TO-15	
MB 320-41910/7	Method Blank	Total/NA	Air	TO-15	

Analysis Batch: 42000

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-7188-20	VW-01-55-VPT-042214	Total/NA	Air	TO-15	
320-7188-22	VW-01-85-VDT-042214	Total/NA	Air	TO-15	
320-7188-23	VW-02-05-VPT-042214	Total/NA	Air	TO-15	
320-7188-24	VW-02-30-VPT-042214	Total/NA	Air	TO-15	
320-7188-25	VW-02-55-VPT-042214	Total/NA	Air	TO-15	
320-7188-26	VW-02-85-VPT-042214	Total/NA	Air	TO-15	
320-7188-27	VW-07-05-VPT-042214	Total/NA	Air	TO-15	
320-7188-28	VW-07-30-VPT-042214	Total/NA	Air	TO-15	
320-7188-29	VW-07-55-VPT-042214	Total/NA	Air	TO-15	
320-7188-30	VW-07-85-VPT-042214	Total/NA	Air	TO-15	
320-7188-31	VML-01-190-VPT-042314	Total/NA	Air	TO-15	
320-7188-32	VML-01-170-VPT-042314	Total/NA	Air	TO-15	
320-7188-33	VML-01-170-VDT-042314	Total/NA	Air	TO-15	
320-7188-34	VML-01-150-VPT-042314	Total/NA	Air	TO-15	
320-7188-35	VML-01-130-VPT-042314	Total/NA	Air	TO-15	
320-7188-36	VML-02-190-VPT-042314	Total/NA	Air	TO-15	
320-7188-37	VML-02-170-VPT-042414	Total/NA	Air	TO-15	
320-7188-38	VML-02-150-VPT-042414	Total/NA	Air	TO-15	

Air - GC/MS VOA (Continued)

Analysis Batch: 42000 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-7188-39	VML-02-130-VPT-042414	Total/NA	Air	TO-15	
320-7188-40	VML-02-130-VDT-042414	Total/NA	Air	TO-15	
LCS 320-42000/4	Lab Control Sample	Total/NA	Air	TO-15	
LCSD 320-42000/5	Lab Control Sample Dup	Total/NA	Air	TO-15	
MB 320-42000/7	Method Blank	Total/NA	Air	TO-15	

Analysis Batch: 42186

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-7188-17 - DL	VW-06-85-VPT-042114	Total/NA	Air	TO-15	
320-7188-31 - DL	VML-01-190-VPT-042314	Total/NA	Air	TO-15	
320-7188-35 - DL	VML-01-130-VPT-042314	Total/NA	Air	TO-15	
320-7188-37 - DL	VML-02-170-VPT-042414	Total/NA	Air	TO-15	
LCS 320-42186/4	Lab Control Sample	Total/NA	Air	TO-15	
LCSD 320-42186/5	Lab Control Sample Dup	Total/NA	Air	TO-15	
MB 320-42186/7	Method Blank	Total/NA	Air	TO-15	

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Client Sample ID: VW-03-05-VPT-042114 — Lab Sample ID: 320-7188-1

Date Collected: 04/21/14 11:16 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	610 mL	250 mL	41830	05/07/14 00:52	TAD	TAL SAC

Client Sample ID: VW-03-30-VPT-042114 — Lab Sample ID: 320-7188-2

Date Collected: 04/21/14 11:07 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	425 mL	250 mL	41830	05/07/14 01:50	TAD	TAL SAC

Client Sample ID: VW-03-55-VPT-042114 — Lab Sample ID: 320-7188-3

Date Collected: 04/21/14 10:56 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	540 mL	250 mL	41830	05/07/14 02:45	TAD	TAL SAC

Client Sample ID: VW-03-85-VPT-042114 — Lab Sample ID: 320-7188-4

Date Collected: 04/21/14 10:41 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	550 mL	250 mL	41830	05/07/14 03:41	TAD	TAL SAC

Client Sample ID: VW-04-05-VPT-042114 — Lab Sample ID: 320-7188-5

Date Collected: 04/21/14 14:05 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	540 mL	250 mL	41830	05/07/14 04:38	TAD	TAL SAC

Client Sample ID: VW-04-30-VPT-042114 — Lab Sample ID: 320-7188-6

Date Collected: 04/21/14 13:41 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		5.98	85 mL	250 mL	41830	05/07/14 05:29	TAD	TAL SAC

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Client Sample ID: VW-04-55-VPT-042114 — Lab Sample ID: 320-7188-7

Date Collected: 04/21/14 13:29 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		4.93	100 mL	250 mL	41830	05/07/14 06:19	TAD	TAL SAC

Client Sample ID: VW-04-85-VPT-042114 — Lab Sample ID: 320-7188-8

Date Collected: 04/21/14 13:11 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		8.31	65 mL	250 mL	41830	05/07/14 07:09	TAD	TAL SAC

Client Sample ID: VW-04-85-VDT-042114 — Lab Sample ID: 320-7188-9

Date Collected: 04/21/14 13:17 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		5.73	100 mL	250 mL	41830	05/07/14 08:01	TAD	TAL SAC

Client Sample ID: VW-05-05-VPT-042114 — Lab Sample ID: 320-7188-10

Date Collected: 04/21/14 15:43 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	560 mL	250 mL	41830	05/07/14 08:57	TAD	TAL SAC

Client Sample ID: VW-05-30-VPT-042114 — Lab Sample ID: 320-7188-11

Date Collected: 04/21/14 15:26 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		29.3	20 mL	250 mL	41830	05/07/14 09:46	TAD	TAL SAC

Client Sample ID: VW-05-55-VPT-042114 — Lab Sample ID: 320-7188-12

Date Collected: 04/21/14 15:16 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		4.16	125 mL	250 mL	41910	05/08/14 00:37	TAD	TAL SAC

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Client Sample ID: VW-05-85-VPT-042114 — Lab Sample ID: 320-7188-13

Date Collected: 04/21/14 14:57 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		73.4	7.5 mL	250 mL	41910	05/08/14 01:28	TAD	TAL SAC

Client Sample ID: VW-06-05-VPT-042114 — Lab Sample ID: 320-7188-14

Date Collected: 04/21/14 10:00 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	529 mL	250 mL	41910	05/08/14 02:25	TAD	TAL SAC

Client Sample ID: VW-06-30-VPT-042114 — Lab Sample ID: 320-7188-15

Date Collected: 04/21/14 09:52 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	501 mL	250 mL	41910	05/08/14 11:23	TAD	TAL SAC

Client Sample ID: VW-06-55-VPT-042114 — Lab Sample ID: 320-7188-16

Date Collected: 04/21/14 09:41 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	490 mL	250 mL	41910	05/08/14 04:10	TAD	TAL SAC

Client Sample ID: VW-06-85-VPT-042114 — Lab Sample ID: 320-7188-17

Date Collected: 04/21/14 09:28 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	523 mL	250 mL	41910	05/08/14 05:05	TAD	TAL SAC
Total/NA	Analysis	TO-15	DL	5.9	150 mL	250 mL	42186	05/13/14 09:45	TAD	TAL SAC

Client Sample ID: VW-01-05-VPT-042214 — Lab Sample ID: 320-7188-18

Date Collected: 04/22/14 17:14 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		4.16	125 mL	250 mL	41910	05/08/14 05:56	TAD	TAL SAC

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Client Sample ID: VW-01-30-VPT-042214 — Lab Sample ID: 320-7188-19

Date Collected: 04/22/14 17:02 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		9.98	50 mL	250 mL	41910	05/08/14 06:47	TAD	TAL SAC

Client Sample ID: VW-01-55-VPT-042214 — Lab Sample ID: 320-7188-20

Date Collected: 04/22/14 16:48 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		4.43	125 mL	250 mL	42000	05/08/14 19:14	TAD	TAL SAC

Client Sample ID: VW-01-85-VPT-042214 — Lab Sample ID: 320-7188-21

Date Collected: 04/22/14 16:26 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	600 mL	250 mL	41910	05/08/14 08:35	TAD	TAL SAC

Client Sample ID: VW-01-85-VDT-042214 — Lab Sample ID: 320-7188-22

Date Collected: 04/22/14 16:33 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	542 mL	250 mL	41910	05/08/14 09:29	TAD	TAL SAC
Total/NA	Analysis	TO-15		1.51	625 mL	250 mL	42000	05/09/14 12:41	TAD	TAL SAC

Client Sample ID: VW-02-05-VPT-042214 — Lab Sample ID: 320-7188-23

Date Collected: 04/22/14 11:08 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	539 mL	250 mL	42000	05/08/14 20:10	TAD	TAL SAC

Client Sample ID: VW-02-30-VPT-042214 — Lab Sample ID: 320-7188-24

Date Collected: 04/22/14 10:58 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	544 mL	250 mL	42000	05/08/14 21:07	TAD	TAL SAC

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Client Sample ID: VW-02-55-VPT-042214 — Lab Sample ID: 320-7188-25

Date Collected: 04/22/14 10:38 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	517 mL	250 mL	42000	05/08/14 23:06	TAD	TAL SAC

Client Sample ID: VW-02-85-VPT-042214 — Lab Sample ID: 320-7188-26

Date Collected: 04/22/14 10:27 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	539 mL	250 mL	42000	05/09/14 00:00	TAD	TAL SAC

Client Sample ID: VW-07-05-VPT-042214 — Lab Sample ID: 320-7188-27

Date Collected: 04/22/14 15:38 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		27.9	20 mL	250 mL	42000	05/09/14 00:50	TAD	TAL SAC

Client Sample ID: VW-07-30-VPT-042214 — Lab Sample ID: 320-7188-28

Date Collected: 04/22/14 15:28 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		110	5 mL	250 mL	42000	05/09/14 01:41	TAD	TAL SAC

Client Sample ID: VW-07-55-VPT-042214 — Lab Sample ID: 320-7188-29

Date Collected: 04/22/14 15:16 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1470	0.375 mL	250 mL	42000	05/09/14 02:31	TAD	TAL SAC

Client Sample ID: VW-07-85-VPT-042214 — Lab Sample ID: 320-7188-30

Date Collected: 04/22/14 15:01 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		556	1 mL	250 mL	42000	05/09/14 03:20	TAD	TAL SAC

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Client Sample ID: VML-01-190-VPT-042314 — Lab Sample ID: 320-7188-31

Date Collected: 04/23/14 09:43 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		193	2.5 mL	250 mL	42000	05/09/14 04:11	TAD	TAL SAC
Total/NA	Analysis	TO-15	DL	483	1 mL	250 mL	42186	05/13/14 04:36	TAD	TAL SAC

Client Sample ID: VML-01-170-VPT-042314 — Lab Sample ID: 320-7188-32

Date Collected: 04/23/14 10:22 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		2620	0.2 mL	250 mL	42000	05/09/14 05:01	TAD	TAL SAC

Client Sample ID: VML-01-170-VDT-042314 — Lab Sample ID: 320-7188-33

Date Collected: 04/23/14 10:27 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		3040	0.2 mL	250 mL	42000	05/09/14 05:51	TAD	TAL SAC

Client Sample ID: VML-01-150-VPT-042314 — Lab Sample ID: 320-7188-34

Date Collected: 04/23/14 14:43 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		961	0.625 mL	250 mL	42000	05/09/14 06:43	TAD	TAL SAC

Client Sample ID: VML-01-130-VPT-042314 — Lab Sample ID: 320-7188-35

Date Collected: 04/23/14 15:16 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		27.5	20 mL	250 mL	42000	05/09/14 07:33	TAD	TAL SAC
Total/NA	Analysis	TO-15	DL	55.1	10 mL	250 mL	42186	05/13/14 05:27	TAD	TAL SAC

Client Sample ID: VML-02-190-VPT-042314 — Lab Sample ID: 320-7188-36

Date Collected: 04/23/14 16:04 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		11000	0.05 mL	250 mL	42000	05/09/14 08:24	TAD	TAL SAC

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Client Sample ID: VML-02-170-VPT-042414 — Lab Sample ID: 320-7188-37

Date Collected: 04/24/14 09:15 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		10000	0.05 mL	250 mL	42000	05/09/14 09:13	TAD	TAL SAC
Total/NA	Analysis	TO-15	DL	12500	0.04 mL	250 mL	42186	05/13/14 06:16	TAD	TAL SAC

Client Sample ID: VML-02-150-VPT-042414 — Lab Sample ID: 320-7188-38

Date Collected: 04/24/14 09:49 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		4950	0.1 mL	250 mL	42000	05/09/14 10:03	TAD	TAL SAC

Client Sample ID: VML-02-130-VPT-042414 — Lab Sample ID: 320-7188-39

Date Collected: 04/24/14 10:21 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		2510	0.2 mL	250 mL	42000	05/09/14 10:54	TAD	TAL SAC

Client Sample ID: VML-02-130-VDT-042414 — Lab Sample ID: 320-7188-40

Date Collected: 04/24/14 10:27 — **Matrix: Air**
Date Received: 04/25/14 09:10

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		283	2 mL	250 mL	42000	05/09/14 11:45	TAD	TAL SAC

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Certification Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Laboratory: TestAmerica Sacramento

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2928-01	05-31-14 *
Alaska (UST)	State Program	10	UST-055	12-18-13 *
Arizona	State Program	9	AZ0708	08-11-14
Arkansas DEQ	State Program	6	88-0691	06-17-14
California	State Program	9	2897	01-31-15
Colorado	State Program	8	N/A	08-31-14
Connecticut	State Program	1	PH-0691	06-30-15
Florida	NELAP	4	E87570	06-30-14
Guam	State Program	9	N/A	08-31-14
Hawaii	State Program	9	N/A	01-29-15
Illinois	NELAP	5	200060	03-17-15
Kansas	NELAP	7	E-10375	10-31-14
Louisiana	NELAP	6	30612	06-30-14
Michigan	State Program	5	9947	01-31-15
Nebraska	State Program	7	NE-OS-22-13	01-29-15
Nevada	State Program	9	CA44	07-31-14
New Jersey	NELAP	2	CA005	06-30-14
New York	NELAP	2	11666	04-01-15
Pennsylvania	NELAP	3	9947	03-31-15
South Carolina	State Program	4	87014	06-30-14
Texas	NELAP	6	T104704399-08-TX	05-31-14
US Fish & Wildlife	Federal		LE148388-0	12-31-14
USDA	Federal		P330-11-00436	12-30-14
USEPA UCMR	Federal	1	CA00044	11-06-14
Utah	NELAP	8	QUAN1	02-28-15
West Virginia DHHR	State Program	3	9930C	12-31-14
Wyoming	State Program	8	8TMS-Q	02-28-14 *

* Expired certification is currently pending renewal and is considered valid.

Method Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Method	Method Description	Protocol	Laboratory
TO-15	Volatile Organic Compounds in Ambient Air	EPA	TAL SAC

Protocol References:

EPA = US Environmental Protection Agency

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Sample Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-7188-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
320-7188-1	VW-03-05-VPT-042114	Air	04/21/14 11:16	04/25/14 09:10
320-7188-2	VW-03-30-VPT-042114	Air	04/21/14 11:07	04/25/14 09:10
320-7188-3	VW-03-55-VPT-042114	Air	04/21/14 10:56	04/25/14 09:10
320-7188-4	VW-03-85-VPT-042114	Air	04/21/14 10:41	04/25/14 09:10
320-7188-5	VW-04-05-VPT-042114	Air	04/21/14 14:05	04/25/14 09:10
320-7188-6	VW-04-30-VPT-042114	Air	04/21/14 13:41	04/25/14 09:10
320-7188-7	VW-04-55-VPT-042114	Air	04/21/14 13:29	04/25/14 09:10
320-7188-8	VW-04-85-VPT-042114	Air	04/21/14 13:11	04/25/14 09:10
320-7188-9	VW-04-85-VDT-042114	Air	04/21/14 13:17	04/25/14 09:10
320-7188-10	VW-05-05-VPT-042114	Air	04/21/14 15:43	04/25/14 09:10
320-7188-11	VW-05-30-VPT-042114	Air	04/21/14 15:26	04/25/14 09:10
320-7188-12	VW-05-55-VPT-042114	Air	04/21/14 15:16	04/25/14 09:10
320-7188-13	VW-05-85-VPT-042114	Air	04/21/14 14:57	04/25/14 09:10
320-7188-14	VW-06-05-VPT-042114	Air	04/21/14 10:00	04/25/14 09:10
320-7188-15	VW-06-30-VPT-042114	Air	04/21/14 09:52	04/25/14 09:10
320-7188-16	VW-06-55-VPT-042114	Air	04/21/14 09:41	04/25/14 09:10
320-7188-17	VW-06-85-VPT-042114	Air	04/21/14 09:28	04/25/14 09:10
320-7188-18	VW-01-05-VPT-042214	Air	04/22/14 17:14	04/25/14 09:10
320-7188-19	VW-01-30-VPT-042214	Air	04/22/14 17:02	04/25/14 09:10
320-7188-20	VW-01-55-VPT-042214	Air	04/22/14 16:48	04/25/14 09:10
320-7188-21	VW-01-85-VPT-042214	Air	04/22/14 16:26	04/25/14 09:10
320-7188-22	VW-01-85-VDT-042214	Air	04/22/14 16:33	04/25/14 09:10
320-7188-23	VW-02-05-VPT-042214	Air	04/22/14 11:08	04/25/14 09:10
320-7188-24	VW-02-30-VPT-042214	Air	04/22/14 10:58	04/25/14 09:10
320-7188-25	VW-02-55-VPT-042214	Air	04/22/14 10:38	04/25/14 09:10
320-7188-26	VW-02-85-VPT-042214	Air	04/22/14 10:27	04/25/14 09:10
320-7188-27	VW-07-05-VPT-042214	Air	04/22/14 15:38	04/25/14 09:10
320-7188-28	VW-07-30-VPT-042214	Air	04/22/14 15:28	04/25/14 09:10
320-7188-29	VW-07-55-VPT-042214	Air	04/22/14 15:16	04/25/14 09:10
320-7188-30	VW-07-85-VPT-042214	Air	04/22/14 15:01	04/25/14 09:10
320-7188-31	VML-01-190-VPT-042314	Air	04/23/14 09:43	04/25/14 09:10
320-7188-32	VML-01-170-VPT-042314	Air	04/23/14 10:22	04/25/14 09:10
320-7188-33	VML-01-170-VDT-042314	Air	04/23/14 10:27	04/25/14 09:10
320-7188-34	VML-01-150-VPT-042314	Air	04/23/14 14:43	04/25/14 09:10
320-7188-35	VML-01-130-VPT-042314	Air	04/23/14 15:16	04/25/14 09:10
320-7188-36	VML-02-190-VPT-042314	Air	04/23/14 16:04	04/25/14 09:10
320-7188-37	VML-02-170-VPT-042414	Air	04/24/14 09:15	04/25/14 09:10
320-7188-38	VML-02-150-VPT-042414	Air	04/24/14 09:49	04/25/14 09:10
320-7188-39	VML-02-130-VPT-042414	Air	04/24/14 10:21	04/25/14 09:10
320-7188-40	VML-02-130-VDT-042414	Air	04/24/14 10:27	04/25/14 09:10

TestAmerica Sacramento
880 Riverside Parkway

West Sacramento, CA 95605
phone 916.374.4378 fax 916.372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc assumes no liability with respect to the collection and shipment of these samples

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact Information	**Project Manager:** Robert Boudra	**Samples Collected By:** Erin Lansey	COC No
Company Name: URS	**Phone:**		1 of 2 COCs
Address: 333 Wetmore Rd Suite 400	**Email:** Robert.Boudra@URS.com		
City/State/Zip: Tucson, AZ, 85705			**For Lab Use Only:**
Phone: 520 887 1800	**Site Contact:**		Walk-in Client:
FAX:	**TA Contact:**		Lab Sampling:
Project Name: Park Euclid	**Anaylsis Turnaround Time**		
Site/Location:	Standard (Specific):		Job / SDG No.
P O #	Rush (Specify)		(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
VW-03-05-VPT-042114	4/21/14	1110	1116	26"	2"	7232	34001803	X														
VW-03-30-VPT-042114	4/21/14	1101	1107	30"	8"	7209	7528	X														
VW-03-55-VPT-042114	4/21/14	1050	1056	30"+	9"	7770	7509	X														
VW-03-85-VPT-042114	4/21/14	1035	1041	27"	4"	7685	34001854	X														
VW-04-05-VPT-042114	4/21/14	1359	1405	30"	6"	7672	34001646	X														
VW-04-30-VPT-042114	4/21/14	1333	1341	27"	3"	7500	34001597	X														
VW-04-55-VPT-042114	4/21/14	1325	1329	28"	2"	7224	34000813	X														
VW-04-85-VPT-042114	4/21/14	1305	1311	23"	2"	7501	34001010	X														
VW-04-85-VDT-042114	4/21/14	1311	1317	25"	3"	7078	8290	X														
VW-05-05-VPT-042114	4/21/14	1538	1543	28"	3"	7266	34001224	X														

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

320-7188 Chain of Custody

Special Instructions/QC Requirements & Comments:

Samples Shipped by:	**Date / Time:** 4-24-14 1300	**Samples Received by:**	
Samples Relinquished by: Erin Lansey	**Date / Time:**	**Received by:** Jim Nelson	4/25/14 910
Relinquished by:	**Date / Time:** 4-24-14 1500	**Received by:**	
Lab Use Only: **Shipper Name:**	**Opened by:**	**Condition:**	

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

TestAmerica Sacramento
880 Riverside Parkway

West Sacramento, CA 95605
phone 916.374.4378 fax 916.372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact Information	**Project Manager:** Robert Boudra	**Samples Collected By:** Erin Lansey	COC No
Company Name: URS	**Phone:**		2 of 2 COCs
Address: 333 Wetmore Rd Suite 400	**Email:** Robert.Boudra@URS.com		
City/State/Zip Tucson, AZ, 85705			**For Lab Use Only:**
Phone: 520 887 1800	**Site Contact:**		Walk-in Client
FAX:	**TA Contact:**		Lab Sampling:
Project Name Park Euclid	**Anaylsis Turnaround Time**		
Site/Location:	Standard (Specific):		Job / SDG No :
P O #	Rush (Specifiy):		(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
VW-05-30-VPT-042114	4/21/14	1521	1526	28"	4"		34001963	X														
VW-05-55-VPT-042114	4/21/14	1508	1516	27"	1"		34001117	X														
VW-05-85-VPT-042114	4/21/14	1452	1457	26"	3"		34000995	X														
VW-06-05-VPT-042114	4/21/14	0955	1000	27"	4"		34001747	X														
VW-06-30 VPT-042114	4/21/14	0946	0952	28"	4"		34001625	X														
VW-06-55-VPT-042114	4/21/14	0934	0941	30"+	9"		34000933	X														
VW-06-85-VPT-042114	4/21/14	0922	0928	28"	3"		34001790	X														

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

Special Instructions/QC Requirements & Comments:

Samples Shipped by:	**Date / Time:** 4-24-14 1300	**Samples Received by:**	
Samples Relinquished by:	**Date / Time:** 4-24-14 1300	**Received by:**	
Relinquished by:	**Date / Time:** 4-24-14 1500	**Received by:** Kim Nelson 4/25/14 910	
Lab Use Only: Shipper Name:	**Opened by:**	**Condition:**	

* CAN Soup 34001709 @ 4/25/14

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

TestAmerica Sacramento
880 Riverside Parkway

West Sacramento, CA 95605
phone 916.374.4378 fax 916.372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact Information	Project Manager: Robert Boudra	Samples Collected By: Erin Langey	COC No:
Company Name: URS	Phone:		1 of 2 COCs
Address: 333 Wetmore Rd. Suite 400	Email: Robert.Boudra@URS.com		
City/State/Zip Tucson, Az, 85705			For Lab Use Only:
Phone: 520 887 1800	Site Contact:		Walk-in Client
FAX:	TA Contact:		Lab Sampling:
Project Name: Park Euclid	Anaylsis Turnaround Time		
Site/Location	Standard (Specific):		Job / SDG No.:
P O #	Rush (Specifiy)		(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
VW-01-05-VPT-042214	4/22/14	1707	1714	29"	3"	7681	34001054	X														
VW-01-30-VPT-042214	4/22/14	1654	1702	26"	2"	7769	34000742	X														
VW-01-55-VPT-042214	4/22/14	1642	1648	26"	5"	7498	34001628	X														
VW-01-85-VPT-042214	4/22/14	1621	1626	26"	5"	7102	34001630	X														
VW-01-85-VDT-042214	4/22/14	1627	1633	27"	4"	7121	34001050	X														
VW-02-05-VPT-042214	4/22/14	1102	1108	27"	4"	7551	34001004	X														
VW-02-30-VPT-042214	4/22/14	1053	1058	26"	3"	7324	34001498	X														
VW-02-55-VPT-042214	4/22/14	1031	1038	29"	4"	7123	34000640	X														
VW-02-85-VPT-042214	4/22/14	1022	1027	26"	3"	7096	34000994	X														
VW-07-05-VPT-042214	4/22/14	1532	1538	26"	4"	7772	34001853	X														

	Temperature (Fahrenheit)			
	Start	Interior	Ambient	
	Stop			

	Temperature (Fahrenheit)			
	Start	Interior	Ambient	
	Stop			

Special Instructions/QC Requirements & Comments:

Samples Shipped by:	Date / Time:	Samples Received by:	
Samples Relinquished by: Erin Langey	Date / Time: 4-24-14 1300	Received by:	
Relinquished by:	Date / Time: 4-24-14 15:00	Received by: Kim Nelson 4/25/14 9:10	
Lab Use Only: Shipper Name:	Opened by:	Condition:	

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

TestAmerica Sacramento
880 Riverside Parkway

West Sacramento, CA 95605
phone 916.374 4378 fax 916.372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact Information	Project Manager: Robert Boudra	Samples Collected By: Erin Lansey	COC No:
Company Name: IARS	Phone:		2 of 2 COCs
Address 333 Wetmore Rd Suite 400	Email: Robert.Boudra@iars.com		
City/State/Zip Tucson AZ 85705			For Lab Use Only:
Phone: 520 887 1800	Site Contact:		Walk-in Client
FAX:	TA Contact:		Lab Sampling
Project Name: Park Euclid	Anaylsis Turnaround Time		
Site/Location	Standard (Specific)		Job / SDG No..
P O #	Rush (Specify)		(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
VW-07-30-VPT-042214	4/22/14	1521	1528	24"	2"	7080	34001104	X														
VW-07-55-VPT-042214	4/22/14	1511	1516	26"	4"	7686	34001136	X														
VW-07-85-VPT-042214	4/22/14	1456	1501	27"	4"	7790	34001059	X														

4/22/14

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

Special Instructions/QC Requirements & Comments:

Samples Shipped by:	Date / Time:	Samples Received by:	
Samples Relinquished by:	Date / Time: 4-24-14 1300	Received by:	
Relinquished by:	Date / Time: 4-24-14 1500	Received by: 4/25/14 910	
Lab Use Only: Shipper Name:	Opened by:	Condition:	

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

TestAmerica Sacramento
880 Riverside Parkway

West Sacramento, CA 95605
phone 916.374 4378 fax 916.372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact Information	Project Manager: Robert Bondra	Samples Collected By: Erin Lansey	COC No:
Company Name: URS	Phone:		1 of 1 COCs
Address 3333 Wetmore Rd Suite 400	Email: robert.bondra@urs.com		
City/State/Zip Tucson AZ 85705			For Lab Use Only:
Phone: 520 887 1800	Site Contact:		Walk-in Client:
FAX:	TA Contact:		Lab Sampling:
Project Name Park Euclid	Anaylsis Turnaround Time		
Site/Location	Standard (Specific):		Job / SDG No..
P O #	Rush (Specifiy):		(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
VML-01-190-VPT-042314	4/23/14	0939	0943	26"	2"	7133	34000906	X														
VML-01-170-VPT-042314	4/23/14	1015	1022	30"	4"	7376	34000909	X														
VML-01-170-VDT-042314	4/23/14	1022	1027	26"	4"	7325	34000959	X														
VML-01-150-VPT-042314	4/23/14	1438	1443	27"	4"	7222	34000748	X														
VML-01-130-VPT-042314	4/23/14	1509	1516	25"	2"	7504	34001064	X														
VML-02-190-VPT-042314	4/23/14	1528	1604	28"	4"	7687	34001596	X														
VML-02-170-VPT-042414	4/24/14	0910	0915	29"	4"	7781	34001190	X														
VML-02-150-VPT-042414	4/24/14	0945	0949	26"	2"	7087	34000673	X														
VML-02-130-VPT-042414	4/24/14	1015	1021	28"	2"	7287	34001598	X														
VML-02-130-VDT-042414	4/24/14	1022	1027	27"	4"	7315	34000329	X														

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

	Temperature (Fahrenheit)		
Start	Interior	Ambient	
Stop			

Special Instructions/QC Requirements & Comments:

Samples Shipped by:	Date / Time:	Samples Received by:
Samples Relinquished by: Erin Lansey	Date / Time: 4-24-14 1300	Received by:
Relinquished by:	Date / Time: 4-24-14 1500	Received by: Tom Nelson 4/25/14 910
Lab Use Only: Shipper Name:	Opened by:	Condition:

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

* TAS Sample VML-02-85-VPT-042314 @ 4/25/14
** TAS Sample VML-02-130-VPT-042314 @ 4/25/14

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 1

Client/Project:		VFR ID:		
Canister Serial #:	34001803	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	10.31	04/28/14	EP
FINAL PRESSURE (PSIA)	25.17	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.44			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.44		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/6/2014	ATMS7			
Canister DF =	2.44	X	Load DF =	0.4098361	X	Bag DF =	1	=	FINAL DF 1.000540618		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	610		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.44	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.44	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 2

Client/Project:		VFR ID:		
Canister Serial #:	7538	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	14.90	04/28/14	EP
FINAL PRESSURE (PSIA)	25.39	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 1.70			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			1.70		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/6/2014	ATMS7			
Canister DF =	1.70	X	Load DF =	0.5882353	X	Bag DF =	1	=	FINAL DF 1.002368733		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	425		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	1.70	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	1.70	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 3

Client/Project:		VFR ID:		
Canister Serial #:	7509	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.70	04/28/14	EP
FINAL PRESSURE (PSIA)	25.27	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.16			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.16		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/6/2014	ATMS7			
Canister DF =	2.16	X	Load DF =	0.462963	X	Bag DF =	1	=	FINAL DF 0.999920861		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	540		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 4

Client/Project:		VFR ID:		
Canister Serial #:	34001854	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.45	04/28/14	EP
FINAL PRESSURE (PSIA)	25.15	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.20			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.20		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/6/2014	ATMS7			
Canister DF =	2.20	X	Load DF =	0.4545455	X	Bag DF =	1	=	FINAL DF 0.998412068		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	550		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.20	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.20	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 5

Client/Project:		VFR ID:		
Canister Serial #:	34001646	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.45	04/28/14	EP
FINAL PRESSURE (PSIA)	24.74	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.16			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.16		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/6/2014	ATMS7			
Canister DF =	2.16	X	Load DF =	0.462963	X	Bag DF =	1	=	FINAL DF 1.000323468		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	540		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 6

Client/Project:		VFR ID:		
Canister Serial #:	34001597	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.27	04/28/14	EP
FINAL PRESSURE (PSIA)	24.97	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.04			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.04		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/6/2014	ATMS7			
Canister DF =	2.04	X	Load DF =	2.9411765	X	Bag DF =	1	=	FINAL DF 5.985425955		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	85		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.04	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.04	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 7

Client/Project:		VFR ID:		
Canister Serial #:	34000813	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.74	04/28/14	EP
FINAL PRESSURE (PSIA)	25.11	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 1.97			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			1.97		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/6/2014	ATMS7			
Canister DF =	1.97	X	Load DF =	2.5	X	Bag DF =	1	=	FINAL DF 4.927394035		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	100		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	1.97	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	1.97	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 8

Client/Project:		VFR ID:		
Canister Serial #:	8290	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.64	04/28/14	EP
FINAL PRESSURE (PSIA)	25.16	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.16			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.16		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/6/2014	ATMS7			
Canister DF =	2.16	X	Load DF =	3.8461538	X	Bag DF =	1	=	FINAL DF 8.313507798		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	65		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 9

Client/Project:		VFR ID:		
Canister Serial #:	34001010	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	10.95	04/28/14	EP
FINAL PRESSURE (PSIA)	25.08	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.29			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.29		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/6/2014	ATMS7			
Canister DF =	2.29	X	Load DF =	2.5	X	Bag DF =	1	=	FINAL DF 5.726027397		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	100		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.29	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.29	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 10

Client/Project:		VFR ID:		
Canister Serial #:	34001224	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.14	04/28/14	EP
FINAL PRESSURE (PSIA)	25.00	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.24			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.24		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/6/2014	ATMS7			
Canister DF =	2.24	X	Load DF =	0.4464286	X	Bag DF =	1	=	FINAL DF 1.001859451		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	560		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.24	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.24	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 11

Client/Project:		VFR ID:		
Canister Serial #:	34001963	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	10.73	04/28/14	EP
FINAL PRESSURE (PSIA)	25.12	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.34			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.34		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

								Date	Instr.	File #	
								5/6/2014	ATMS7		
Canister DF =	2.34	X	Load DF =	12.5	X	Bag DF =	1	=		FINAL DF	29.26374651
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	20		Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.34	X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.34	X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 12

Client/Project:		VFR ID:		
Canister Serial #:	34001117	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.03	04/28/14	EP
FINAL PRESSURE (PSIA)	25.05	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.08			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.08		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/7/2014	MS7			
Canister DF =	2.08	X	Load DF =	2	X	Bag DF =	1	=	FINAL DF 4.164588529		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	125		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.08	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.08	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 13

Client/Project:		VFR ID:		
Canister Serial #:	34000995	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.30	04/28/14	EP
FINAL PRESSURE (PSIA)	24.90	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.20			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.20		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/7/2014	MS7			
Canister DF =	2.20	X	Load DF =	1.6666667	X	Bag DF =	20	=	FINAL DF 73.45132743		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	150		Bvi (mLs)	50				
							Date	Instr.	File #		
Canister DF =	2.20	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.20	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 14

Client/Project:		VFR ID:		
Canister Serial #:	34001747	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.87	04/28/14	EP
FINAL PRESSURE (PSIA)	25.14	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.12			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.12		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/7/2014	MS7			
Canister DF =	2.12	X	Load DF =	0.4725898	X	Bag DF =	1	=	FINAL DF 1.000918902		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	529		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.12	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.12	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 15

Client/Project:		VFR ID:		
Canister Serial #:	34001625	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.33	04/28/14	EP
FINAL PRESSURE (PSIA)	24.73	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.01			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.01		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #	
							5/7/2014	MS7		
Canister DF =	2.01	X	Load DF =	3.3333333	X	Bag DF =	1	=	FINAL DF	6.6855907
			LVf (mLs)	250		BVf (mLs)				
			LVi (mLs)	75		Bvi (mLs)				
							Date	Instr.	File #	
							5/8/2014	MS7		
Canister DF =	2.01	X	Load DF =	0.499002	X	Bag DF =	1	=	FINAL DF	1.000836931
			LVf (mLs)	250		BVf (mLs)				
			LVi (mLs)	501		Bvi (mLs)				
							Date	Instr.	File #	
Canister DF =	2.01	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)				
			LVi (mLs)			Bvi (mLs)				

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 16

Client/Project:		VFR ID:		
Canister Serial #:	34000933	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.75	04/28/14	EP
FINAL PRESSURE (PSIA)	25.01	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 1.96			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			1.96		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/7/2014	MS7			
Canister DF =	1.96	X	Load DF =	0.5102041	X	Bag DF =	1	=	FINAL DF 1.00080032		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	490		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	1.96	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	1.96	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 17

Client/Project:		VFR ID:		
Canister Serial #:	34001709	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.20	04/28/14	EP
FINAL PRESSURE (PSIA)	25.55	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.09			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
05/12/14	14.62	24.82	2.09	SRS for MC	3.56
			3.56		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #	
							5/7/2014	MS7		
Canister DF =	2.09	X	Load DF =	0.4780115	X	Bag DF =	1	=	FINAL DF	1.001081403
			LVf (mLs)	250		BVf (mLs)				
			LVi (mLs)	523		Bvi (mLs)				
							Date	Instr.	File #	
							5/12/2014	MS7		
Canister DF =	3.56	X	Load DF =	0.3333333	X	Bag DF =	1	=	FINAL DF	1.185125175
			LVf (mLs)	250		BVf (mLs)				
			LVi (mLs)	750		Bvi (mLs)				
							Date	Instr.	File #	
							5/13/2014	MS7		
Canister DF =	3.56	X	Load DF =	1.6666667	X	Bag DF =	1	=	FINAL DF	5.925625874
			LVf (mLs)	250		BVf (mLs)				
			LVi (mLs)	150		Bvi (mLs)				

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 18

Client/Project:		VFR ID:		
Canister Serial #:	34001054	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.07	04/28/14	EP
FINAL PRESSURE (PSIA)	25.10	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.08			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.08		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/7/2014	MS7			
Canister DF =	2.08	X	Load DF =	2	X	Bag DF =	1	=	FINAL DF 4.15907208		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	125		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.08	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.08	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 19

Client/Project:		VFR ID:		
Canister Serial #:	34000742	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.54	04/28/14	EP
FINAL PRESSURE (PSIA)	25.02	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.00			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.00		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/7/2014	MS7			
Canister DF =	2.00	X	Load DF =	5	X	Bag DF =	1	=	FINAL DF 9.976076555		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	50		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.00	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.00	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 20

Client/Project:		VFR ID:		
Canister Serial #:	34001628	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.36	04/28/14	EP
FINAL PRESSURE (PSIA)	25.16	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.21			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.21		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/7/2014	MS7			
Canister DF =	2.21	X	Load DF =	5	X	Bag DF =	1	=	FINAL DF 11.07394366		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	50		Bvi (mLs)					
							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	2.21	X	Load DF =	2	X	Bag DF =	1	=	FINAL DF 4.429577465		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	125		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.21	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 21

Client/Project:		VFR ID:		
Canister Serial #:	34001630	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	10.40	04/28/14	EP
FINAL PRESSURE (PSIA)	24.97	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.40			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.40		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/7/2014	MS7			
Canister DF =	2.40	X	Load DF =	0.4166667	X	Bag DF =	1	=	FINAL DF	1.000400641
			LVf (mLs)	250		BVf (mLs)				
			LVi (mLs)	600		Bvi (mLs)				
							Date	Instr.	File #		
Canister DF =	2.40	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)				
			LVi (mLs)			Bvi (mLs)				
							Date	Instr.	File #		
Canister DF =	2.40	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)				
			LVi (mLs)			Bvi (mLs)				

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 22

Client/Project:		VFR ID:		
Canister Serial #:	34001050	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.51	04/28/14	EP
FINAL PRESSURE (PSIA)	24.99	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.17			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
05/09/14	14.82	25.82	2.17	LHS	3.78
			3.78		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #	
							5/7/2014	MS7		
Canister DF =	2.17	X	Load DF =	0.4612546	X	Bag DF =	1	=	FINAL DF	1.001455497
			LVf (mLs)	250		BVf (mLs)				
			LVi (mLs)	542		Bvi (mLs)				
							Date	Instr.	File #	
							5/9/2014	MS7		
Canister DF =	3.78	X	Load DF =	0.4	X	Bag DF =	1	=	FINAL DF	1.513069783
			LVf (mLs)	250		BVf (mLs)				
			LVi (mLs)	625		Bvi (mLs)				
							Date	Instr.	File #	
Canister DF =	2.17	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)				
			LVi (mLs)			Bvi (mLs)				

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 23

Client/Project:		VFR ID:		
Canister Serial #:	34001004	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.59	04/28/14	EP
FINAL PRESSURE (PSIA)	25.01	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.16			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.16		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	2.16	X	Load DF =	0.4638219	X	Bag DF =	1	=	FINAL DF 1.00087882		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	539		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 24

Client/Project:		VFR ID:		
Canister Serial #:	34001498	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.49	04/28/14	EP
FINAL PRESSURE (PSIA)	25.04	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.18			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.18		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	2.18	X	Load DF =	0.4595588	X	Bag DF =	1	=	FINAL DF 1.001510265		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	544		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.18	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.18	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 25

Client/Project:		VFR ID:		
Canister Serial #:	34000640	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.13	04/28/14	EP
FINAL PRESSURE (PSIA)	25.11	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.07			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.07		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	2.07	X	Load DF =	0.483559	X	Bag DF =	1	=	FINAL DF 1.001002996		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	517		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.07	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.07	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 26

Client/Project:		VFR ID:		
Canister Serial #:	34000994	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.58	04/28/14	EP
FINAL PRESSURE (PSIA)	25.00	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.16			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.16		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

								Date	Instr.	File #	
								5/8/2014	MS7		
Canister DF =	2.16	X	Load DF =	0.4638219	X	Bag DF =	1	=	FINAL DF	1.0013426	
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	539		Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!	
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!	
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 27

Client/Project:		VFR ID:		
Canister Serial #:	34001853	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.21	04/28/14	EP
FINAL PRESSURE (PSIA)	25.05	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.23			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.23		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

								Date	Instr.	File #	
								5/8/2014	MS7		
Canister DF =	2.23	X	Load DF =	12.5	X	Bag DF =	1	=		FINAL DF	27.93264942
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	20		Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.23	X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.23	X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 28

Client/Project:		VFR ID:		
Canister Serial #:	34001104	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.35	04/28/14	EP
FINAL PRESSURE (PSIA)	24.99	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.20			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.20		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	2.20	X	Load DF =	2.5	X	Bag DF =	20	=	FINAL DF 110.0881057		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	100		Bvi (mLs)	50				
							Date	Instr.	File #		
Canister DF =	2.20	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.20	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 29

Client/Project:		VFR ID:		
Canister Serial #:	34001136	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.32	04/28/14	EP
FINAL PRESSURE (PSIA)	25.02	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.21			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.21		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

								Date	Instr.	File #	
								5/8/2014	MS7		
Canister DF =	2.21	X	Load DF =	3.3333333	X	Bag DF =	200	=	FINAL DF	1473.498233	
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	75		Bvi (mLs)	5				
								Date	Instr.	File #	
Canister DF =	2.21	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!	
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.21	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!	
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 30

Client/Project:		VFR ID:		
Canister Serial #:	34001059	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.27	04/28/14	EP
FINAL PRESSURE (PSIA)	25.06	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.22			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.22		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	2.22	X	Load DF =	5	X	Bag DF =	50	=	FINAL DF 555.9006211		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	50		Bvi (mLs)	20				
							Date	Instr.	File #		
Canister DF =	2.22	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.22	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 31

Client/Project:		VFR ID:		
Canister Serial #:	34000906	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.96	04/28/14	EP
FINAL PRESSURE (PSIA)	25.05	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 1.93			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			1.93		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			FINAL DF
Canister DF =	1.93	X	Load DF =	5	X	Bag DF =	20	=	193.287037
			LVf (mLs)	250		BVf (mLs)	1000		
			LVi (mLs)	50		Bvi (mLs)	50		
							Date	Instr.	File #		
							5/9/2014	MS7			FINAL DF
Canister DF =	1.93	X	Load DF =	5	X	Bag DF =	100	=	966.4351852
			LVf (mLs)	250		BVf (mLs)	1000		
			LVi (mLs)	50		Bvi (mLs)	10		
							Date	Instr.	File #		
							5/12/2014	MS7			FINAL DF
Canister DF =	1.93	X	Load DF =	2.5	X	Bag DF =	100	=	483.2175926
			LVf (mLs)	250		BVf (mLs)	1000		
			LVi (mLs)	100		Bvi (mLs)	10		

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 32

Client/Project:		VFR ID:		
Canister Serial #:	34000909	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.94	04/28/14	EP
FINAL PRESSURE (PSIA)	24.98	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.09			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.09		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	2.09	X	Load DF =	6.25	X	Bag DF =	200	=	FINAL DF 2615.159129		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	40		Bvi (mLs)	5				
							Date	Instr.	File #		
Canister DF =	2.09	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.09	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 33

Client/Project:		VFR ID:		
Canister Serial #:	34000759	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	10.32	04/28/14	EP
FINAL PRESSURE (PSIA)	25.08	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.43			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.43		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	2.43	X	Load DF =	6.25	X	Bag DF =	200	=	FINAL DF 3037.790698		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	40		Bvi (mLs)	5				
							Date	Instr.	File #		
Canister DF =	2.43	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.43	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 34

Client/Project:		VFR ID:		
Canister Serial #:	34000748	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	10.41	04/28/14	EP
FINAL PRESSURE (PSIA)	25.00	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.40			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.40		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	2.40	X	Load DF =	2	X	Bag DF =	200	=	FINAL DF 960.6147935		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	125		Bvi (mLs)	5				
							Date	Instr.	File #		
Canister DF =	2.40	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.40	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 35

Client/Project:		VFR ID:		
Canister Serial #:	34001064	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.37	04/28/14	EP
FINAL PRESSURE (PSIA)	25.05	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.20			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.20		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	2.20	X	Load DF =	12.5	X	Bag DF =	1	=	FINAL DF 27.53957784		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	20		Bvi (mLs)					
							Date	Instr.	File #		
							5/9/2014	MS7			
Canister DF =	2.20	X	Load DF =	5	X	Bag DF =	10	=	FINAL DF 110.1583113		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	50		Bvi (mLs)	100				
							Date	Instr.	File #		
							5/12/2014	ms7			
Canister DF =	2.20	X	Load DF =	2.5	X	Bag DF =	10	=	FINAL DF 55.07915567		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	100		Bvi (mLs)	100				

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 36

Client/Project:		VFR ID:		
Canister Serial #:	34001596	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.38	04/28/14	EP
FINAL PRESSURE (PSIA)	24.96	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.19			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.19		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	2.19	X	Load DF =	5	X	Bag DF =	1000	=	FINAL DF 10966.60808		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	50		Bvi (mLs)	1				
							Date	Instr.	File #		
Canister DF =	2.19	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.19	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 37

Client/Project:		VFR ID:		
Canister Serial #:	34001190	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.49	04/28/14	EP
FINAL PRESSURE (PSIA)	25.05	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.01			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.01		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			FINAL DF
Canister DF =	2.01	X	Load DF =	5	X	Bag DF =	1000	=	10028.02242
			LVf (mLs)	250		BVf (mLs)	1000		
			LVi (mLs)	50		Bvi (mLs)	1		
							Date	Instr.	File #		
							5/9/2014	MS7			FINAL DF
Canister DF =	2.01	X	Load DF =	12.5	X	Bag DF =	1000	=	25070.05604
			LVf (mLs)	250		BVf (mLs)	1000		
			LVi (mLs)	20		Bvi (mLs)	1		
							Date	Instr.	File #		
							5/12/2014	ATMS7			FINAL DF
Canister DF =	2.01	X	Load DF =	6.25	X	Bag DF =	1000	=	12535.02802
			LVf (mLs)	250		BVf (mLs)	1000		
			LVi (mLs)	40		Bvi (mLs)	1		

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 38

Client/Project:		VFR ID:		
Canister Serial #:	34000643	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.67	04/28/14	EP
FINAL PRESSURE (PSIA)	25.08	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 1.98			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			1.98		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							5/8/2014	MS7			
Canister DF =	1.98	X	Load DF =	2.5	X	Bag DF =	1000	=	FINAL DF 4948.697711		
			LVf (mLs)	250		BVf (mLs)	1000				
			LVi (mLs)	100		Bvi (mLs)	1				
							Date	Instr.	File #		
Canister DF =	1.98	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	1.98	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 39

Client/Project:		VFR ID:		
Canister Serial #:	34001598	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.44	04/28/14	EP
FINAL PRESSURE (PSIA)	25.01	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.01			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.01		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #	
							5/8/2014	MS7		
Canister DF =	2.01	X	Load DF =	1.25	X	Bag DF =	1000	=	FINAL DF	2513.062701
			LVf (mLs)	250		BVf (mLs)	1000			
			LVi (mLs)	200		Bvi (mLs)	1			
							Date	Instr.	File #	
Canister DF =	2.01	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)				
			LVi (mLs)			Bvi (mLs)				
							Date	Instr.	File #	
Canister DF =	2.01	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)				
			LVi (mLs)			Bvi (mLs)				

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-7188
Sample # 40

Client/Project:		VFR ID:		
Canister Serial #:	34000329	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.12	04/28/14	EP
FINAL PRESSURE (PSIA)	25.16	04/28/14	EP
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.26			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.26		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #	
							5/8/2014	MS7		
Canister DF =	2.26	X	Load DF =	1.25	X	Bag DF =	100	=	FINAL DF	282.823741
			LVf (mLs)	250		BVf (mLs)	1000			
			LVi (mLs)	200		Bvi (mLs)	10			
							Date	Instr.	File #	
Canister DF =	2.26	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)				
			LVi (mLs)			Bvi (mLs)				
							Date	Instr.	File #	
Canister DF =	2.26	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)				
			LVi (mLs)			Bvi (mLs)				

Login Sample Receipt Checklist

Client: URS Corporation

Job Number: 320-7188-1

Login Number: 7188

List Source: TestAmerica Sacramento

List Number: 1

Creator: Nelson, Kym D

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

320-6717 Chain of Custody

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Sacramento
Canister QC Certification

Certification Type: TO15 SCAN

Date Cleaned/Batch ID 3/24/14 320-6717

Date of QC 3/27/14

Data File Number MS7032705

CANISTER ID NUMBERS

34001497	34000905	
1117	1848	
0813 *	1688	
0230	1748	
1023		
1010		
0771		
1190		

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

1st level Reviewed By: Date: 3/28/14

2nd level Reviewed By: Date: 3/31/14

Q:\FORMS\QA-814 CAN QC CERT 20130729.DOC
QA-814 *ERS 7/29/2013*

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Sacramento
Canister QC Certification
Individual Certification

Certification Type: TO15 SCAN

Date Cleaned/Batch ID: 3/18/14 320-6761

Date of QC: 3/27/14 ; 3/28/14

320-6761 Chain of Custody

Canister ID	Filename	Canister ID	Filename
34001597	MS7032809		
0986	—		
0985	—		
1050	MS7032710		
1963	MS7032711		
1498	MS7032712		
0983	MS7032713		
0640	MS7032804		
1853	MS7032805		
0759	MS7032806		
1246	—		
0234	MS7032808		

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

1st level Reviewed By: [signature] Date: 3/29/14

2nd level Reviewed By: [signature] Date: 3/30/14

Q:\FORMS\QA-821 IND CAN QC 20130729.DOC
QA-821

ERS 7/29/2013

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Cani
In

320-6793 Chain of Custody

Certification Type: TO15 SCAN

Date Cleaned/Batch ID: 3/19/14 320-6793

Date of QC: 03/29/14 ; 03/31/14

Canister ID	Filename	Canister ID	Filename
34000906	MS703290 6	39001596	MS6703292 1
1064	10	0931	
0653	11	0748	MS703313
1054	12	1965	14
1059	13		
0756	14		
0329	15		
0643	16		
1085	17		
1650			
1630	MS703291 9		
0909	20		

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

1st level Reviewed By — Date: 4/1/14

2nd level Reviewed By — Date: 4/1/14

Q:\FORMS\QA-821 IND CAN QC 20130729.DOC
QA-821

ERS 7/29/2013

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Sacramento
Canister QC Certification
Individual Certification

Certification Type: TO-15

Date Cleaned/Batch ID: 03-13-14 320-6800

Date of QC: 3/29/14

320-6800 Chain of Custody

Canister ID	Filename	Canister ID	Filename
34001136	MS5032905		
0994	MS5032906		
1795	—		
1004	MS5032908		
1230	MS5032909		
8290	MS5032910		
34001747	MS5032911		
1854	MS5032912		
1874	—		
1709	MS5032914		
1803	MS5032915		
9509	MS5032916		

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

1st level Reviewed By: _____ Date: 3/31/14

2nd level Reviewed By: _____ Date: 4/1/14

Q:\FORMS\QA-821 IND CAN QC 20130729.DOC
QA-821

ERS 7/29/2013

320-6850 Chain of Custody

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Sacramento

Canister QC Certification

Certification Type: TO15 8CAN

Date Cleaned/Batch ID: 3/31/14 320-6850

Date of QC: 4/2/14

Data File Number: MS70402 11

CANISTER ID NUMBERS

34001646	34000970	
0742	1224	
1628	0929	
1598*	7538	
1104		
1057		
0995		
0739		

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

1st level Reviewed By: _____ Date: 4/3/14

2nd level Reviewed By: _____ Date: 4/3/14

Q:\FORMS\QA-814 CAN QC CERT 20130729.DOC
QA-814

ERS 7/29/2013

320-6903 Chain of Custody

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Sacramento

Canister QC Certification

Certification Type: TO15 SCAN

Date Cleaned/Batch ID: 4/4/14 320-6903

Date of QC: 4/4/14

Data File Number: M07040407

CANISTER ID NUMBERS

34000860	34002173*	
0681	1220	
0735	1946	
0644	8318	
0933		
8319		
34001099		
1625		

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

1st level Reviewed By: [signature] Date: 4/7/14

2nd level Reviewed By: [signature] Date: 4/7/2014

Q:\FORMS\QA-814 CAN QC CERT 20130729.DOC
QA-814 *ERS 7/29/2013*

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6717-1

SDG No.:

Client Sample ID: 34000813 | Lab Sample ID: 320-6717-3

Matrix: Air | Lab File ID: MS7032705.d

Analysis Method: TO-15 | Date Collected: 03/24/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/27/2014 15:55

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39177 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.44	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6717-1

SDG No.:

Client Sample ID: 34000813 | Lab Sample ID: 320-6717-3

Matrix: Air | Lab File ID: MS7032705.d

Analysis Method: TO-15 | Date Collected: 03/24/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/27/2014 15:55

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39177 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6717-1

SDG No.:

Client Sample ID: 34000813 Lab Sample ID: 320-6717-3

Matrix: Air Lab File ID: MS7032705.d

Analysis Method: TO-15 Date Collected: 03/24/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/27/2014 15:55

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39177 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	96		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	99		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032705.d				
Lims ID:	320-6717-A-3	Lab Sample ID:	320-6717-3		
Client ID:	34000813				
Sample Type:	Client				
Inject. Date:	27-Mar-2014 15:55:30	ALS Bottle#:	5	Worklist Smp#:	5
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	320-6717-3				
Misc. Info.:	500mL; 34000813				
Operator ID:	AO	Instrument ID:	ATMS7		
Method:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\TO15_ATMS7N.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	28-Mar-2014 11:35:41	Calib Date:	27-Mar-2014 14:12:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032703.d				
Column 1 :	RTX Volatiles (0.32 mm)		Det: MS SCAN		
Process Host:	XAWRK021				
First Level Reviewer: ortizam		Date:	28-Mar-2014 11:35:01		

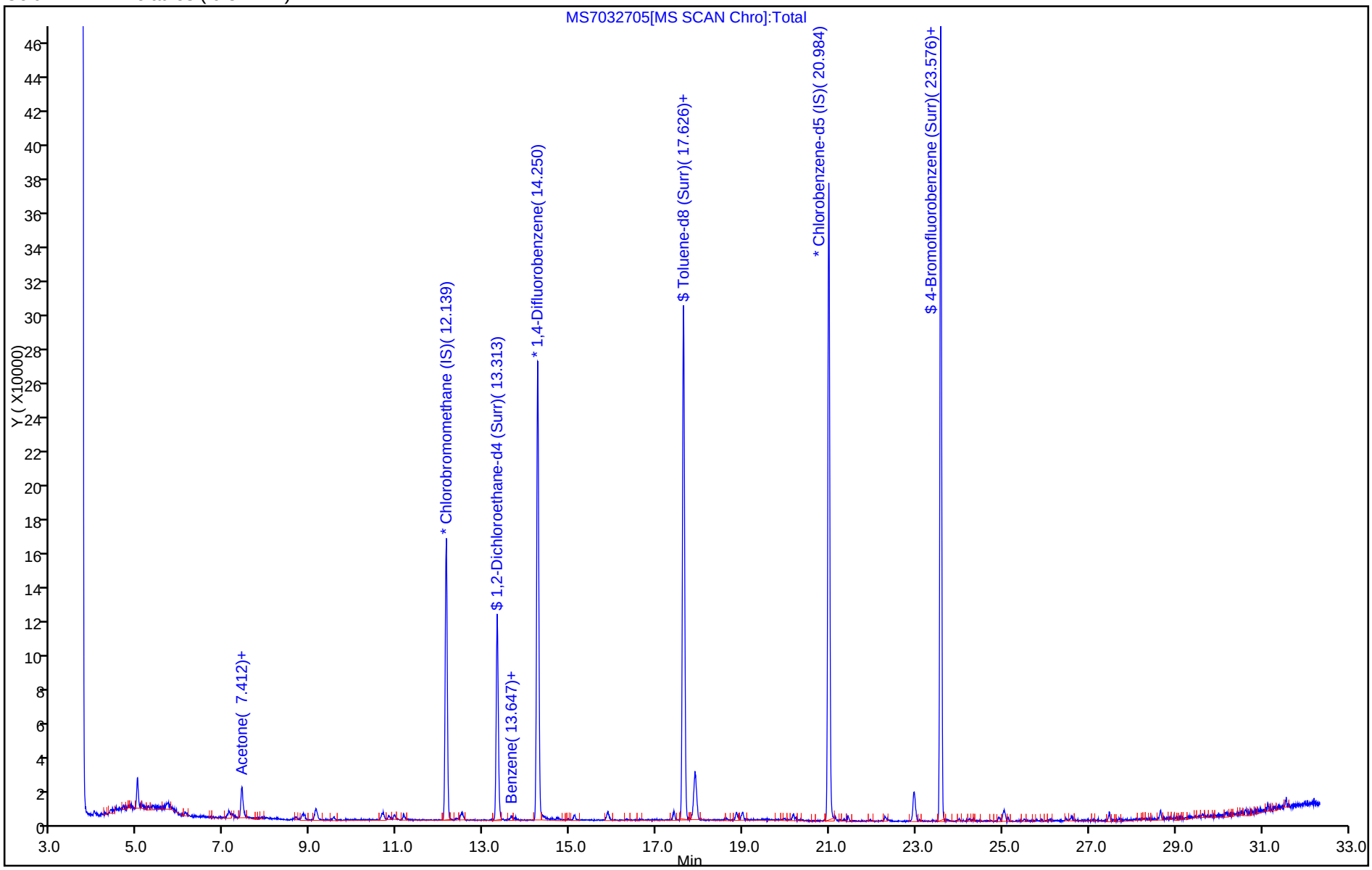
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.139	12.133	0.006	89	87453	4.00	
* 2 1,4-Difluorobenzene	114	14.250	14.244	0.006	90	346867	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.984	20.978	0.006	87	328267	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.313	13.313	0.0	0	151414	3.95	
$ 5 Toluene-d8 (Surr)	100	17.626	17.620	0.006	89	229156	4.01	
$ 6 4-Bromofluorobenzene (Surr)	95	23.576	23.570	0.006	90	245140	3.83	
14 Propene	41	3.993	3.993	0.0	68	1486	0.0280	
31 Acetone	43	7.406	7.418	-0.012	96	42863	0.4382	
68 Benzene	78	13.629	13.641	-0.012	22	4406	0.0279	

Report Date: 28-Mar-2014 11:35:42 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032705.d				
Injection Date:	27-Mar-2014 15:55:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6717-A-3	Lab Sample ID:	320-6717-3	Worklist Smp#:	5
Client ID:	34000813				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	5
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

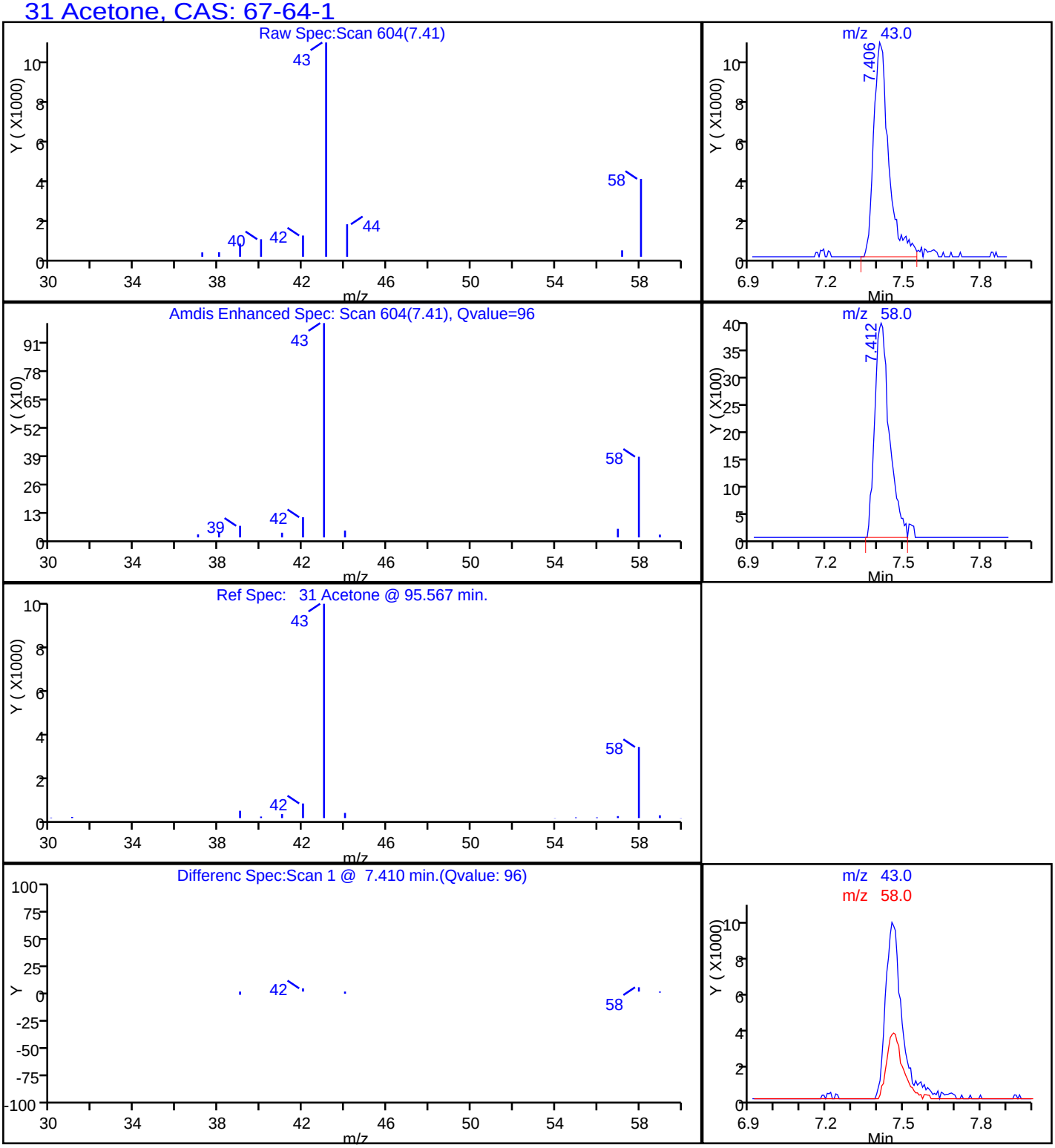


Report Date: 28-Mar-2014 11:35:42 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032705.d				
Injection Date:	27-Mar-2014 15:55:30	Instrument ID:	ATMS7		
Lims ID:	320-6717-A-3	Lab Sample ID:	320-6717-3		
Client ID:	34000813				
Operator ID:	AO	ALS Bottle#:	5	Worklist Smp#:	5
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001597 | Lab Sample ID: 320-6761-1

Matrix: Air | Lab File ID: MS7032809.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 22:28

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39284 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	3.5	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001597 Lab Sample ID: 320-6761-1

Matrix: Air Lab File ID: MS7032809.d

Analysis Method: TO-15 Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/28/2014 22:28

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39284 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001597 Lab Sample ID: 320-6761-1

Matrix: Air Lab File ID: MS7032809.d

Analysis Method: TO-15 Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/28/2014 22:28

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39284 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	100		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032809.d
Lims ID: 320-6761-A-1 Lab Sample ID: 320-6761-1
Client ID: 34001597
Sample Type: Client
Inject. Date: 28-Mar-2014 22:28:30 ALS Bottle#: 13 Worklist Smp#: 9
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6761-1
Misc. Info.: 500mL; 34001597
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 29-Mar-2014 11:09:01 Calib Date: 28-Mar-2014 15:57:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032802.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK048

First Level Reviewer: ortizam Date: 29-Mar-2014 11:11:09

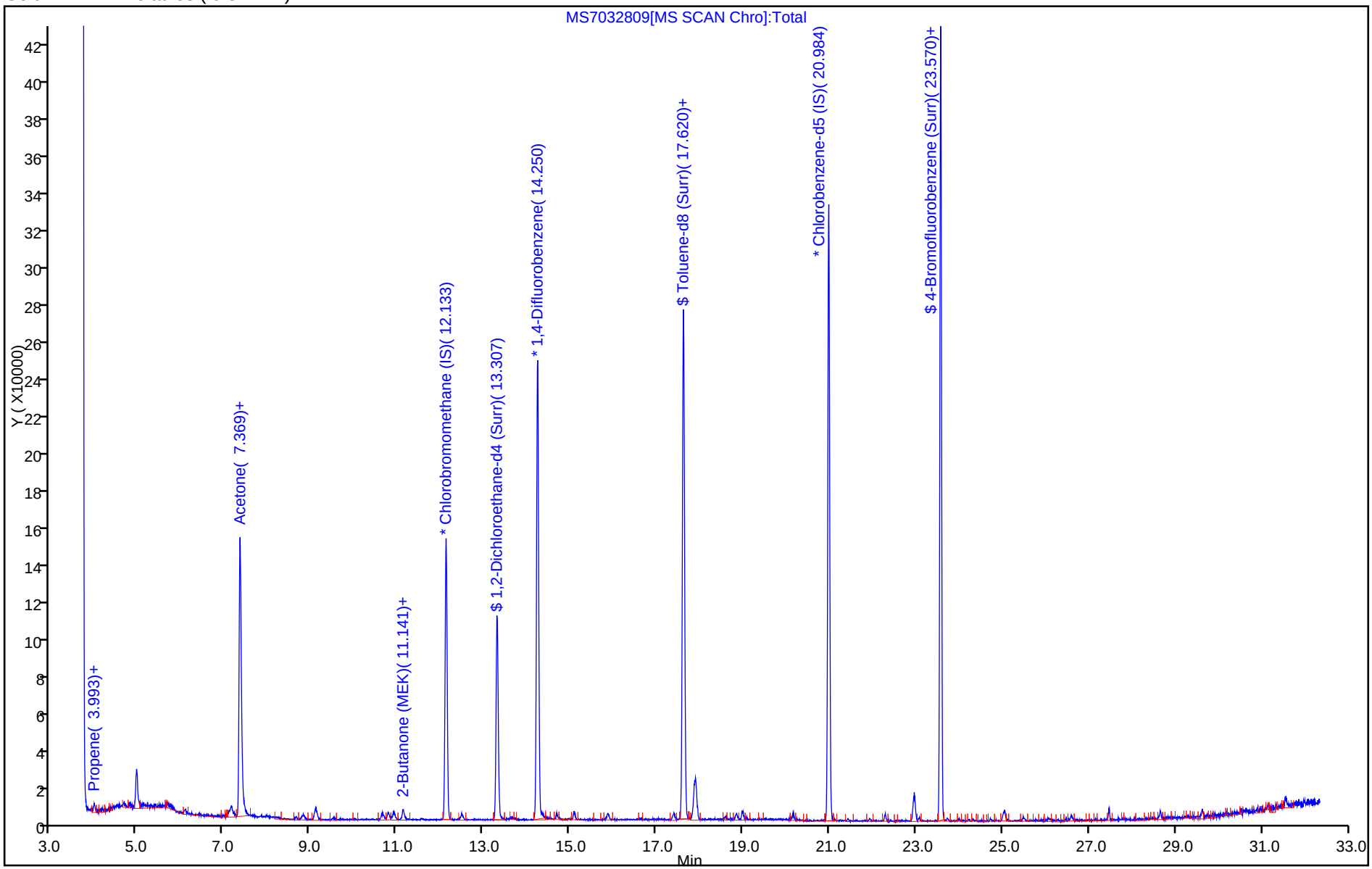
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.133	12.126	0.007	91	79600	4.00	
* 2 1,4-Difluorobenzene	114	14.250	14.250	0.0	90	321209	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.984	20.990	-0.006	87	298348	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.313	13.313	0.0	0	143793	3.98	
$ 5 Toluene-d8 (Surr)	100	17.620	17.632	-0.012	88	214074	4.01	
$ 6 4-Bromofluorobenzene (Surr)	95	23.570	23.576	-0.006	89	221491	3.81	
14 Propene	41	4.005	3.962	0.043	91	2828	0.0560	
18 Chloromethane	50	4.516	4.467	0.049	28	1590	0.0316	
29 Acrolein	56	7.229	7.217	0.012	25	794	0.0427	
31 Acetone	43	7.363	7.375	-0.012	97	380711	3.54	
54 2-Butanone (MEK)	72	11.147	11.135	0.012	92	2106	0.1215	

Report Date: 29-Mar-2014 11:11:09 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032809.d				
Injection Date:	28-Mar-2014 22:28:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6761-A-1	Lab Sample ID:	320-6761-1	Worklist Smp#:	9
Client ID:	34001597				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	13
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

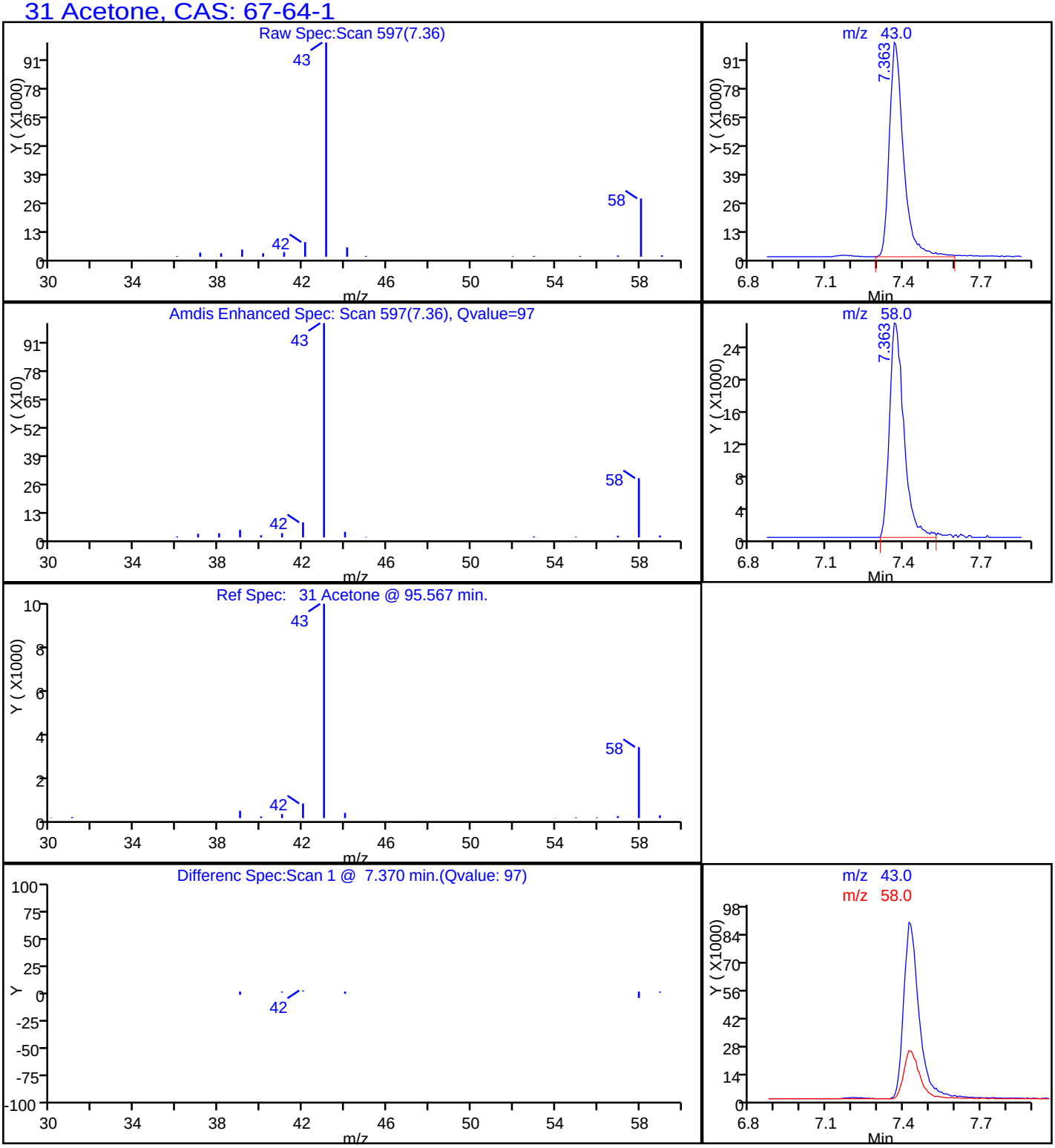


Report Date: 29-Mar-2014 11:11:09 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032809.d				
Injection Date:	28-Mar-2014 22:28:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-1	Lab Sample ID:	320-6761-1		
Client ID:	34001597				
Operator ID:	AO	ALS Bottle#:	13	Worklist Smp#:	9
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001050 | Lab Sample ID: 320-6761-4

Matrix: Air | Lab File ID: MS7032710.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 10:12

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39177 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	3.3	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001050 | Lab Sample ID: 320-6761-4

Matrix: Air | Lab File ID: MS7032710.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 10:12

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39177 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001050 Lab Sample ID: 320-6761-4

Matrix: Air Lab File ID: MS7032710.d

Analysis Method: TO-15 Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/28/2014 10:12

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39177 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	97		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	101		70-130
2037-26-5	Toluene-d8 (Surr)	101		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032710.d				
Lims ID:	320-6761-A-4	Lab Sample ID:	320-6761-4		
Client ID:	34001050				
Sample Type:	Client				
Inject. Date:	28-Mar-2014 10:12:30	ALS Bottle#:	10	Worklist Smp#:	10
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	320-6761-4				
Misc. Info.:	500mL; 34001050				
Operator ID:	AO	Instrument ID:	ATMS7		
Method:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\TO15_ATMS7N.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	28-Mar-2014 11:22:24	Calib Date:	27-Mar-2014 14:12:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032703.d				
Column 1 :	RTX Volatiles (0.32 mm)		Det: MS SCAN		
Process Host:	XAWRK021				
First Level Reviewer: ortizam		Date:	28-Mar-2014 11:24:36		

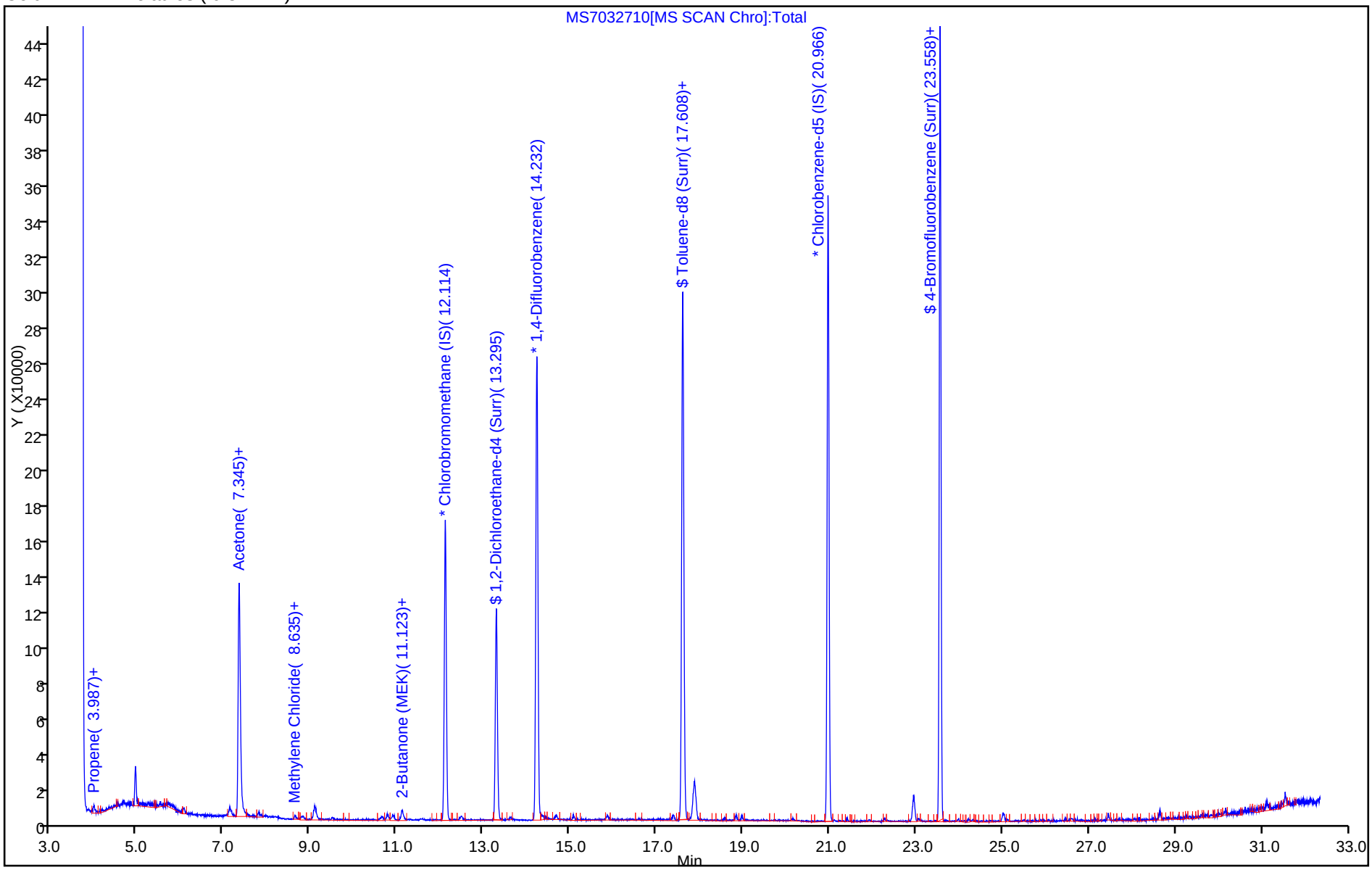
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.114	12.133	-0.019	89	85415	4.00	
* 2 1,4-Difluorobenzene	114	14.232	14.244	-0.012	90	338801	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.966	20.978	-0.012	87	312999	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.295	13.313	-0.018	0	150480	4.02	
$ 5 Toluene-d8 (Surr)	100	17.608	17.620	-0.012	89	226638	4.06	
$ 6 4-Bromofluorobenzene (Surr)	95	23.558	23.570	-0.012	89	236984	3.89	
14 Propene	41	3.987	3.993	-0.006	90	2316	0.0447	
31 Acetone	43	7.351	7.418	-0.067	97	319026	3.34	
47 Methylene Chloride	49	8.653	8.659	-0.006	21	2421	0.0343	
54 2-Butanone (MEK)	72	11.123	11.147	-0.024	83	2812	0.1590	

Report Date: 28-Mar-2014 11:24:37 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032710.d				
Injection Date:	28-Mar-2014 10:12:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6761-A-4	Lab Sample ID:	320-6761-4	Worklist Smp#:	10
Client ID:	34001050				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	10
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

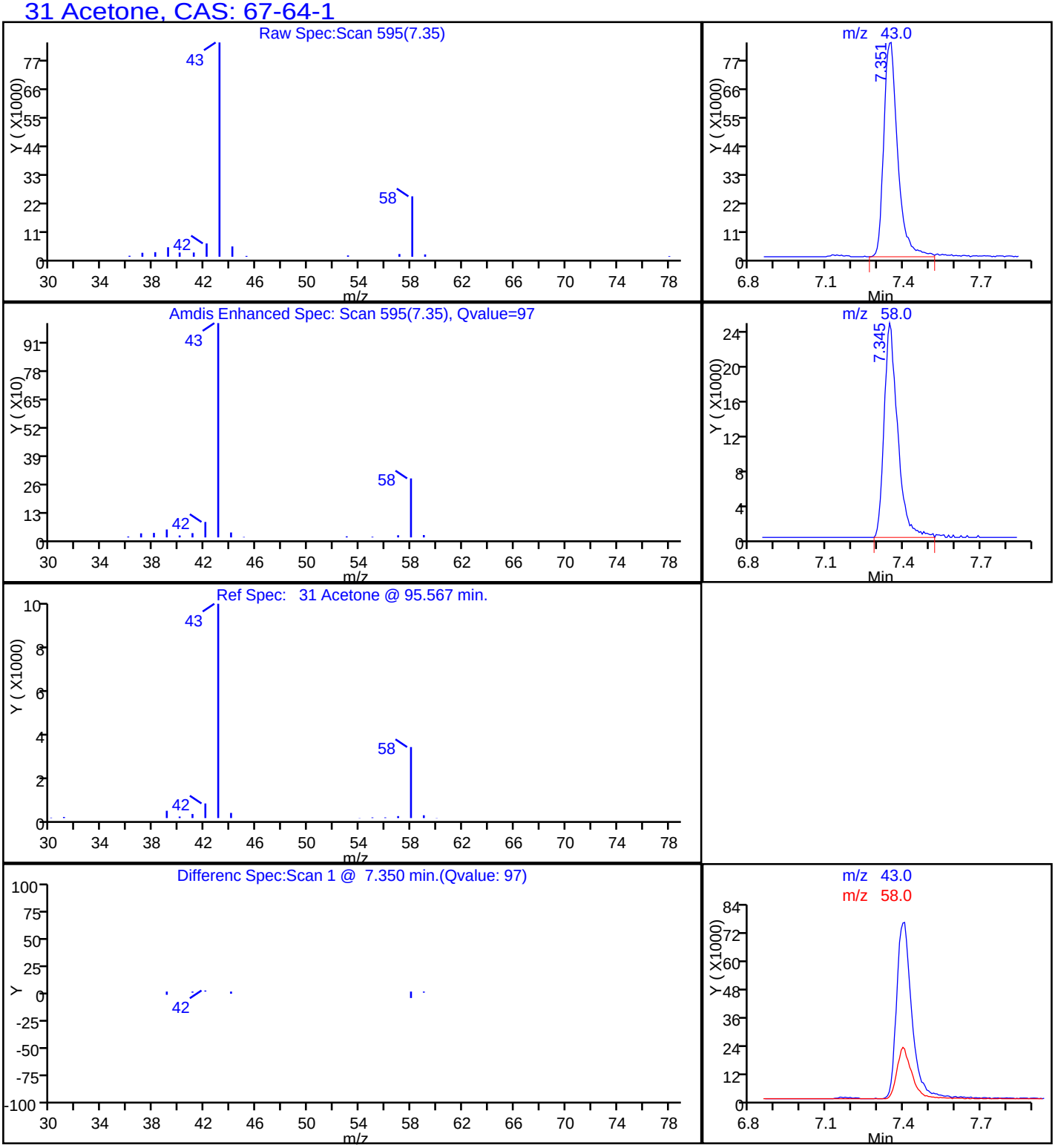


Report Date: 28-Mar-2014 11:24:37 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032710.d				
Injection Date:	28-Mar-2014 10:12:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-4	Lab Sample ID:	320-6761-4		
Client ID:	34001050				
Operator ID:	AO	ALS Bottle#:	10	Worklist Smp#:	10
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001963 | Lab Sample ID: 320-6761-5

Matrix: Air | Lab File ID: MS7032711.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 11:06

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39177 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.47	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001963 | Lab Sample ID: 320-6761-5

Matrix: Air | Lab File ID: MS7032711.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 11:06

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39177 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001963 Lab Sample ID: 320-6761-5

Matrix: Air Lab File ID: MS7032711.d

Analysis Method: TO-15 Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/28/2014 11:06

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39177 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	96		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	101		70-130
2037-26-5	Toluene-d8 (Surr)	102		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032711.d
Lims ID: 320-6761-A-5 Lab Sample ID: 320-6761-5
Client ID: 34001963
Sample Type: Client
Inject. Date: 28-Mar-2014 11:06:30 ALS Bottle#: 11 Worklist Smp#: 11
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6761-5
Misc. Info.: 500mL; 34001963
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140327-11420.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 28-Mar-2014 11:50:04 Calib Date: 27-Mar-2014 14:12:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032703.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK021

First Level Reviewer: ortizam Date: 28-Mar-2014 12:30:09

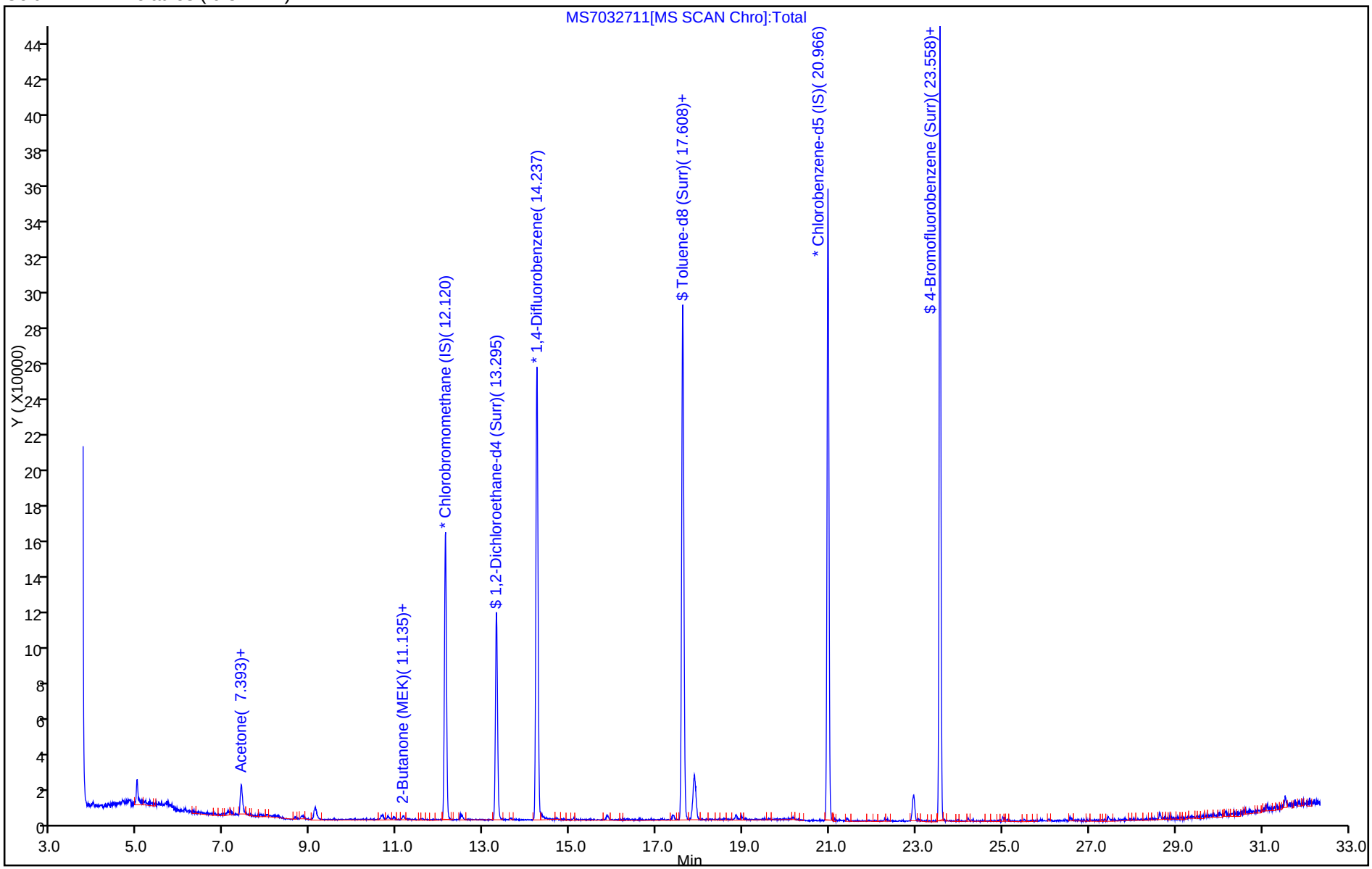
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.114	12.133	-0.019	90	83409	4.00	
* 2 1,4-Difluorobenzene	114	14.231	14.244	-0.013	90	336177	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.966	20.978	-0.012	87	317743	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.295	13.313	-0.018	0	149926	4.04	
$ 5 Toluene-d8 (Surr)	100	17.608	17.620	-0.012	89	226057	4.08	
$ 6 4-Bromofluorobenzene (Surr)	95	23.558	23.570	-0.012	89	238690	3.86	
14 Propene	41	3.968	3.993	-0.025	74	1415	0.0279	
31 Acetone	43	7.393	7.418	-0.025	98	43928	0.4709	
54 2-Butanone (MEK)	72	11.147	11.147	0.0	73	502	0.0291	

Report Date: 28-Mar-2014 12:30:09 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032711.d				
Injection Date:	28-Mar-2014 11:06:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6761-A-5	Lab Sample ID:	320-6761-5	Worklist Smp#:	11
Client ID:	34001963				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	11
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

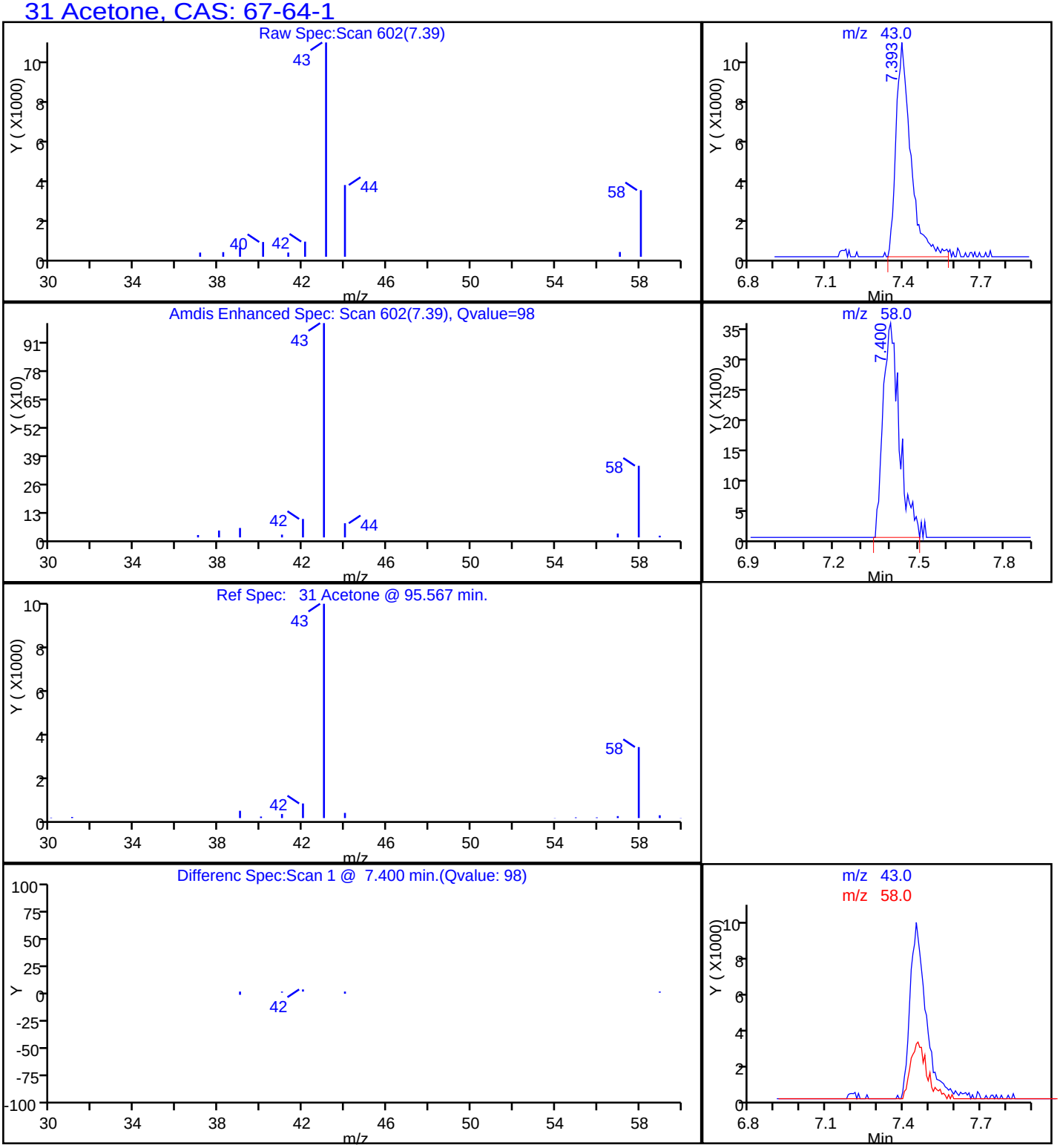


Report Date: 28-Mar-2014 12:30:09 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032711.d				
Injection Date:	28-Mar-2014 11:06:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-5	Lab Sample ID:	320-6761-5		
Client ID:	34001963				
Operator ID:	AO	ALS Bottle#:	11	Worklist Smp#:	11
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001498 | Lab Sample ID: 320-6761-6

Matrix: Air | Lab File ID: MS7032712.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 12:02

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39177 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.38	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001498 | Lab Sample ID: 320-6761-6

Matrix: Air | Lab File ID: MS7032712.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 12:02

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39177 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001498 Lab Sample ID: 320-6761-6

Matrix: Air Lab File ID: MS7032712.d

Analysis Method: TO-15 Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/28/2014 12:02

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39177 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	100		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032712.d				
Lims ID:	320-6761-A-6	Lab Sample ID:	320-6761-6		
Client ID:	34001498				
Sample Type:	Client				
Inject. Date:	28-Mar-2014 12:02:30	ALS Bottle#:	12	Worklist Smp#:	12
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	320-6761-6				
Misc. Info.:	500mL; 34001498				
Operator ID:	AO	Instrument ID:	ATMS7		
Method:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\TO15_ATMS7N.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	28-Mar-2014 13:14:58	Calib Date:	27-Mar-2014 14:12:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032703.d				
Column 1 :	RTX Volatiles (0.32 mm)		Det: MS SCAN		
Process Host:	XAWRK021				
First Level Reviewer: ortizam		Date:	28-Mar-2014 13:15:11		

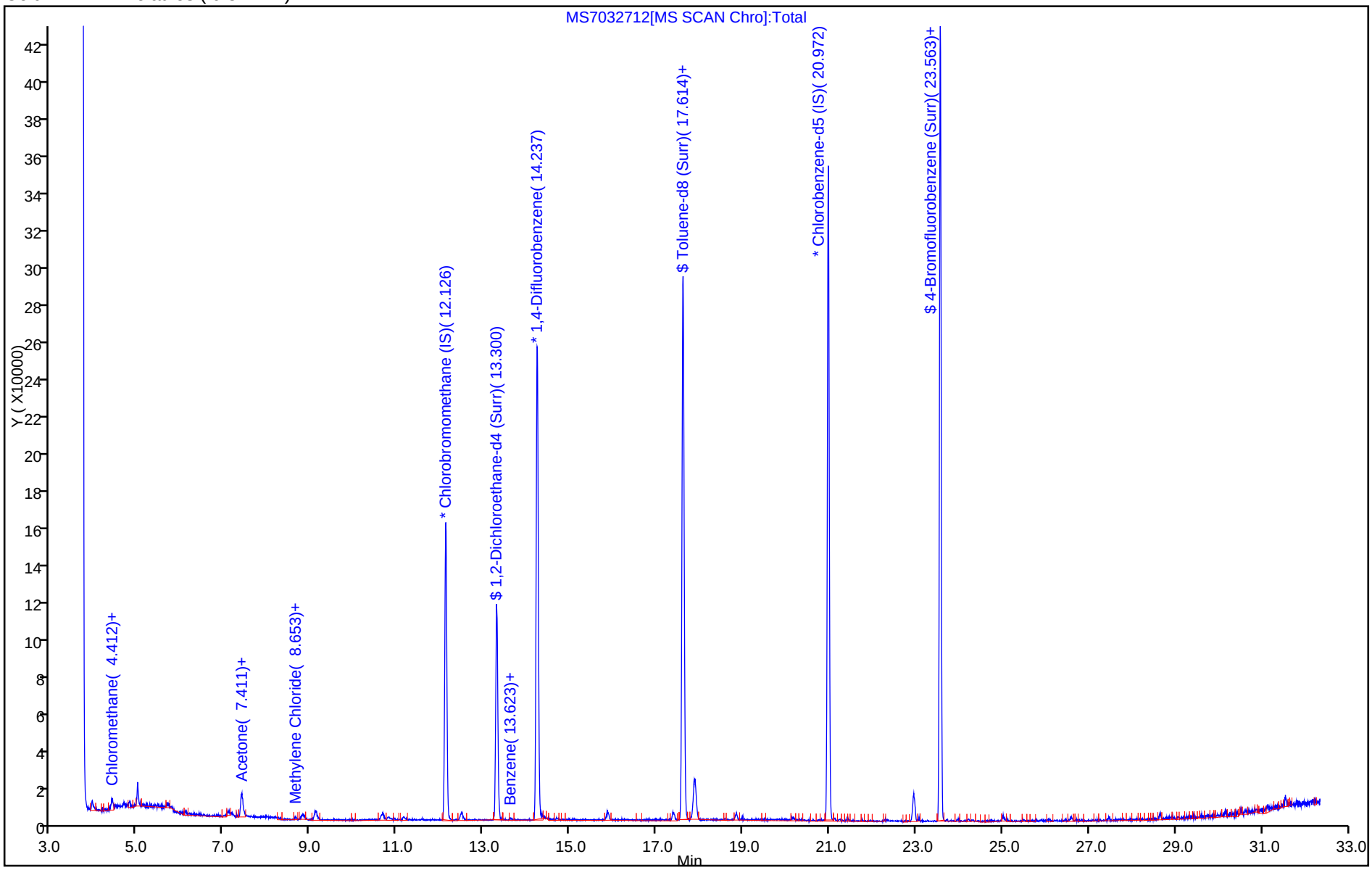
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.126	12.133	-0.007	86	83438	4.00	
* 2 1,4-Difluorobenzene	114	14.243	14.244	-0.001	90	333196	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.972	20.978	-0.006	87	310962	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.300	13.313	-0.013	0	147609	4.01	
$ 5 Toluene-d8 (Surr)	100	17.614	17.620	-0.006	89	219337	3.99	
$ 6 4-Bromofluorobenzene (Surr)	95	23.563	23.570	-0.007	89	229121	3.78	
14 Propene	41	3.993	3.993	0.0	76	1536	0.0303	
18 Chloromethane	50	4.406	4.492	-0.086	1	1855	0.0374	
31 Acetone	43	7.399	7.418	-0.019	93	35013	0.3752	
47 Methylene Chloride	49	8.653	8.659	-0.006	22	1709	0.0248	
68 Benzene	78	13.623	13.641	-0.018	1	3372	0.0222	

Report Date: 28-Mar-2014 13:15:11 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032712.d				
Injection Date:	28-Mar-2014 12:02:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6761-A-6	Lab Sample ID:	320-6761-6	Worklist Smp#:	12
Client ID:	34001498				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	12
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

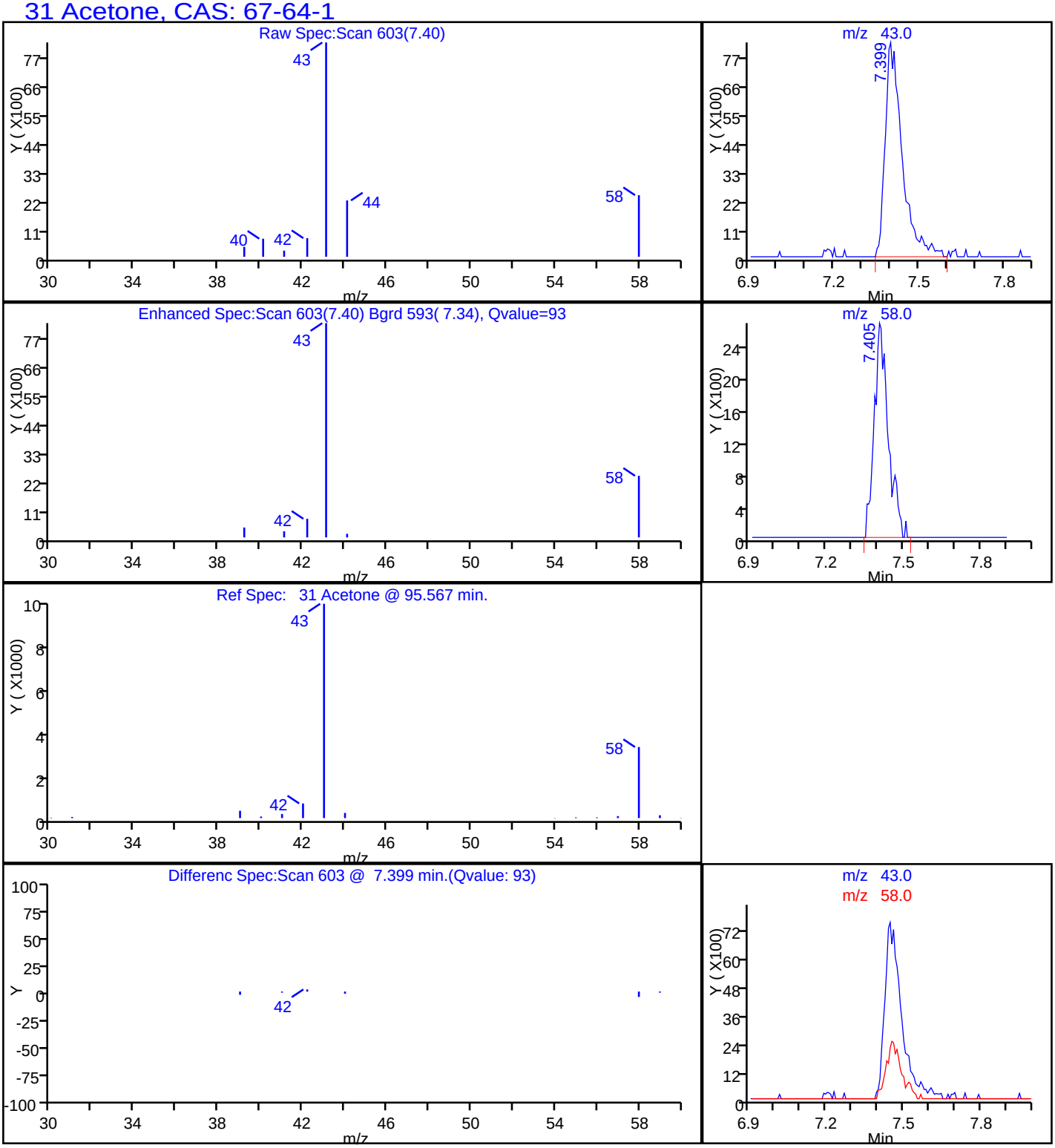


Report Date: 28-Mar-2014 13:15:11 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032712.d				
Injection Date:	28-Mar-2014 12:02:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-6	Lab Sample ID:	320-6761-6		
Client ID:	34001498				
Operator ID:	AO	ALS Bottle#:	12	Worklist Smp#:	12
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000983 | Lab Sample ID: 320-6761-7

Matrix: Air | Lab File ID: MS7032713.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 13:01

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39177 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	1.0	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000983 | Lab Sample ID: 320-6761-7

Matrix: Air | Lab File ID: MS7032713.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 13:01

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39177 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000983 Lab Sample ID: 320-6761-7

Matrix: Air Lab File ID: MS7032713.d

Analysis Method: TO-15 Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/28/2014 13:01

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39177 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	96		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	100		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032713.d				
Lims ID:	320-6761-A-7	Lab Sample ID:	320-6761-7		
Client ID:	34000983				
Sample Type:	Client				
Inject. Date:	28-Mar-2014 13:01:30	ALS Bottle#:	13	Worklist Smp#:	13
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	320-6761-7				
Misc. Info.:	500mL; 34000983				
Operator ID:	AO	Instrument ID:	ATMS7		
Method:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\TO15_ATMS7N.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	28-Mar-2014 14:21:00	Calib Date:	27-Mar-2014 14:12:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032703.d				
Column 1 :	RTX Volatiles (0.32 mm)		Det: MS SCAN		
Process Host:	XAWRK021				
First Level Reviewer: ortizam		Date:	28-Mar-2014 14:21:19		

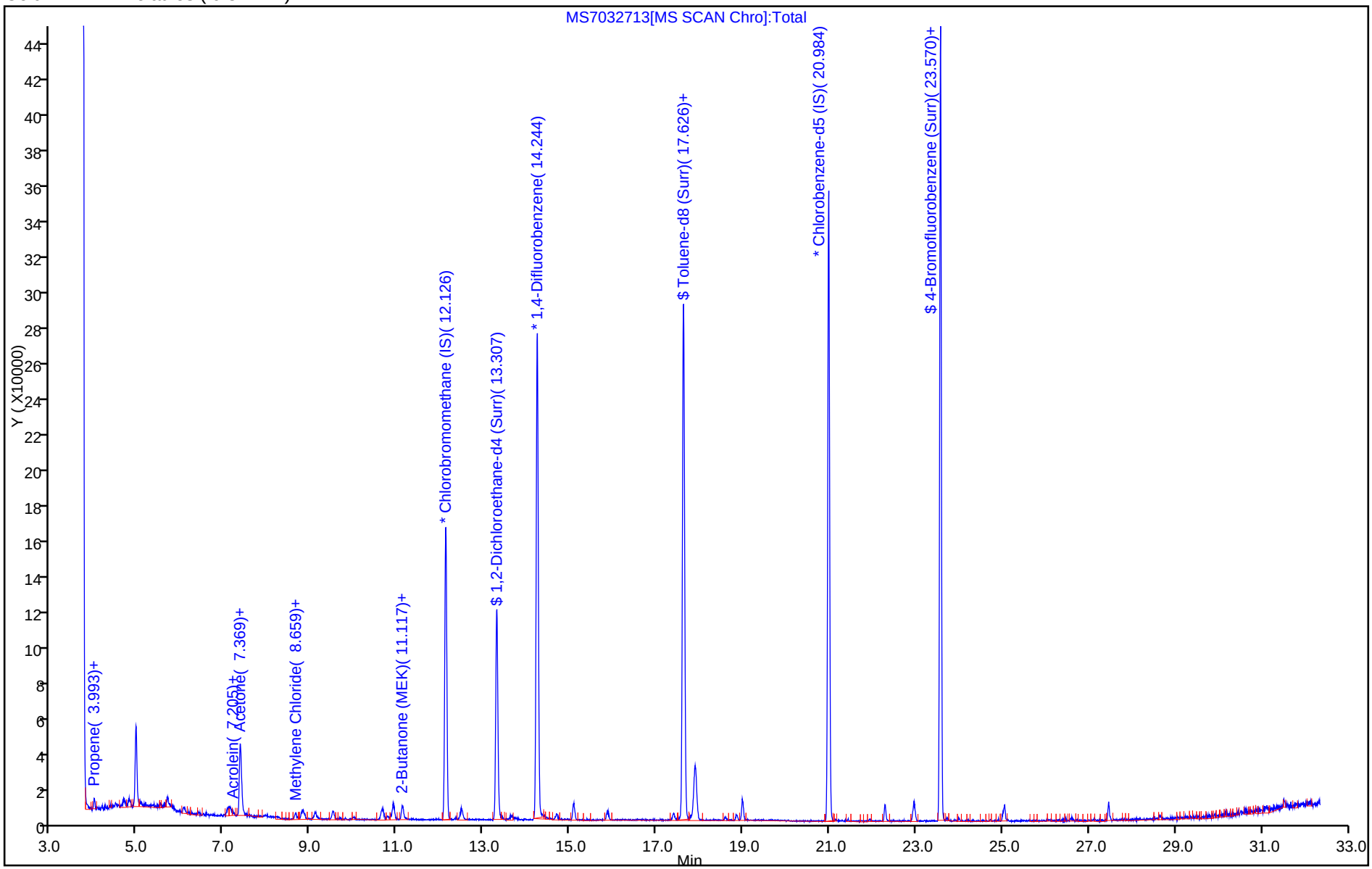
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.126	12.133	-0.007	89	87658	4.00	
* 2 1,4-Difluorobenzene	114	14.244	14.244	0.0	90	351558	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.984	20.978	0.006	86	316802	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.301	13.313	-0.012	0	155170	4.00	
$ 5 Toluene-d8 (Surr)	100	17.620	17.620	0.0	89	229498	3.96	
$ 6 4-Bromofluorobenzene (Surr)	95	23.570	23.570	0.0	89	237360	3.85	
14 Propene	41	3.993	3.993	0.0	93	4735	0.0890	
18 Chloromethane	50	4.485	4.492	-0.007	57	5051	0.0970	
29 Acrolein	56	7.235	7.254	-0.019	32	2047	0.1014	
31 Acetone	43	7.369	7.418	-0.049	99	98491	1.00	
47 Methylene Chloride	49	8.653	8.659	-0.006	65	4118	0.0569	
54 2-Butanone (MEK)	72	11.110	11.147	-0.037	86	3317	0.1827	

Report Date: 28-Mar-2014 14:21:19 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032713.d				
Injection Date:	28-Mar-2014 13:01:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6761-A-7	Lab Sample ID:	320-6761-7	Worklist Smp#:	13
Client ID:	34000983				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	13
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

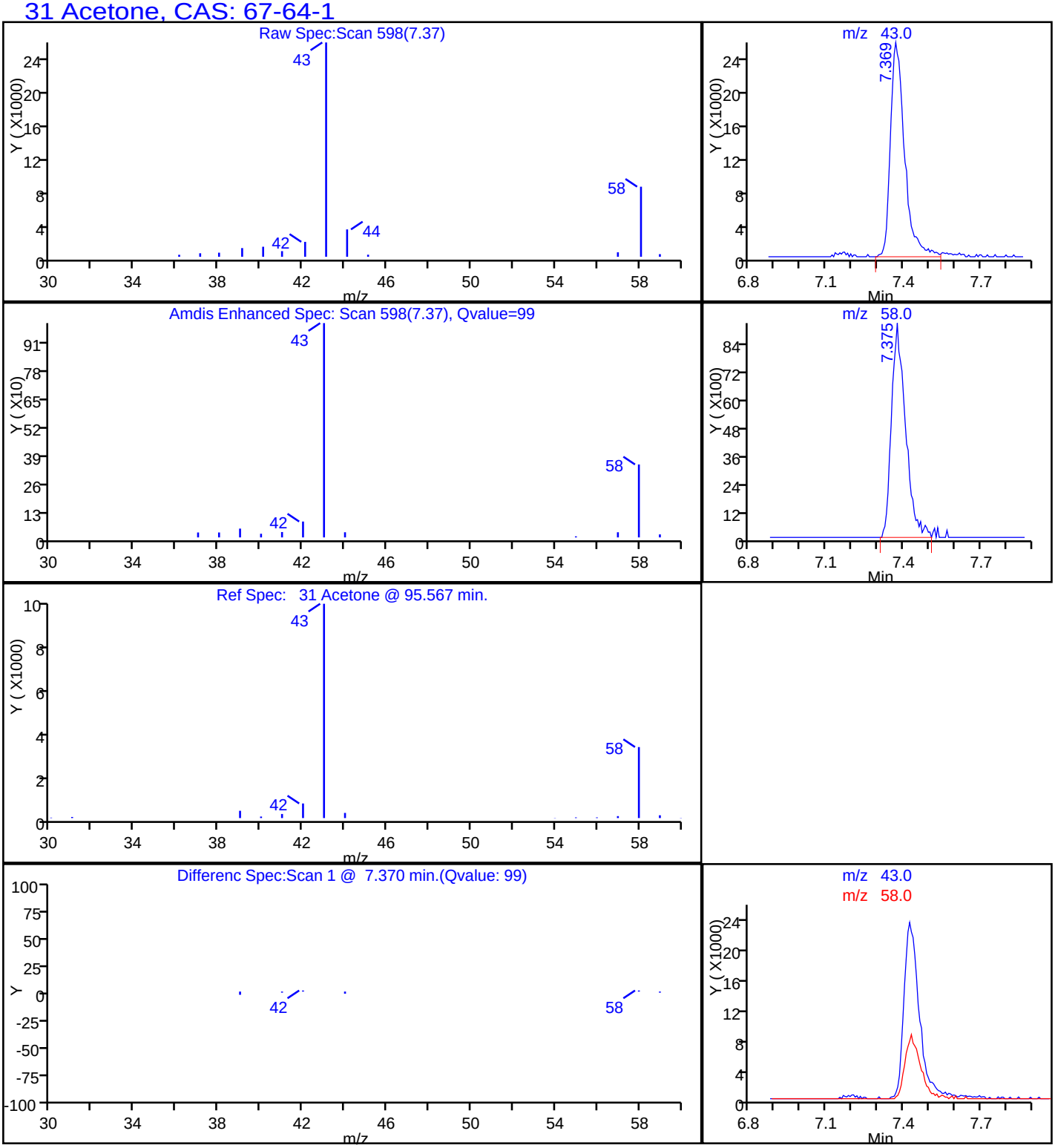


Report Date: 28-Mar-2014 14:21:19 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140327-11420.b\MS7032713.d				
Injection Date:	28-Mar-2014 13:01:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-7	Lab Sample ID:	320-6761-7		
Client ID:	34000983				
Operator ID:	AO	ALS Bottle#:	13	Worklist Smp#:	13
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000640 | Lab Sample ID: 320-6761-8

Matrix: Air | Lab File ID: MS7032804.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 17:47

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39284 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	1.5	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	0.33	J	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000640 | Lab Sample ID: 320-6761-8

Matrix: Air | Lab File ID: MS7032804.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 17:47

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39284 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	0.29	J	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	0.12	J	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I TO-15

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000640 Lab Sample ID: 320-6761-8

Matrix: Air Lab File ID: MS7032804.d

Analysis Method: TO-15 Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/28/2014 17:47

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39284 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	98		70-130
2037-26-5	Toluene-d8 (Surr)	101		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032804.d
Lims ID: 320-6761-A-8 Lab Sample ID: 320-6761-8
Client ID: 34000640
Sample Type: Client
Inject. Date: 28-Mar-2014 17:47:30 ALS Bottle#: 14 Worklist Smp#: 4
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6761-8
Misc. Info.: 500mL; 34000640
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 29-Mar-2014 11:08:42 Calib Date: 28-Mar-2014 15:57:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032802.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK048

First Level Reviewer: ortizam Date: 29-Mar-2014 11:08:42

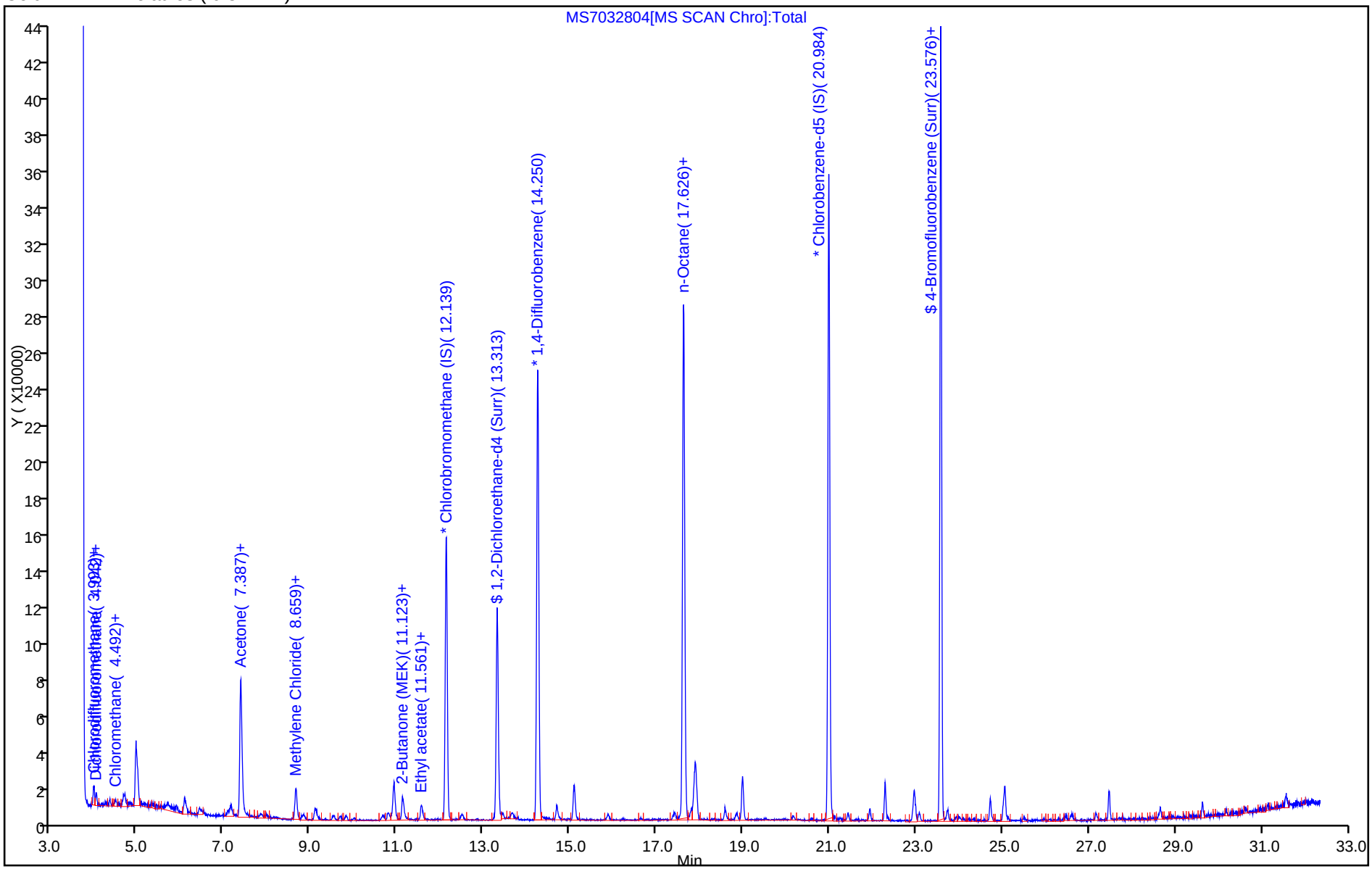
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.133	12.126	0.007	89	80689	4.00	
* 2 1,4-Difluorobenzene	114	14.256	14.250	0.006	90	330051	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.984	20.990	-0.006	87	318968	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.313	13.313	0.0	0	144871	3.90	
$ 5 Toluene-d8 (Surr)	100	17.620	17.632	-0.012	88	221867	4.05	
$ 6 4-Bromofluorobenzene (Surr)	95	23.576	23.576	0.0	89	235020	3.78	
14 Propene	41	3.981	3.962	0.019	93	5937	0.1159	
13 Chlorodifluoromethane	51	4.005	3.975	0.031	14	3974	0.0433	
15 Dichlorodifluoromethane	85	4.048	4.023	0.025	63	6899	0.0490	
18 Chloromethane	50	4.492	4.467	0.025	58	5395	0.1059	
29 Acrolein	56	7.260	7.217	0.043	35	831	0.0441	
31 Acetone	43	7.387	7.375	0.012	99	168963	1.55	
47 Methylene Chloride	49	8.653	8.647	0.006	84	20696	0.2916	
54 2-Butanone (MEK)	72	11.129	11.135	-0.006	95	5810	0.3306	
58 Ethyl acetate	43	11.561	11.549	0.012	78	22262	0.1618	
88 n-Octane	43	17.644	17.669	-0.025	13	4462	0.0261	

Report Date: 29-Mar-2014 11:08:43 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032804.d				
Injection Date:	28-Mar-2014 17:47:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6761-A-8	Lab Sample ID:	320-6761-8	Worklist Smp#:	4
Client ID:	34000640				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	14
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

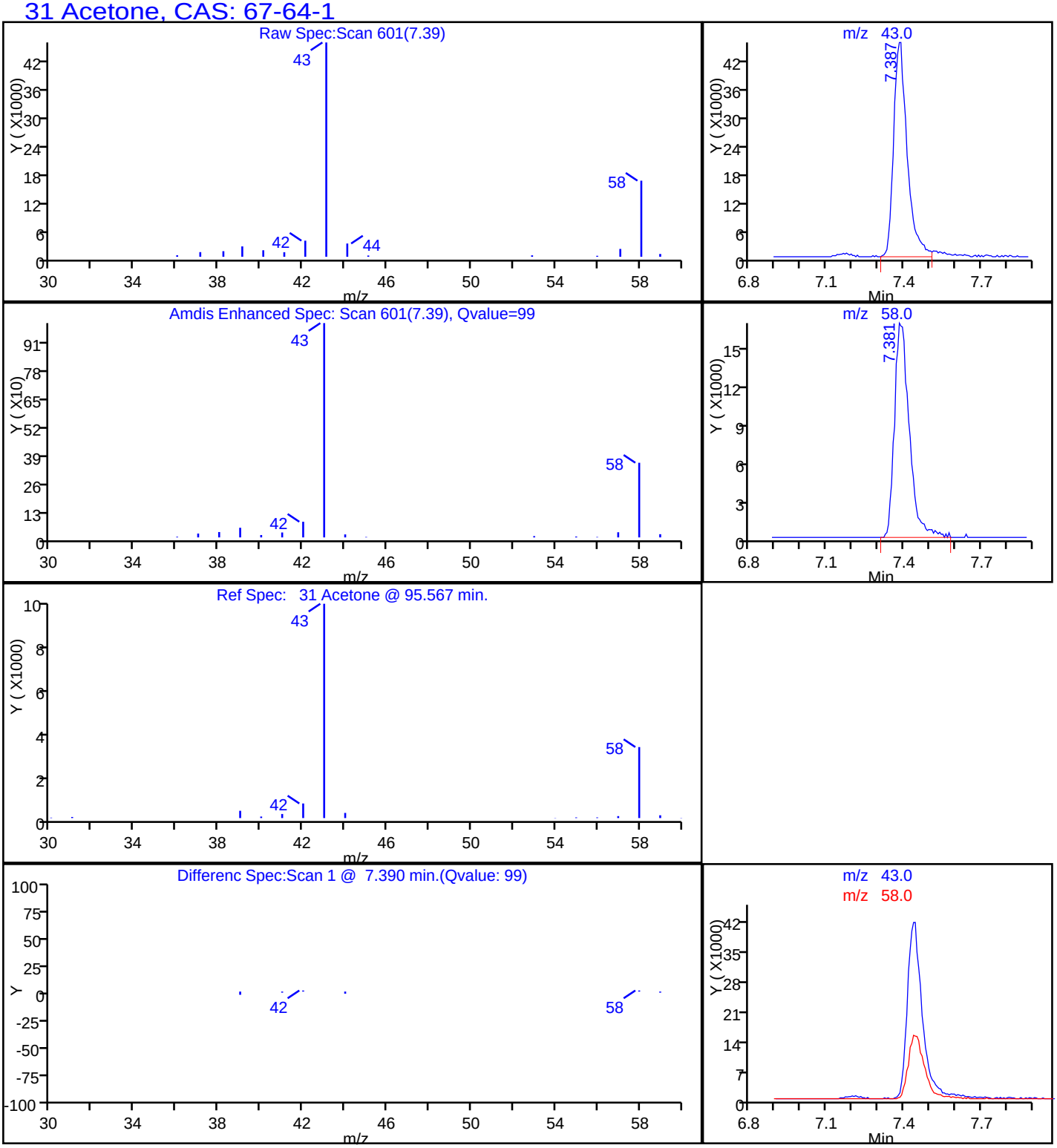


Report Date: 29-Mar-2014 11:08:43 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032804.d				
Injection Date:	28-Mar-2014 17:47:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-8	Lab Sample ID:	320-6761-8		
Client ID:	34000640				
Operator ID:	AO	ALS Bottle#:	14	Worklist Smp#:	4
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1

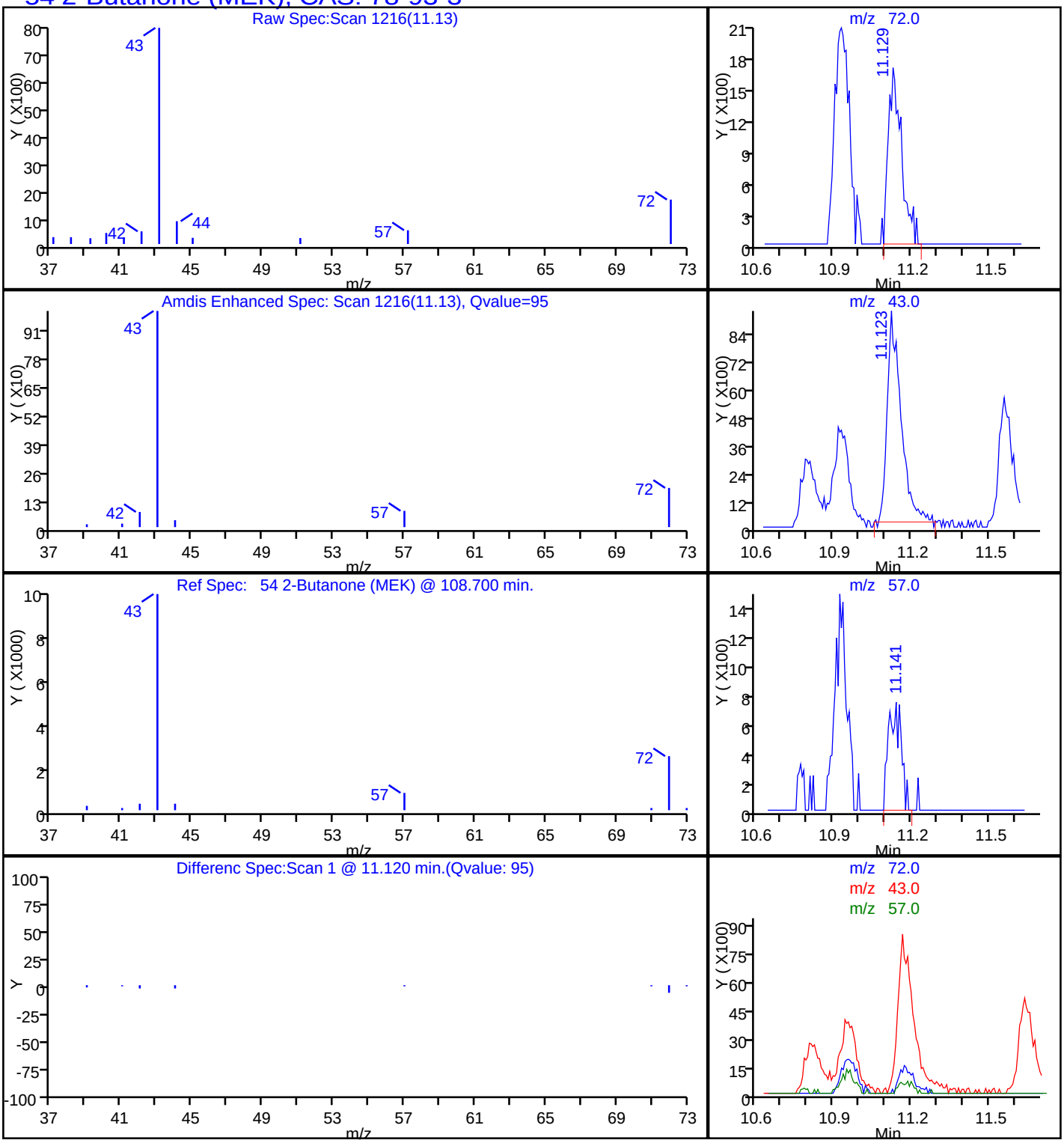


Report Date: 29-Mar-2014 11:08:43 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032804.d				
Injection Date:	28-Mar-2014 17:47:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-8	Lab Sample ID:	320-6761-8		
Client ID:	34000640				
Operator ID:	AO	ALS Bottle#:	14	Worklist Smp#:	4
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

54 2-Butanone (MEK), CAS: 78-93-3

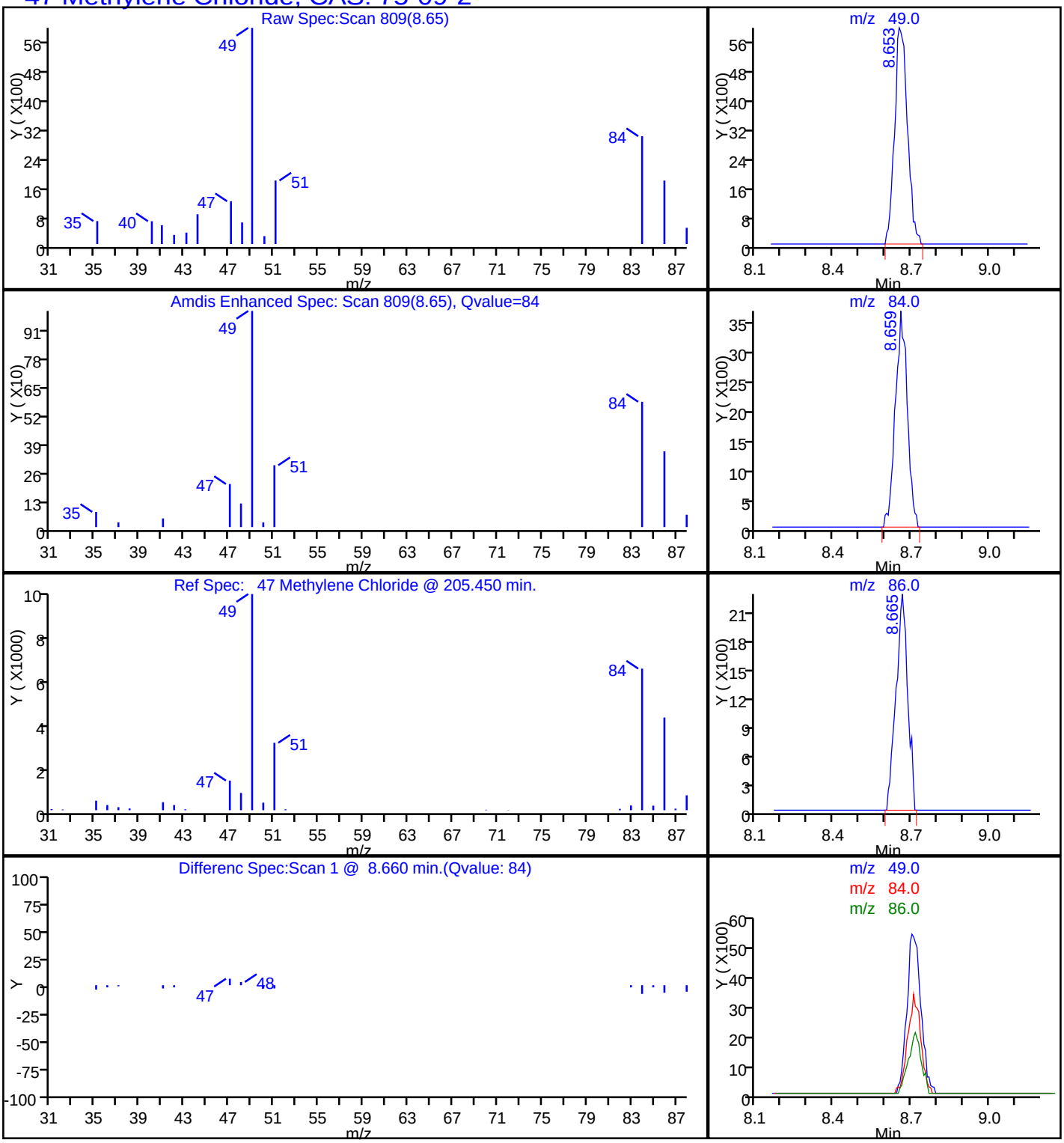


Report Date: 29-Mar-2014 11:08:43 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032804.d				
Injection Date:	28-Mar-2014 17:47:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-8	Lab Sample ID:	320-6761-8		
Client ID:	34000640				
Operator ID:	AO	ALS Bottle#:	14	Worklist Smp#:	4
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

47 Methylene Chloride, CAS: 75-09-2

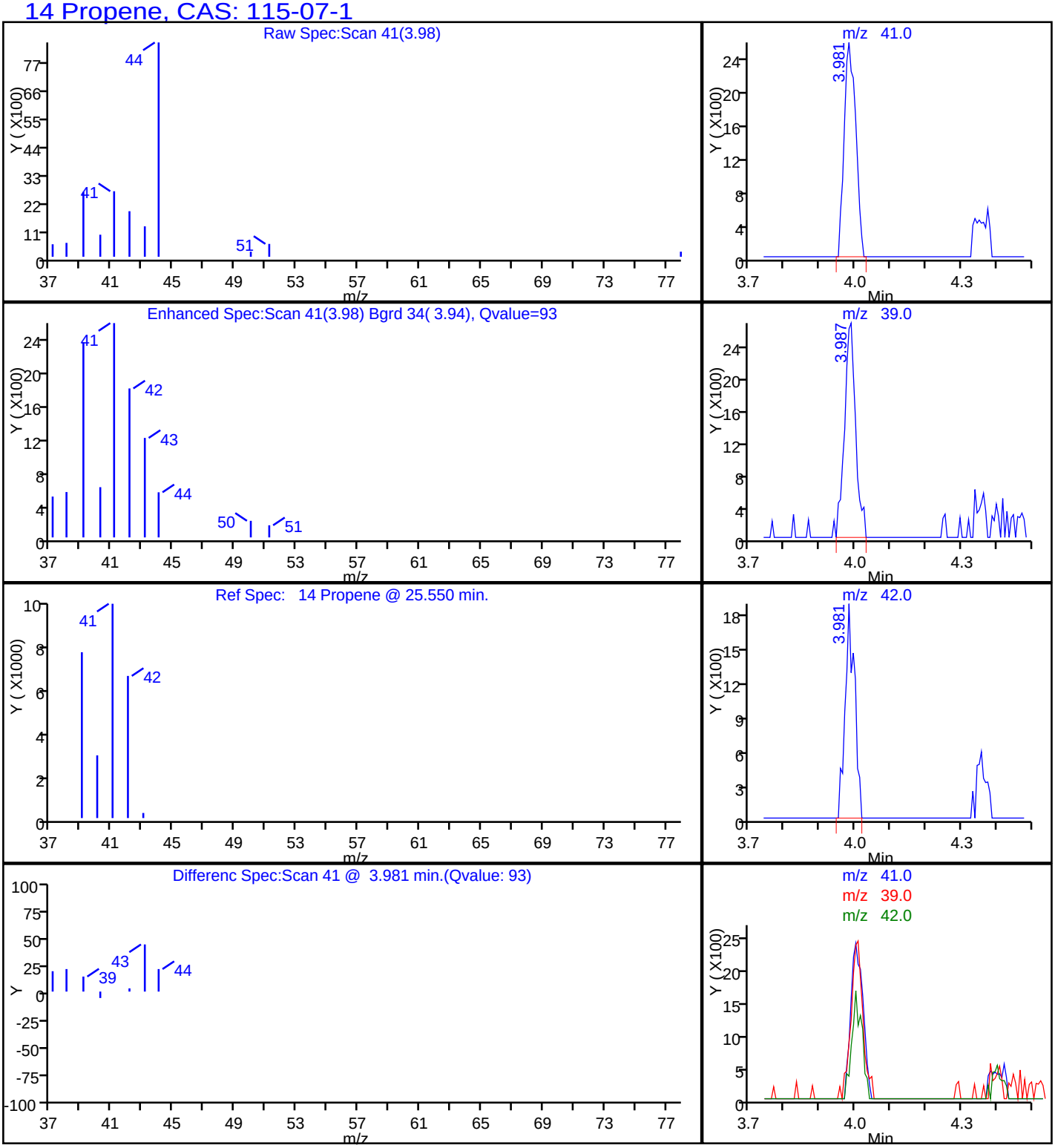


Report Date: 29-Mar-2014 11:08:43 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032804.d				
Injection Date:	28-Mar-2014 17:47:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-8	Lab Sample ID:	320-6761-8		
Client ID:	34000640				
Operator ID:	AO	ALS Bottle#:	14	Worklist Smp#:	4
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

14 Propene, CAS: 115-07-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001853 | Lab Sample ID: 320-6761-9

Matrix: Air | Lab File ID: MS7032805.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 18:44

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39284 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.48	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001853 | Lab Sample ID: 320-6761-9

Matrix: Air | Lab File ID: MS7032805.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 18:44

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39284 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34001853 Lab Sample ID: 320-6761-9

Matrix: Air Lab File ID: MS7032805.d

Analysis Method: TO-15 Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/28/2014 18:44

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39284 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	99		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032805.d
Lims ID: 320-6761-A-9 Lab Sample ID: 320-6761-9
Client ID: 34001853
Sample Type: Client
Inject. Date: 28-Mar-2014 18:44:30 ALS Bottle#: 15 Worklist Smp#: 5
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6761-9
Misc. Info.: 500mL; 34001853
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 29-Mar-2014 11:09:01 Calib Date: 28-Mar-2014 15:57:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032802.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK048

First Level Reviewer: ortizam Date: 29-Mar-2014 11:09:01

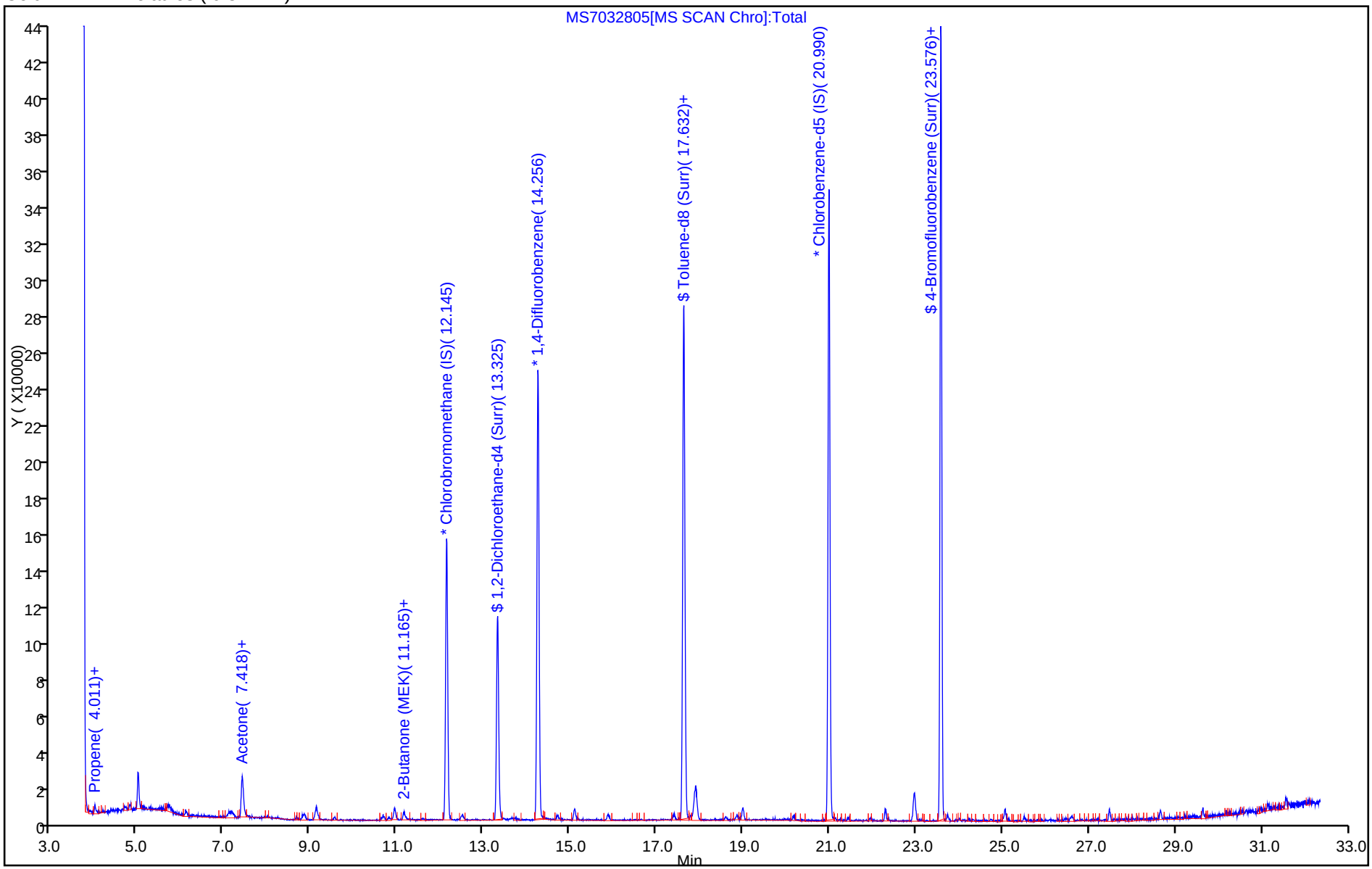
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.151	12.126	0.025	86	82148	4.00	
* 2 1,4-Difluorobenzene	114	14.262	14.250	0.012	90	333140	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.990	20.990	0.0	86	319163	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.325	13.313	0.012	0	148090	3.95	
$ 5 Toluene-d8 (Surr)	100	17.632	17.632	0.0	89	221629	4.00	
$ 6 4-Bromofluorobenzene (Surr)	95	23.576	23.576	0.0	90	237251	3.81	
14 Propene	41	4.017	3.962	0.055	92	2528	0.0485	
31 Acetone	43	7.418	7.375	0.043	93	53397	0.4807	
54 2-Butanone (MEK)	72	11.165	11.135	0.030	90	2096	0.1171	

Report Date: 29-Mar-2014 11:09:01 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032805.d				
Injection Date:	28-Mar-2014 18:44:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6761-A-9	Lab Sample ID:	320-6761-9	Worklist Smp#:	5
Client ID:	34001853				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	15
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

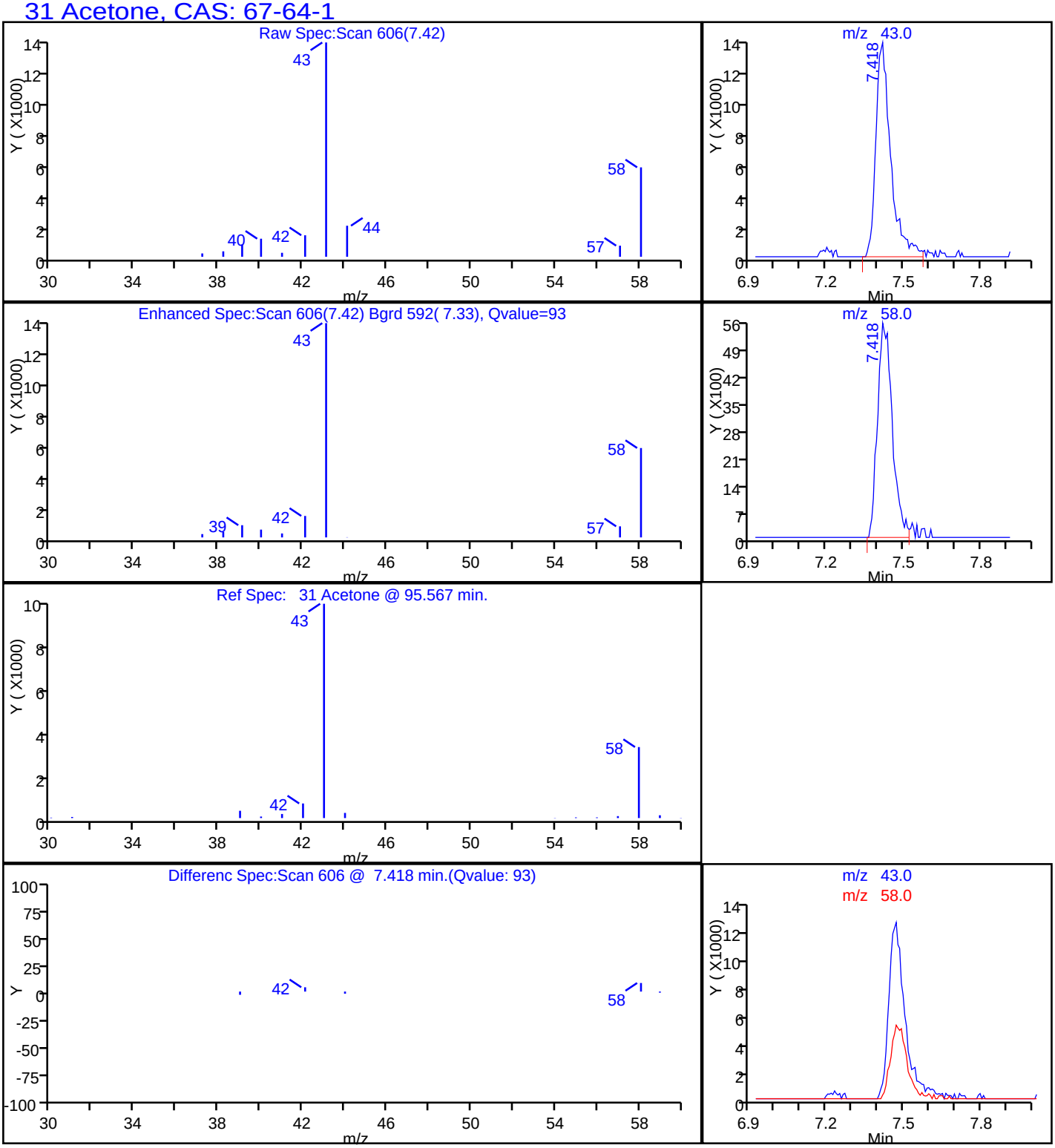


Report Date: 29-Mar-2014 11:09:01 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032805.d				
Injection Date:	28-Mar-2014 18:44:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-9	Lab Sample ID:	320-6761-9		
Client ID:	34001853				
Operator ID:	AO	ALS Bottle#:	15	Worklist Smp#:	5
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000759 | Lab Sample ID: 320-6761-10

Matrix: Air | Lab File ID: MS7032806.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 19:39

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39284 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.39	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000759 | Lab Sample ID: 320-6761-10

Matrix: Air | Lab File ID: MS7032806.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 19:39

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39284 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000759 Lab Sample ID: 320-6761-10

Matrix: Air Lab File ID: MS7032806.d

Analysis Method: TO-15 Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/28/2014 19:39

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39284 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	98		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032806.d				
Lims ID:	320-6761-A-10	Lab Sample ID:	320-6761-10		
Client ID:	34000759				
Sample Type:	Client				
Inject. Date:	28-Mar-2014 19:39:30	ALS Bottle#:	16	Worklist Smp#:	6
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	320-6761-10				
Misc. Info.:	500mL; 34000759				
Operator ID:	AO	Instrument ID:	ATMS7		
Method:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\TO15_ATMS7N.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	29-Mar-2014 11:09:01	Calib Date:	28-Mar-2014 15:57:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032802.d				
Column 1 :	RTX Volatiles (0.32 mm)		Det: MS SCAN		
Process Host:	XAWRK048				
First Level Reviewer: ortizam		Date:	29-Mar-2014 11:09:10		

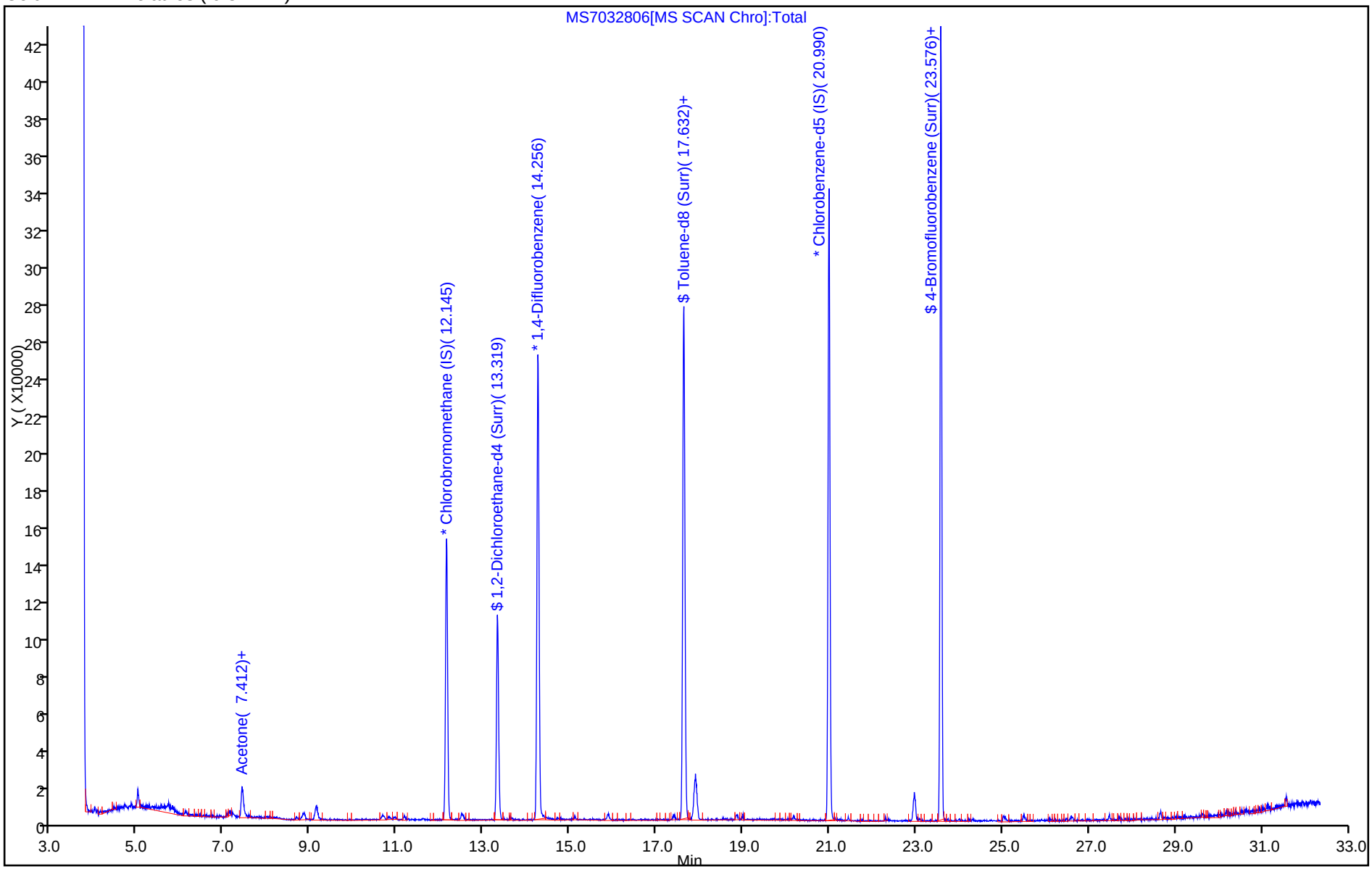
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.145	12.126	0.019	87	82395	4.00	
* 2 1,4-Difluorobenzene	114	14.256	14.250	0.006	90	326565	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.990	20.990	0.0	86	306187	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.319	13.313	0.006	0	143599	3.91	
$ 5 Toluene-d8 (Surr)	100	17.632	17.632	0.0	89	216813	4.00	
$ 6 4-Bromofluorobenzene (Surr)	95	23.576	23.576	0.0	89	227811	3.82	
14 Propene	41	4.005	3.962	0.043	91	1495	0.0286	
31 Acetone	43	7.412	7.375	0.037	95	43254	0.3882	

Report Date: 29-Mar-2014 11:09:11 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032806.d				
Injection Date:	28-Mar-2014 19:39:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6761-A-10	Lab Sample ID:	320-6761-10	Worklist Smp#:	6
Client ID:	34000759				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	16
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

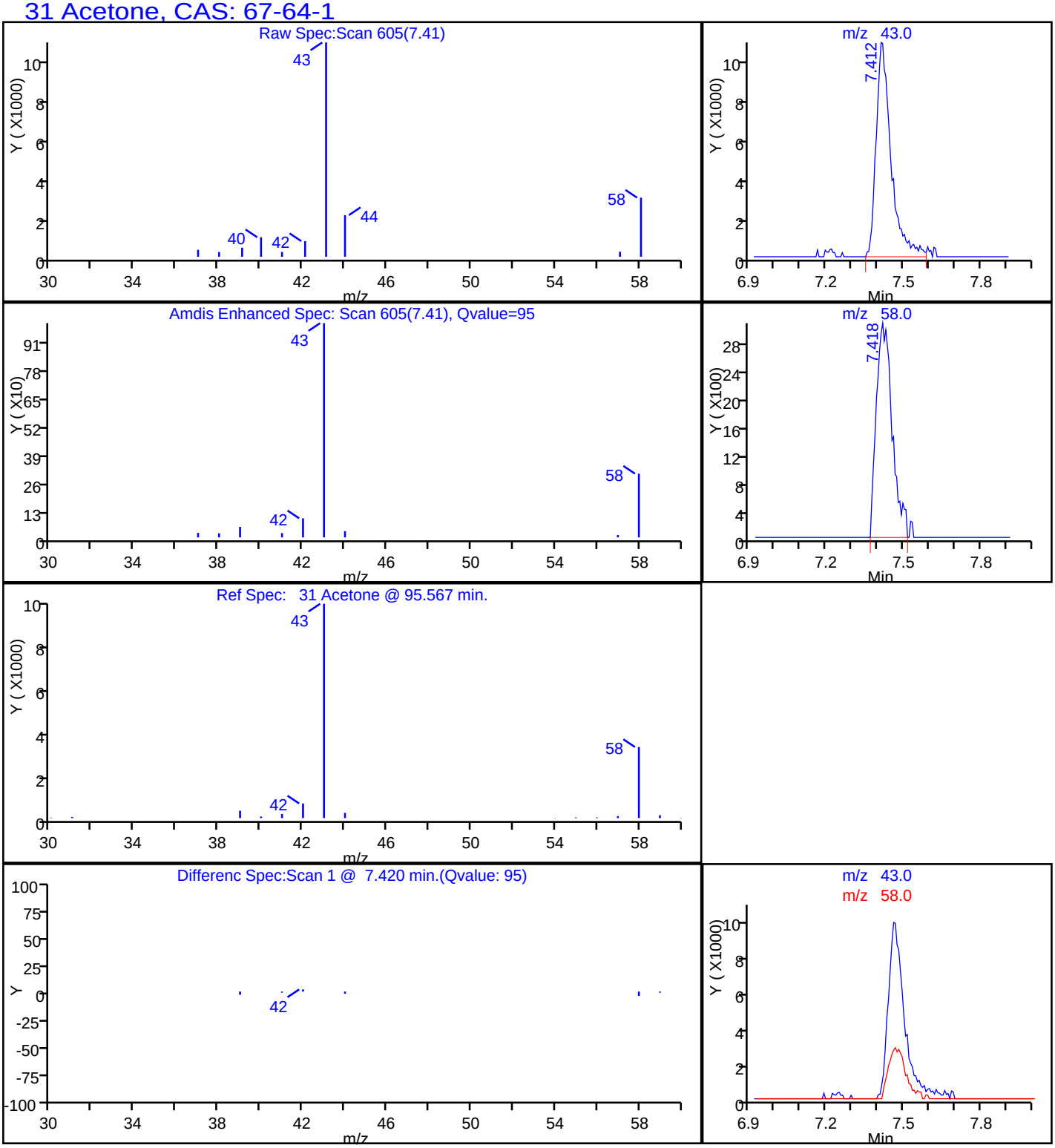


Report Date: 29-Mar-2014 11:09:11 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032806.d				
Injection Date:	28-Mar-2014 19:39:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-10	Lab Sample ID:	320-6761-10		
Client ID:	34000759				
Operator ID:	AO	ALS Bottle#:	16	Worklist Smp#:	6
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000234 | Lab Sample ID: 320-6761-12

Matrix: Air | Lab File ID: MS7032808.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 21:31

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39284 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.28	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000234 | Lab Sample ID: 320-6761-12

Matrix: Air | Lab File ID: MS7032808.d

Analysis Method: TO-15 | Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/28/2014 21:31

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39284 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6761-1

SDG No.:

Client Sample ID: 34000234 Lab Sample ID: 320-6761-12

Matrix: Air Lab File ID: MS7032808.d

Analysis Method: TO-15 Date Collected: 03/18/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/28/2014 21:31

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39284 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	97		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	101		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032808.d
Lims ID: 320-6761-A-12 Lab Sample ID: 320-6761-12
Client ID: 34000234
Sample Type: Client
Inject. Date: 28-Mar-2014 21:31:30 ALS Bottle#: 4 Worklist Smp#: 8
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6761-12
Misc. Info.: 500mL; 34000234
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 29-Mar-2014 11:09:01 Calib Date: 28-Mar-2014 15:57:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032802.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK048

First Level Reviewer: ortizam Date: 29-Mar-2014 11:09:54

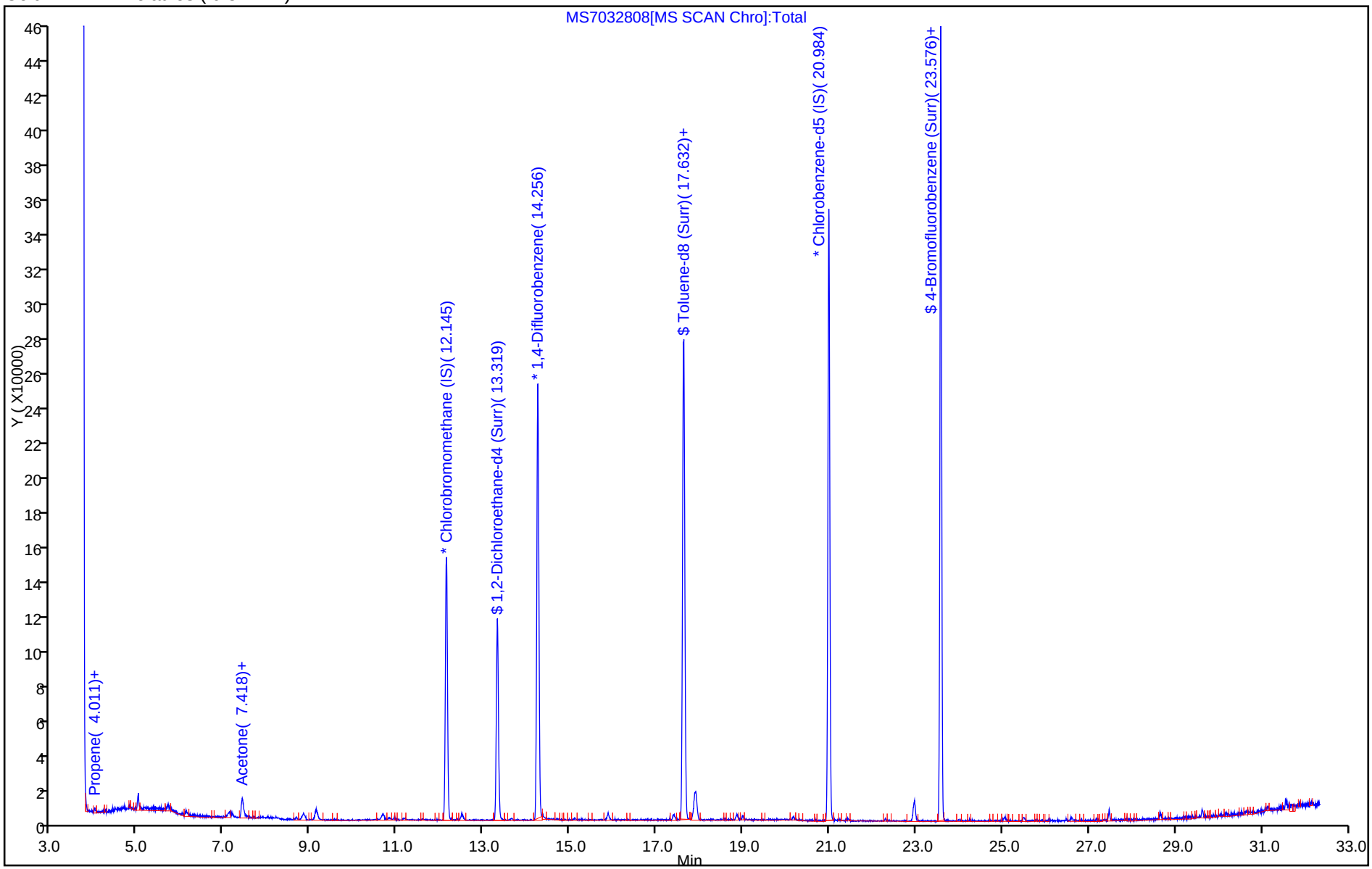
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.145	12.126	0.019	90	82708	4.00	
* 2 1,4-Difluorobenzene	114	14.256	14.250	0.006	90	330600	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.990	20.990	0.0	85	318476	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.319	13.313	0.006	0	149554	4.02	
$ 5 Toluene-d8 (Surr)	100	17.620	17.632	-0.012	88	220693	4.02	
$ 6 4-Bromofluorobenzene (Surr)	95	23.576	23.576	0.0	89	241845	3.90	
14 Propene	41	3.999	3.962	0.037	91	1487	0.0283	
31 Acetone	43	7.418	7.375	0.043	90	31021	0.2774	

Report Date: 29-Mar-2014 11:09:54 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032808.d				
Injection Date:	28-Mar-2014 21:31:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6761-A-12	Lab Sample ID:	320-6761-12	Worklist Smp#:	8
Client ID:	34000234				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	4
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

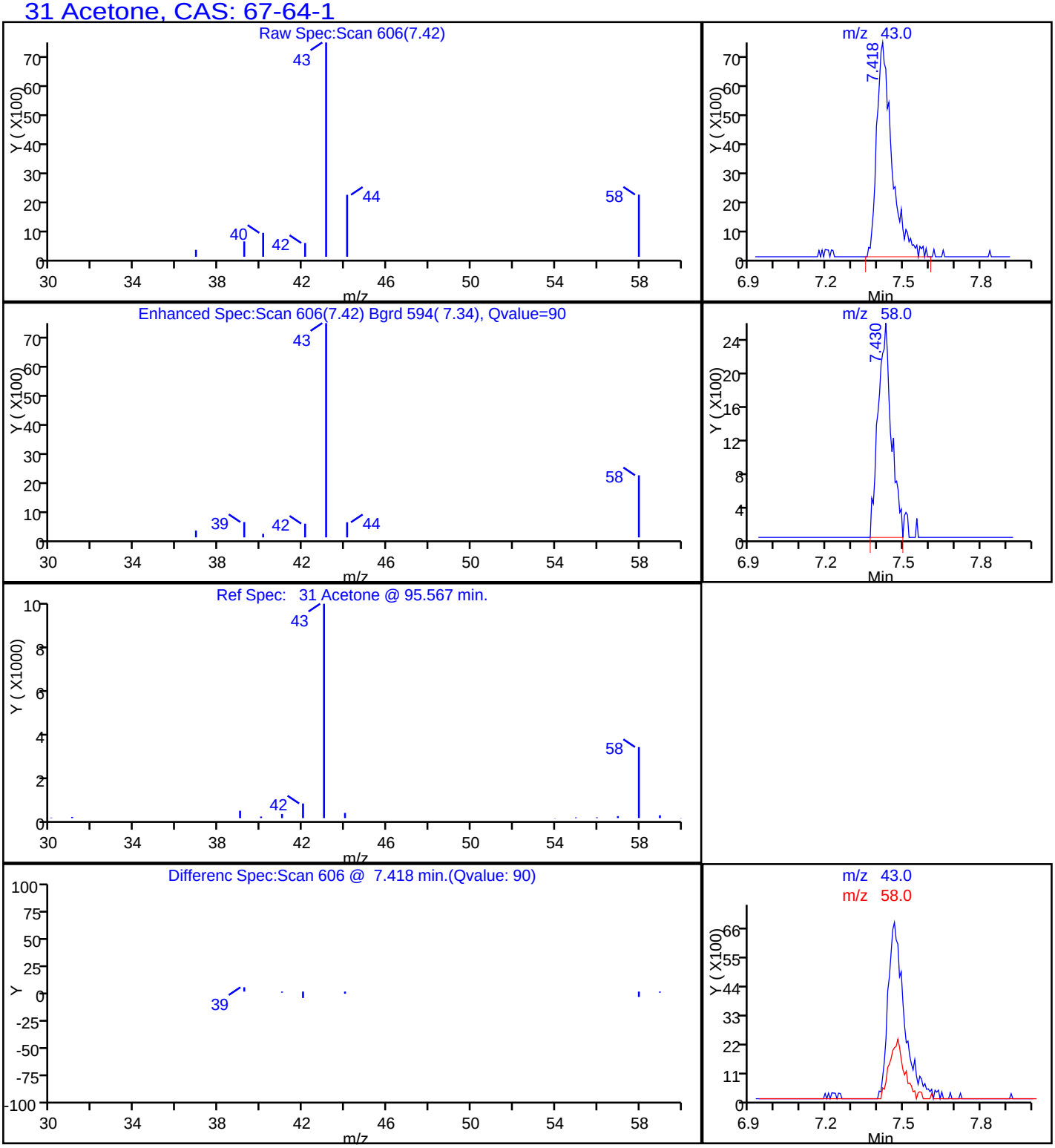


Report Date: 29-Mar-2014 11:09:54 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140328-11446.b\MS7032808.d				
Injection Date:	28-Mar-2014 21:31:30	Instrument ID:	ATMS7		
Lims ID:	320-6761-A-12	Lab Sample ID:	320-6761-12		
Client ID:	34000234				
Operator ID:	AO	ALS Bottle#:	4	Worklist Smp#:	8
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000906 | Lab Sample ID: 320-6793-1

Matrix: Air | Lab File ID: MS7032906.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 15:28

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.31	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000906 | Lab Sample ID: 320-6793-1

Matrix: Air | Lab File ID: MS7032906.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 15:28

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	ND	*	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000906 Lab Sample ID: 320-6793-1

Matrix: Air Lab File ID: MS7032906.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 15:28

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	91		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	86	*	70-130
2037-26-5	Toluene-d8 (Surr)	86	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032906.d
Lims ID: 320-6793-A-1 Lab Sample ID: 320-6793-1
Client ID: 34000906
Sample Type: Client
Inject. Date: 29-Mar-2014 15:28:30 ALS Bottle#: 5 Worklist Smp#: 6
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6794-9
Misc. Info.: 500mL; 34000773
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:22:50 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:23:19

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.157	12.145	0.012	87	76465	4.00	s
* 2 1,4-Difluorobenzene	114	14.268	14.262	0.006	90	299076	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.996	20.990	0.006	86	278536	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.331	13.325	0.006	0	134967	3.45	
$ 5 Toluene-d8 (Surr)	100	17.638	17.626	0.012	88	202892	3.43	
$ 6 4-Bromofluorobenzene (Surr)	95	23.588	23.582	0.006	90	210733	3.65	
31 Acetone	43	7.424	7.400	0.024	95	44944	0.3087	

QC Flag Legend

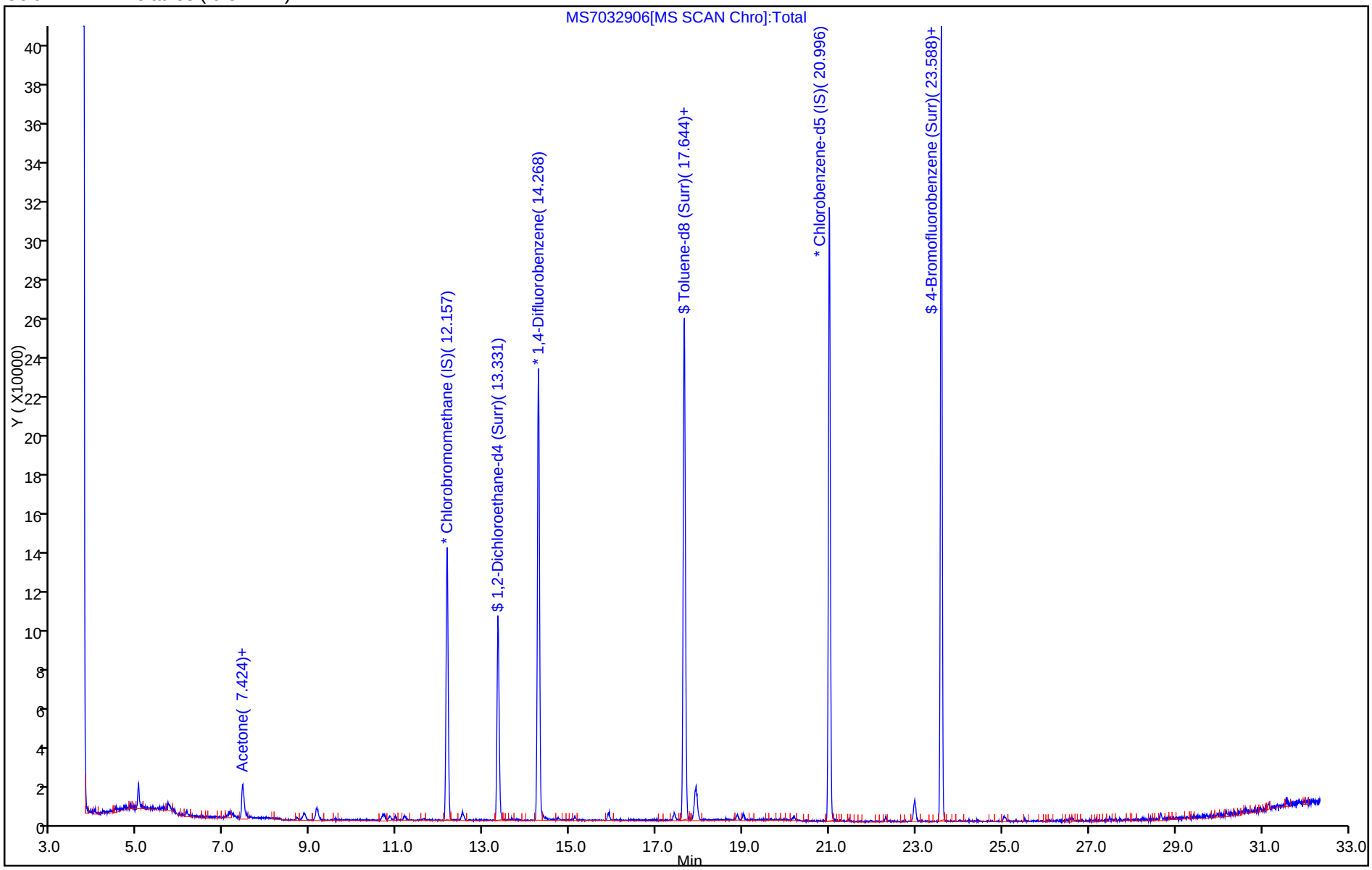
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:23:19 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032906.d				
Injection Date:	29-Mar-2014 15:28:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-1	Lab Sample ID:	320-6793-1	Worklist Smp#:	6
Client ID:	34000906				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	5
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

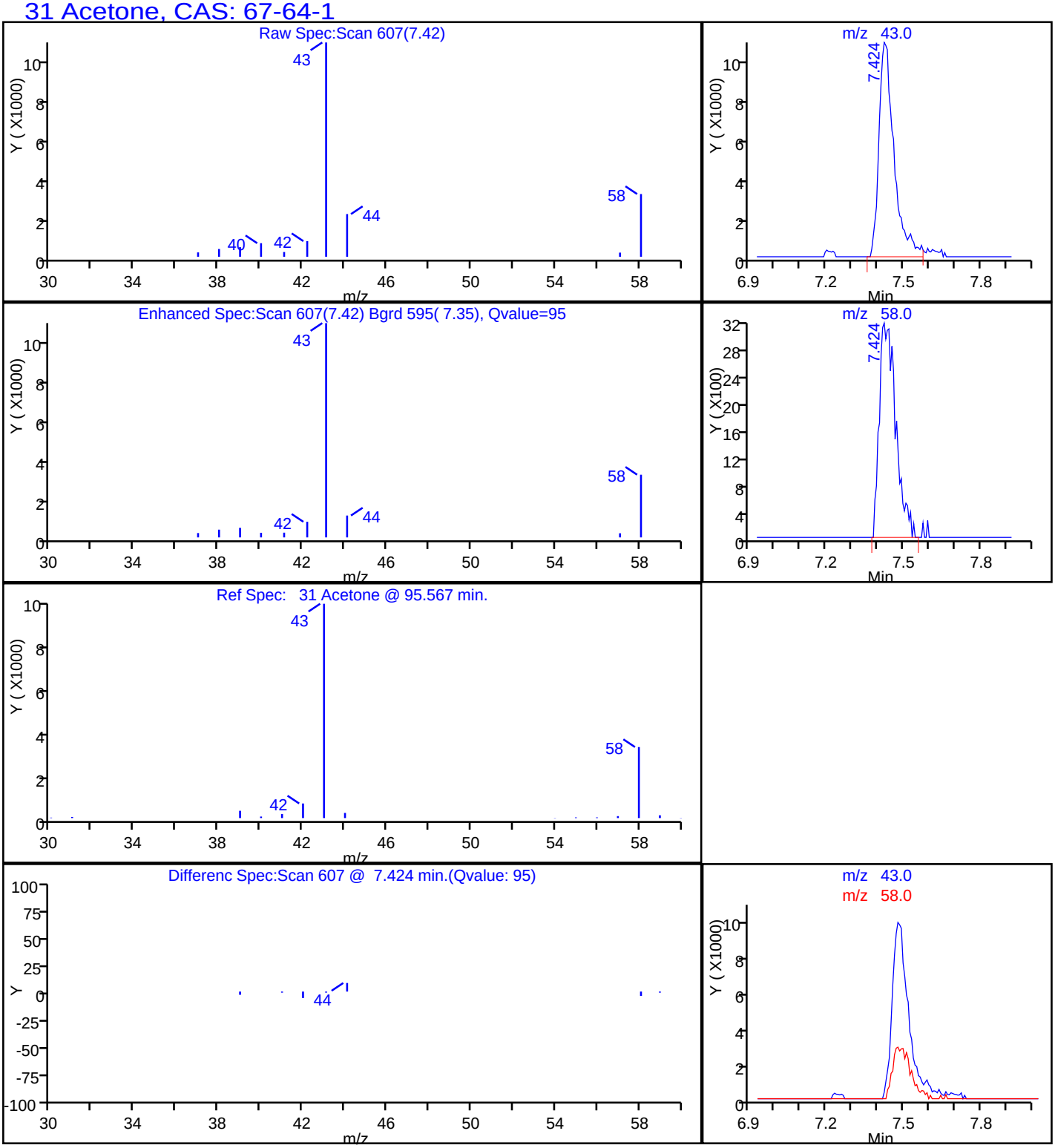


Report Date: 31-Mar-2014 10:23:20 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032906.d				
Injection Date:	29-Mar-2014 15:28:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-1	Lab Sample ID:	320-6793-1		
Client ID:	34000906				
Operator ID:	AO	ALS Bottle#:	5	Worklist Smp#:	6
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001064 | Lab Sample ID: 320-6793-2

Matrix: Air | Lab File ID: MS7032910.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 19:17

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	1.3	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001064 | Lab Sample ID: 320-6793-2

Matrix: Air | Lab File ID: MS7032910.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 19:17

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	ND	*	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001064 Lab Sample ID: 320-6793-2

Matrix: Air Lab File ID: MS7032910.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 19:17

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	90		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	88	*	70-130
2037-26-5	Toluene-d8 (Surr)	84	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032910.d
Lims ID: 320-6793-A-2 Lab Sample ID: 320-6793-2
Client ID: 34001064
Sample Type: Client
Inject. Date: 29-Mar-2014 19:17:30 ALS Bottle#: 9 Worklist Smp#: 10
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-2
Misc. Info.: 500mL; 34001064
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:24:12 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:24:22

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.157	12.145	0.012	90	74745	4.00	s
* 2 1,4-Difluorobenzene	114	14.268	14.262	0.006	90	299815	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.996	20.990	0.006	87	281183	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.325	13.325	0.0	0	137922	3.52	
$ 5 Toluene-d8 (Surr)	100	17.638	17.626	0.012	88	200325	3.38	
$ 6 4-Bromofluorobenzene (Surr)	95	23.588	23.582	0.006	90	210634	3.61	
31 Acetone	43	7.394	7.400	-0.006	97	188772	1.33	

QC Flag Legend

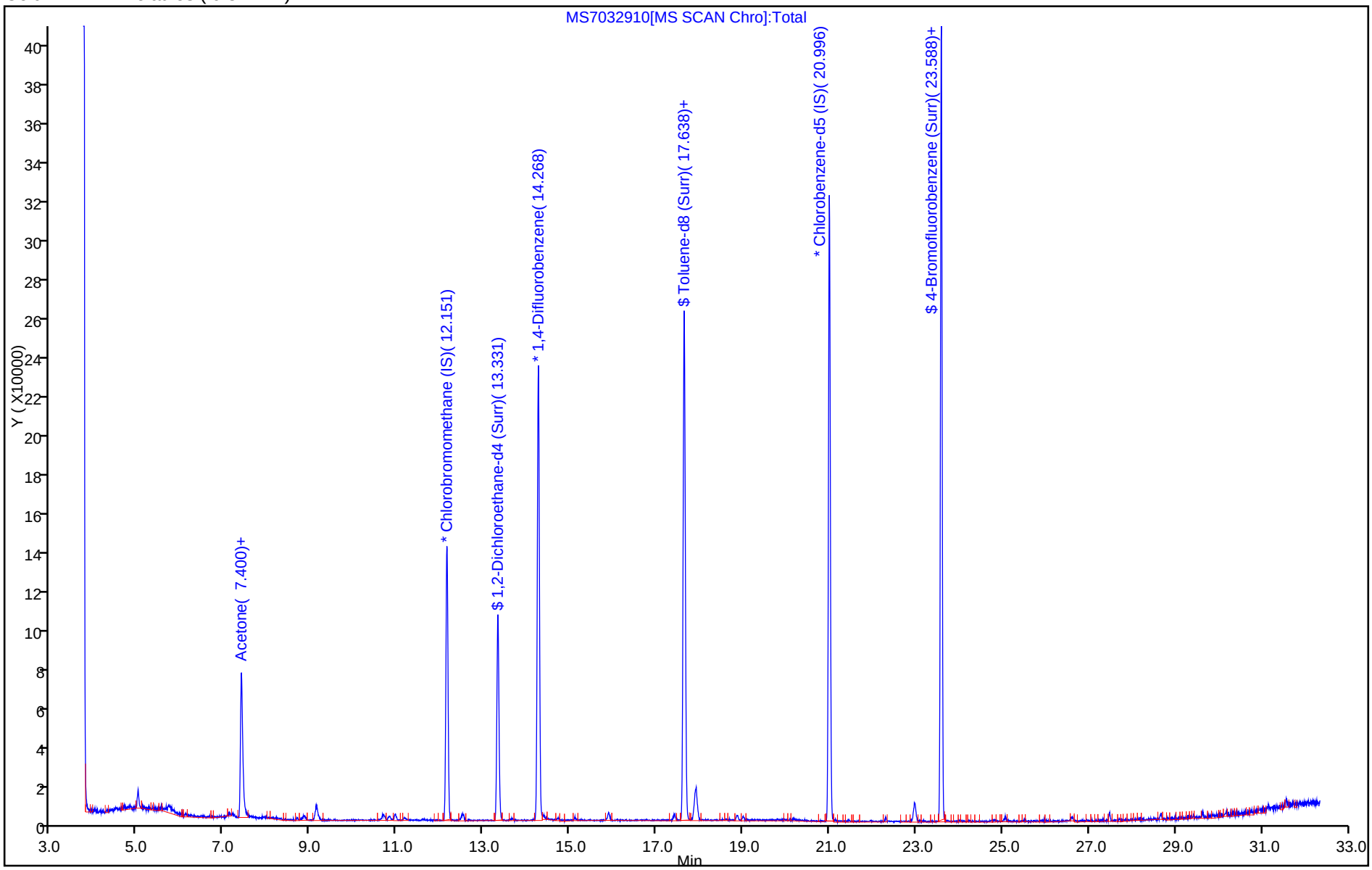
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:24:23 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032910.d				
Injection Date:	29-Mar-2014 19:17:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-2	Lab Sample ID:	320-6793-2	Worklist Smp#:	10
Client ID:	34001064				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	9
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

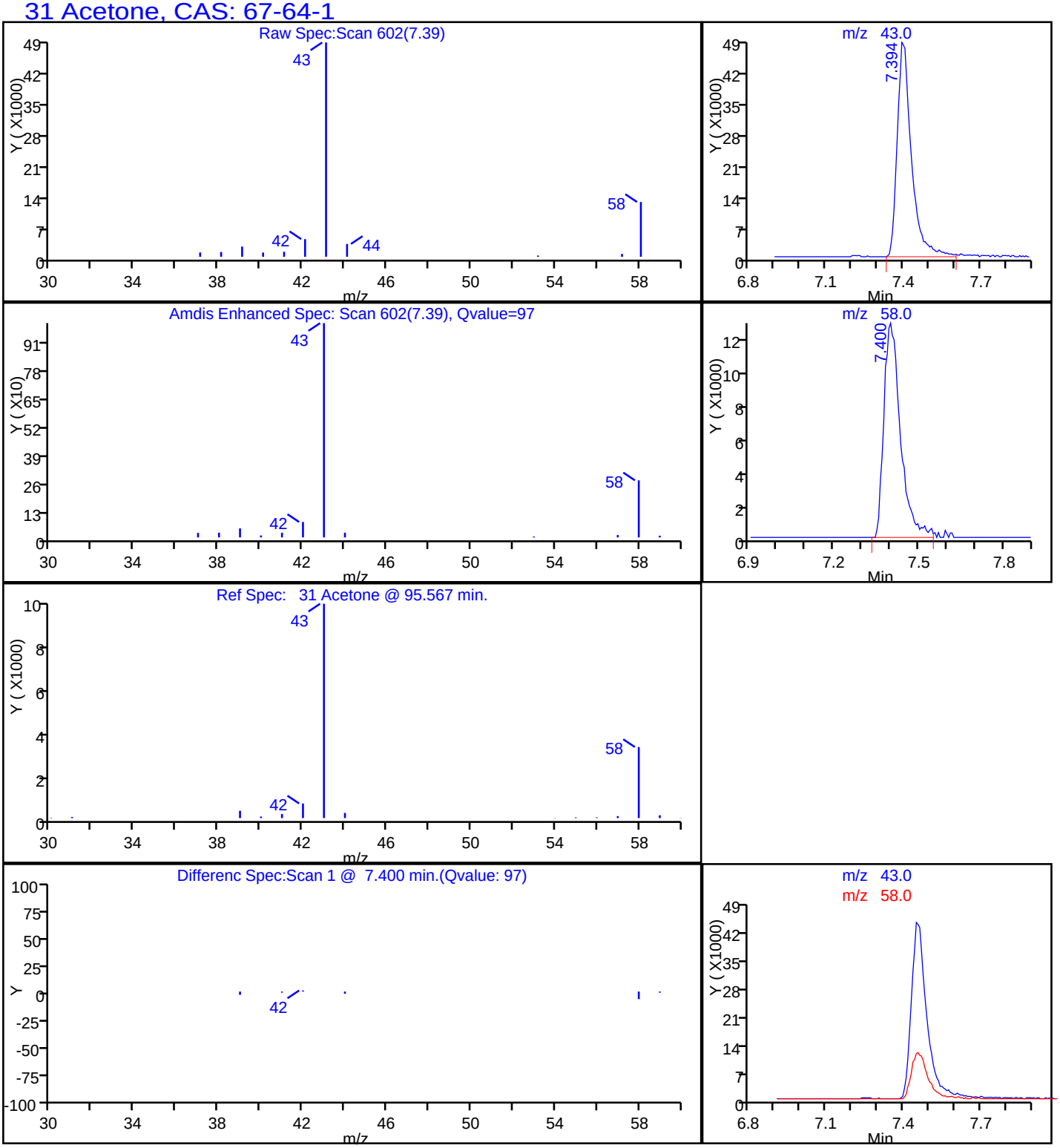


Report Date: 31-Mar-2014 10:24:23 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032910.d				
Injection Date:	29-Mar-2014 19:17:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-2	Lab Sample ID:	320-6793-2		
Client ID:	34001064				
Operator ID:	AO	ALS Bottle#:	9	Worklist Smp#:	10
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000653 | Lab Sample ID: 320-6793-3

Matrix: Air | Lab File ID: MS7032911.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 20:17

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND	*	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000653 | Lab Sample ID: 320-6793-3

Matrix: Air | Lab File ID: MS7032911.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 20:17

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	ND	*	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000653 Lab Sample ID: 320-6793-3

Matrix: Air Lab File ID: MS7032911.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 20:17

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	89		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	88	*	70-130
2037-26-5	Toluene-d8 (Surr)	85	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032911.d
Lims ID: 320-6793-A-3 Lab Sample ID: 320-6793-3
Client ID: 34000653
Sample Type: Client
Inject. Date: 29-Mar-2014 20:17:30 ALS Bottle#: 10 Worklist Smp#: 11
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-3
Misc. Info.: 500mL; 34000653
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:24:12 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:24:35

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.145	12.145	0.0	88	72396	4.00	s
* 2 1,4-Difluorobenzene	114	14.262	14.262	0.0	90	290715	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.990	20.990	0.0	87	269157	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.319	13.325	-0.006	0	133132	3.50	
$ 5 Toluene-d8 (Surr)	100	17.632	17.626	0.006	88	194963	3.39	
$ 6 4-Bromofluorobenzene (Surr)	95	23.582	23.582	0.0	90	199607	3.58	
31 Acetone	43	7.412	7.400	0.012	89	21259	0.1542	
47 Methylene Chloride	49	8.671	8.677	-0.006	55	2411	0.0266	

QC Flag Legend

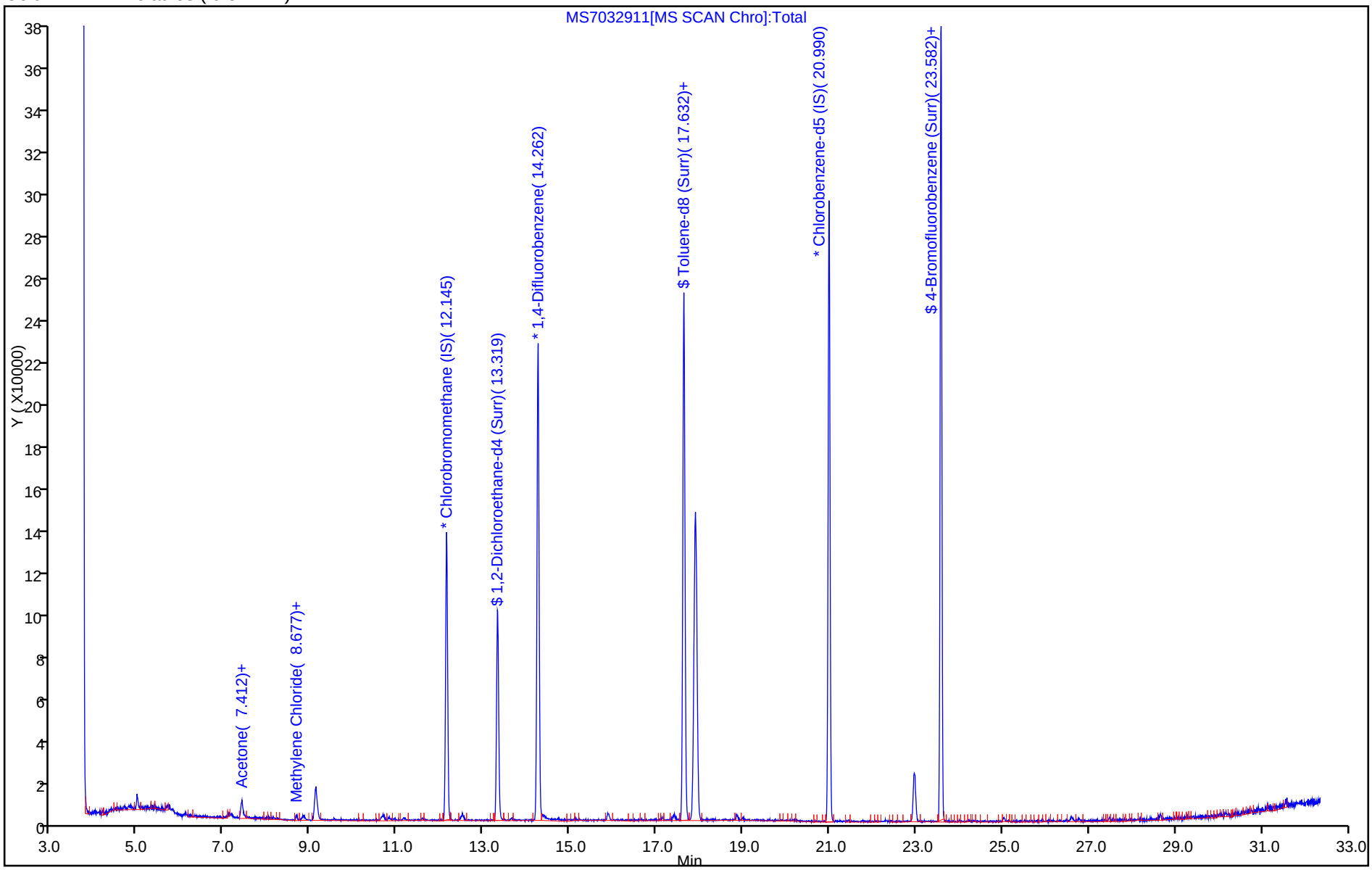
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:24:36 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032911.d				
Injection Date:	29-Mar-2014 20:17:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-3	Lab Sample ID:	320-6793-3	Worklist Smp#:	11
Client ID:	34000653				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	10
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001054 | Lab Sample ID: 320-6793-4

Matrix: Air | Lab File ID: MS7032912.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 21:15

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.65	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001054 | Lab Sample ID: 320-6793-4

Matrix: Air | Lab File ID: MS7032912.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 21:15

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	ND	*	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001054 Lab Sample ID: 320-6793-4

Matrix: Air Lab File ID: MS7032912.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 21:15

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	93		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	88	*	70-130
2037-26-5	Toluene-d8 (Surr)	85	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032912.d
Lims ID: 320-6793-A-4 Lab Sample ID: 320-6793-4
Client ID: 34001054
Sample Type: Client
Inject. Date: 29-Mar-2014 21:15:30 ALS Bottle#: 11 Worklist Smp#: 12
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-4
Misc. Info.: 500mL; 34001054
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:24:12 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:25:02

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.139	12.145	-0.006	90	72220	4.00	s
* 2 1,4-Difluorobenzene	114	14.262	14.262	0.0	90	289556	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.990	20.990	0.0	88	267267	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.325	13.325	0.0	0	133644	3.53	
$ 5 Toluene-d8 (Surr)	100	17.626	17.626	0.0	88	195133	3.40	
$ 6 4-Bromofluorobenzene (Surr)	95	23.576	23.582	-0.006	89	206507	3.73	
14 Propene	41	4.005	3.993	0.012	89	1561	0.0239	
31 Acetone	43	7.387	7.400	-0.013	97	89322	0.6496	
54 2-Butanone (MEK)	72	11.141	11.117	0.024	87	2345	0.0780	
72 1,4-Dioxane	88	15.831	15.819	0.012	1	1136	0.0289	
87 2-Hexanone	58	18.587	18.581	0.006	67	2915	0.0531	

QC Flag Legend

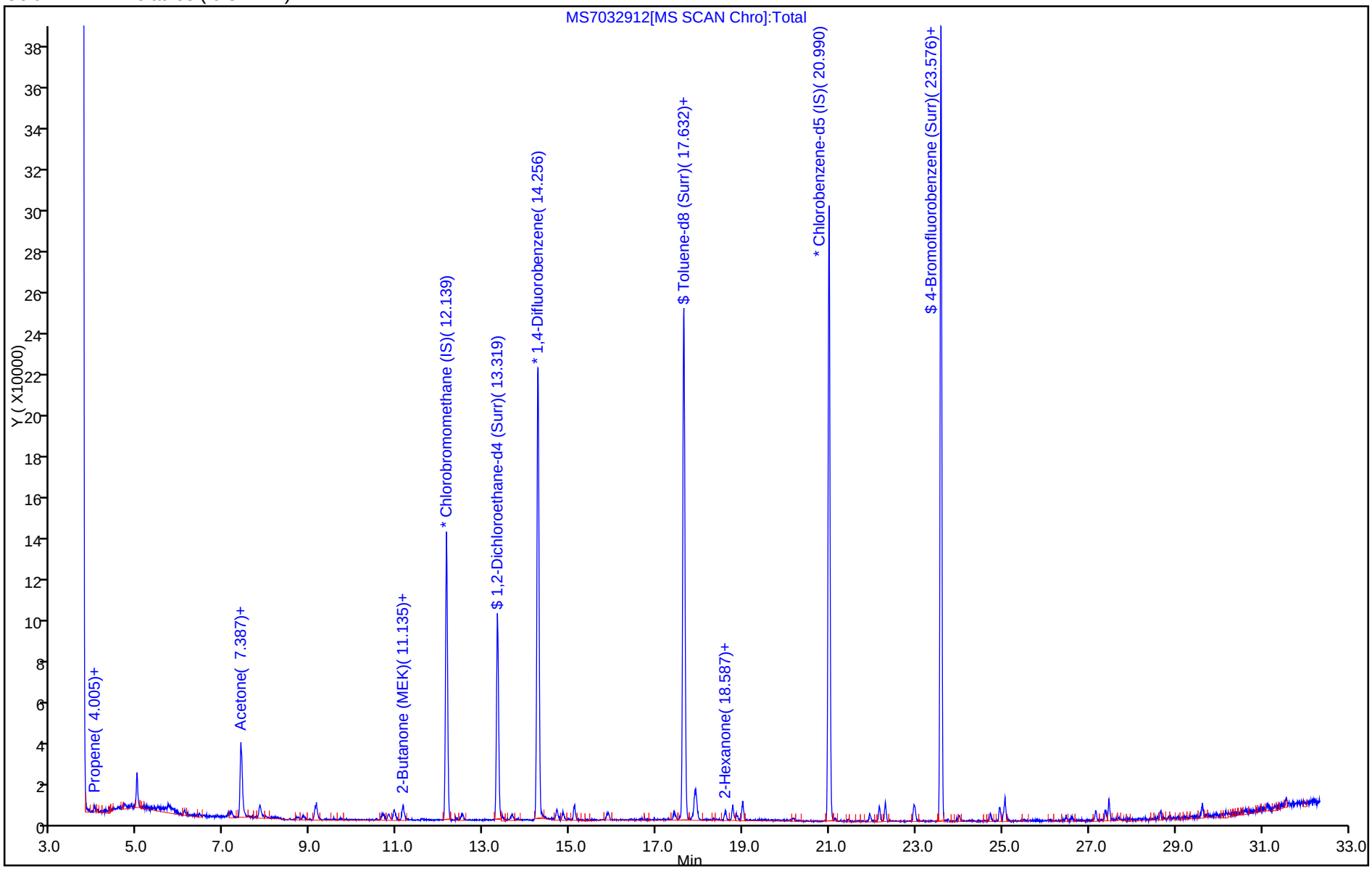
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:25:02 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032912.d				
Injection Date:	29-Mar-2014 21:15:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-4	Lab Sample ID:	320-6793-4	Worklist Smp#:	12
Client ID:	34001054				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	11
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

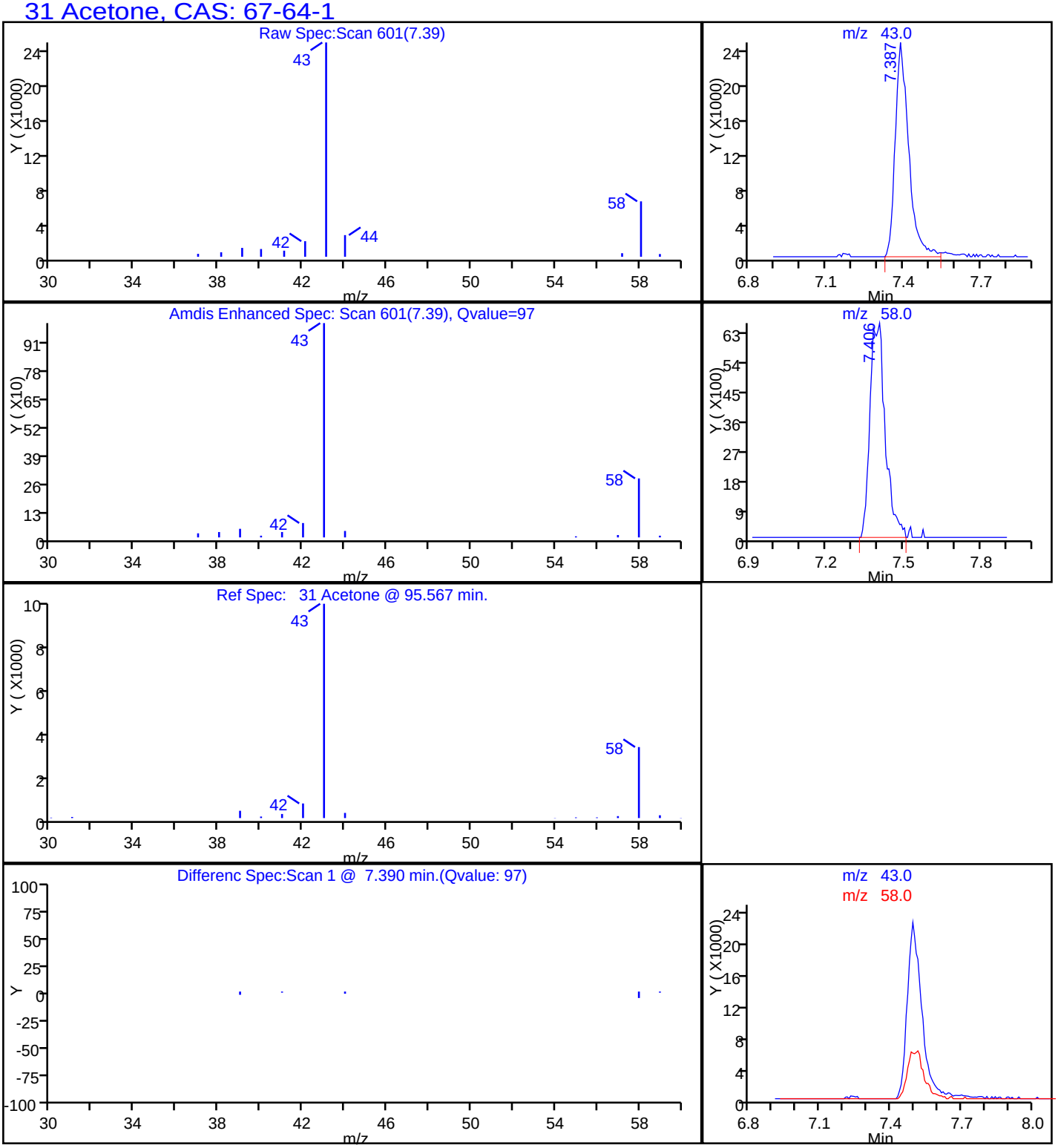


Report Date: 31-Mar-2014 10:25:02 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032912.d				
Injection Date:	29-Mar-2014 21:15:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-4	Lab Sample ID:	320-6793-4		
Client ID:	34001054				
Operator ID:	AO	ALS Bottle#:	11	Worklist Smp#:	12
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001059 | Lab Sample ID: 320-6793-5

Matrix: Air | Lab File ID: MS7032913.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 22:14

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.38	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001059 | Lab Sample ID: 320-6793-5

Matrix: Air | Lab File ID: MS7032913.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 22:14

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	ND	*	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001059 Lab Sample ID: 320-6793-5

Matrix: Air Lab File ID: MS7032913.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 22:14

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	92		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	90	*	70-130
2037-26-5	Toluene-d8 (Surr)	85	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032913.d
Lims ID: 320-6793-A-5 Lab Sample ID: 320-6793-5
Client ID: 34001059
Sample Type: Client
Inject. Date: 29-Mar-2014 22:14:30 ALS Bottle#: 12 Worklist Smp#: 13
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-5
Misc. Info.: 500mL; 34001059
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:24:12 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:25:07

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.145	12.145	0.0	90	72849	4.00	s
* 2 1,4-Difluorobenzene	114	14.262	14.262	0.0	89	287171	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.990	20.990	0.0	88	272424	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.325	13.325	0.0	0	135092	3.60	
$ 5 Toluene-d8 (Surr)	100	17.626	17.626	0.0	88	193382	3.40	
$ 6 4-Bromofluorobenzene (Surr)	95	23.576	23.582	-0.006	90	206927	3.66	
31 Acetone	43	7.406	7.400	0.006	95	52752	0.3804	

QC Flag Legend

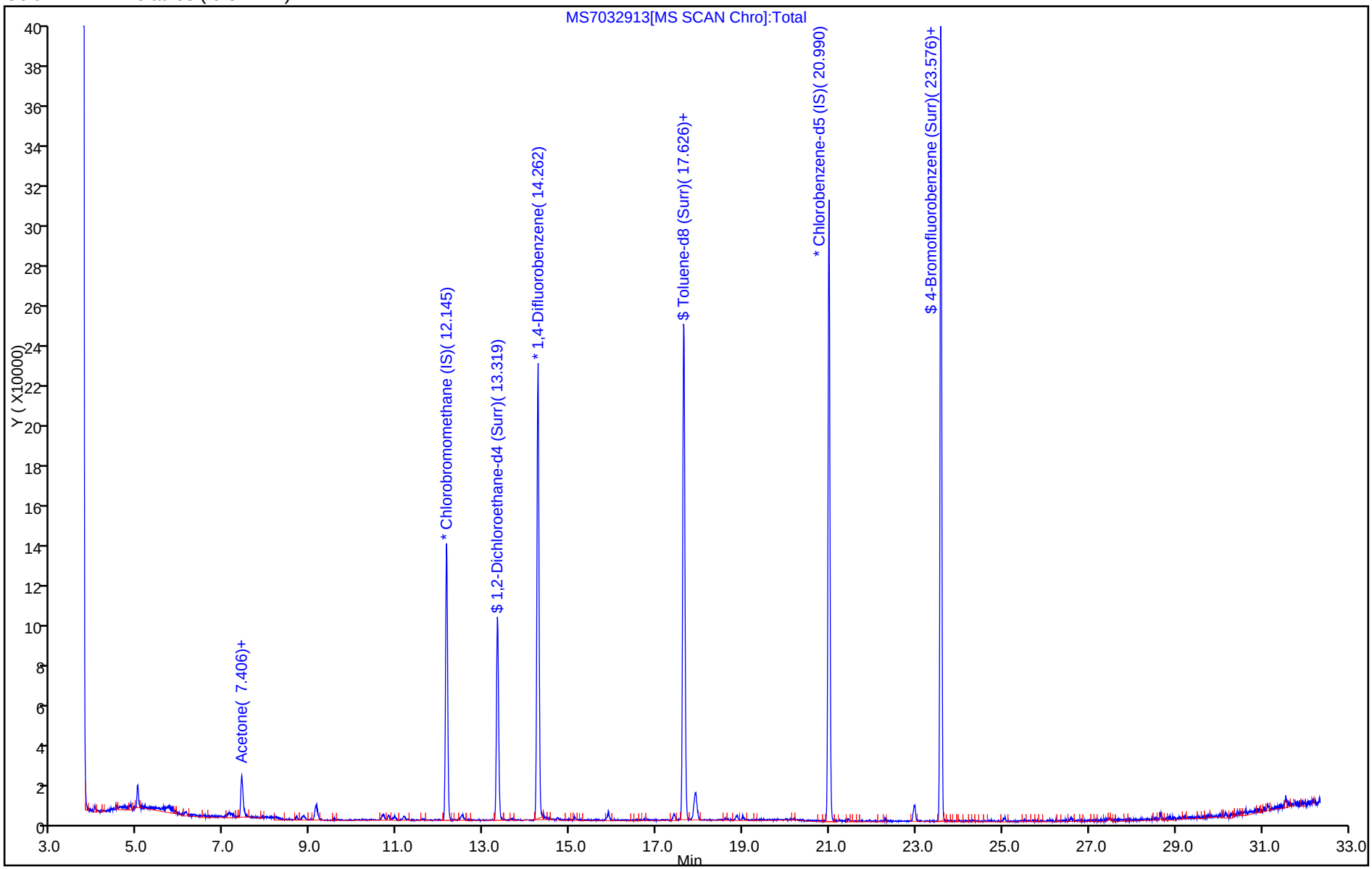
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:25:07 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032913.d				
Injection Date:	29-Mar-2014 22:14:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-5	Lab Sample ID:	320-6793-5	Worklist Smp#:	13
Client ID:	34001059				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	12
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

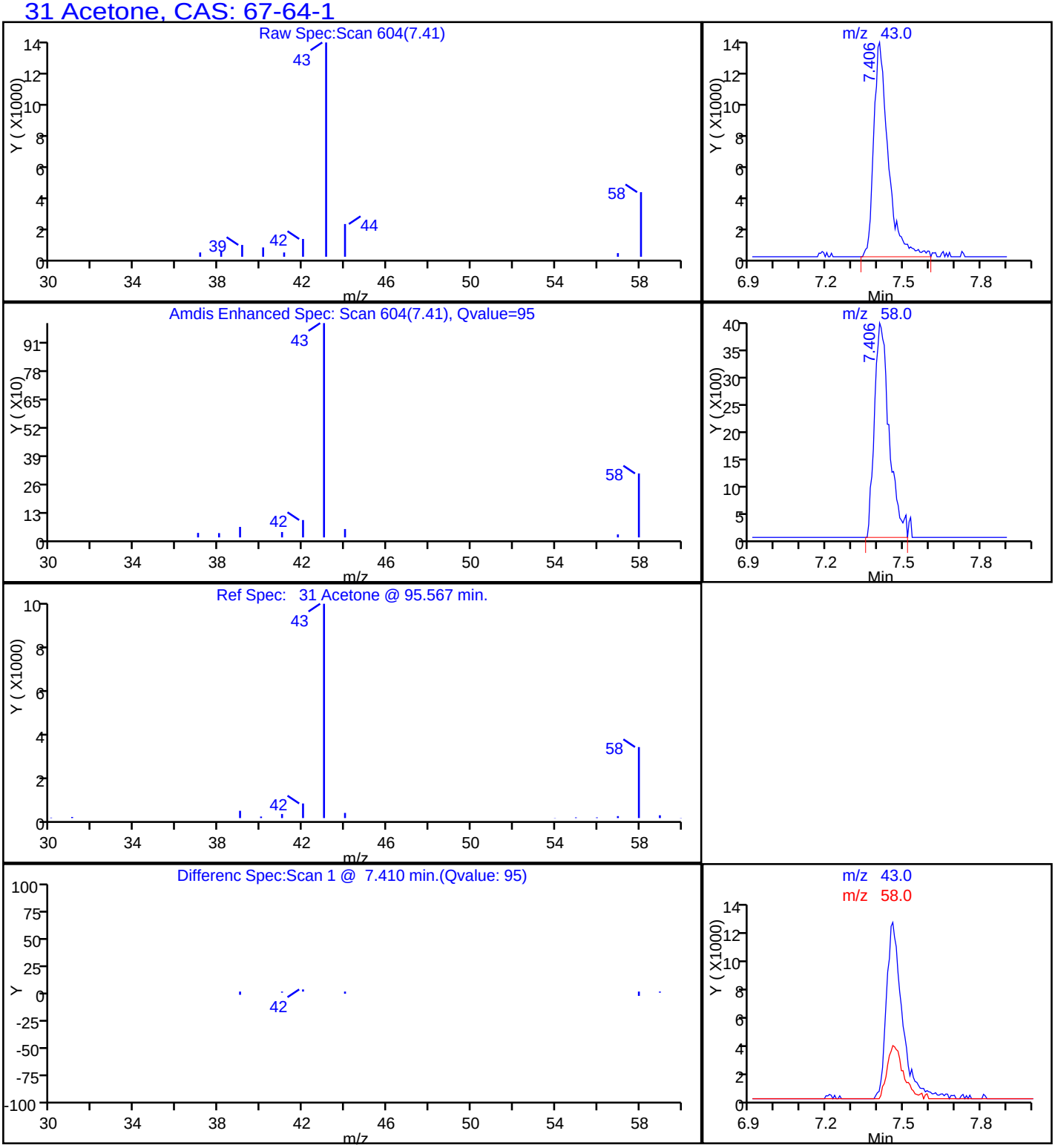


Report Date: 31-Mar-2014 10:25:07 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032913.d				
Injection Date:	29-Mar-2014 22:14:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-5	Lab Sample ID:	320-6793-5		
Client ID:	34001059				
Operator ID:	AO	ALS Bottle#:	12	Worklist Smp#:	13
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000756 | Lab Sample ID: 320-6793-6

Matrix: Air | Lab File ID: MS7032914.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 23:16

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.99	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000756 | Lab Sample ID: 320-6793-6

Matrix: Air | Lab File ID: MS7032914.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 23:16

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	0.28	J *	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000756 Lab Sample ID: 320-6793-6

Matrix: Air Lab File ID: MS7032914.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 23:16

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	93		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	89	*	70-130
2037-26-5	Toluene-d8 (Surr)	84	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032914.d
Lims ID: 320-6793-A-6 Lab Sample ID: 320-6793-6
Client ID: 34000756
Sample Type: Client
Inject. Date: 29-Mar-2014 23:16:30 ALS Bottle#: 13 Worklist Smp#: 14
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-6
Misc. Info.: 500mL; 34000756
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:24:12 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:25:16

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.139	12.145	-0.006	90	70167	4.00	s
* 2 1,4-Difluorobenzene	114	14.256	14.262	-0.006	90	281785	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.984	20.990	-0.006	87	267552	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.319	13.325	-0.006	0	131229	3.56	
$ 5 Toluene-d8 (Surr)	100	17.620	17.626	-0.006	88	186983	3.35	
$ 6 4-Bromofluorobenzene (Surr)	95	23.570	23.582	-0.012	90	205456	3.71	
14 Propene	41	4.023	3.993	0.030	92	5802	0.0913	
15 Dichlorodifluoromethane	85	4.078	4.054	0.024	66	9034	0.0498	
18 Chloromethane	50	4.522	4.498	0.024	55	6425	0.0998	
22 Butane	43	4.735	4.717	0.018	79	5746	0.0554	
29 Acrolein	56	7.235	7.242	-0.007	32	1754	0.0795	
31 Acetone	43	7.388	7.400	-0.012	98	132583	0.99	
47 Methylene Chloride	49	8.671	8.677	-0.006	87	24158	0.2755	
54 2-Butanone (MEK)	72	11.141	11.117	0.024	83	3401	0.1164	
58 Ethyl acetate	43	11.579	11.567	0.012	58	9056	0.0515	
68 Benzene	78	13.641	13.654	-0.013	40	5170	0.0284	
85 Toluene	91	17.803	17.815	-0.012	41	6674	0.0311	
87 2-Hexanone	58	18.581	18.581	0.0	11	1440	0.0262	

QC Flag Legend

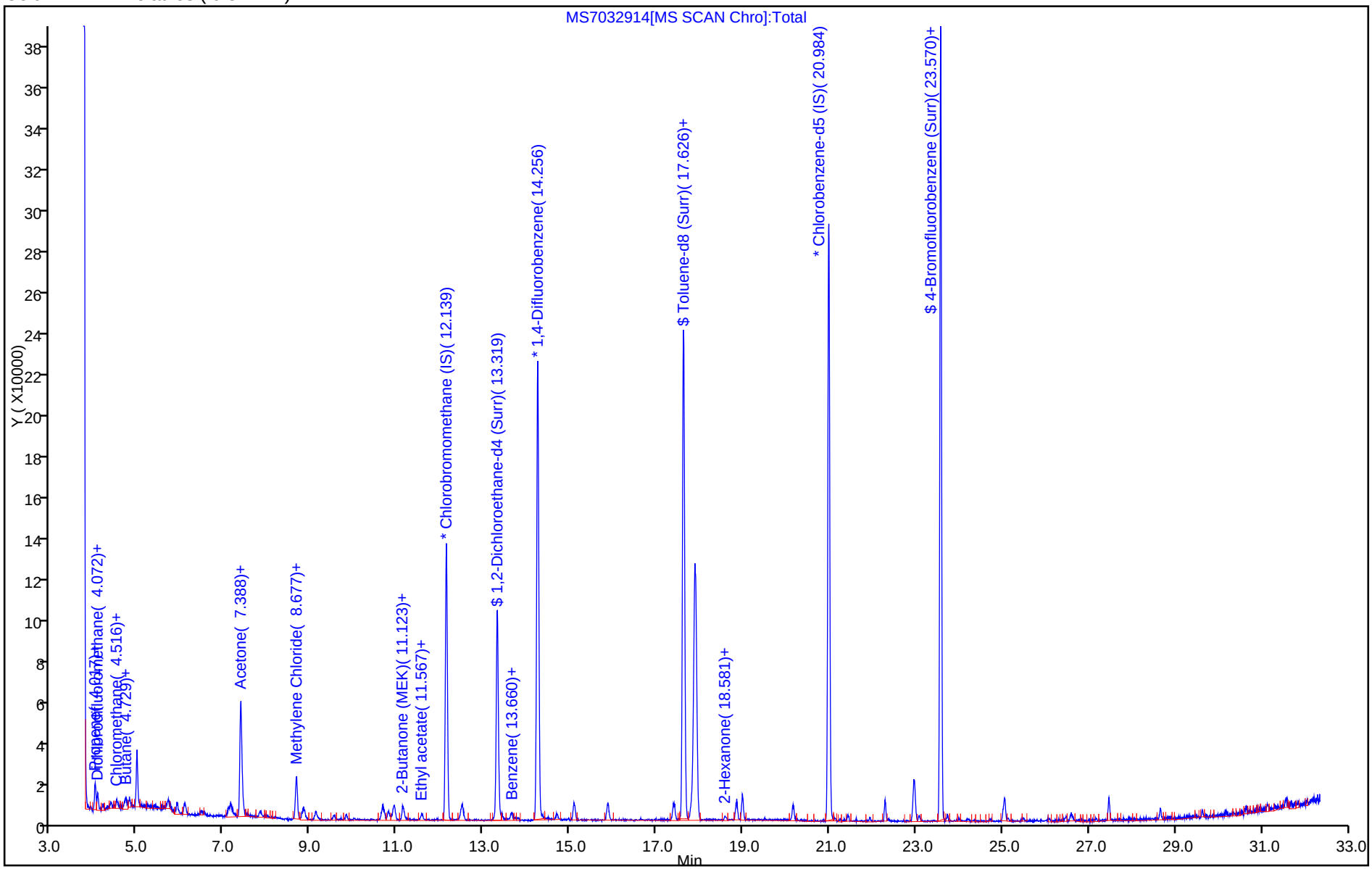
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:25:17 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032914.d				
Injection Date:	29-Mar-2014 23:16:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-6	Lab Sample ID:	320-6793-6	Worklist Smp#:	14
Client ID:	34000756				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	13
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

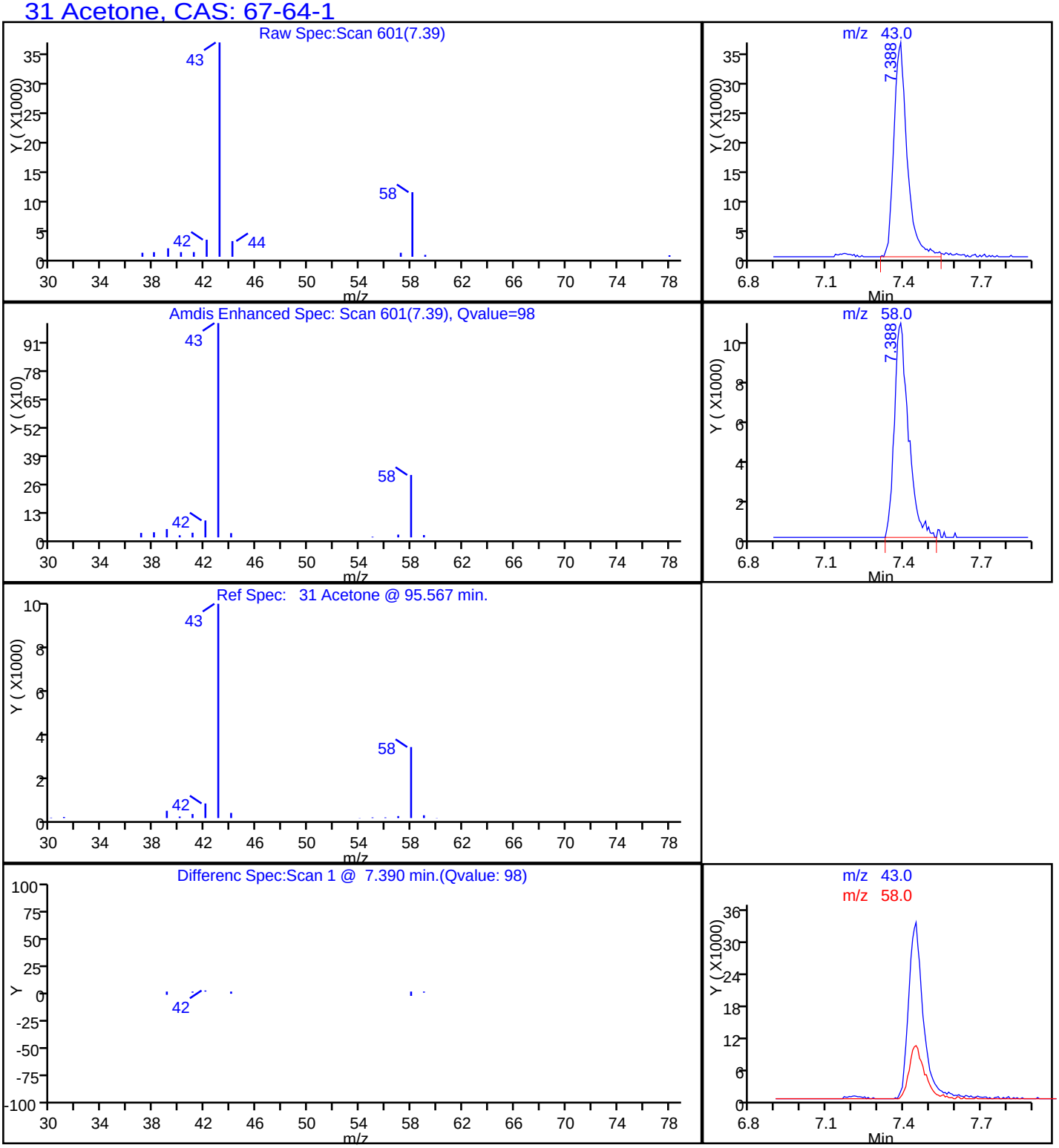


Report Date: 31-Mar-2014 10:25:17 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032914.d				
Injection Date:	29-Mar-2014 23:16:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-6	Lab Sample ID:	320-6793-6		
Client ID:	34000756				
Operator ID:	AO	ALS Bottle#:	13	Worklist Smp#:	14
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1

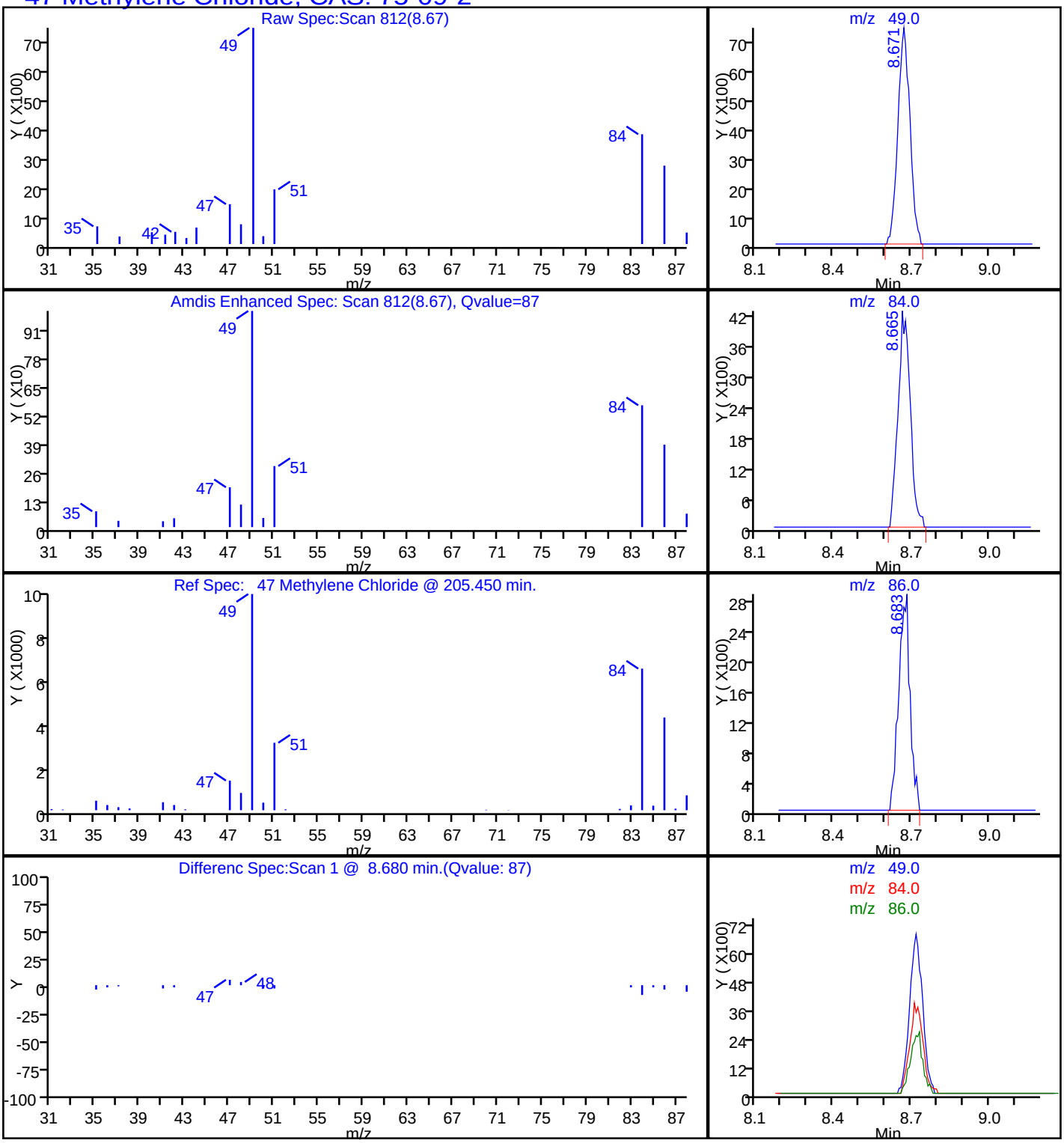


Report Date: 31-Mar-2014 10:25:17 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032914.d				
Injection Date:	29-Mar-2014 23:16:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-6	Lab Sample ID:	320-6793-6		
Client ID:	34000756				
Operator ID:	AO	ALS Bottle#:	13	Worklist Smp#:	14
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

47 Methylene Chloride, CAS: 75-09-2



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000329 | Lab Sample ID: 320-6793-7

Matrix: Air | Lab File ID: MS7032915.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 00:13

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.25	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000329 | Lab Sample ID: 320-6793-7

Matrix: Air | Lab File ID: MS7032915.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 00:13

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	ND	*	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000329 Lab Sample ID: 320-6793-7

Matrix: Air Lab File ID: MS7032915.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/30/2014 00:13

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	91		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	90	*	70-130
2037-26-5	Toluene-d8 (Surr)	83	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032915.d
Lims ID: 320-6793-A-7 Lab Sample ID: 320-6793-7
Client ID: 34000329
Sample Type: Client
Inject. Date: 30-Mar-2014 00:13:30 ALS Bottle#: 14 Worklist Smp#: 15
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-7
Misc. Info.: 500mL; 34000329
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:24:12 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:25:21

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.127	12.145	-0.018	91	72905	4.00	s
* 2 1,4-Difluorobenzene	114	14.244	14.262	-0.018	90	281235	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.984	20.990	-0.006	87	264758	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.307	13.325	-0.018	0	131829	3.59	
$ 5 Toluene-d8 (Surr)	100	17.614	17.626	-0.012	88	184429	3.31	
$ 6 4-Bromofluorobenzene (Surr)	95	23.570	23.582	-0.012	90	199974	3.64	
31 Acetone	43	7.388	7.400	-0.012	90	34822	0.2509	
47 Methylene Chloride	49	8.653	8.677	-0.024	65	5699	0.0625	

QC Flag Legend

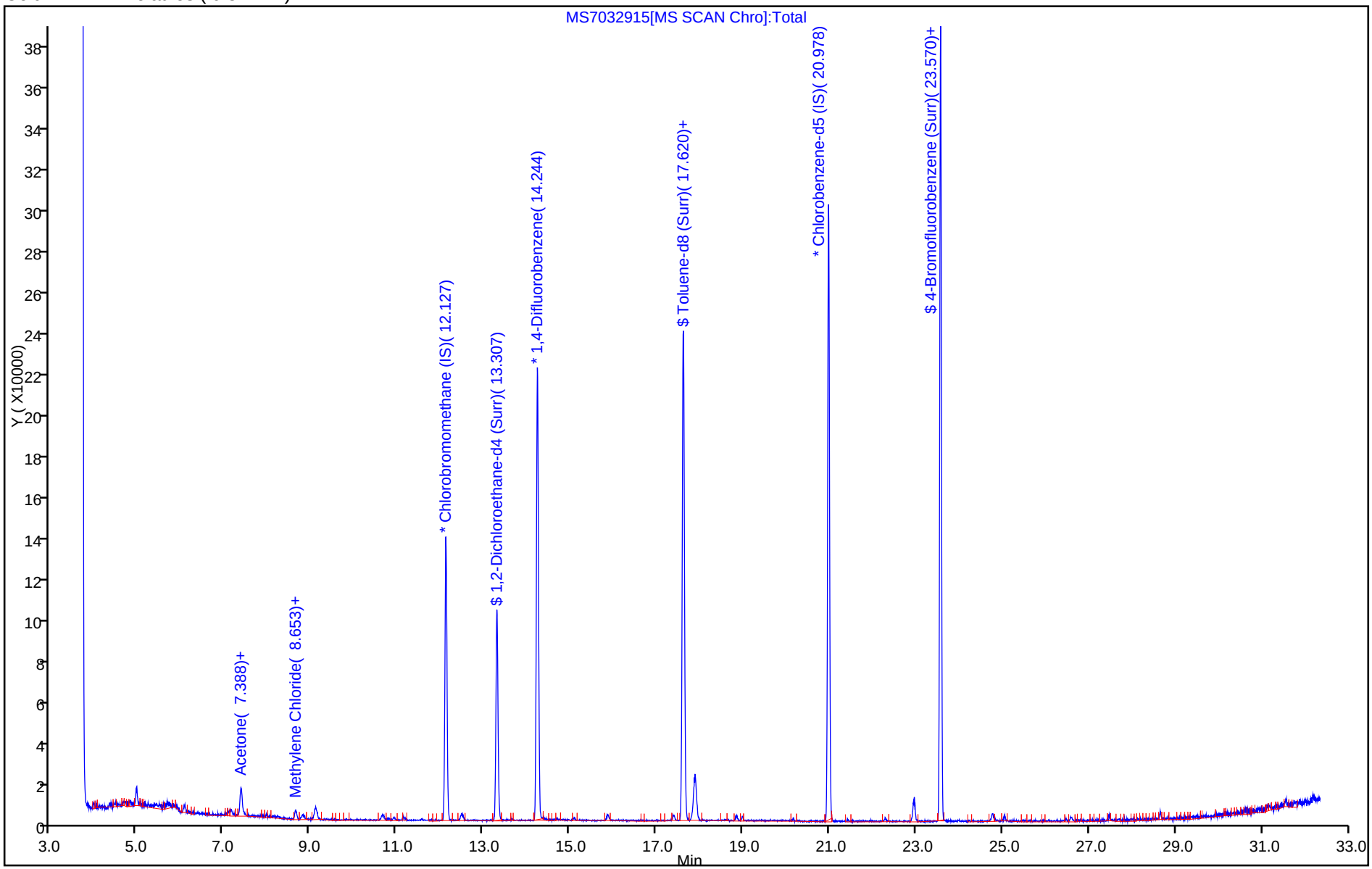
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:25:21 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032915.d				
Injection Date:	30-Mar-2014 00:13:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-7	Lab Sample ID:	320-6793-7	Worklist Smp#:	15
Client ID:	34000329				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	14
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

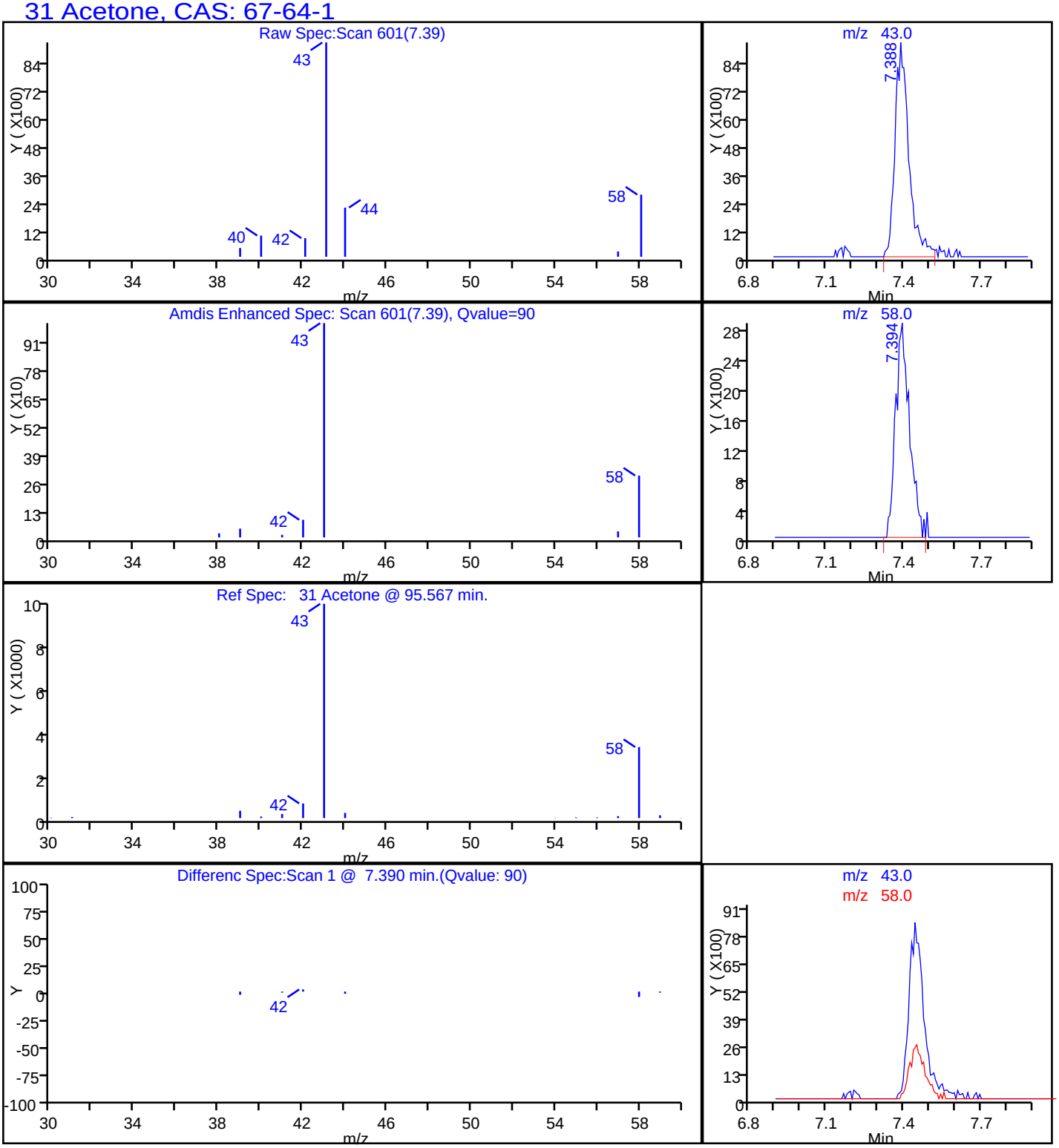


Report Date: 31-Mar-2014 10:25:21 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032915.d				
Injection Date:	30-Mar-2014 00:13:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-7	Lab Sample ID:	320-6793-7		
Client ID:	34000329				
Operator ID:	AO	ALS Bottle#:	14	Worklist Smp#:	15
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000643 | Lab Sample ID: 320-6793-8

Matrix: Air | Lab File ID: MS7032916.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 01:12

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.48	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000643 | Lab Sample ID: 320-6793-8

Matrix: Air | Lab File ID: MS7032916.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 01:12

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	ND	*	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000643 Lab Sample ID: 320-6793-8

Matrix: Air Lab File ID: MS7032916.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/30/2014 01:12

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	89		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	90	*	70-130
2037-26-5	Toluene-d8 (Surr)	84	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032916.d
Lims ID: 320-6793-A-8 Lab Sample ID: 320-6793-8
Client ID: 34000643
Sample Type: Client
Inject. Date: 30-Mar-2014 01:12:30 ALS Bottle#: 15 Worklist Smp#: 16
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-8
Misc. Info.: 500mL; 34000643
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:24:12 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:25:25

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.127	12.145	-0.018	89	67992	4.00	s
* 2 1,4-Difluorobenzene	114	14.244	14.262	-0.018	90	278004	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.972	20.990	-0.018	85	267764	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.307	13.325	-0.018	0	130912	3.60	
$ 5 Toluene-d8 (Surr)	100	17.614	17.626	-0.012	90	184186	3.35	
$ 6 4-Bromofluorobenzene (Surr)	95	23.564	23.582	-0.018	90	197415	3.56	
18 Chloromethane	50	4.516	4.498	0.018	1	1457	0.0234	
31 Acetone	43	7.400	7.400	0.0	89	62660	0.4841	

QC Flag Legend

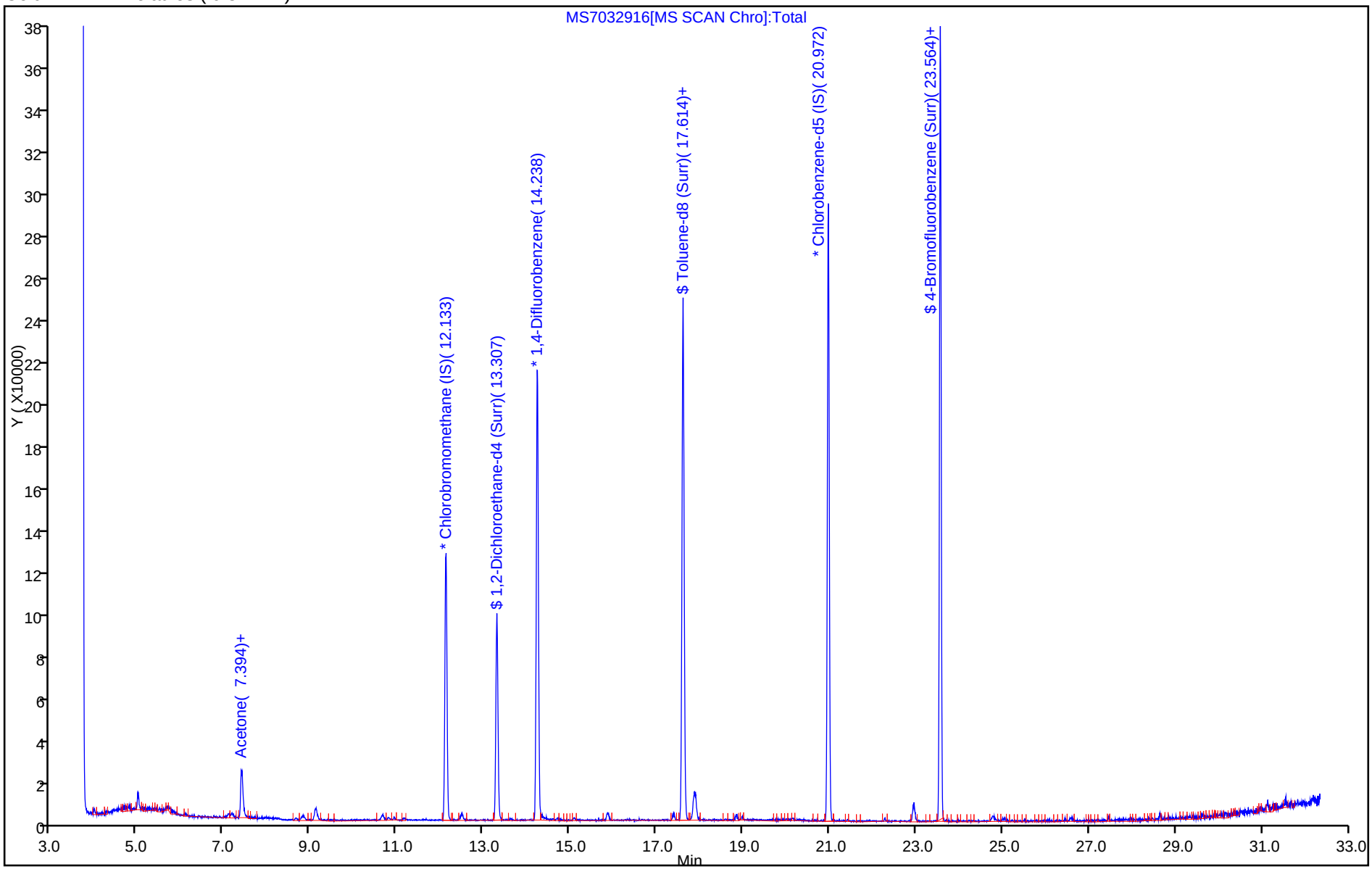
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:25:25 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032916.d				
Injection Date:	30-Mar-2014 01:12:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-8	Lab Sample ID:	320-6793-8	Worklist Smp#:	16
Client ID:	34000643				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	15
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

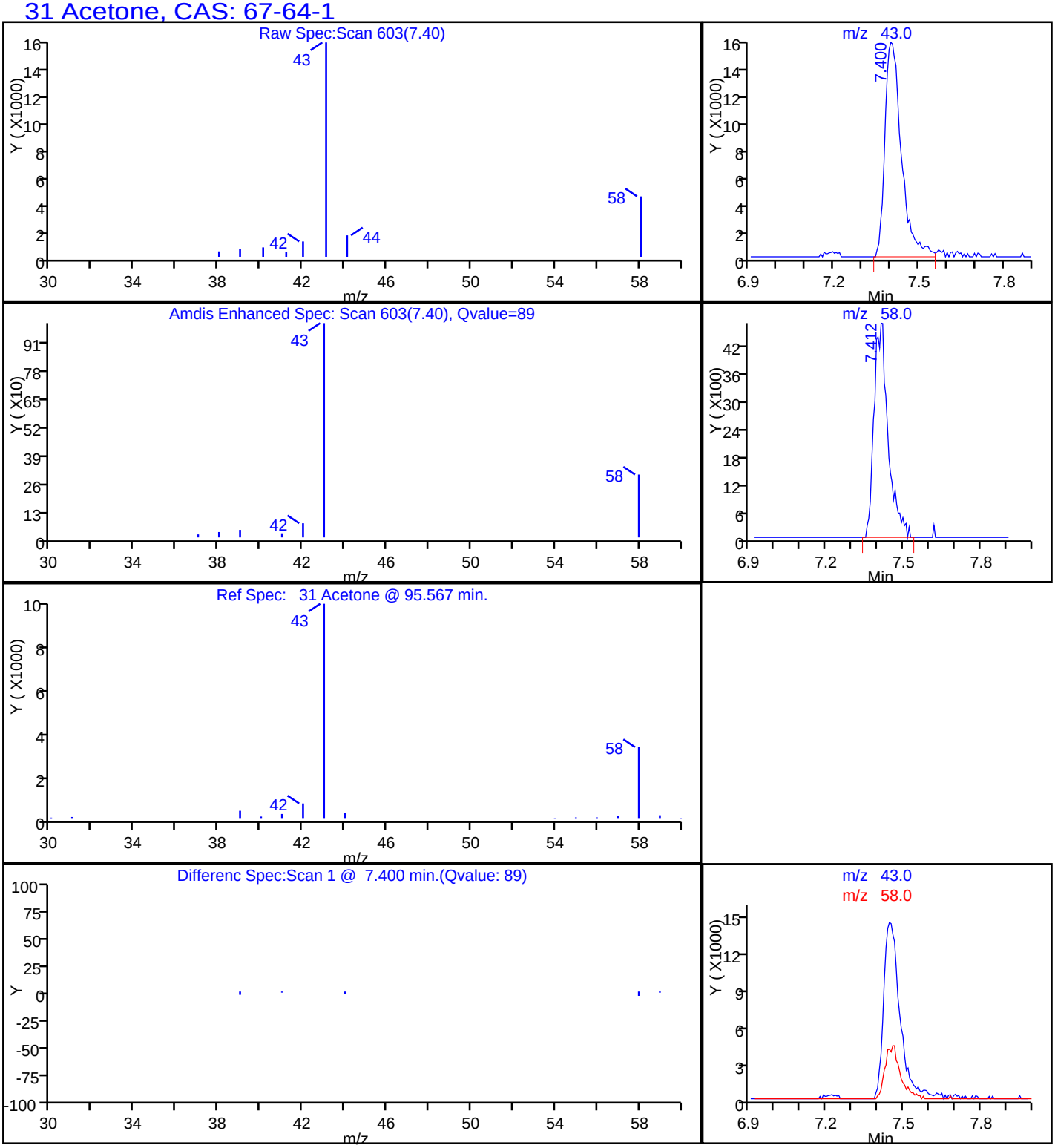


Report Date: 31-Mar-2014 10:25:25 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032916.d				
Injection Date:	30-Mar-2014 01:12:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-8	Lab Sample ID:	320-6793-8		
Client ID:	34000643				
Operator ID:	AO	ALS Bottle#:	15	Worklist Smp#:	16
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001085 | Lab Sample ID: 320-6793-9

Matrix: Air | Lab File ID: MS7032917.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 02:10

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.22	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001085 | Lab Sample ID: 320-6793-9

Matrix: Air | Lab File ID: MS7032917.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 02:10

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	ND	*	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001085 Lab Sample ID: 320-6793-9

Matrix: Air Lab File ID: MS7032917.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/30/2014 02:10

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	89		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	90	*	70-130
2037-26-5	Toluene-d8 (Surr)	84	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032917.d
Lims ID: 320-6793-A-9 Lab Sample ID: 320-6793-9
Client ID: 34001085
Sample Type: Client
Inject. Date: 30-Mar-2014 02:10:30 ALS Bottle#: 16 Worklist Smp#: 17
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-9
Misc. Info.: 500mL; 34001085
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:24:12 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:25:29

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.133	12.145	-0.012	90	68260	4.00	s
* 2 1,4-Difluorobenzene	114	14.237	14.262	-0.025	90	268931	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.966	20.990	-0.024	87	256866	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.301	13.325	-0.024	0	125997	3.58	
$ 5 Toluene-d8 (Surr)	100	17.608	17.626	-0.018	88	178851	3.36	
$ 6 4-Bromofluorobenzene (Surr)	95	23.564	23.582	-0.018	91	189322	3.56	
31 Acetone	43	7.412	7.400	0.012	91	29131	0.2242	

QC Flag Legend

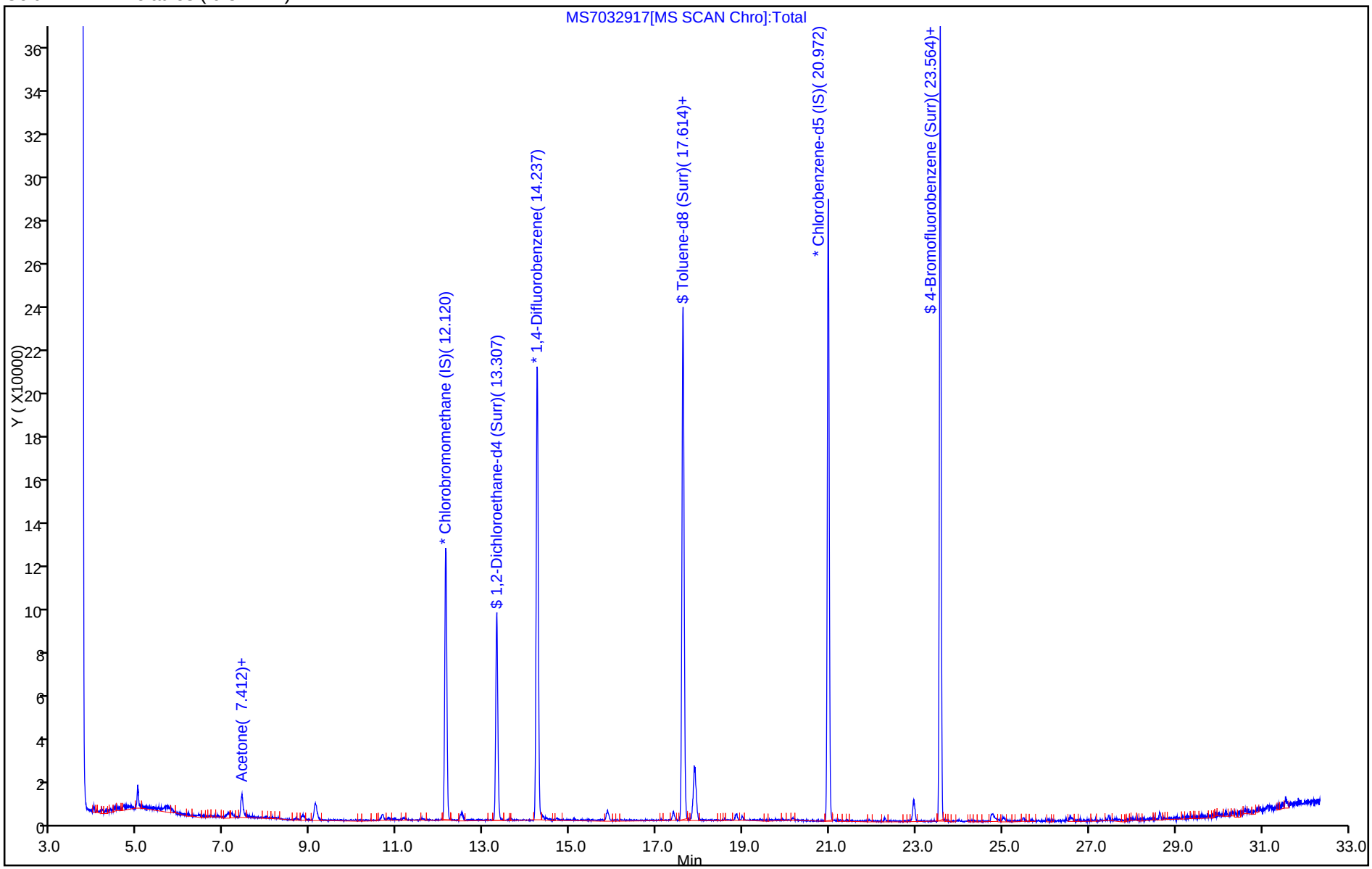
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:25:29 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032917.d				
Injection Date:	30-Mar-2014 02:10:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-9	Lab Sample ID:	320-6793-9	Worklist Smp#:	17
Client ID:	34001085				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	16
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

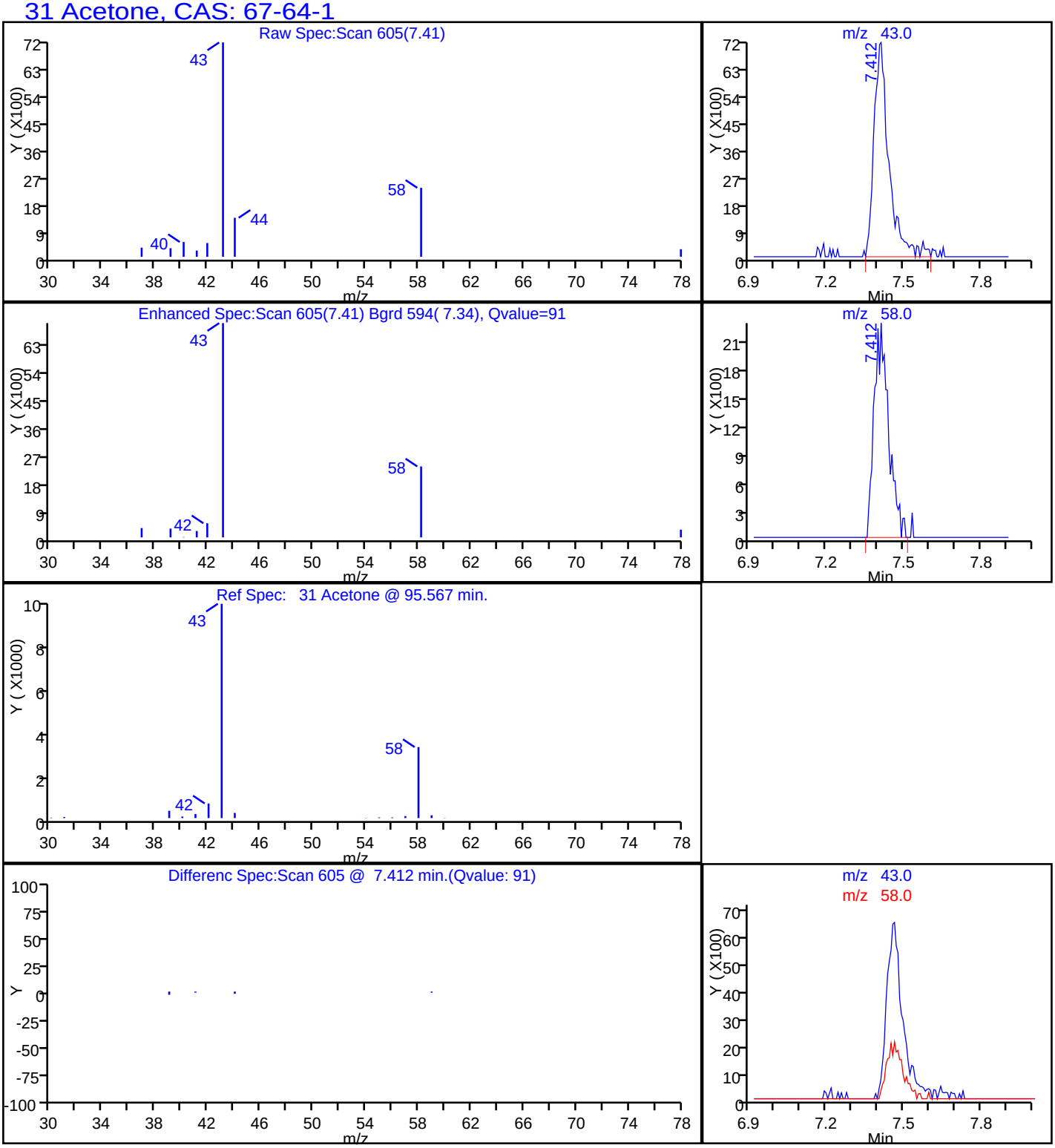


Report Date: 31-Mar-2014 10:25:29 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032917.d				
Injection Date:	30-Mar-2014 02:10:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-9	Lab Sample ID:	320-6793-9		
Client ID:	34001085				
Operator ID:	AO	ALS Bottle#:	16	Worklist Smp#:	17
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001630 | Lab Sample ID: 320-6793-11

Matrix: Air | Lab File ID: MS7032919.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 04:12

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.42	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001630 | Lab Sample ID: 320-6793-11

Matrix: Air | Lab File ID: MS7032919.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 04:12

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	0.16	J *	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001630 Lab Sample ID: 320-6793-11

Matrix: Air Lab File ID: MS7032919.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/30/2014 04:12

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	89		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	91	*	70-130
2037-26-5	Toluene-d8 (Surr)	84	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032919.d
Lims ID: 320-6793-A-11 Lab Sample ID: 320-6793-11
Client ID: 34001630
Sample Type: Client
Inject. Date: 30-Mar-2014 04:12:30 ALS Bottle#: 6 Worklist Smp#: 19
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-11
Misc. Info.: 500mL; 34001630
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:24:12 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:25:42

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.114	12.145	-0.031	93	69143	4.00	s
* 2 1,4-Difluorobenzene	114	14.231	14.262	-0.031	90	273054	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.966	20.990	-0.024	86	258208	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.295	13.325	-0.030	0	129971	3.64	
$ 5 Toluene-d8 (Surr)	100	17.608	17.626	-0.018	88	180873	3.35	
$ 6 4-Bromofluorobenzene (Surr)	95	23.558	23.582	-0.024	90	191486	3.58	
14 Propene	41	3.981	3.993	-0.012	82	2106	0.0336	
15 Dichlorodifluoromethane	85	4.042	4.054	-0.012	44	4747	0.0266	
18 Chloromethane	50	4.486	4.498	-0.012	44	4218	0.0665	
31 Acetone	43	7.375	7.400	-0.025	93	55649	0.4227	
47 Methylene Chloride	49	8.647	8.677	-0.030	83	13736	0.1589	
54 2-Butanone (MEK)	72	11.123	11.117	0.006	61	657	0.0228	

QC Flag Legend

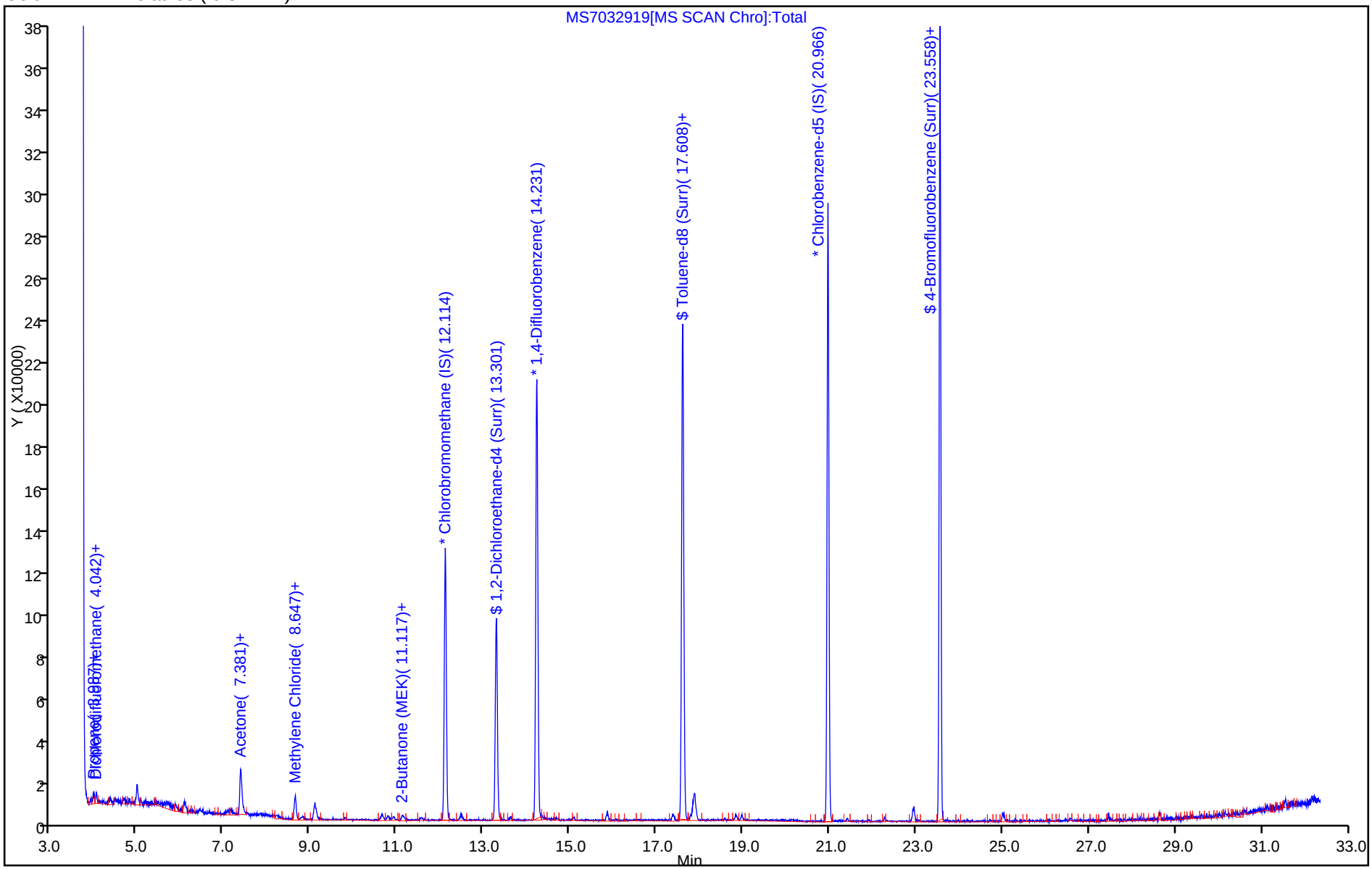
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:25:42 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032919.d				
Injection Date:	30-Mar-2014 04:12:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-11	Lab Sample ID:	320-6793-11	Worklist Smp#:	19
Client ID:	34001630				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	6
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

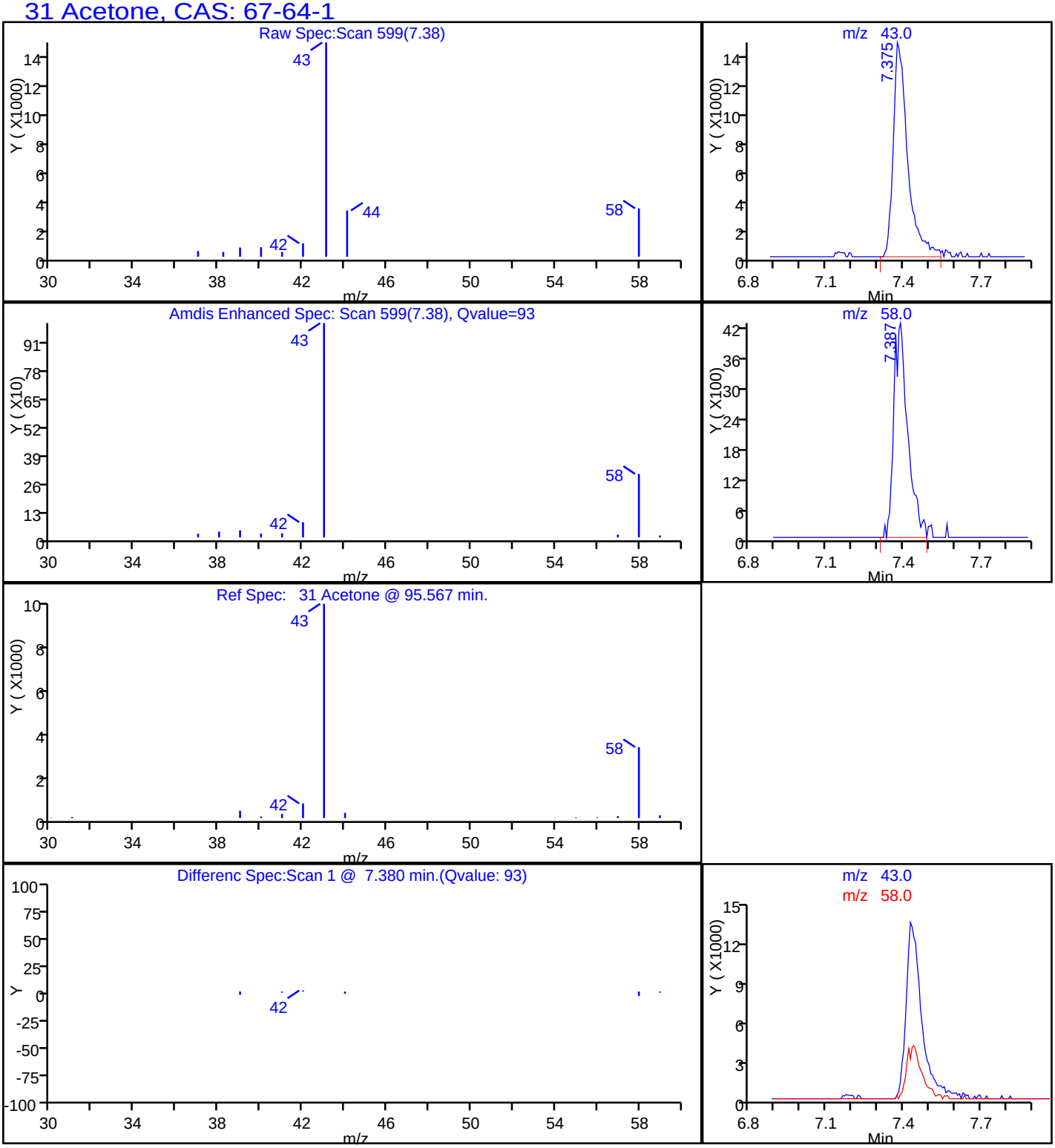


Report Date: 31-Mar-2014 10:25:42 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032919.d				
Injection Date:	30-Mar-2014 04:12:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-11	Lab Sample ID:	320-6793-11		
Client ID:	34001630				
Operator ID:	AO	ALS Bottle#:	6	Worklist Smp#:	19
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1

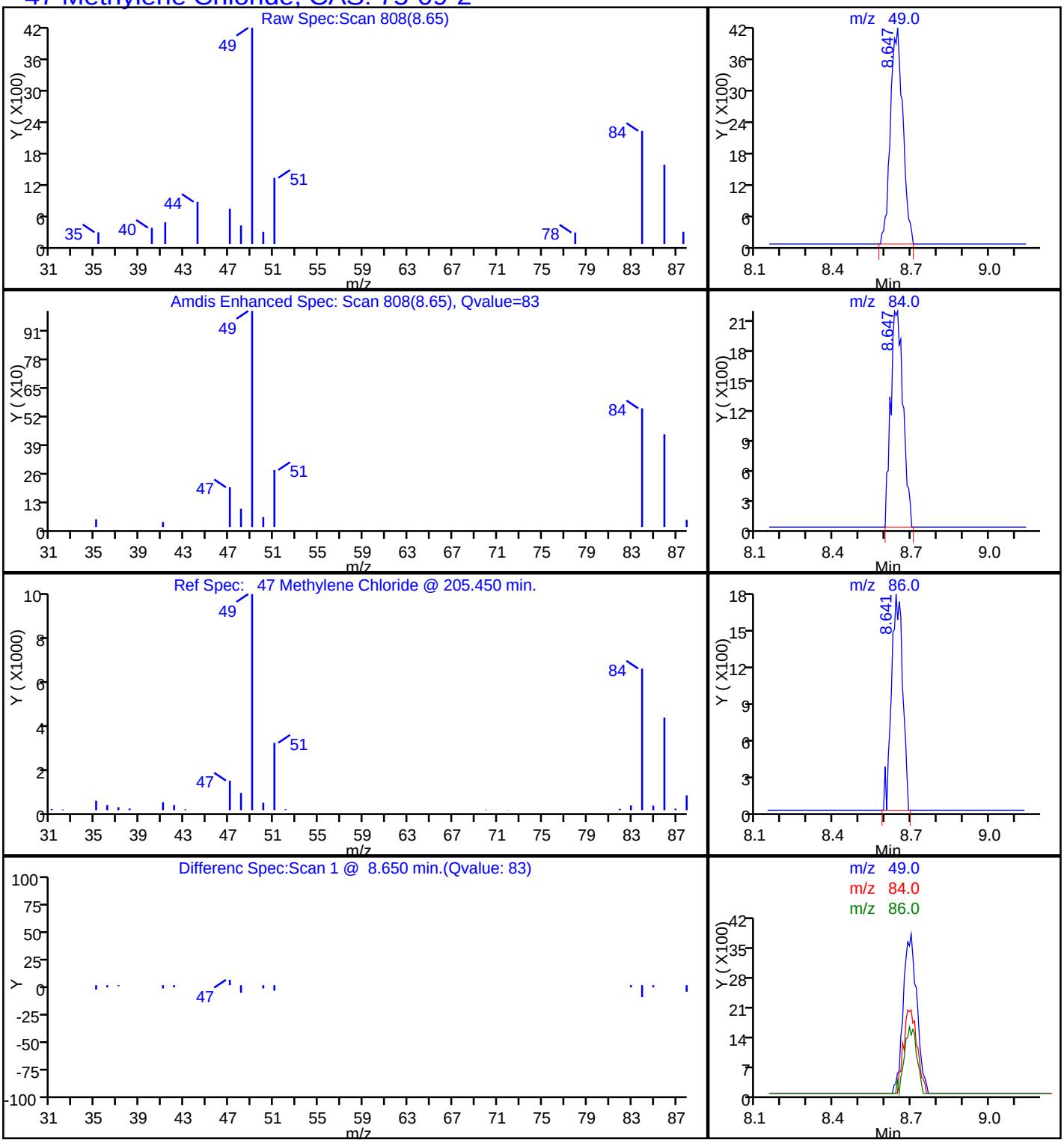


Report Date: 31-Mar-2014 10:25:42 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032919.d				
Injection Date:	30-Mar-2014 04:12:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-11	Lab Sample ID:	320-6793-11		
Client ID:	34001630				
Operator ID:	AO	ALS Bottle#:	6	Worklist Smp#:	19
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

47 Methylene Chloride, CAS: 75-09-2



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000909 | Lab Sample ID: 320-6793-12

Matrix: Air | Lab File ID: MS7032920.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 05:12

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.61	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000909 | Lab Sample ID: 320-6793-12

Matrix: Air | Lab File ID: MS7032920.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 05:12

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	ND	*	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000909 Lab Sample ID: 320-6793-12

Matrix: Air Lab File ID: MS7032920.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/30/2014 05:12

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	92		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	91	*	70-130
2037-26-5	Toluene-d8 (Surr)	86	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032920.d
Lims ID: 320-6793-A-12 Lab Sample ID: 320-6793-12
Client ID: 34000909
Sample Type: Client
Inject. Date: 30-Mar-2014 05:12:30 ALS Bottle#: 7 Worklist Smp#: 20
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-12
Misc. Info.: 500mL; 34000909
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:24:12 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:25:46

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.114	12.145	-0.031	87	66542	4.00	s
* 2 1,4-Difluorobenzene	114	14.231	14.262	-0.031	90	266538	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.966	20.990	-0.024	87	256263	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.288	13.325	-0.037	0	126491	3.63	
$ 5 Toluene-d8 (Surr)	100	17.596	17.626	-0.030	88	181551	3.44	
$ 6 4-Bromofluorobenzene (Surr)	95	23.551	23.582	-0.031	90	195144	3.67	
14 Propene	41	3.987	3.993	-0.006	91	5349	0.0887	
13 Chlorodifluoromethane	51	3.993	4.011	-0.018	5	5182	0.0459	
15 Dichlorodifluoromethane	85	4.041	4.054	-0.013	78	9380	0.0546	
18 Chloromethane	50	4.492	4.498	-0.006	32	5467	0.0896	
22 Butane	43	4.711	4.717	-0.006	72	4394	0.0447	
28 Trichlorofluoromethane	101	6.438	6.469	-0.031	10	4442	0.0249	
29 Acrolein	56	7.235	7.242	-0.007	34	820	0.0392	
31 Acetone	43	7.381	7.400	-0.019	98	77048	0.6082	
54 2-Butanone (MEK)	72	11.135	11.117	0.018	82	2207	0.0796	
68 Benzene	78	13.617	13.654	-0.037	30	4501	0.0262	
85 Toluene	91	17.772	17.815	-0.043	43	5658	0.0279	
98 m-Xylene & p-Xylene	91	21.404	21.441	-0.037	80	10029	0.0614	

QC Flag Legend

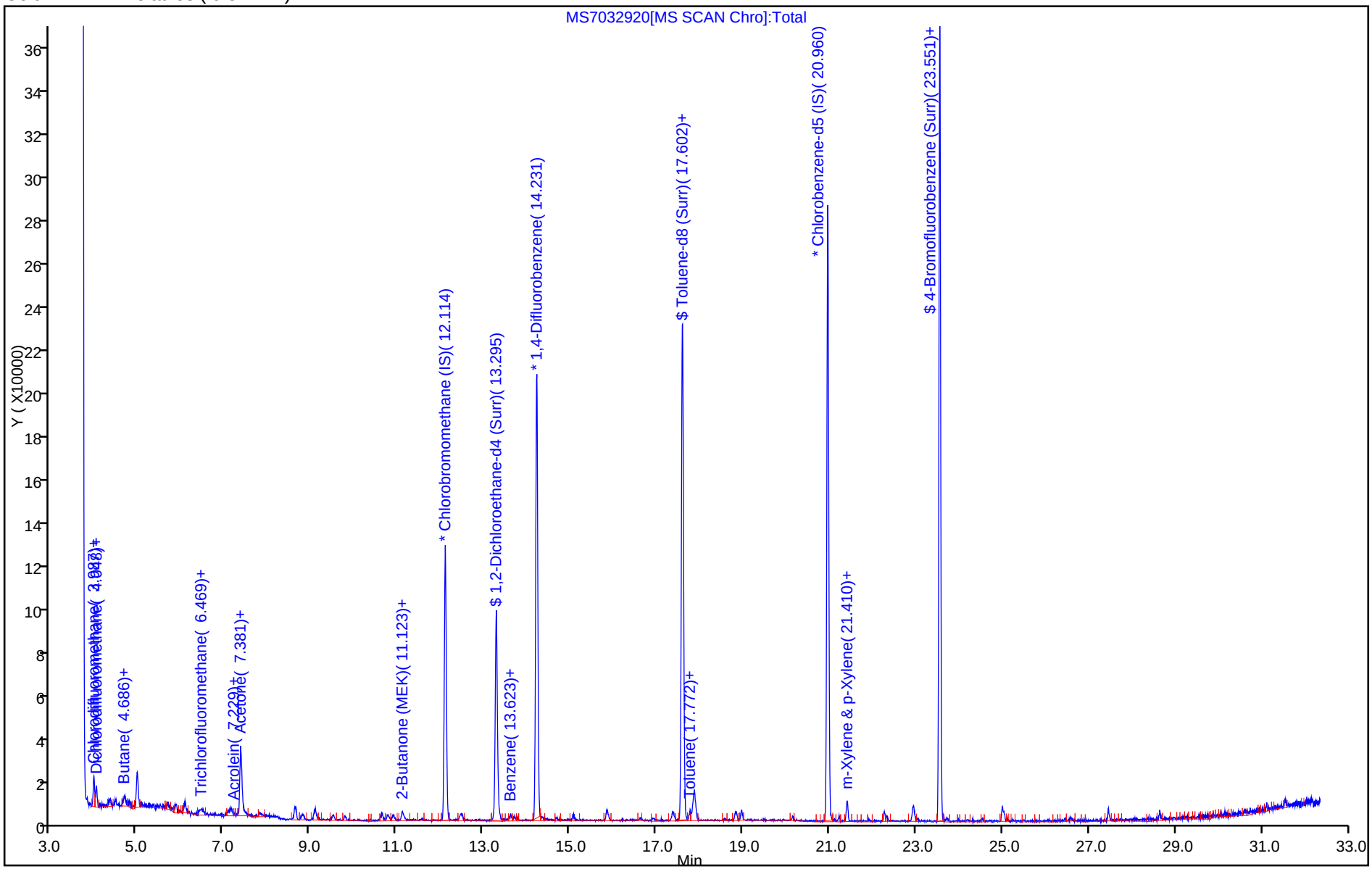
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:25:46 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032920.d				
Injection Date:	30-Mar-2014 05:12:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-12	Lab Sample ID:	320-6793-12	Worklist Smp#:	20
Client ID:	34000909				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	7
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

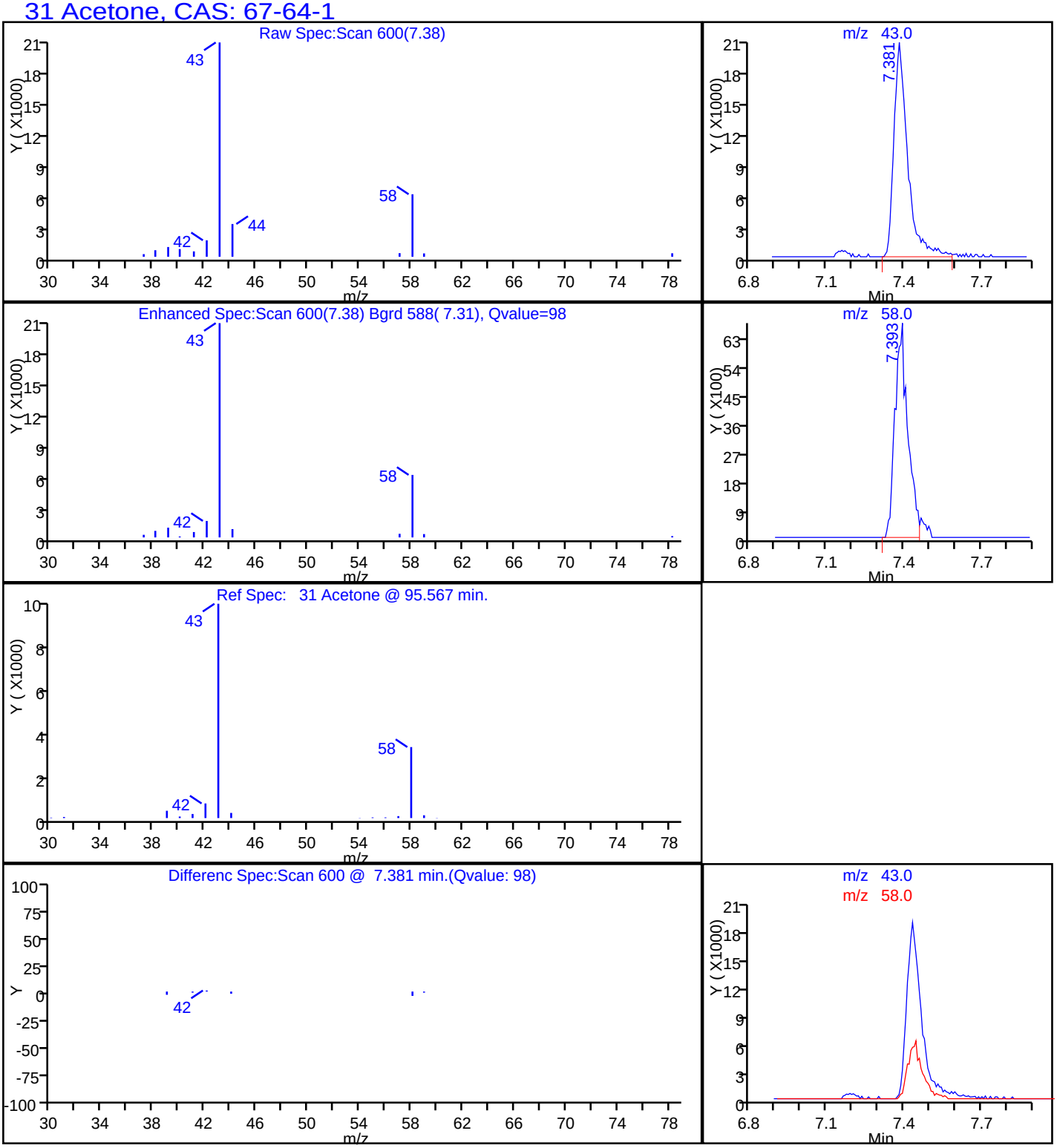


Report Date: 31-Mar-2014 10:25:46 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032920.d				
Injection Date:	30-Mar-2014 05:12:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-12	Lab Sample ID:	320-6793-12		
Client ID:	34000909				
Operator ID:	AO	ALS Bottle#:	7	Worklist Smp#:	20
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001596 | Lab Sample ID: 320-6793-13

Matrix: Air | Lab File ID: MS7032921.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 06:08

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.40	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001596 | Lab Sample ID: 320-6793-13

Matrix: Air | Lab File ID: MS7032921.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 06:08

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39343 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	0.083	J *	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001596 Lab Sample ID: 320-6793-13

Matrix: Air Lab File ID: MS7032921.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/30/2014 06:08

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39343 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	88		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	89	*	70-130
2037-26-5	Toluene-d8 (Surr)	85	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032921.d
Lims ID: 320-6793-A-13 Lab Sample ID: 320-6793-13
Client ID: 34001596
Sample Type: Client
Inject. Date: 30-Mar-2014 06:08:30 ALS Bottle#: 8 Worklist Smp#: 21
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-13
Misc. Info.: 500mL; 34001596
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 10:24:12 Calib Date: 29-Mar-2014 13:38:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032904.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 10:26:06

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.108	12.145	-0.037	91	68410	4.00	s
* 2 1,4-Difluorobenzene	114	14.225	14.262	-0.037	90	269587	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.966	20.990	-0.024	87	256791	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.288	13.325	-0.037	0	126158	3.58	
$ 5 Toluene-d8 (Surr)	100	17.608	17.626	-0.018	88	180756	3.39	
$ 6 4-Bromofluorobenzene (Surr)	95	23.558	23.582	-0.024	89	187248	3.52	
18 Chloromethane	50	4.473	4.498	-0.025	6	2763	0.0440	
31 Acetone	43	7.375	7.400	-0.025	95	52706	0.4047	
47 Methylene Chloride	49	8.635	8.677	-0.042	71	7104	0.0831	

QC Flag Legend

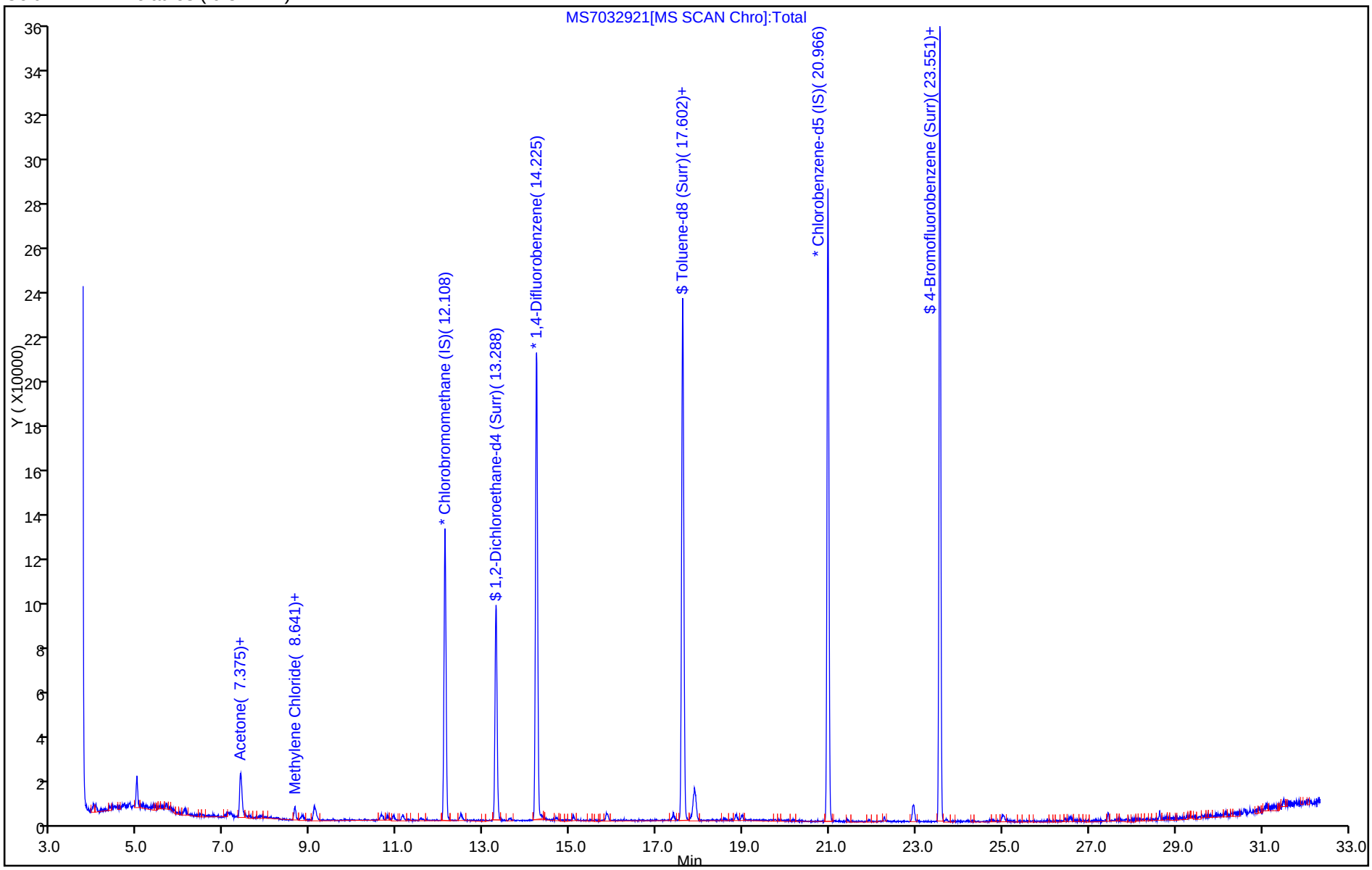
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 31-Mar-2014 10:26:06 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032921.d				
Injection Date:	30-Mar-2014 06:08:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-13	Lab Sample ID:	320-6793-13	Worklist Smp#:	21
Client ID:	34001596				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	8
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

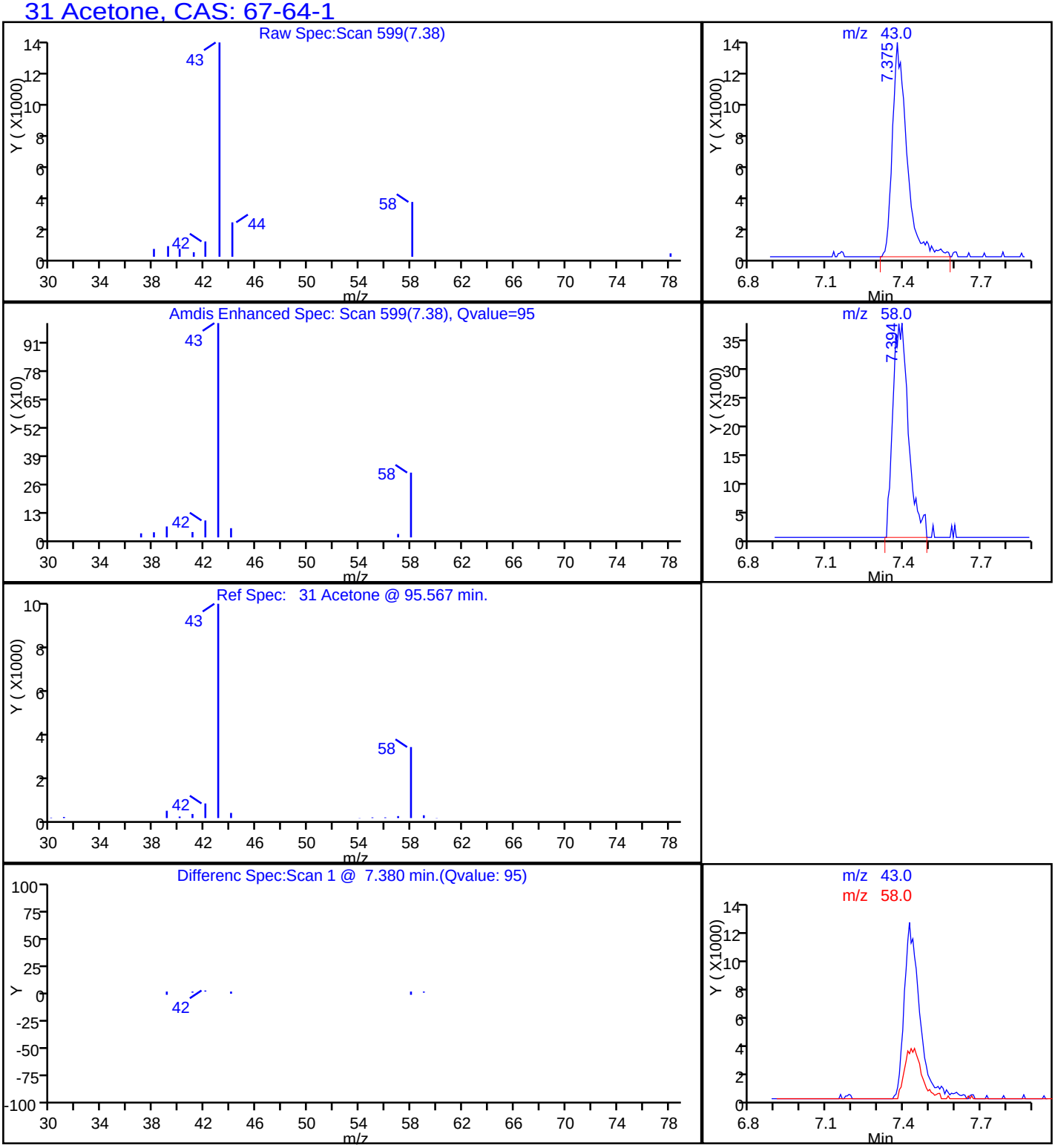


Report Date: 31-Mar-2014 10:26:06 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032921.d				
Injection Date:	30-Mar-2014 06:08:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-13	Lab Sample ID:	320-6793-13		
Client ID:	34001596				
Operator ID:	AO	ALS Bottle#:	8	Worklist Smp#:	21
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1

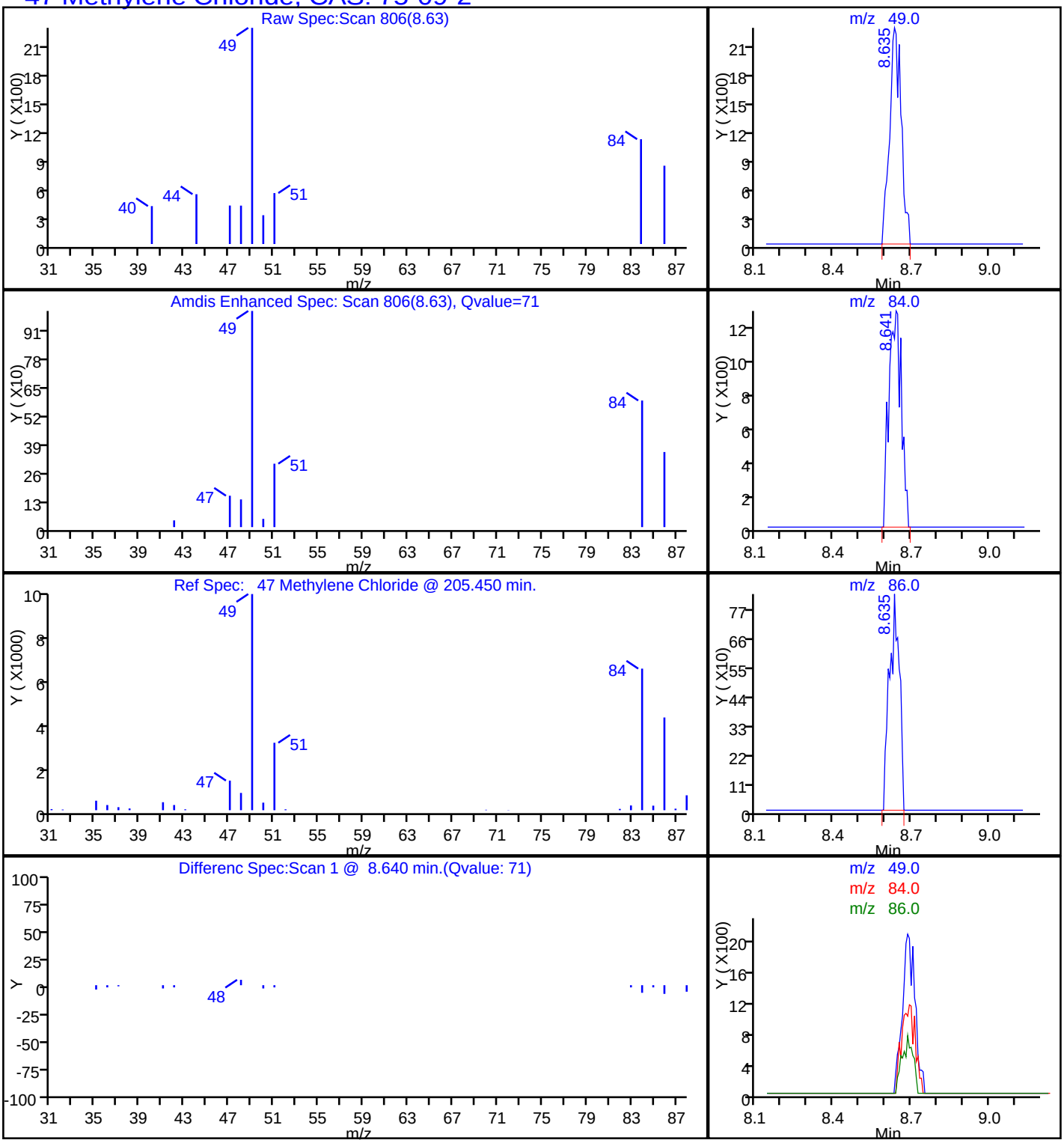


Report Date: 31-Mar-2014 10:26:06 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140329-11457.b\MS7032921.d				
Injection Date:	30-Mar-2014 06:08:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-13	Lab Sample ID:	320-6793-13		
Client ID:	34001596				
Operator ID:	AO	ALS Bottle#:	8	Worklist Smp#:	21
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

47 Methylene Chloride, CAS: 75-09-2



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000748 | Lab Sample ID: 320-6793-15

Matrix: Air | Lab File ID: MS7033113.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/31/2014 20:00

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39424 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	1.3	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000748 | Lab Sample ID: 320-6793-15

Matrix: Air | Lab File ID: MS7033113.d

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/31/2014 20:00

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39424 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	ND	*	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34000748 Lab Sample ID: 320-6793-15

Matrix: Air Lab File ID: MS7033113.d

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/31/2014 20:00

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39424 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	88		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	84	*	70-130
2037-26-5	Toluene-d8 (Surr)	80	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140331-11484.b\MS7033113.d
Lims ID: 320-6793-A-15 Lab Sample ID: 320-6793-15
Client ID: 34000748
Sample Type: Client
Inject. Date: 31-Mar-2014 20:00:30 ALS Bottle#: 2 Worklist Smp#: 12
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6793-15
Misc. Info.: 500mL; 34000748
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140331-11484.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 01-Apr-2014 10:56:10 Calib Date: 31-Mar-2014 12:32:30
Integrator: RTE ID Type: RT Order ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140331-11484.b\MS7033103.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK006

First Level Reviewer: ortizam Date: 01-Apr-2014 10:34:54

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.151	12.151	0.0	90	67340	4.00	s
* 2 1,4-Difluorobenzene	114	14.262	14.262	0.0	90	261280	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.978	20.984	-0.006	87	249587	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.331	13.331	0.0	0	122285	3.35	
$ 5 Toluene-d8 (Surr)	100	17.626	17.632	-0.006	88	175411	3.22	
$ 6 4-Bromofluorobenzene (Surr)	95	23.564	23.570	-0.006	90	188302	3.52	
31 Acetone	43	7.406	7.424	-0.018	97	159056	1.29	
54 2-Butanone (MEK)	72	11.165	11.165	0.0	48	630	0.0286	

QC Flag Legend

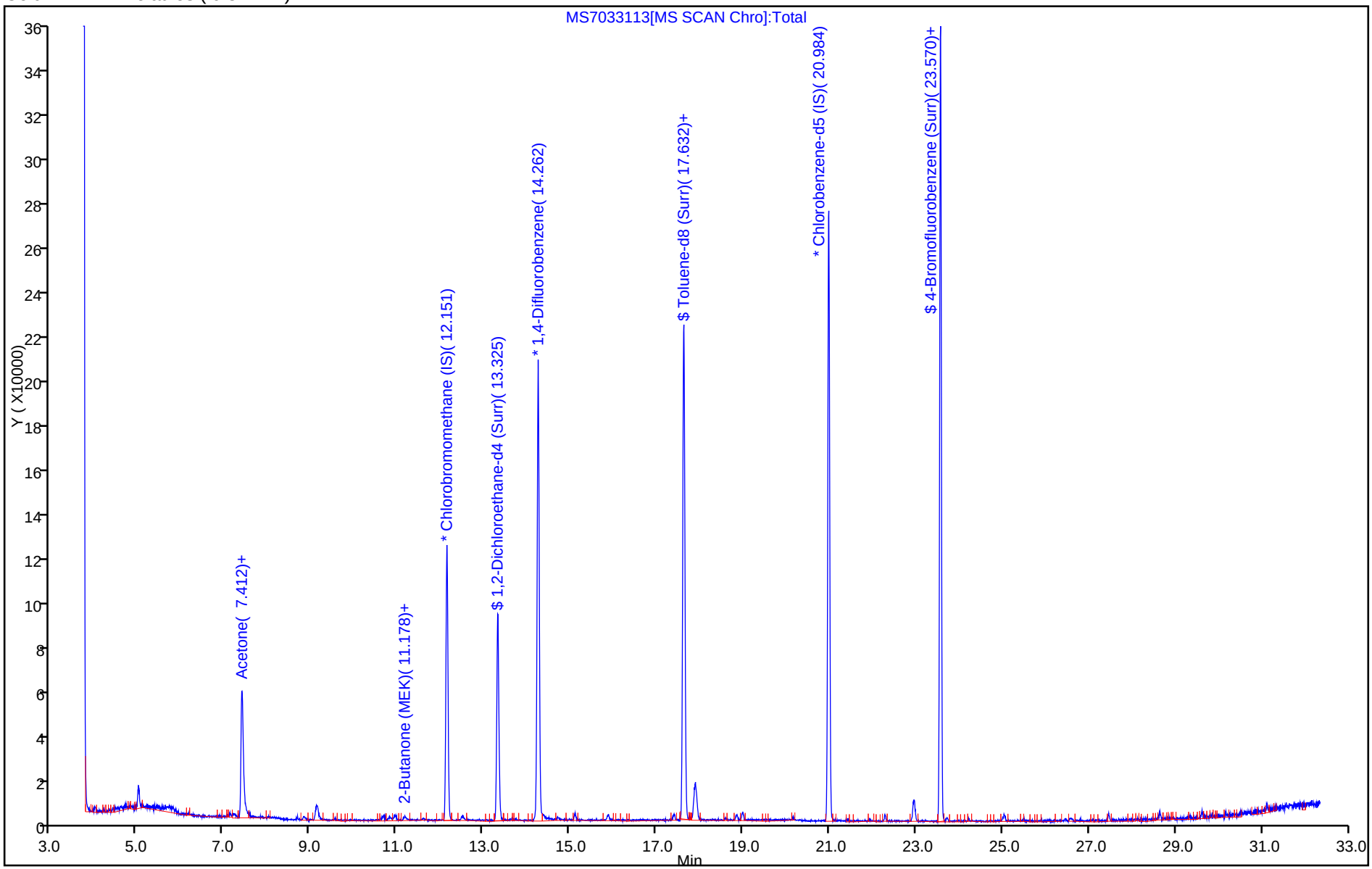
Processing Flags
s - Failed ISTD Recovery Test

Report Date: 01-Apr-2014 10:56:11 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140331-11484.b\MS7033113.d				
Injection Date:	31-Mar-2014 20:00:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-15	Lab Sample ID:	320-6793-15	Worklist Smp#:	12
Client ID:	34000748				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	2
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

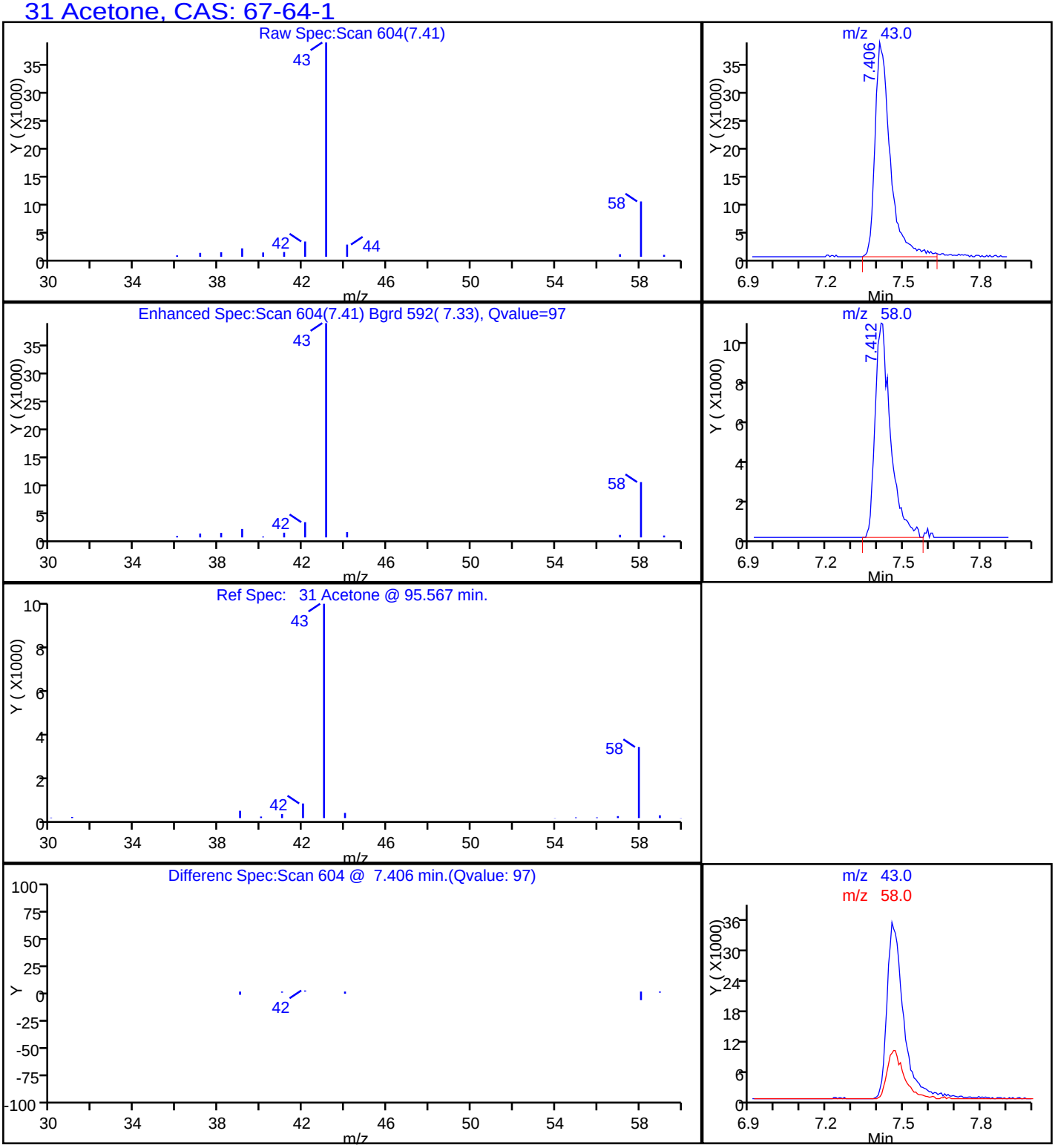


Report Date: 01-Apr-2014 10:56:11 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140331-11484.b\MS7033113.d				
Injection Date:	31-Mar-2014 20:00:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-15	Lab Sample ID:	320-6793-15		
Client ID:	34000748				
Operator ID:	AO	ALS Bottle#:	2	Worklist Smp#:	12
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001965 Lab Sample ID: 320-6793-16

Matrix: Air Lab File ID: MS7033114.D

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/31/2014 20:54

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39424 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	2.0	J *	5.0
107-02-8	Acrolein	ND	*	2.0
107-13-1	Acrylonitrile	ND	*	2.0
107-05-1	Allyl chloride	ND	*	0.80
71-43-2	Benzene	ND	*	0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND	*	0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND	*	0.80
106-99-0	1,3-Butadiene	ND	*	0.80
106-97-8	n-Butane	ND	*	0.40
78-93-3	2-Butanone (MEK)	ND	*	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND	*	2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND	*	0.80
56-23-5	Carbon tetrachloride	ND	*	0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND	*	0.80
75-00-3	Chloroethane	ND	*	0.80
67-66-3	Chloroform	ND	*	0.30
74-87-3	Chloromethane	ND	*	0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND	*	0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND	*	0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	*	0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND	*	0.40
75-34-3	1,1-Dichloroethane	ND	*	0.30
107-06-2	1,2-Dichloroethane	ND	*	0.80
75-35-4	1,1-Dichloroethene	ND	*	0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001965 | Lab Sample ID: 320-6793-16

Matrix: Air | Lab File ID: MS7033114.D

Analysis Method: TO-15 | Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/31/2014 20:54

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39424 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND	*	0.40
156-60-5	trans-1,2-Dichloroethene	ND	*	0.40
78-87-5	1,2-Dichloropropane	ND	*	0.40
10061-01-5	cis-1,3-Dichloropropene	ND	*	0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND	*	0.80
141-78-6	Ethyl acetate	ND	*	0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND	*	0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND	*	0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND	*	0.80
80-62-6	Methyl methacrylate	ND	*	0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	*	0.40
75-09-2	Methylene Chloride	ND	*	0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND	*	0.80
115-07-1	Propylene	ND	*	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND	*	0.80
108-88-3	Toluene	ND	*	0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND	*	0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND	*	0.40
75-69-4	Trichlorofluoromethane	ND	*	0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6793-1

SDG No.:

Client Sample ID: 34001965 Lab Sample ID: 320-6793-16

Matrix: Air Lab File ID: MS7033114.D

Analysis Method: TO-15 Date Collected: 03/19/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/31/2014 20:54

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39424 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND	*	0.40
108-05-4	Vinyl acetate	ND	*	0.80
593-60-2	Vinyl bromide	ND	*	0.80
75-01-4	Vinyl chloride	ND	*	0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	87	*	70-130
2037-26-5	Toluene-d8 (Surr)	80	*	70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File:	\\SACCHROM\ChromData\ATMS7\20140331-11484.b\MS7033114.D				
Lims ID:	320-6793-A-16	Lab Sample ID:			
Client ID:	34001965				
Sample Type:	Client				
Inject. Date:	31-Mar-2014 20:54:30	ALS Bottle#:	4	Worklist Smp#:	25
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	320-6793-16				
Misc. Info.:	500mL; 34001965				
Operator ID:	AO	Instrument ID:	ATMS7		
Method:	\\SACCHROM\ChromData\ATMS7\20140331-11484.b\TO15_ATMS7N.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	01-Apr-2014 11:44:41	Calib Date:	31-Mar-2014 12:32:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS7\20140331-11484.b\MS7033103.d				
Column 1 :	RTX Volatiles (0.32 mm)		Det: MS SCAN		
Process Host:	XAWRK006				

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.151	12.151	0.0	91	65818	4.00	s
* 2 1,4-Difluorobenzene	114	14.262	14.262	0.0	90	261599	4.00	s
* 3 Chlorobenzene-d5 (IS)	117	20.978	20.984	-0.006	86	267707	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.319	13.331	-0.012	0	126528	3.46	
$ 5 Toluene-d8 (Surr)	100	17.626	17.632	-0.006	89	174899	3.21	
$ 6 4-Bromofluorobenzene (Surr)	95	23.557	23.570	-0.013	90	218467	3.80	
31 Acetone	43	7.399	7.424	-0.025	97	245335	2.04	

QC Flag Legend

Processing Flags
s - Failed ISTD Recovery Test

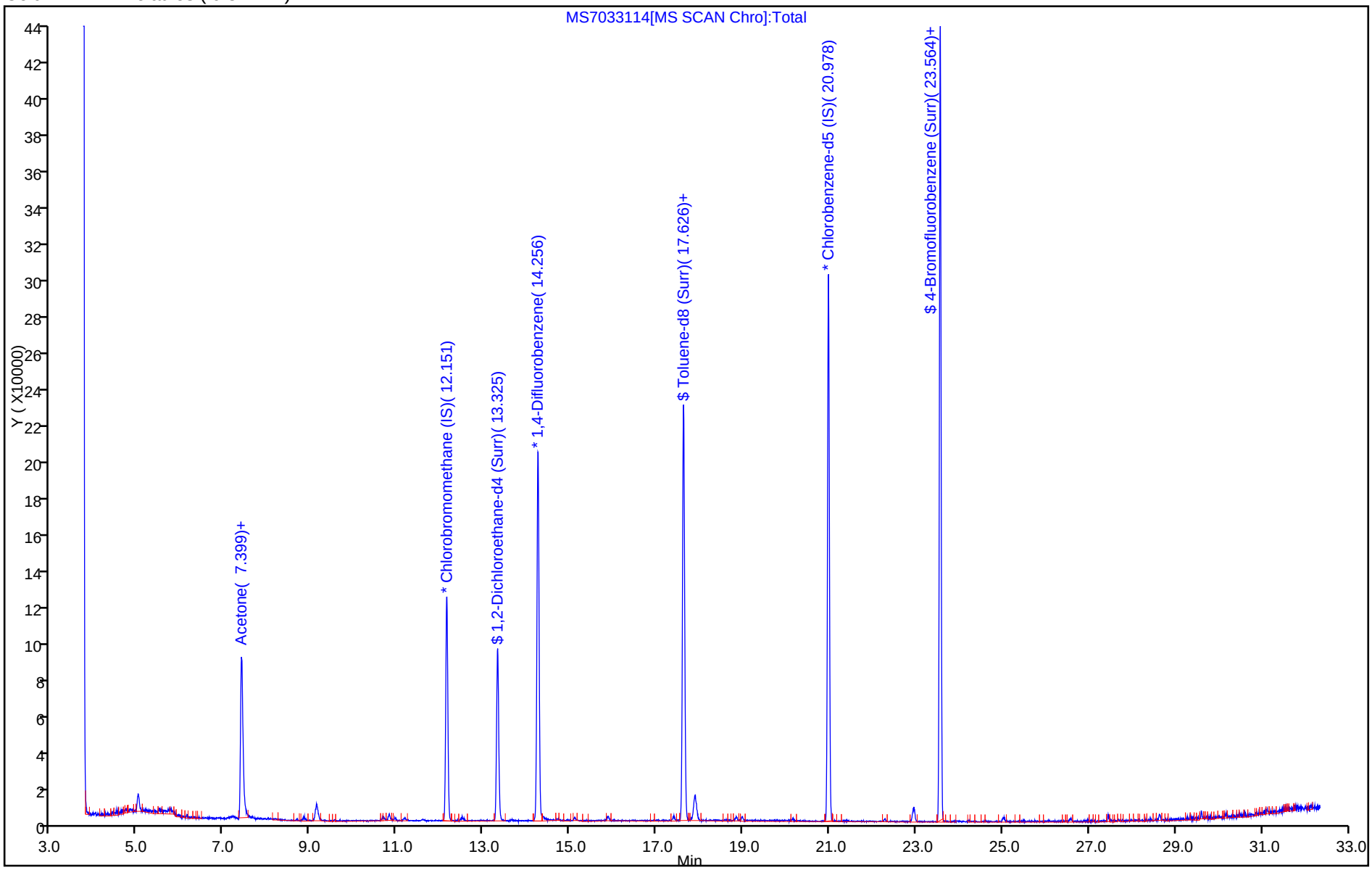
Report Date: 01-Apr-2014 11:46:05 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File: \\SACCHROM\ChromData\ATMS7\20140331-11484.b\MS7033114.D

Injection Date:	31-Mar-2014 20:54:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6793-A-16	Lab Sample ID:		Worklist Smp#:	25
Client ID:	34001965				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	4
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

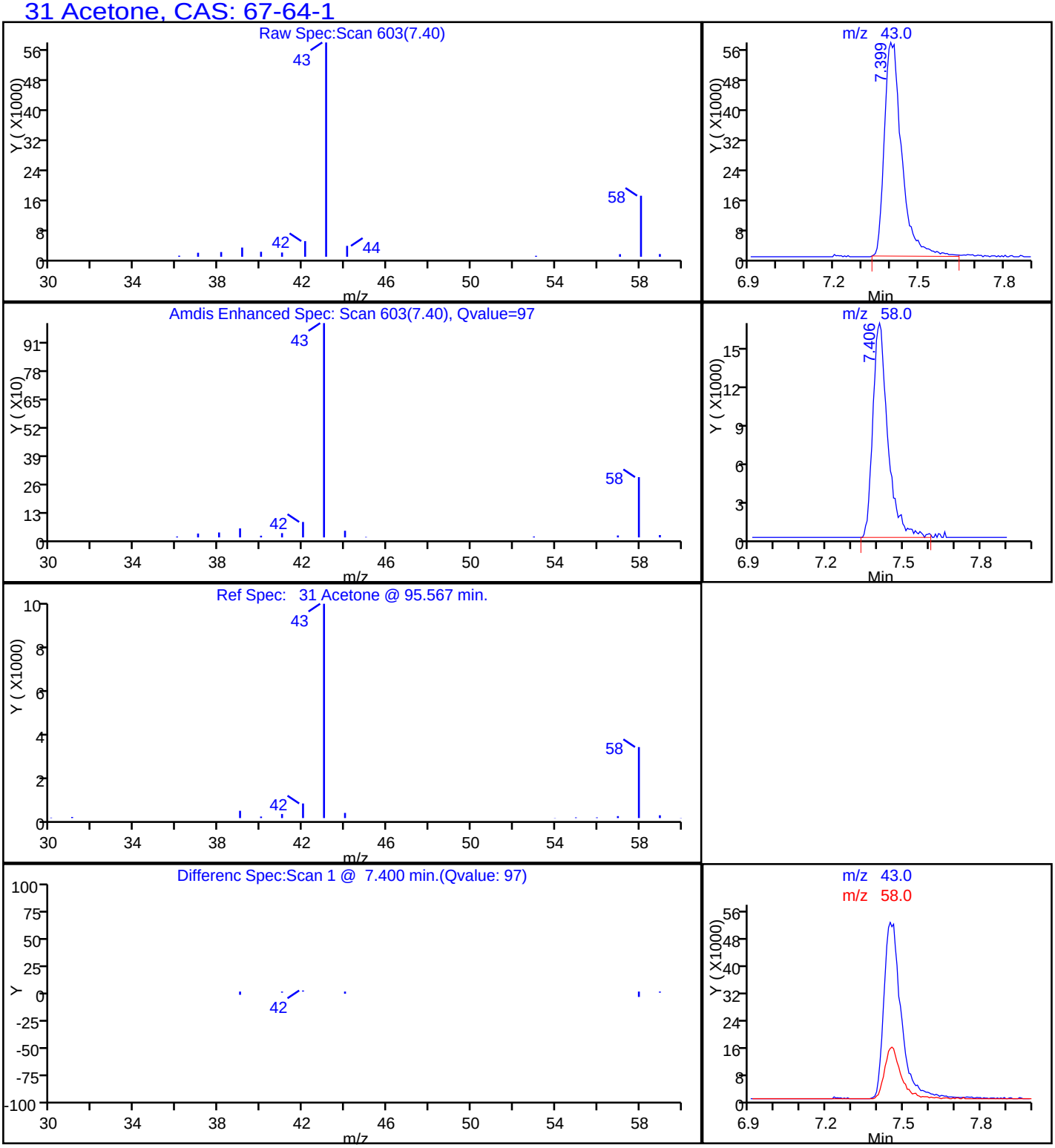


Report Date: 01-Apr-2014 11:46:05 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140331-11484.b\MS7033114.D				
Injection Date:	31-Mar-2014 20:54:30	Instrument ID:	ATMS7		
Lims ID:	320-6793-A-16	Lab Sample ID:			
Client ID:	34001965				
Operator ID:	AO	ALS Bottle#:	4	Worklist Smp#:	25
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001136 | Lab Sample ID: 320-6800-1

Matrix: Air | Lab File ID: MS5032905.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 14:40

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001136 | Lab Sample ID: 320-6800-1

Matrix: Air | Lab File ID: MS5032905.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 14:40

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001136 Lab Sample ID: 320-6800-1

Matrix: Air Lab File ID: MS5032905.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 14:40

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	94		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	100		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032905.D
Lims ID: 320-6800-A-1 Lab Sample ID: 320-6800-1
Client ID: 34001136
Sample Type: Client
Inject. Date: 29-Mar-2014 14:40:30 ALS Bottle#: 5 Worklist Smp#: 6
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6800-1
Misc. Info.: 500mL;34001136
Operator ID: AO Instrument ID: ATMS5

Method: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\TO15_ATMS5.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 09:26:47 Calib Date: 29-Mar-2014 12:33:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032903.D

Column 1 : Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 09:26:47

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	92	322963	7.76	
* 2 1,4-Difluorobenzene	114	12.578	12.584	-0.006	93	1303986	8.00	
* 3 Chlorobenzene-d5 (IS)	117	16.775	16.775	0.0	82	1113439	8.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.975	-0.006	0	372613	7.76	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	93	821477	7.94	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	91	701073	7.56	
33 Acetone	43	7.358	7.358	0.012	66	2793	0.0282	7a

QC Flag Legend

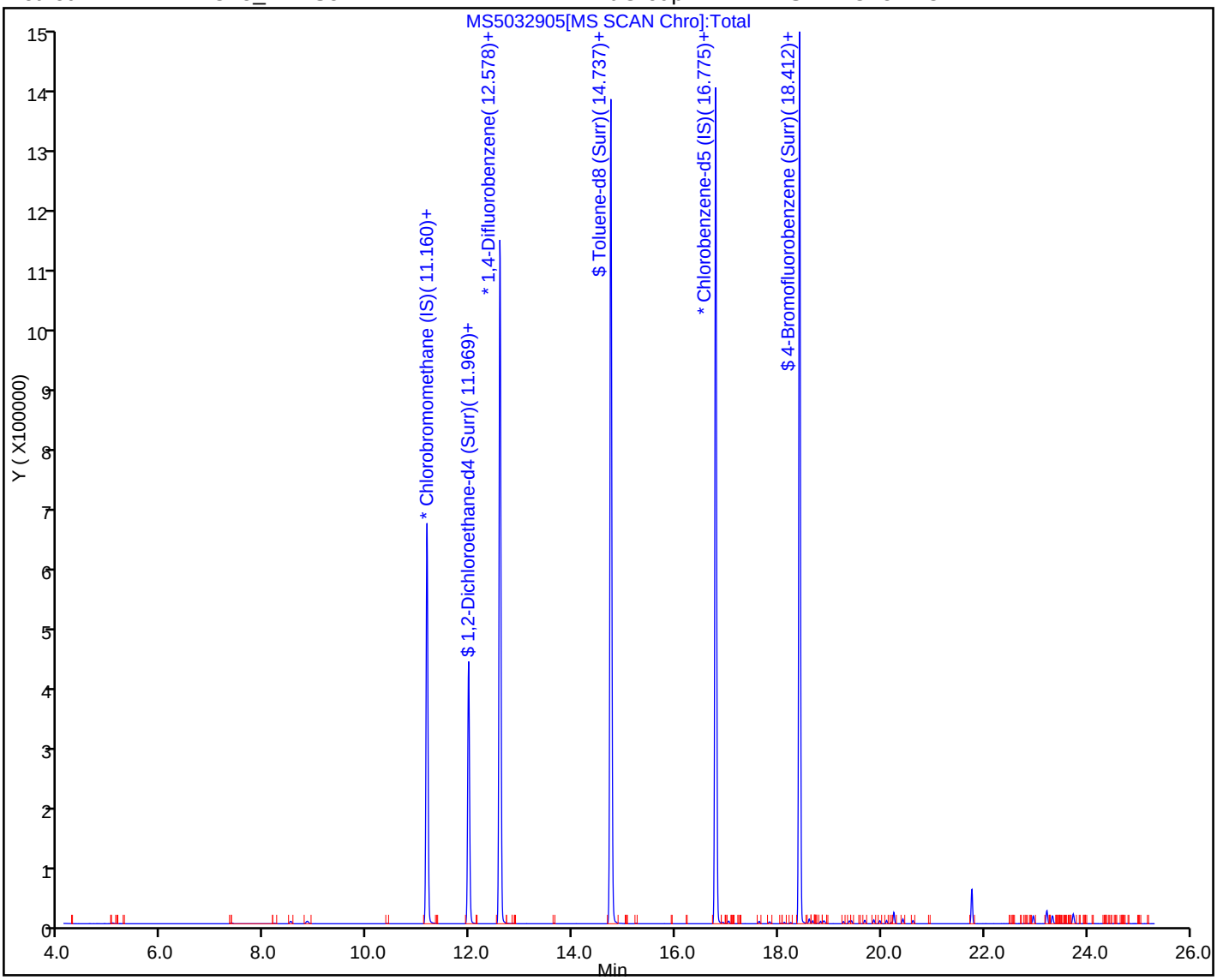
Processing Flags
7 - Failed Limit of Detection

Review Flags
a - User Assigned ID

Report Date: 31-Mar-2014 09:26:48 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032905.D				
Injection Date:	29-Mar-2014 14:40:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-1	Lab Sample ID:	320-6800-1		
Client ID:	34001136				
Operator ID:	AO	ALS Bottle#:	5	Worklist Smp#:	6
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



Manual Integration/User Assign Peak Report

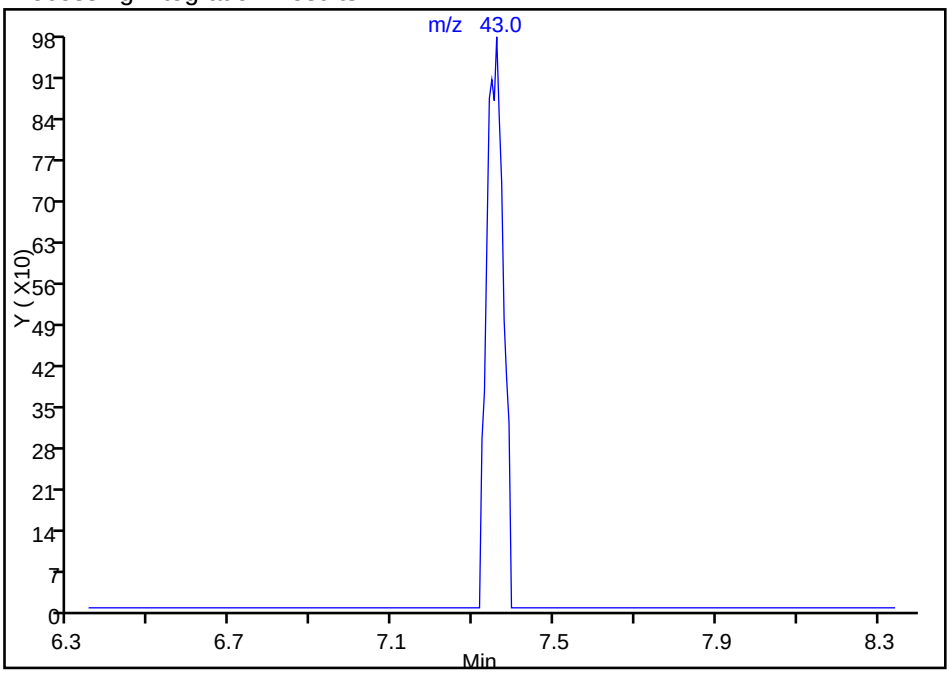
TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032905.D				
Injection Date:	29-Mar-2014 14:40:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-1	Lab Sample ID:	320-6800-1		
Client ID:	34001136				
Operator ID:	AO	ALS Bottle#:	5	Worklist Smp#:	6
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1

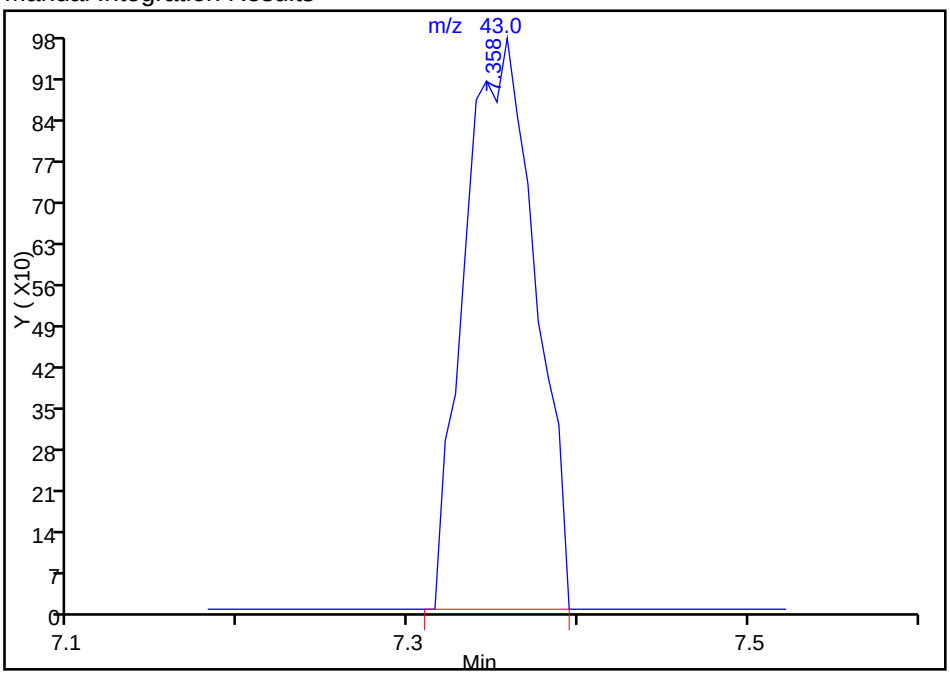
Not Detected
Expected RT: 7.35

Processing Integration Results



Manual Integration Results

RT: 7.36
Response: 2793
Amount: 0.028188



Reviewer: ortizam, 31-Mar-2014 09:26:47
Audit Action: Assigned Compound ID
Audit Reason:

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34000994 | Lab Sample ID: 320-6800-2

Matrix: Air | Lab File ID: MS5032906.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 15:47

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.45	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34000994 | Lab Sample ID: 320-6800-2

Matrix: Air | Lab File ID: MS5032906.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 15:47

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34000994 Lab Sample ID: 320-6800-2

Matrix: Air Lab File ID: MS5032906.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 15:47

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	100		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032906.D
Lims ID: 320-6800-A-2 Lab Sample ID: 320-6800-2
Client ID: 34000994
Sample Type: Client
Inject. Date: 29-Mar-2014 15:47:30 ALS Bottle#: 6 Worklist Smp#: 7
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6800-2
Misc. Info.: 500mL;34000994
Operator ID: AO Instrument ID: ATMS5

Method: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\TO15_ATMS5.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 09:26:47 Calib Date: 29-Mar-2014 12:33:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032903.D

Column 1 : Det: MS SCAN
Process Host: XAWRK025

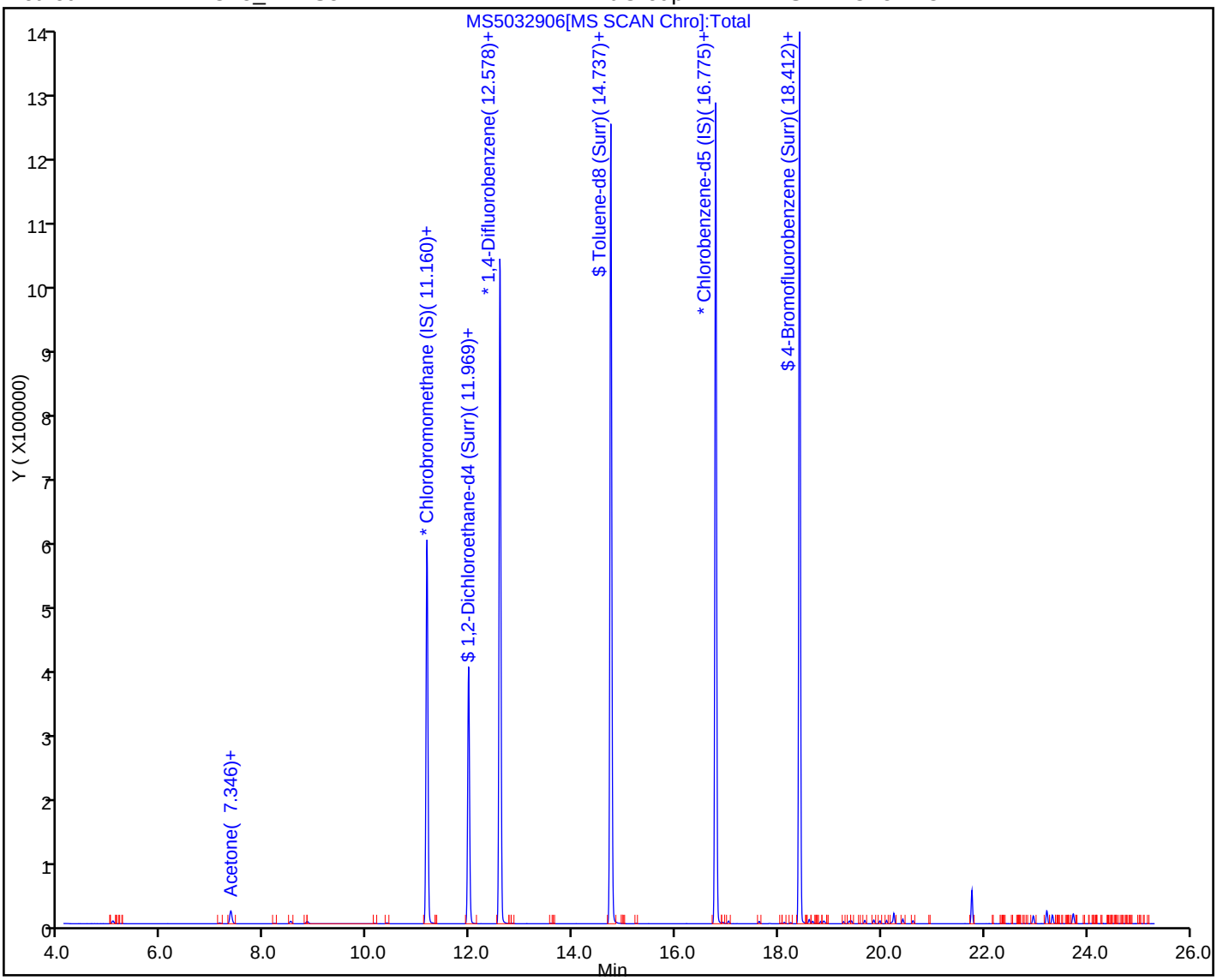
First Level Reviewer: ortizam Date: 31-Mar-2014 09:26:54

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	92	306943	7.76	
* 2 1,4-Difluorobenzene	114	12.578	12.584	-0.006	93	1239341	8.00	
* 3 Chlorobenzene-d5 (IS)	117	16.775	16.775	0.0	82	1064554	8.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.975	-0.006	0	355332	7.78	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	93	778630	7.92	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	91	676996	7.63	
33 Acetone	43	7.340	7.346	-0.006	96	42095	0.4470	

Report Date: 31-Mar-2014 09:26:54 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032906.D				
Injection Date:	29-Mar-2014 15:47:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-2	Lab Sample ID:	320-6800-2		
Client ID:	34000994				
Operator ID:	AO	ALS Bottle#:	6	Worklist Smp#:	7
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		

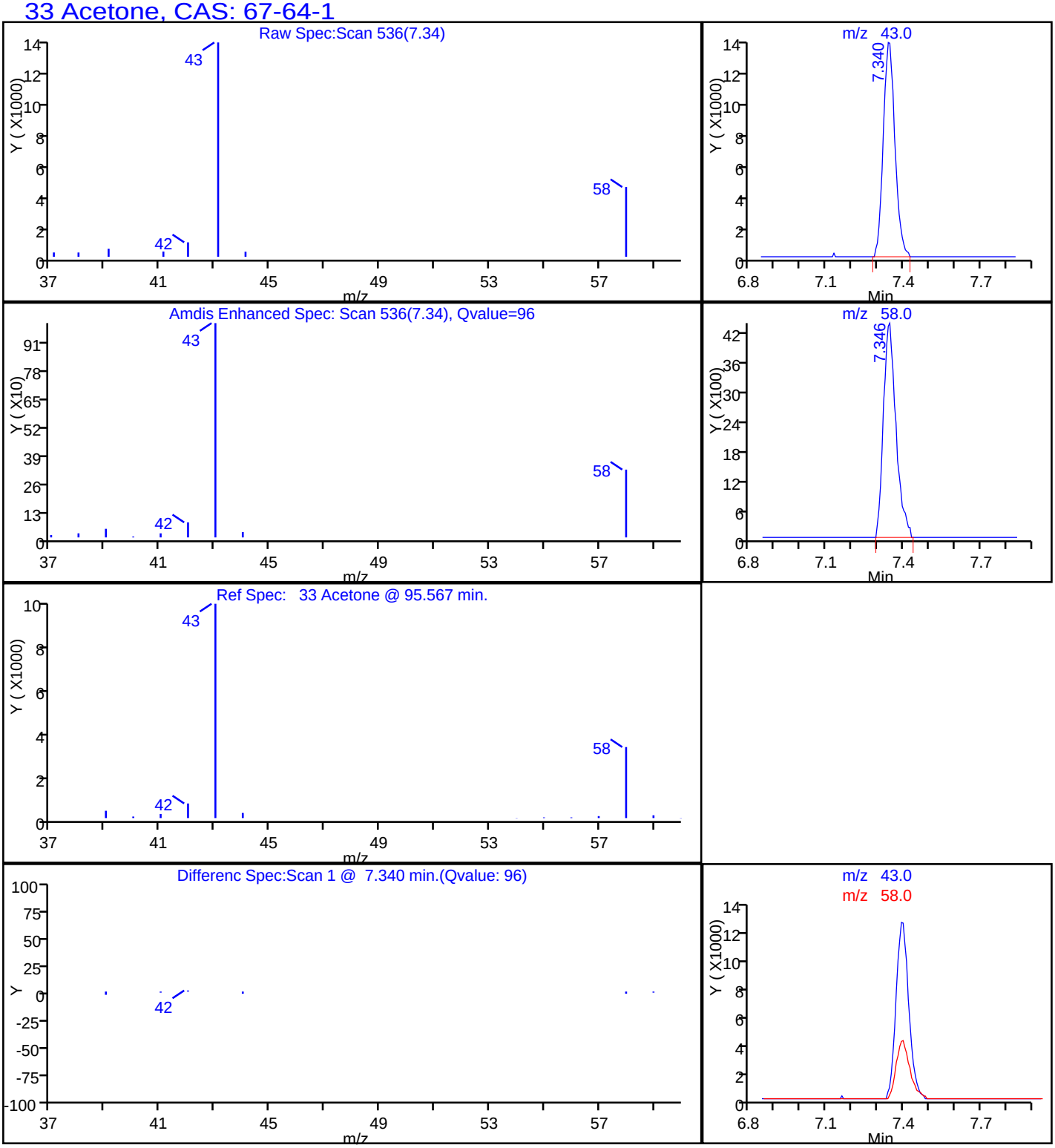


Report Date: 31-Mar-2014 09:26:54 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032906.D				
Injection Date:	29-Mar-2014 15:47:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-2	Lab Sample ID:	320-6800-2		
Client ID:	34000994				
Operator ID:	AO	ALS Bottle#:	6	Worklist Smp#:	7
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001004 | Lab Sample ID: 320-6800-4

Matrix: Air | Lab File ID: MS5032908.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 18:06

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.22	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001004 | Lab Sample ID: 320-6800-4

Matrix: Air | Lab File ID: MS5032908.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 18:06

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001004 Lab Sample ID: 320-6800-4

Matrix: Air Lab File ID: MS5032908.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 18:06

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	100		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032908.D
Lims ID: 320-6800-A-4 Lab Sample ID: 320-6800-4
Client ID: 34001004
Sample Type: Client
Inject. Date: 29-Mar-2014 18:06:30 ALS Bottle#: 8 Worklist Smp#: 9
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6800-4
Misc. Info.: 500mL;34001004
Operator ID: AO Instrument ID: ATMS5

Method: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\TO15_ATMS5.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 09:26:47 Calib Date: 29-Mar-2014 12:33:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032903.D

Column 1 : Det: MS SCAN
Process Host: XAWRK025

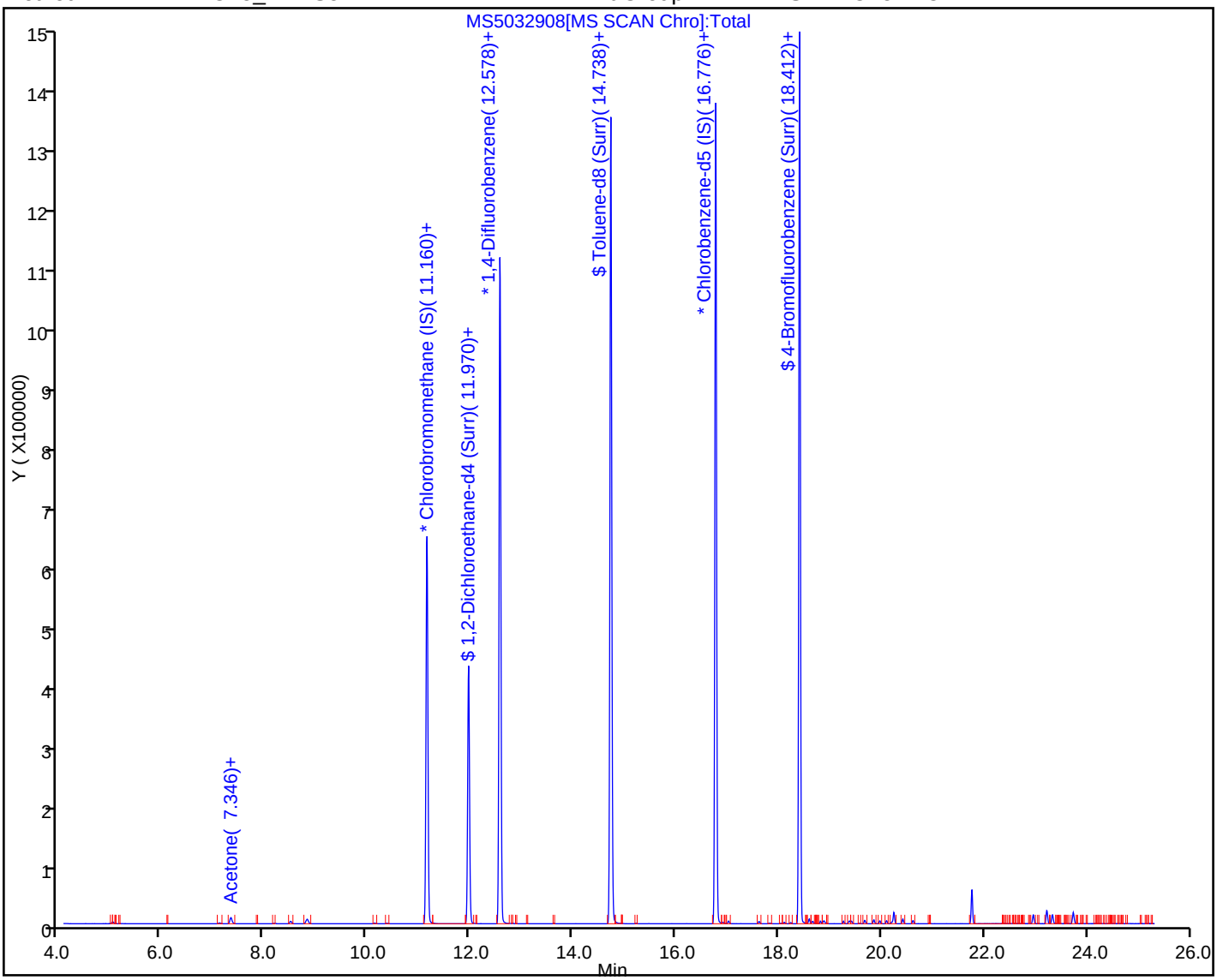
First Level Reviewer: ortizam Date: 31-Mar-2014 09:27:28

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	92	313493	7.76	
* 2 1,4-Difluorobenzene	114	12.578	12.584	-0.006	93	1271719	8.00	
* 3 Chlorobenzene-d5 (IS)	117	16.776	16.775	0.001	82	1093113	8.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.970	11.975	-0.005	0	364467	7.78	
$ 5 Toluene-d8 (Surr)	100	14.738	14.737	0.001	93	796536	7.90	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	91	695015	7.63	
33 Acetone	43	7.346	7.346	0.0	92	20949	0.2178	

Report Date: 31-Mar-2014 09:27:29 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032908.D				
Injection Date:	29-Mar-2014 18:06:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-4	Lab Sample ID:	320-6800-4		
Client ID:	34001004				
Operator ID:	AO	ALS Bottle#:	8	Worklist Smp#:	9
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		

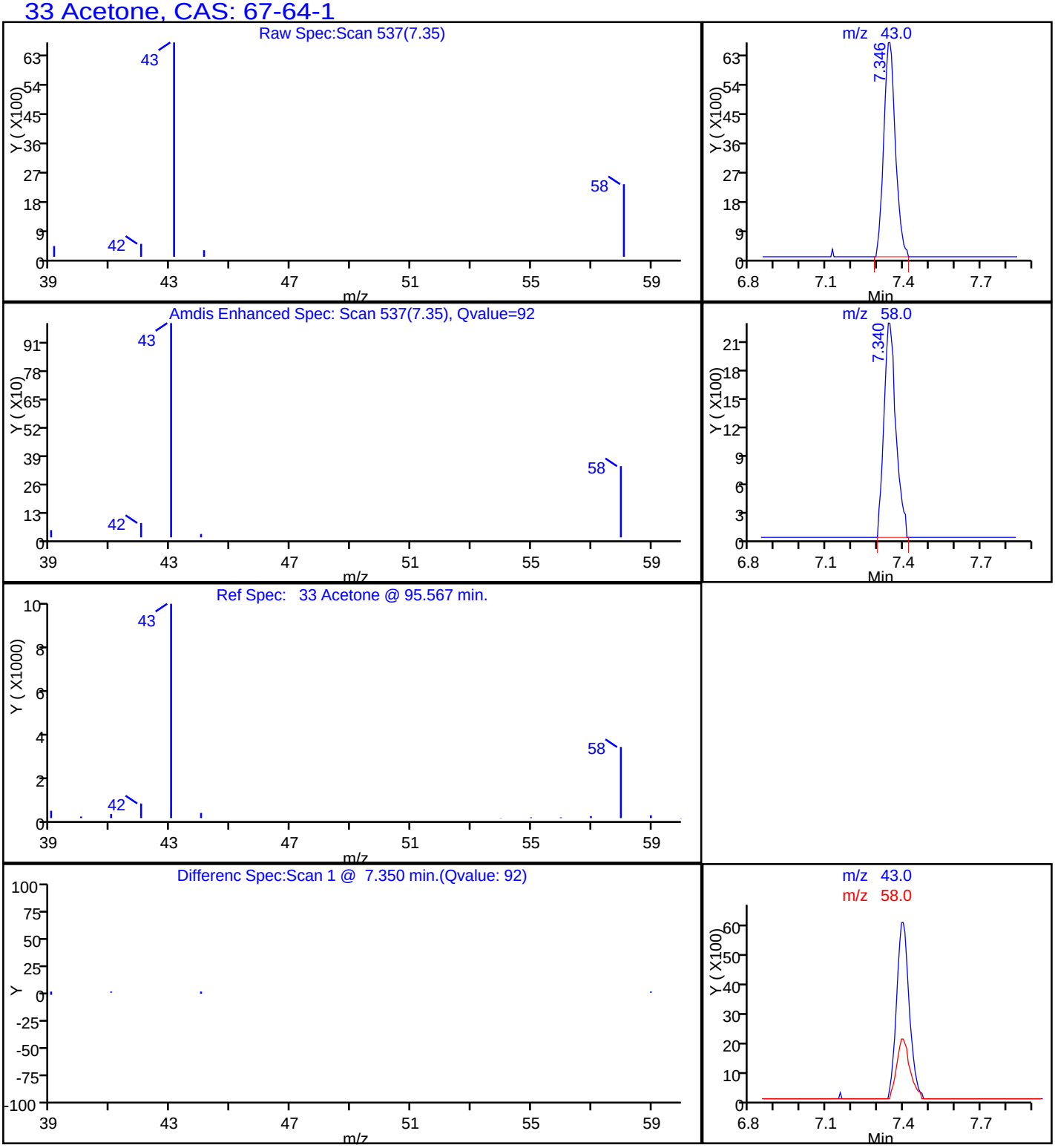


Report Date: 31-Mar-2014 09:27:29 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032908.D				
Injection Date:	29-Mar-2014 18:06:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-4	Lab Sample ID:	320-6800-4		
Client ID:	34001004				
Operator ID:	AO	ALS Bottle#:	8	Worklist Smp#:	9
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001230 | Lab Sample ID: 320-6800-5

Matrix: Air | Lab File ID: MS5032909.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 19:15

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.18	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001230 | Lab Sample ID: 320-6800-5

Matrix: Air | Lab File ID: MS5032909.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 19:15

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001230 Lab Sample ID: 320-6800-5

Matrix: Air Lab File ID: MS5032909.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 19:15

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	100		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032909.D
Lims ID: 320-6800-A-5 Lab Sample ID: 320-6800-5
Client ID: 34001230
Sample Type: Client
Inject. Date: 29-Mar-2014 19:15:30 ALS Bottle#: 9 Worklist Smp#: 10
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6800-5
Misc. Info.: 500mL;34001230
Operator ID: AO Instrument ID: ATMS5

Method: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\TO15_ATMS5.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 09:27:39 Calib Date: 29-Mar-2014 12:33:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032903.D

Column 1 : Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 09:27:44

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	93	315078	7.76	
* 2 1,4-Difluorobenzene	114	12.584	12.584	0.0	93	1286292	8.00	
* 3 Chlorobenzene-d5 (IS)	117	16.775	16.775	0.0	84	1093904	8.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.975	-0.006	0	366666	7.74	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	93	810012	7.94	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	91	691548	7.59	
33 Acetone	43	7.352	7.352	0.006	87	17161	0.1775	7a

QC Flag Legend

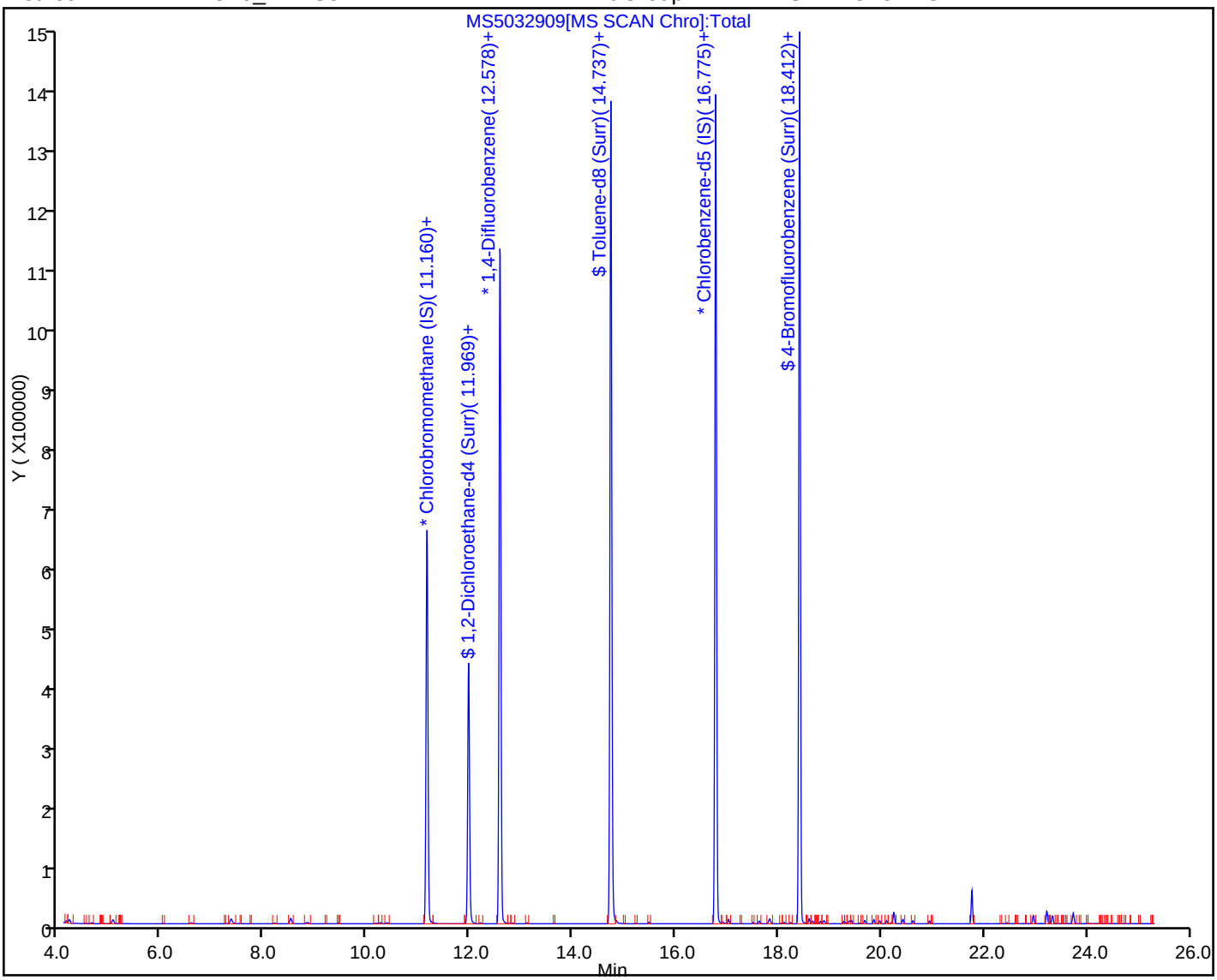
Processing Flags
7 - Failed Limit of Detection

Review Flags
a - User Assigned ID

Report Date: 31-Mar-2014 09:27:44 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032909.D				
Injection Date:	29-Mar-2014 19:15:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-5	Lab Sample ID:	320-6800-5		
Client ID:	34001230				
Operator ID:	AO	ALS Bottle#:	9	Worklist Smp#:	10
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		

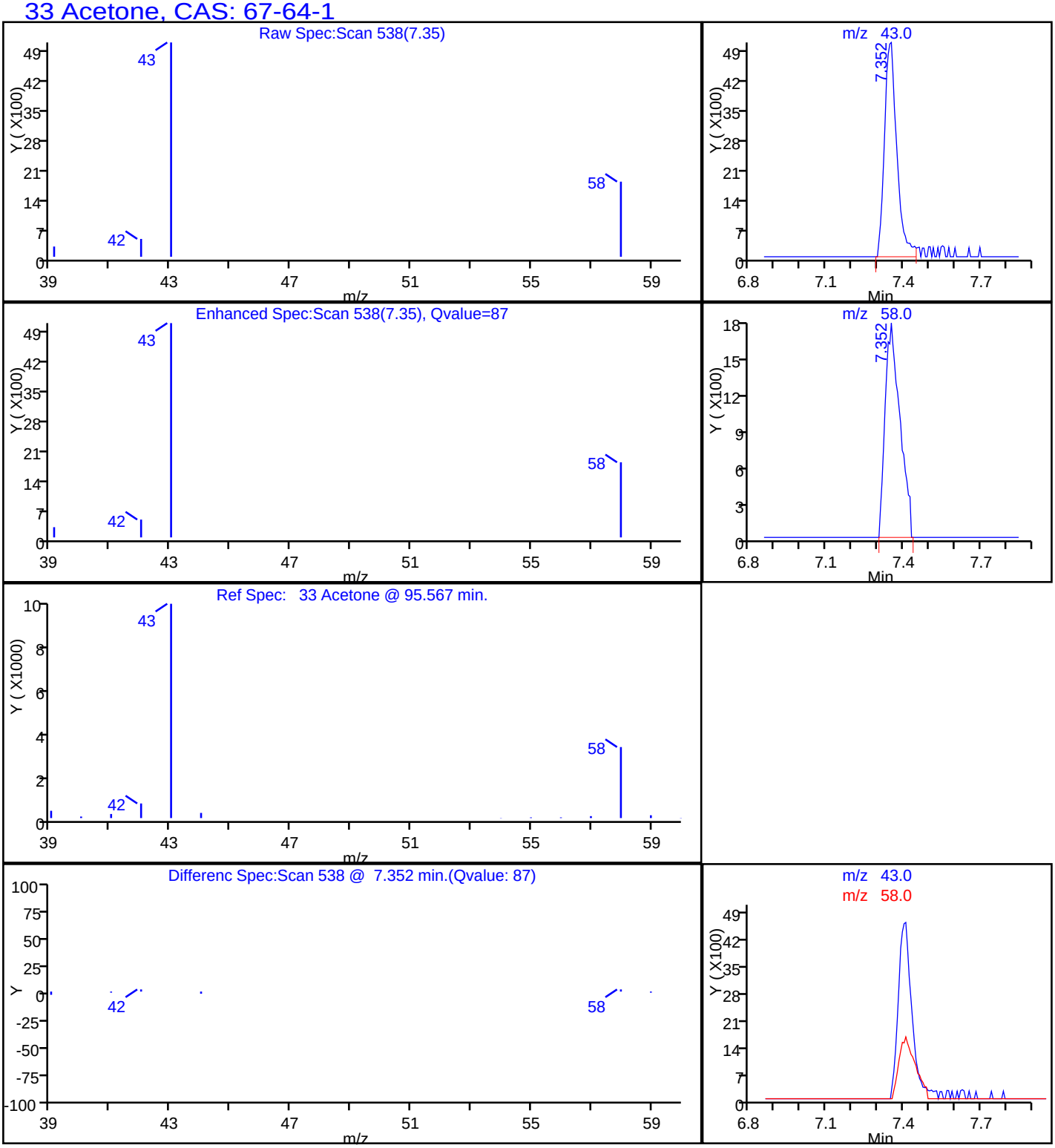


Report Date: 31-Mar-2014 09:27:44 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032909.D				
Injection Date:	29-Mar-2014 19:15:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-5	Lab Sample ID:	320-6800-5		
Client ID:	34001230				
Operator ID:	AO	ALS Bottle#:	9	Worklist Smp#:	10
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1



Manual Integration/User Assign Peak Report

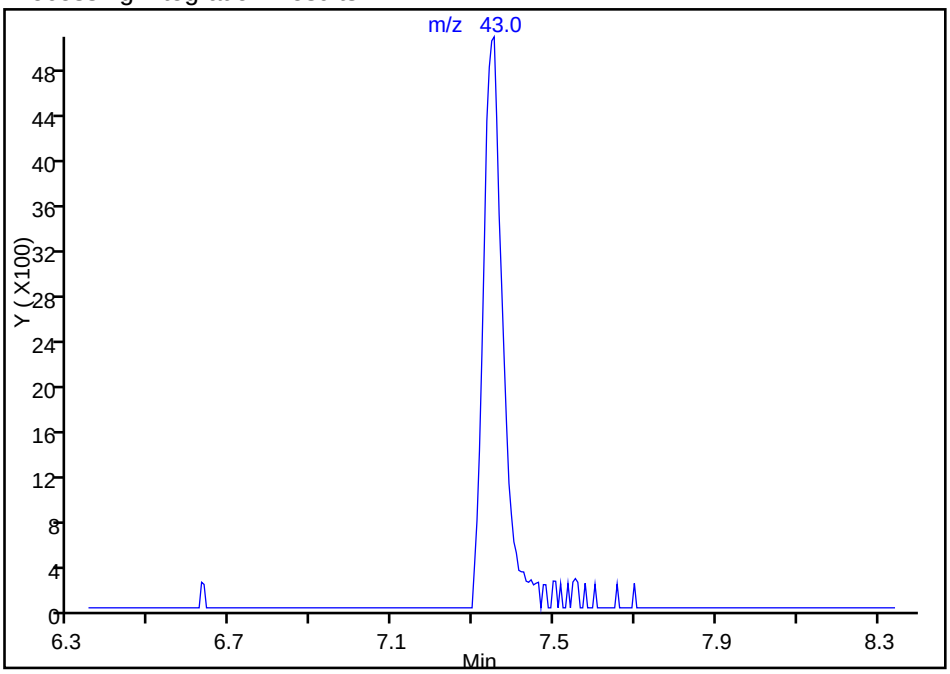
TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032909.D				
Injection Date:	29-Mar-2014 19:15:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-5	Lab Sample ID:	320-6800-5		
Client ID:	34001230				
Operator ID:	AO	ALS Bottle#:	9	Worklist Smp#:	10
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1

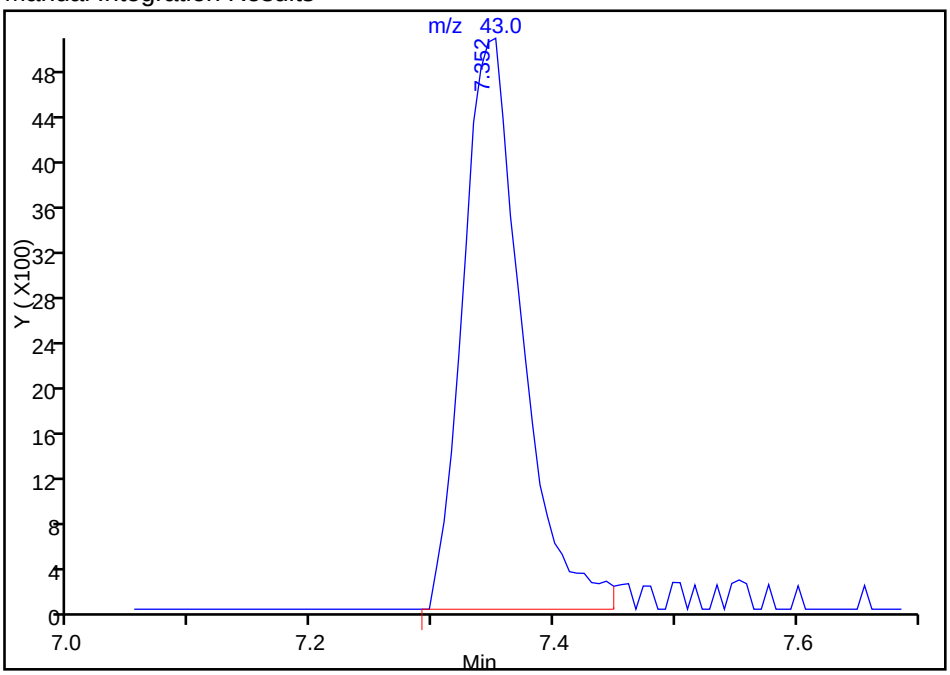
Not Detected
Expected RT: 7.35

Processing Integration Results



RT: 7.35
Response: 17161
Amount: 0.177529

Manual Integration Results



Reviewer: ortizam, 31-Mar-2014 09:27:44
Audit Action: Assigned Compound ID
Audit Reason:

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 8290 | Lab Sample ID: 320-6800-6

Matrix: Air | Lab File ID: MS5032910.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 20:23

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 8290 | Lab Sample ID: 320-6800-6

Matrix: Air | Lab File ID: MS5032910.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 20:23

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 8290 Lab Sample ID: 320-6800-6

Matrix: Air Lab File ID: MS5032910.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 20:23

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	101		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032910.D
Lims ID: 320-6800-A-6 Lab Sample ID: 320-6800-6
Client ID: 8290
Sample Type: Client
Inject. Date: 29-Mar-2014 20:23:30 ALS Bottle#: 10 Worklist Smp#: 11
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6800-6
Misc. Info.: 500mL;8290
Operator ID: AO Instrument ID: ATMS5

Method: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\TO15_ATMS5.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 09:27:54 Calib Date: 29-Mar-2014 12:33:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032903.D

Column 1 : Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 09:27:54

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	93	312157	7.76	
* 2 1,4-Difluorobenzene	114	12.584	12.584	0.0	93	1260952	8.00	
* 3 Chlorobenzene-d5 (IS)	117	16.782	16.775	0.007	82	1071892	8.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.975	-0.006	0	363540	7.82	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	93	795247	7.95	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	91	676140	7.57	
33 Acetone	43	7.364	7.364	0.018	65	2213	0.0231	7a

QC Flag Legend

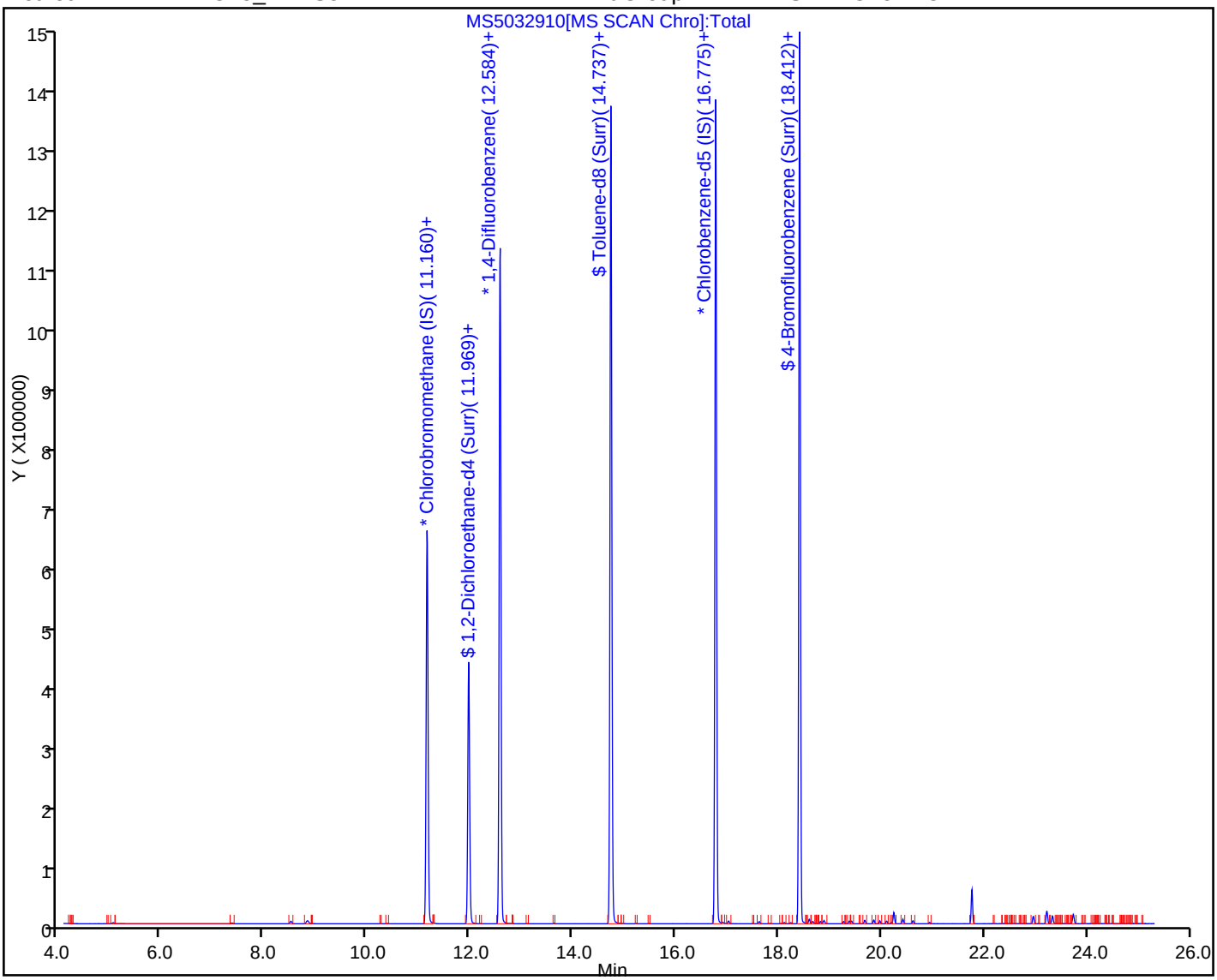
Processing Flags
7 - Failed Limit of Detection

Review Flags
a - User Assigned ID

Report Date: 31-Mar-2014 09:27:54 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032910.D				
Injection Date:	29-Mar-2014 20:23:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-6	Lab Sample ID:	320-6800-6		
Client ID:	8290				
Operator ID:	AO	ALS Bottle#:	10	Worklist Smp#:	11
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



Manual Integration/User Assign Peak Report

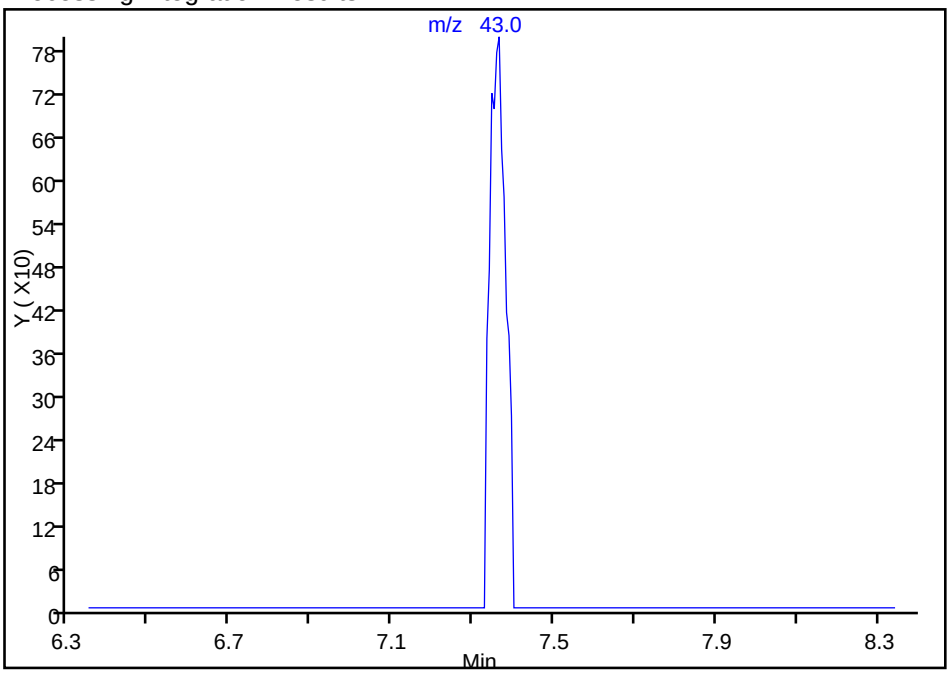
TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032910.D				
Injection Date:	29-Mar-2014 20:23:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-6	Lab Sample ID:	320-6800-6		
Client ID:	8290				
Operator ID:	AO	ALS Bottle#:	10	Worklist Smp#:	11
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1

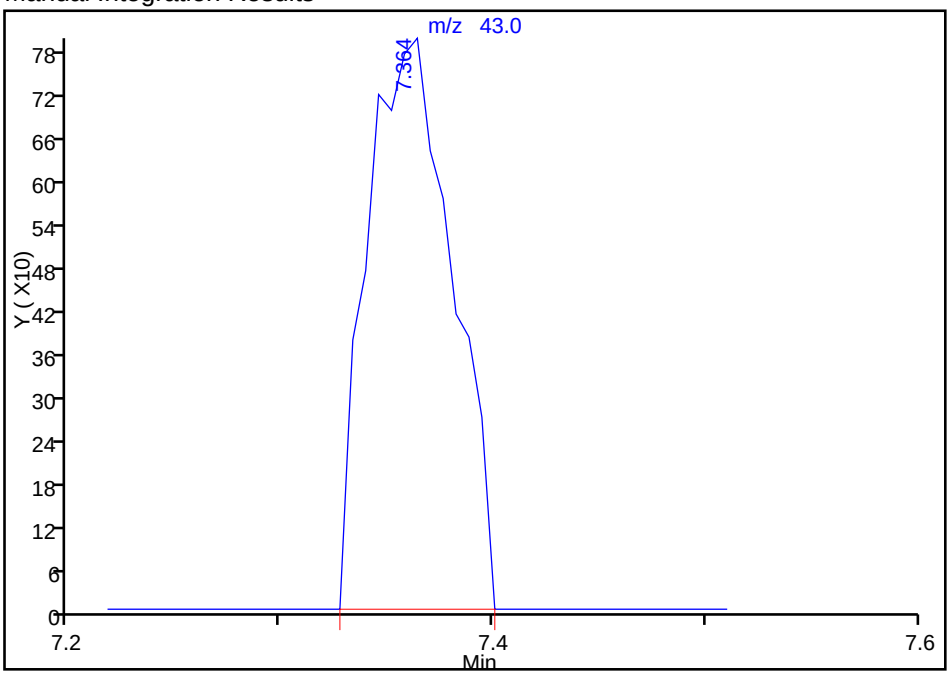
Not Detected
Expected RT: 7.35

Processing Integration Results



RT: 7.36
Response: 2213
Amount: 0.023107

Manual Integration Results



Reviewer: ortizam, 31-Mar-2014 09:27:54
Audit Action: Assigned Compound ID
Audit Reason:

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001747 Lab Sample ID: 320-6800-7

Matrix: Air Lab File ID: MS5032911.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 21:31

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001747 | Lab Sample ID: 320-6800-7

Matrix: Air | Lab File ID: MS5032911.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/29/2014 21:31

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001747 Lab Sample ID: 320-6800-7

Matrix: Air Lab File ID: MS5032911.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 21:31

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	94		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	102		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032911.D
Lims ID: 320-6800-A-7 Lab Sample ID: 320-6800-7
Client ID: 34001747
Sample Type: Client
Inject. Date: 29-Mar-2014 21:31:30 ALS Bottle#: 11 Worklist Smp#: 12
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6800-7
Misc. Info.: 500mL;34001747
Operator ID: AO Instrument ID: ATMS5

Method: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\TO15_ATMS5.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 09:28:02 Calib Date: 29-Mar-2014 12:33:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032903.D

Column 1 : Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 09:28:02

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	93	313594	7.76	
* 2 1,4-Difluorobenzene	114	12.578	12.584	-0.006	93	1267329	8.00	
* 3 Chlorobenzene-d5 (IS)	117	16.775	16.775	0.0	82	1070233	8.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.975	-0.006	0	368798	7.90	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	93	797017	7.93	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	91	672823	7.55	
33 Acetone	43	7.346	7.346	0.0	67	4869	0.0506	7a

QC Flag Legend

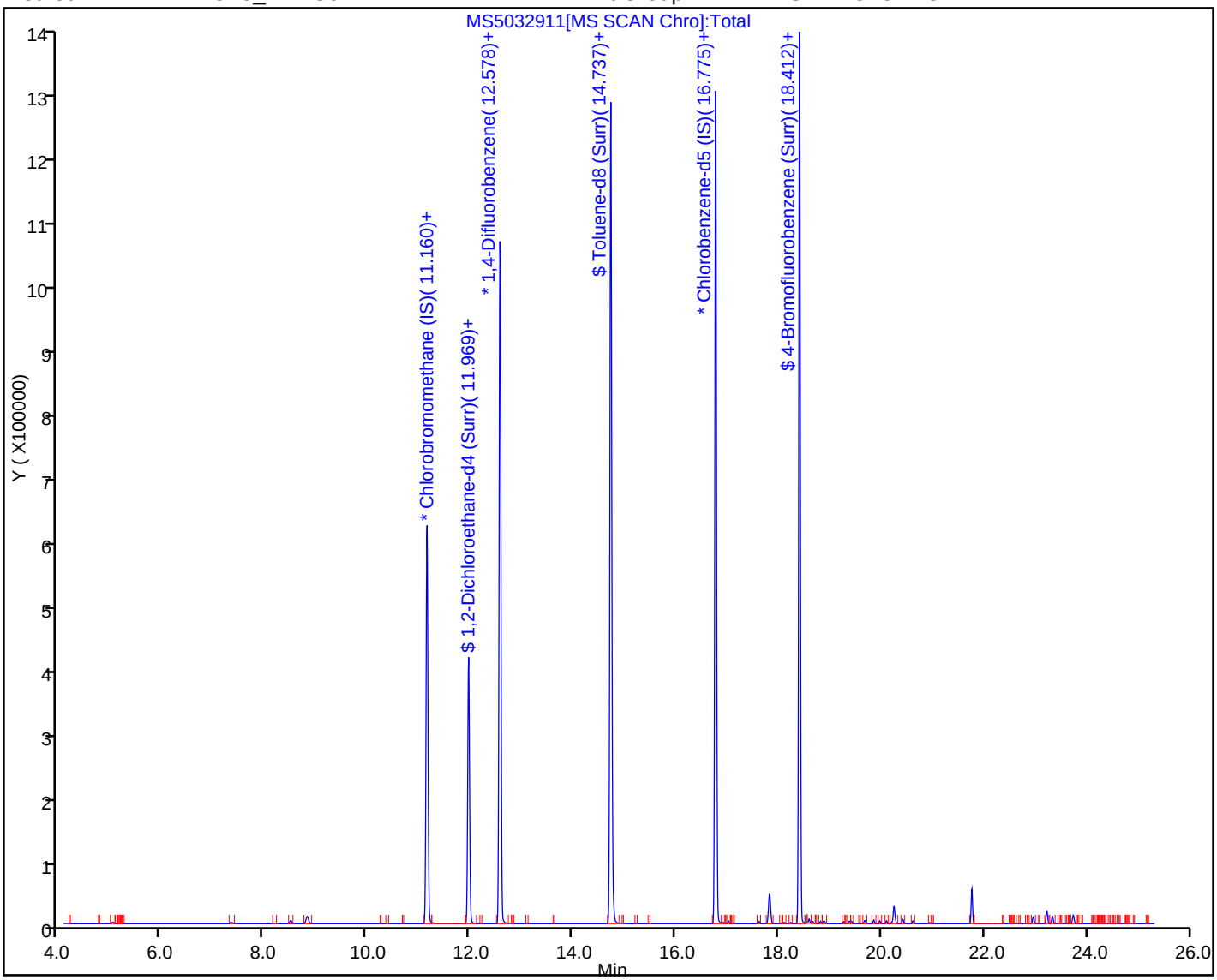
Processing Flags
7 - Failed Limit of Detection

Review Flags
a - User Assigned ID

Report Date: 31-Mar-2014 09:28:03 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032911.D				
Injection Date:	29-Mar-2014 21:31:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-7	Lab Sample ID:	320-6800-7		
Client ID:	34001747				
Operator ID:	AO	ALS Bottle#:	11	Worklist Smp#:	12
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



Manual Integration/User Assign Peak Report

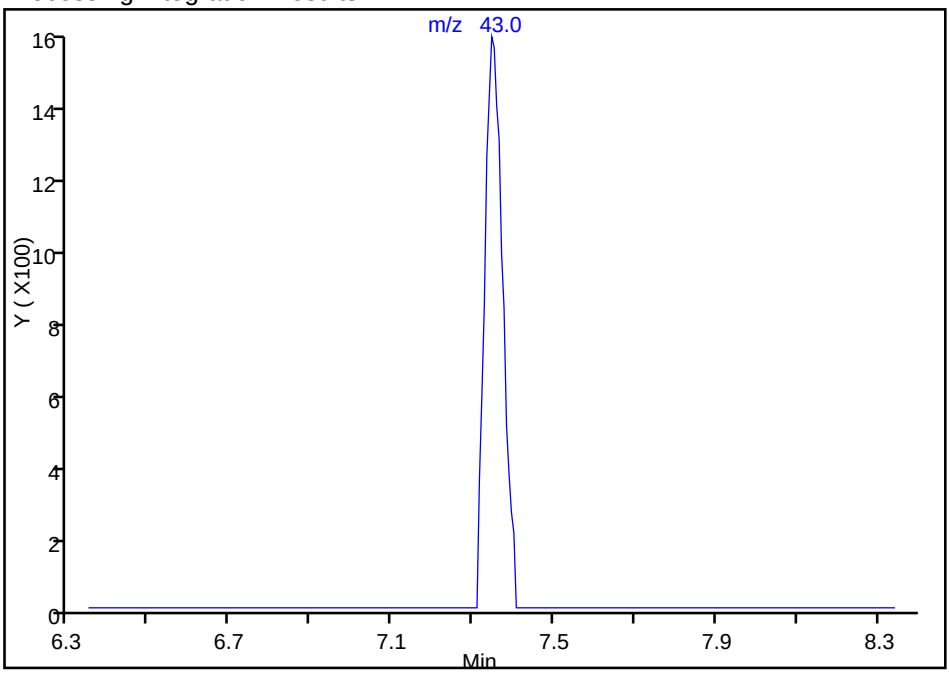
TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032911.D				
Injection Date:	29-Mar-2014 21:31:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-7	Lab Sample ID:	320-6800-7		
Client ID:	34001747				
Operator ID:	AO	ALS Bottle#:	11	Worklist Smp#:	12
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1

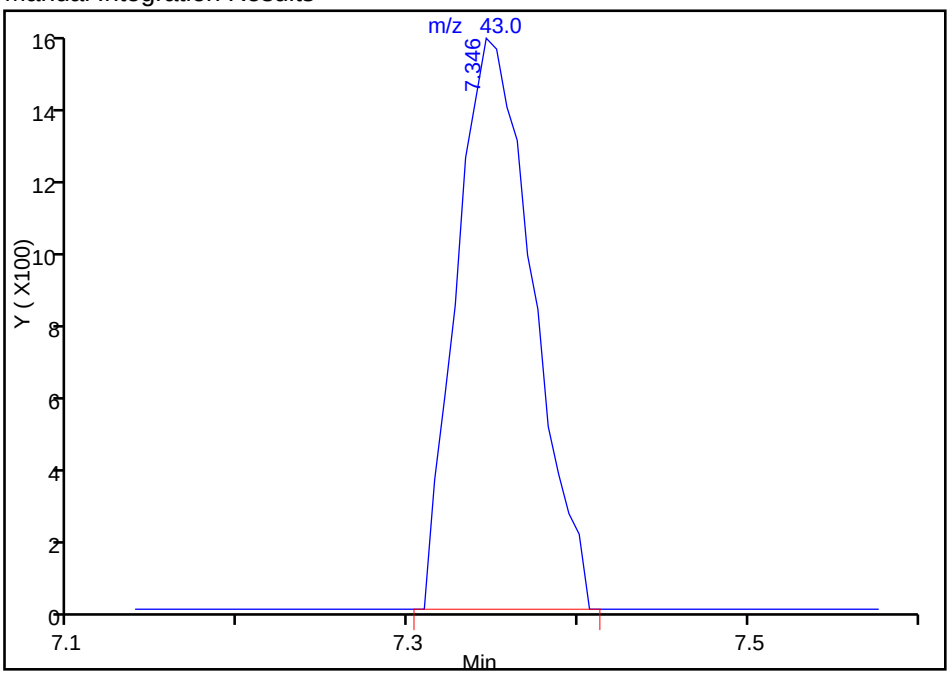
Not Detected
Expected RT: 7.35

Processing Integration Results



RT: 7.35
Response: 4869
Amount: 0.050608

Manual Integration Results



Reviewer: ortizam, 31-Mar-2014 09:28:02
Audit Action: Assigned Compound ID
Audit Reason:

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001854 Lab Sample ID: 320-6800-8

Matrix: Air Lab File ID: MS5032912.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 22:41

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001854 Lab Sample ID: 320-6800-8

Matrix: Air Lab File ID: MS5032912.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 22:41

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001854 Lab Sample ID: 320-6800-8

Matrix: Air Lab File ID: MS5032912.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/29/2014 22:41

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	102		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032912.D
Lims ID: 320-6800-A-8 Lab Sample ID: 320-6800-8
Client ID: 34001854
Sample Type: Client
Inject. Date: 29-Mar-2014 22:41:30 ALS Bottle#: 13 Worklist Smp#: 13
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6800-8
Misc. Info.: 500mL;34001854
Operator ID: AO Instrument ID: ATMS5

Method: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\TO15_ATMS5.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 09:28:11 Calib Date: 29-Mar-2014 12:33:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032903.D

Column 1 : Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 09:28:11

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	93	310617	7.76	
* 2 1,4-Difluorobenzene	114	12.578	12.584	-0.006	93	1262753	8.00	
* 3 Chlorobenzene-d5 (IS)	117	16.775	16.775	0.0	82	1078541	8.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.975	-0.006	0	367375	7.90	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	93	797242	7.96	
$ 6 4-Bromofluorobenzene (Surr)	95	18.406	18.412	-0.006	90	684706	7.62	
33 Acetone	43	7.352	7.352	0.006	67	3322	0.0349	7a

QC Flag Legend

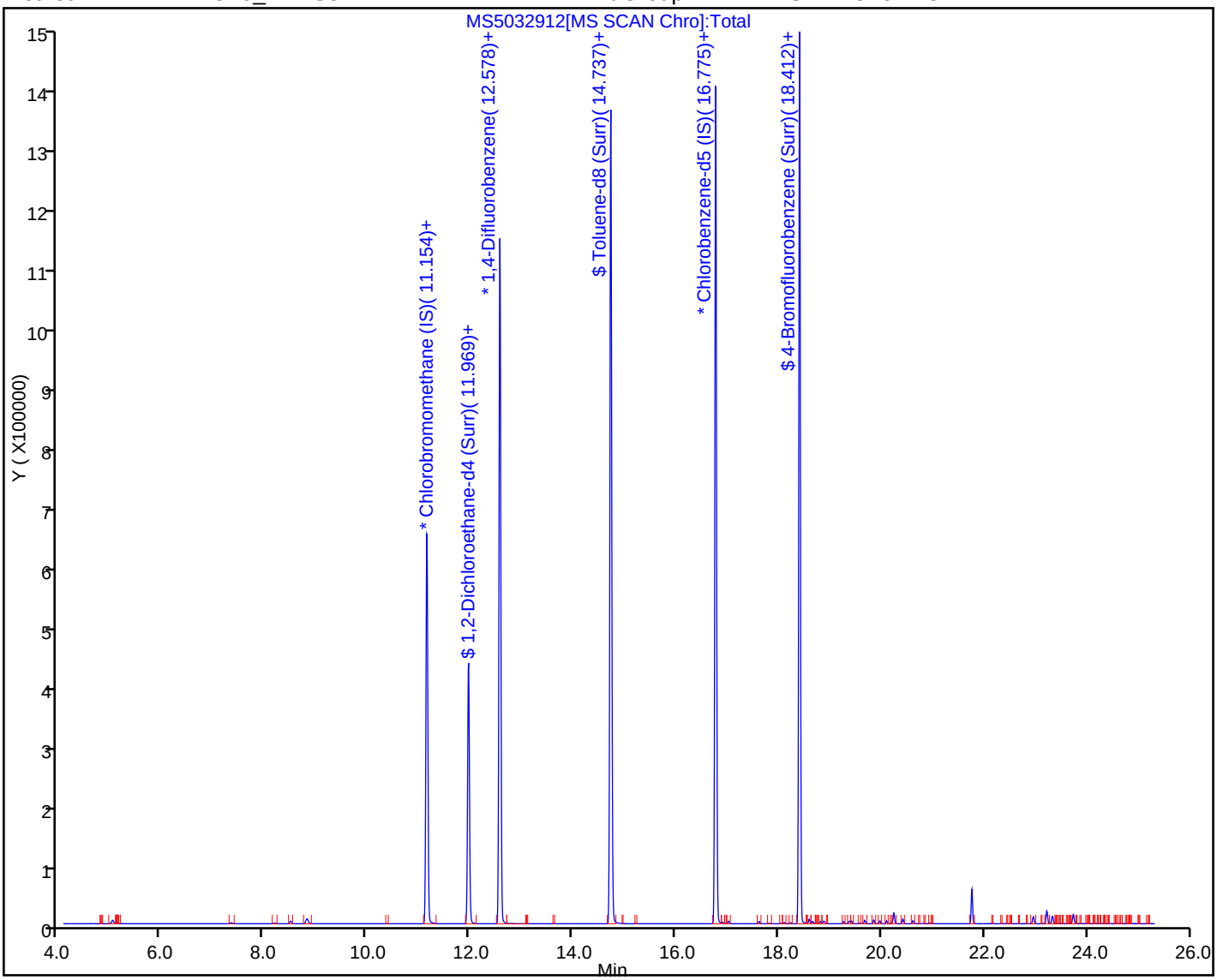
Processing Flags
7 - Failed Limit of Detection

Review Flags
a - User Assigned ID

Report Date: 31-Mar-2014 09:28:12 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032912.D				
Injection Date:	29-Mar-2014 22:41:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-8	Lab Sample ID:	320-6800-8		
Client ID:	34001854				
Operator ID:	AO	ALS Bottle#:	13	Worklist Smp#:	13
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



Manual Integration/User Assign Peak Report

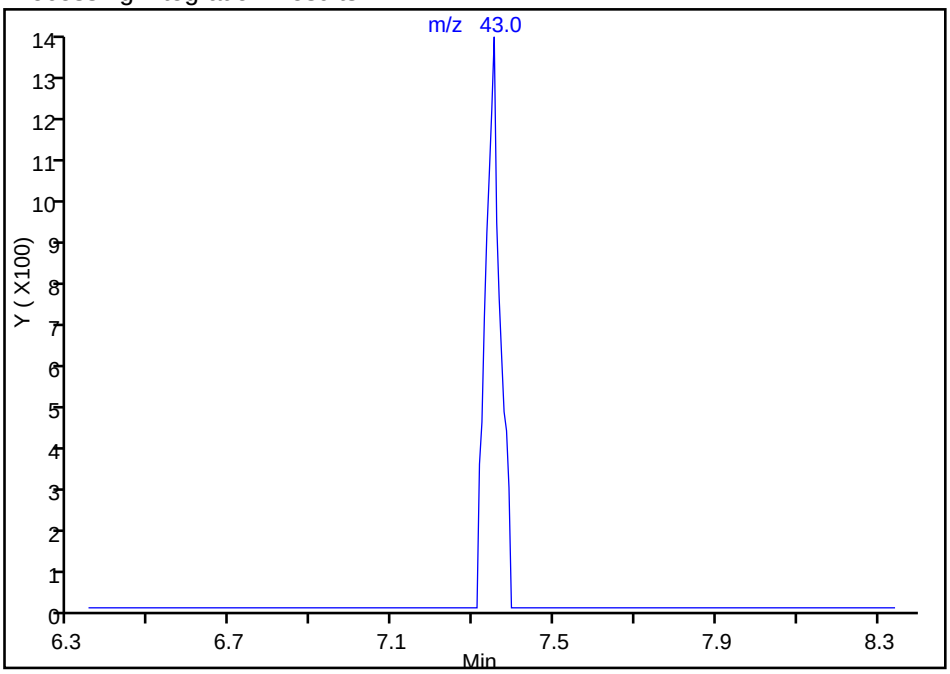
TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032912.D				
Injection Date:	29-Mar-2014 22:41:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-8	Lab Sample ID:	320-6800-8		
Client ID:	34001854				
Operator ID:	AO	ALS Bottle#:	13	Worklist Smp#:	13
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1

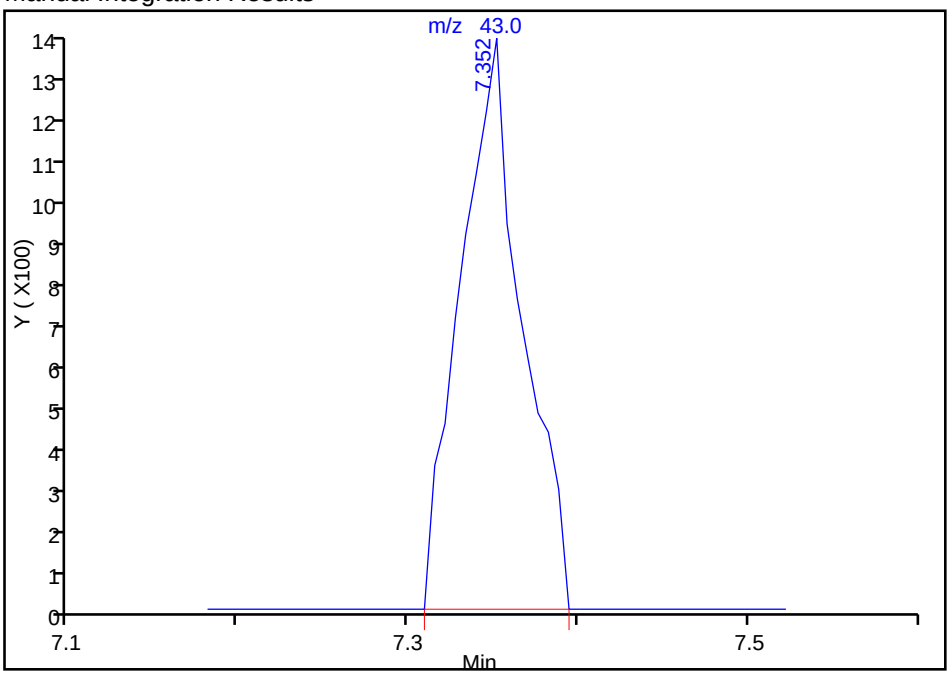
Not Detected
Expected RT: 7.35

Processing Integration Results



RT: 7.35
Response: 3322
Amount: 0.034859

Manual Integration Results



Reviewer: ortizam, 31-Mar-2014 09:28:11
Audit Action: Assigned Compound ID
Audit Reason:

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001709 | Lab Sample ID: 320-6800-10

Matrix: Air | Lab File ID: MS5032914.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 00:54

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001709 Lab Sample ID: 320-6800-10

Matrix: Air Lab File ID: MS5032914.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/30/2014 00:54

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001709 Lab Sample ID: 320-6800-10

Matrix: Air Lab File ID: MS5032914.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/30/2014 00:54

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	95		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	103		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032914.D
Lims ID: 320-6800-A-10 Lab Sample ID: 320-6800-10
Client ID: 34001709
Sample Type: Client
Inject. Date: 30-Mar-2014 00:54:30 ALS Bottle#: 15 Worklist Smp#: 15
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6800-10
Misc. Info.: 500mL;34001709
Operator ID: AO Instrument ID: ATMS5

Method: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\TO15_ATMS5.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 09:28:33 Calib Date: 29-Mar-2014 12:33:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032903.D

Column 1 : Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 09:28:33

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	93	299609	7.76	
* 2 1,4-Difluorobenzene	114	12.578	12.584	-0.006	93	1219500	8.00	
* 3 Chlorobenzene-d5 (IS)	117	16.775	16.775	0.0	82	1034701	8.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.975	-0.006	0	358307	7.97	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	94	773934	8.00	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	90	654528	7.59	
33 Acetone	43	7.352	7.352	0.006	66	4542	0.0494	7a

QC Flag Legend

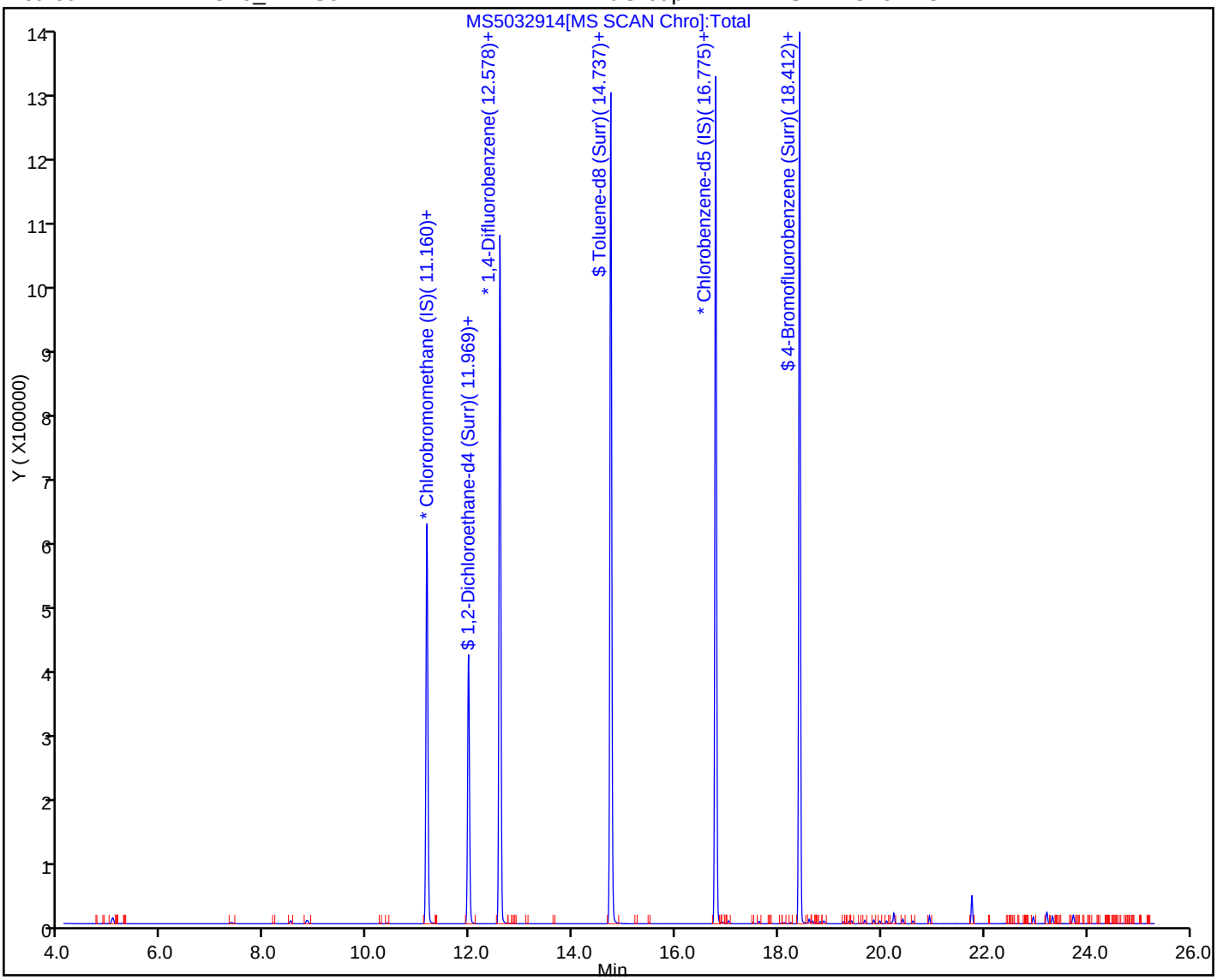
Processing Flags
7 - Failed Limit of Detection

Review Flags
a - User Assigned ID

Report Date: 31-Mar-2014 09:28:33 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032914.D				
Injection Date:	30-Mar-2014 00:54:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-10	Lab Sample ID:	320-6800-10		
Client ID:	34001709				
Operator ID:	AO	ALS Bottle#:	15	Worklist Smp#:	15
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



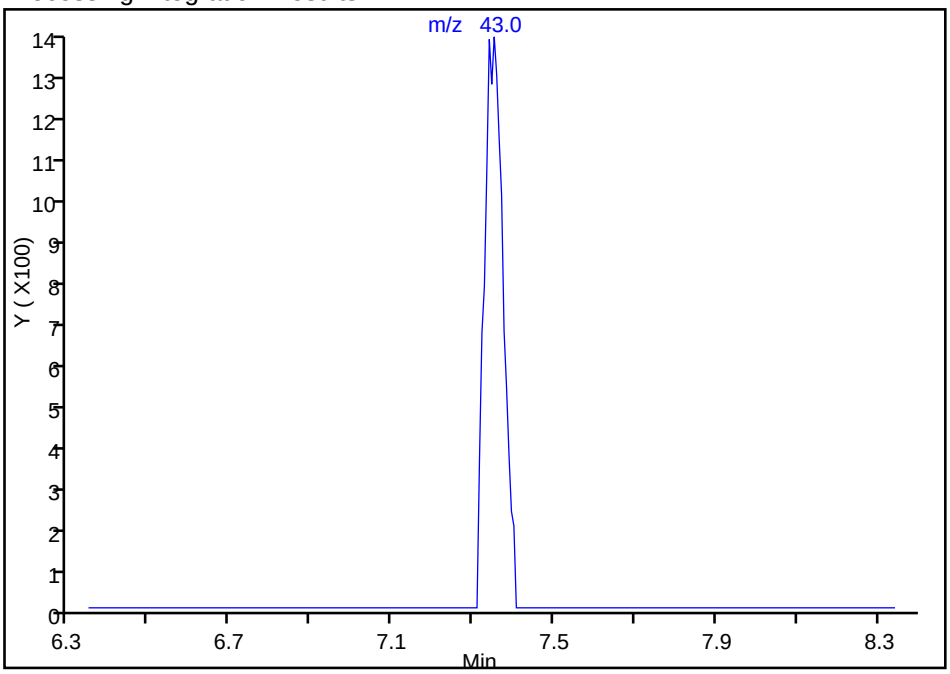
TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032914.D				
Injection Date:	30-Mar-2014 00:54:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-10	Lab Sample ID:	320-6800-10		
Client ID:	34001709				
Operator ID:	AO	ALS Bottle#:	15	Worklist Smp#:	15
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1

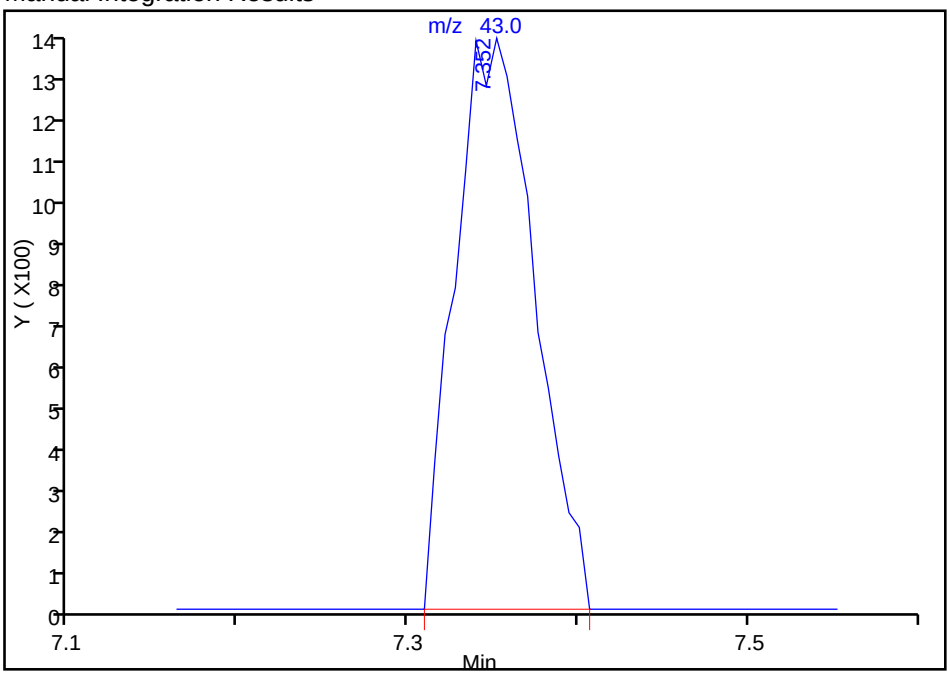
Not Detected
Expected RT: 7.35

Processing Integration Results



RT: 7.35
Response: 4542
Amount: 0.049412

Manual Integration Results



Reviewer: ortizam, 31-Mar-2014 09:28:33
Audit Action: Assigned Compound ID
Audit Reason:

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001803 | Lab Sample ID: 320-6800-11

Matrix: Air | Lab File ID: MS5032915.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 02:05

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001803 | Lab Sample ID: 320-6800-11

Matrix: Air | Lab File ID: MS5032915.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 02:05

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 34001803 Lab Sample ID: 320-6800-11

Matrix: Air Lab File ID: MS5032915.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/30/2014 02:05

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	93		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	104		70-130
2037-26-5	Toluene-d8 (Surr)	100		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032915.D
Lims ID: 320-6800-A-11 Lab Sample ID: 320-6800-11
Client ID: 34001803
Sample Type: Client
Inject. Date: 30-Mar-2014 02:05:30 ALS Bottle#: 16 Worklist Smp#: 16
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6800-11
Misc. Info.: 500mL;34001803
Operator ID: AO Instrument ID: ATMS5

Method: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\TO15_ATMS5.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 09:28:41 Calib Date: 29-Mar-2014 12:33:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032903.D

Column 1 : Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 09:28:41

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	93	300257	7.76	
* 2 1,4-Difluorobenzene	114	12.578	12.584	-0.006	93	1216364	8.00	
* 3 Chlorobenzene-d5 (IS)	117	16.776	16.775	0.001	82	1032598	8.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.970	11.975	-0.005	0	360488	8.04	
$ 5 Toluene-d8 (Surr)	100	14.738	14.737	0.001	93	772503	8.01	
$ 6 4-Bromofluorobenzene (Surr)	95	18.406	18.412	-0.006	90	642024	7.46	
33 Acetone	43	7.346	7.346	0.0	29	1379	0.0150	7a

QC Flag Legend

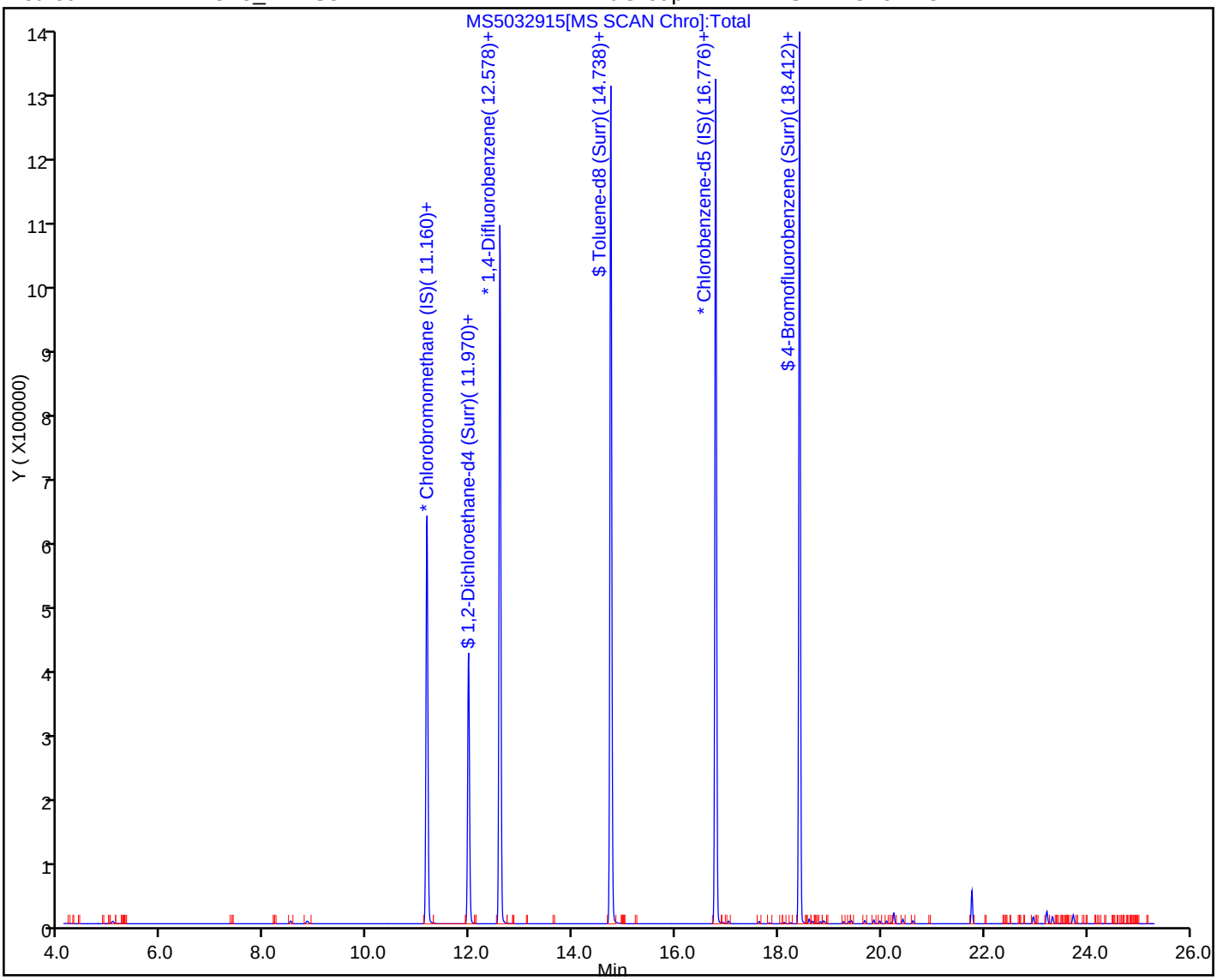
Processing Flags
7 - Failed Limit of Detection

Review Flags
a - User Assigned ID

Report Date: 31-Mar-2014 09:28:41 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032915.D				
Injection Date:	30-Mar-2014 02:05:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-11	Lab Sample ID:	320-6800-11		
Client ID:	34001803				
Operator ID:	AO	ALS Bottle#:	16	Worklist Smp#:	16
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



Manual Integration/User Assign Peak Report

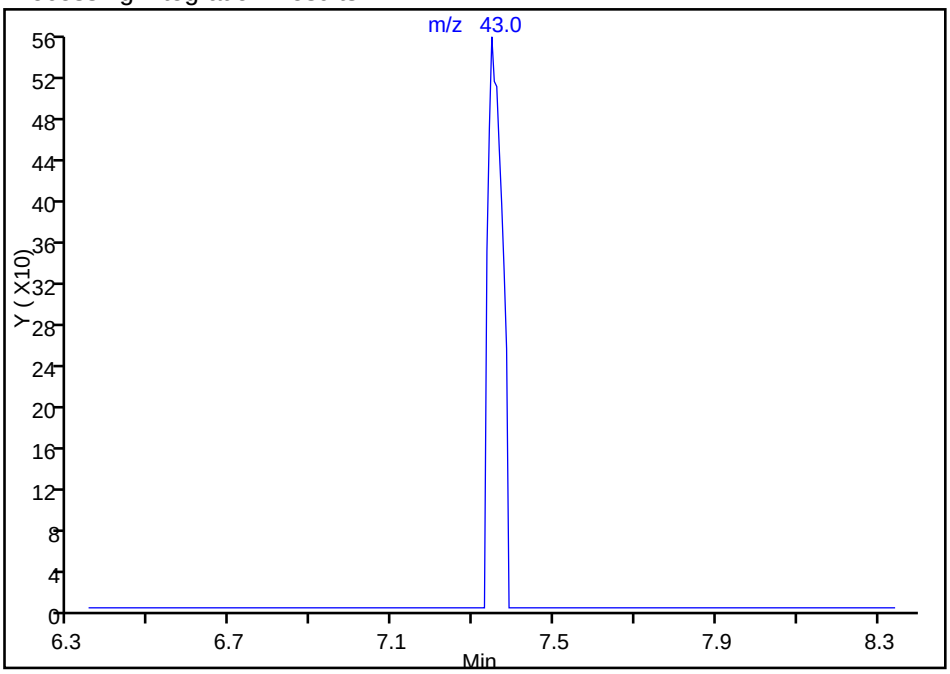
TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032915.D				
Injection Date:	30-Mar-2014 02:05:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-11	Lab Sample ID:	320-6800-11		
Client ID:	34001803				
Operator ID:	AO	ALS Bottle#:	16	Worklist Smp#:	16
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1

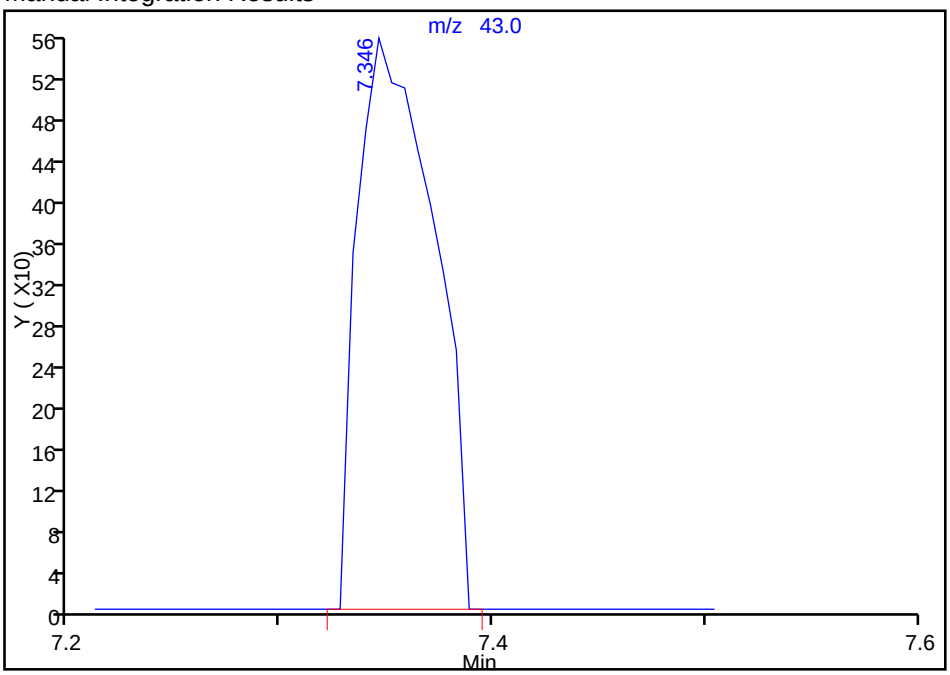
Not Detected
Expected RT: 7.35

Processing Integration Results



RT: 7.35
Response: 1379
Amount: 0.014970

Manual Integration Results



Reviewer: ortizam, 31-Mar-2014 09:28:41
Audit Action: Assigned Compound ID
Audit Reason:

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 7509 | Lab Sample ID: 320-6800-12

Matrix: Air | Lab File ID: MS5032916.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 03:16

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	ND		5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6800-1

SDG No.:

Client Sample ID: 7509 | Lab Sample ID: 320-6800-12

Matrix: Air | Lab File ID: MS5032916.D

Analysis Method: TO-15 | Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 03/30/2014 03:16

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39332 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6800-1

SDG No.:

Client Sample ID: 7509 Lab Sample ID: 320-6800-12

Matrix: Air Lab File ID: MS5032916.D

Analysis Method: TO-15 Date Collected: 03/13/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 03/30/2014 03:16

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39332 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	93		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	104		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032916.D
Lims ID: 320-6800-A-12 Lab Sample ID: 320-6800-12
Client ID: 7509
Sample Type: Client
Inject. Date: 30-Mar-2014 03:16:30 ALS Bottle#: 12 Worklist Smp#: 17
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6800-12
Misc. Info.: 500mL;7509
Operator ID: AO Instrument ID: ATMS5

Method: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\TO15_ATMS5.m
Limit Group: MSA - TO15 - ICAL
Last Update: 31-Mar-2014 09:29:23 Calib Date: 29-Mar-2014 12:33:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032903.D

Column 1 : Det: MS SCAN
Process Host: XAWRK025

First Level Reviewer: ortizam Date: 31-Mar-2014 09:31:14

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.166	-0.006	93	287391	7.76	
* 2 1,4-Difluorobenzene	114	12.578	12.584	-0.006	93	1162257	8.00	
* 3 Chlorobenzene-d5 (IS)	117	16.775	16.775	0.0	82	982095	8.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	11.969	11.975	-0.006	0	344346	8.04	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.0	93	729615	7.92	
$ 6 4-Bromofluorobenzene (Surr)	95	18.412	18.412	0.0	91	610410	7.46	
33 Acetone	43	7.346	7.346	0.0	67	7944	0.0901	7a

QC Flag Legend

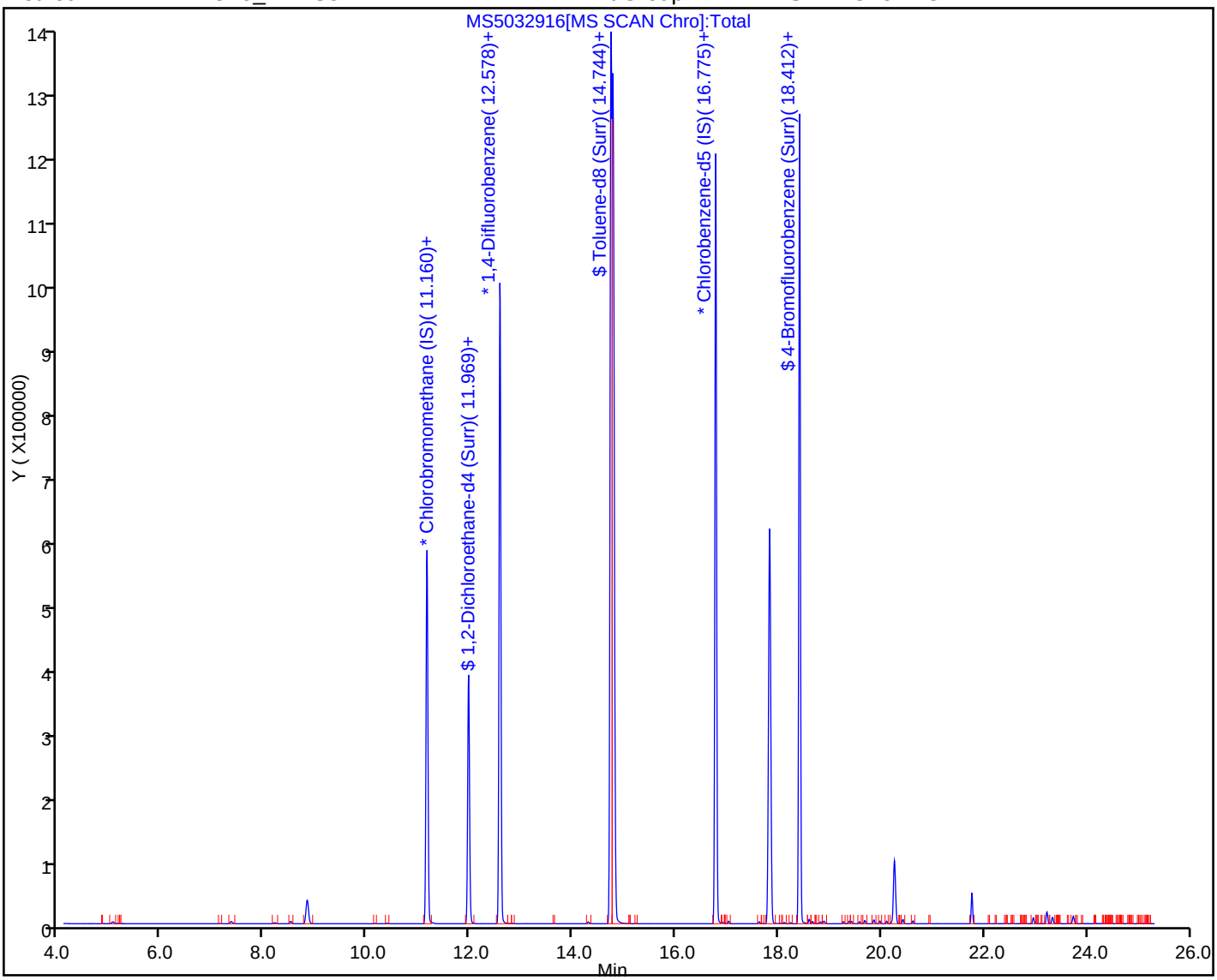
Processing Flags
7 - Failed Limit of Detection

Review Flags
a - User Assigned ID

Report Date: 31-Mar-2014 09:31:15 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032916.D				
Injection Date:	30-Mar-2014 03:16:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-12	Lab Sample ID:	320-6800-12		
Client ID:	7509				
Operator ID:	AO	ALS Bottle#:	12	Worklist Smp#:	17
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		



Manual Integration/User Assign Peak Report

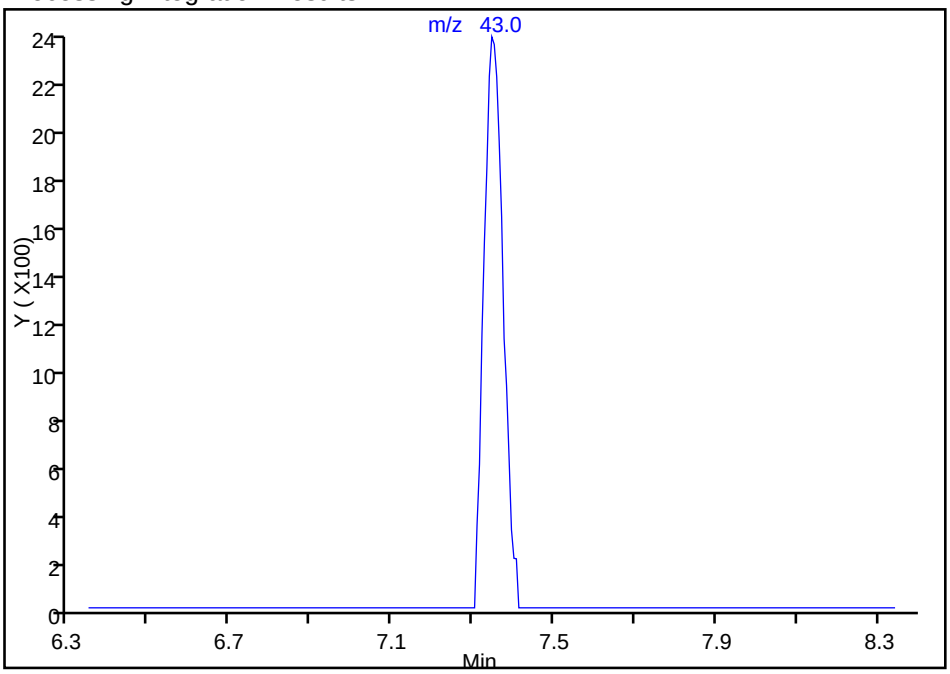
TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140329-11455.b\MS5032916.D				
Injection Date:	30-Mar-2014 03:16:30	Instrument ID:	ATMS5		
Lims ID:	320-6800-A-12	Lab Sample ID:	320-6800-12		
Client ID:	7509				
Operator ID:	AO	ALS Bottle#:	12	Worklist Smp#:	17
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1

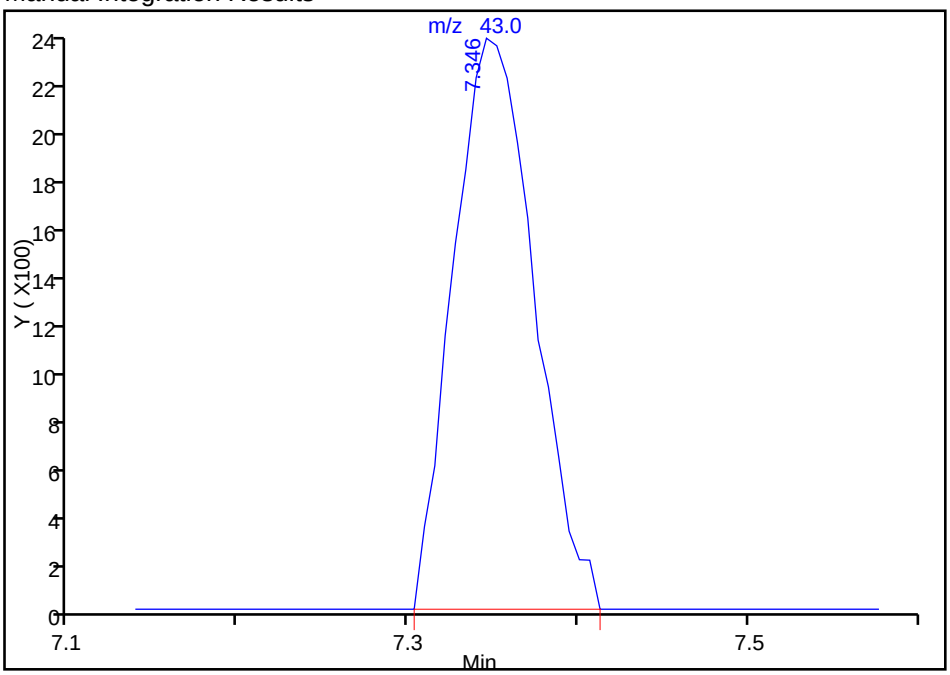
Not Detected
Expected RT: 7.35

Processing Integration Results



RT: 7.35
Response: 7944
Amount: 0.090097

Manual Integration Results



Reviewer: ortizam, 31-Mar-2014 09:31:14
Audit Action: Assigned Compound ID
Audit Reason:

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6850-1

SDG No.:

Client Sample ID: 34001598 | Lab Sample ID: 320-6850-4

Matrix: Air | Lab File ID: MS7040211.d

Analysis Method: TO-15 | Date Collected: 03/31/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 04/02/2014 21:31

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39755 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	1.5	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6850-1

SDG No.:

Client Sample ID: 34001598 | Lab Sample ID: 320-6850-4

Matrix: Air | Lab File ID: MS7040211.d

Analysis Method: TO-15 | Date Collected: 03/31/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 04/02/2014 21:31

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39755 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6850-1

SDG No.:

Client Sample ID: 34001598 Lab Sample ID: 320-6850-4

Matrix: Air Lab File ID: MS7040211.d

Analysis Method: TO-15 Date Collected: 03/31/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 04/02/2014 21:31

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39755 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	92		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	102		70-130
2037-26-5	Toluene-d8 (Surr)	101		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140402-11551.b\MS7040211.d
Lims ID: 320-6850-A-4 Lab Sample ID: 320-6850-4
Client ID: 34001598
Sample Type: Client
Inject. Date: 02-Apr-2014 21:31:30 ALS Bottle#: 11 Worklist Smp#: 10
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6850-4
Misc. Info.: 500mL;34001598
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140402-11551.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 03-Apr-2014 11:48:14 Calib Date: 02-Apr-2014 14:22:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140402-11551.b\MS7040203.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK048

First Level Reviewer: ortizam Date: 03-Apr-2014 09:52:28

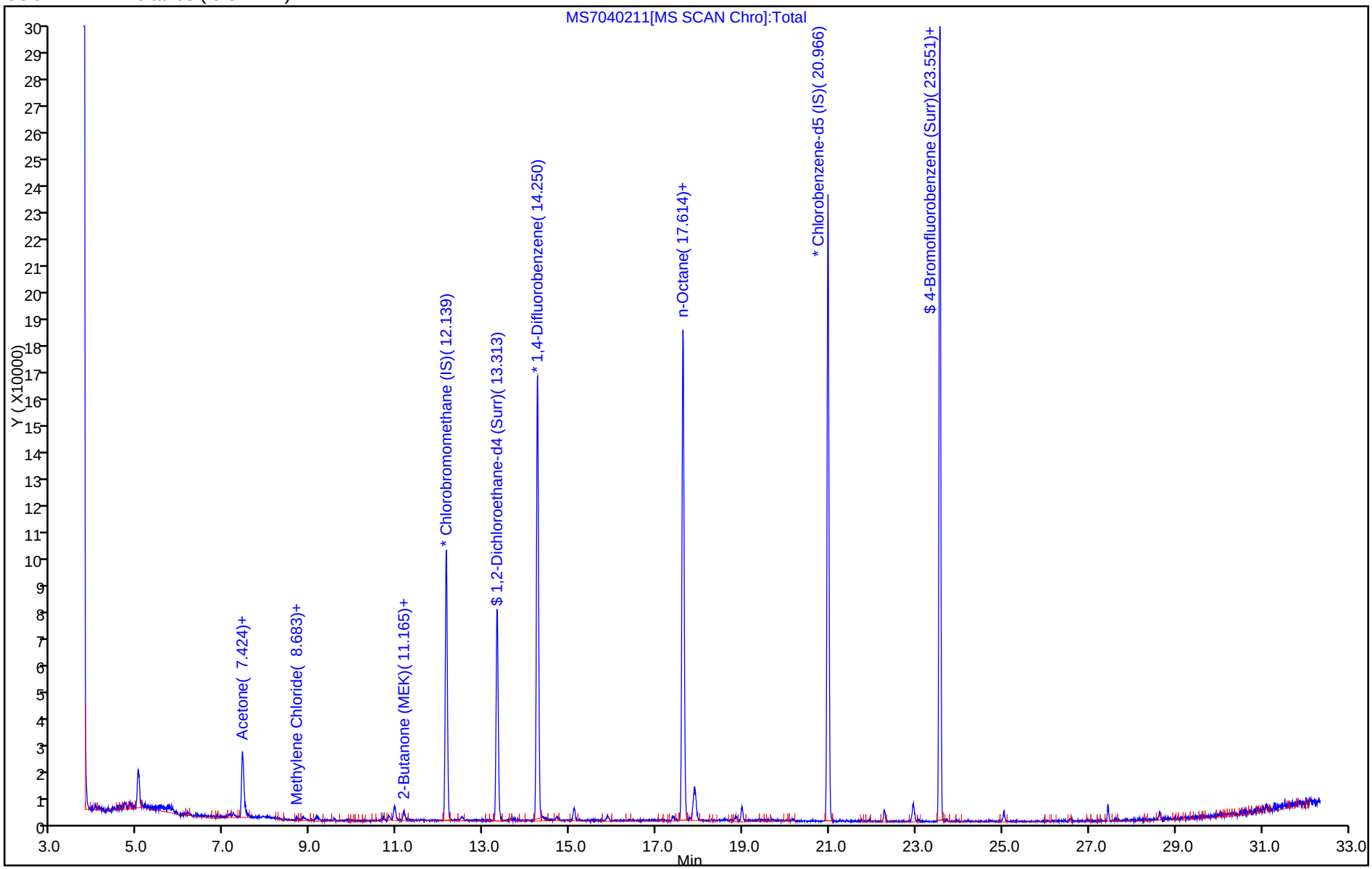
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.145	12.139	0.006	90	52977	4.00	
* 2 1,4-Difluorobenzene	114	14.250	14.243	0.007	90	210945	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.966	20.966	0.0	86	199674	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.307	13.313	-0.006	0	108219	4.08	
$ 5 Toluene-d8 (Surr)	100	17.608	17.620	-0.012	89	137557	4.03	
$ 6 4-Bromofluorobenzene (Surr)	95	23.551	23.557	-0.006	90	150842	3.66	
31 Acetone	43	7.418	7.436	-0.018	99	59124	1.46	
47 Methylene Chloride	49	8.695	8.665	0.030	1	1165	0.0364	
54 2-Butanone (MEK)	72	11.153	11.141	0.012	77	1388	0.1710	
88 n-Octane	43	17.589	17.650	-0.061	1	1164	0.0228	

Report Date: 03-Apr-2014 13:44:15 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140402-11551.b\MS7040211.d				
Injection Date:	02-Apr-2014 21:31:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6850-A-4	Lab Sample ID:	320-6850-4	Worklist Smp#:	10
Client ID:	34001598				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	11
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

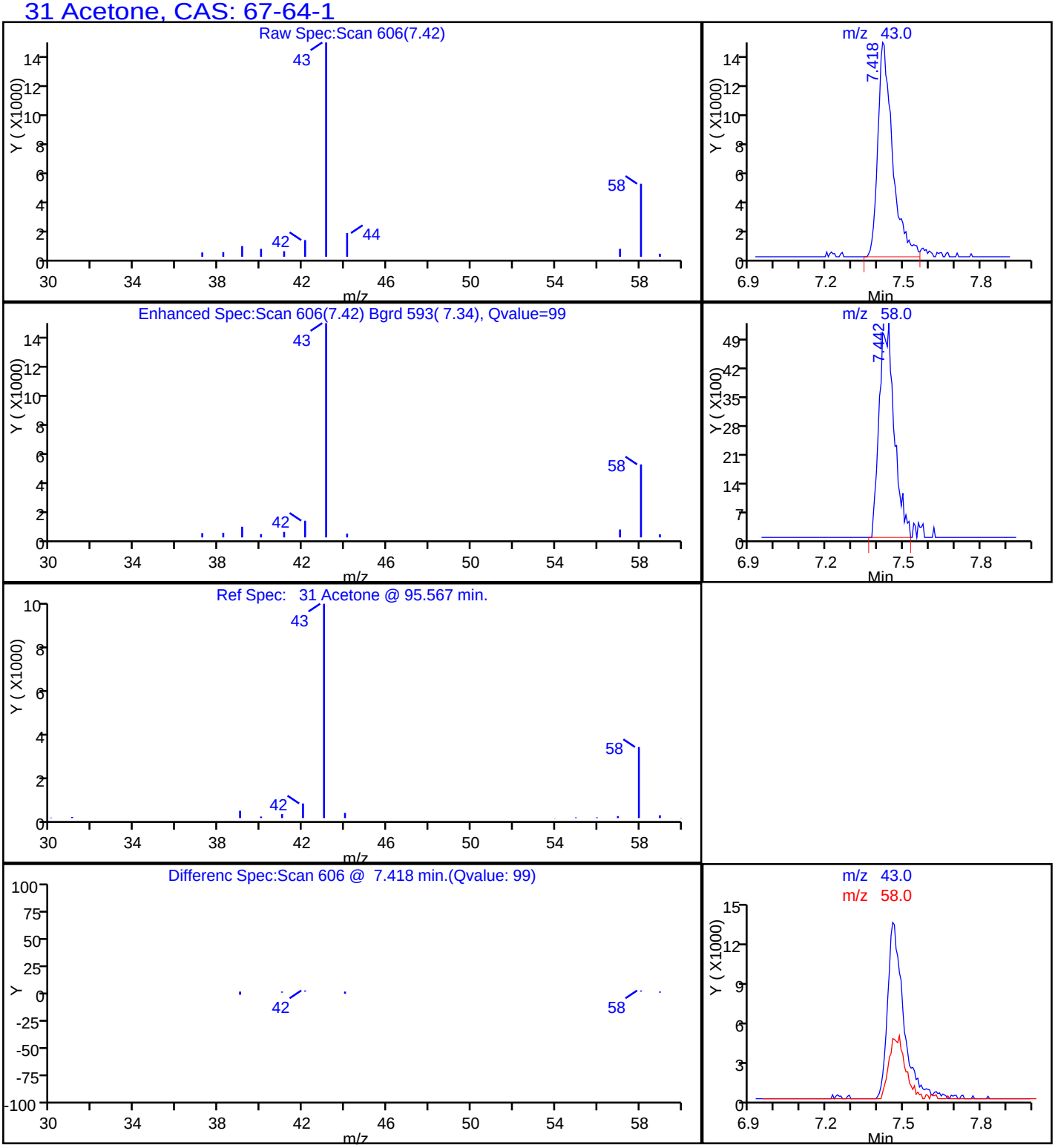


Report Date: 03-Apr-2014 13:44:15 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140402-11551.b\MS7040211.d				
Injection Date:	02-Apr-2014 21:31:30	Instrument ID:	ATMS7		
Lims ID:	320-6850-A-4	Lab Sample ID:	320-6850-4		
Client ID:	34001598				
Operator ID:	AO	ALS Bottle#:	11	Worklist Smp#:	10
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6903-1

SDG No.:

Client Sample ID: 34002173 | Lab Sample ID: 320-6903-9

Matrix: Air | Lab File ID: MS7040407.d

Analysis Method: TO-15 | Date Collected: 04/04/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 04/04/2014 17:58

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39847 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	1.3	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	0.28	J	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-6903-1

SDG No.:

Client Sample ID: 34002173 | Lab Sample ID: 320-6903-9

Matrix: Air | Lab File ID: MS7040407.d

Analysis Method: TO-15 | Date Collected: 04/04/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 04/04/2014 17:58

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 39847 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	0.30	J	0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-6903-1

SDG No.:

Client Sample ID: 34002173 Lab Sample ID: 320-6903-9

Matrix: Air Lab File ID: MS7040407.d

Analysis Method: TO-15 Date Collected: 04/04/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 04/04/2014 17:58

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 39847 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	97		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	101		70-130
2037-26-5	Toluene-d8 (Surr)	114		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS7\20140404-11601.b\MS7040407.d
Lims ID: 320-6903-A-9 Lab Sample ID: 320-6903-9
Client ID: 34002173
Sample Type: Client
Inject. Date: 04-Apr-2014 17:58:30 ALS Bottle#: 6 Worklist Smp#: 7
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-6903-9
Misc. Info.: 500mL; 34002173
Operator ID: AO Instrument ID: ATMS7

Method: \\SACCHROM\ChromData\ATMS7\20140404-11601.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 07-Apr-2014 09:32:14 Calib Date: 04-Apr-2014 12:47:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS7\20140404-11601.b\MS7040403.d

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK023

First Level Reviewer: ortizam Date: 07-Apr-2014 09:32:40

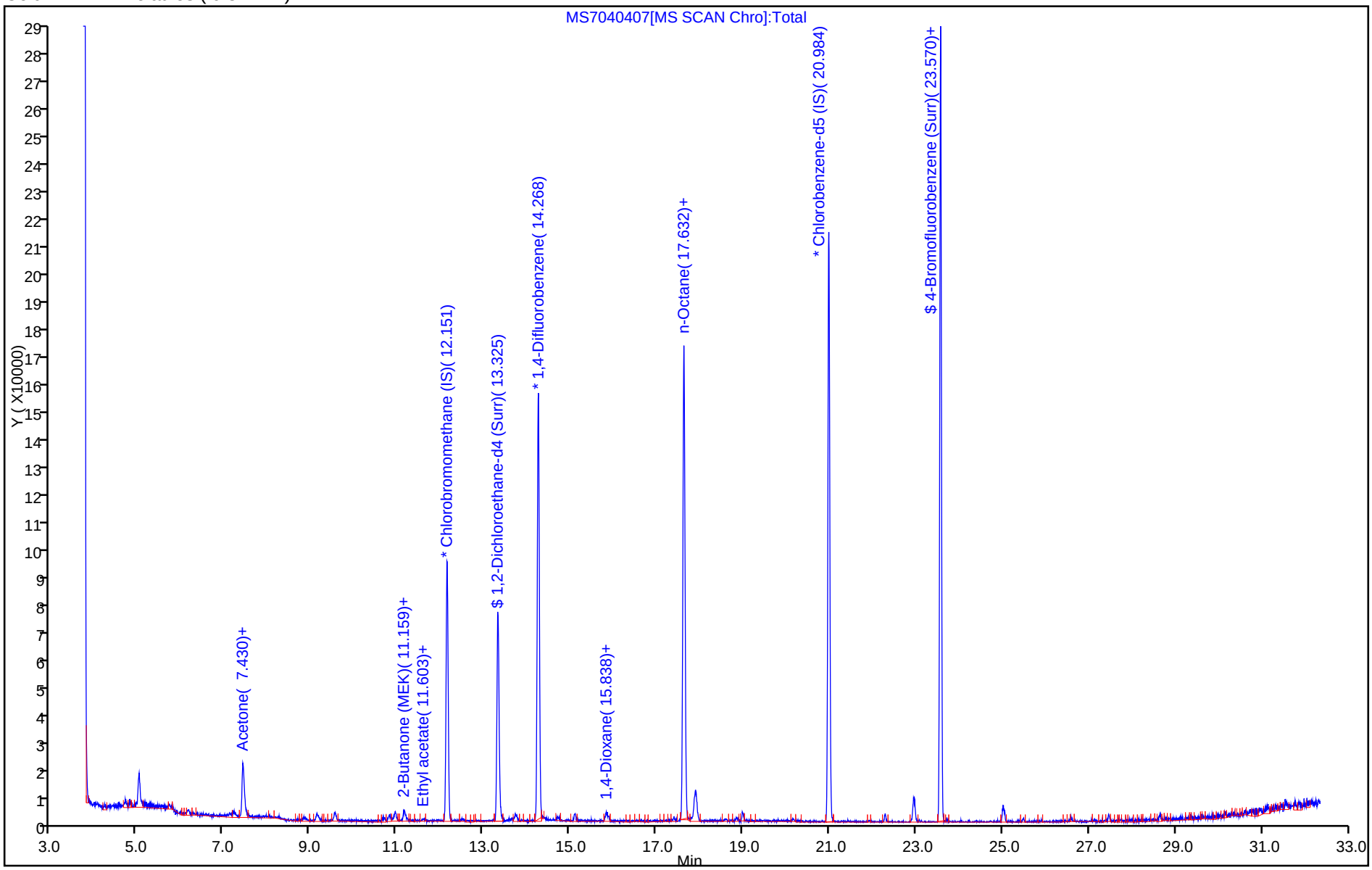
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	On-Col Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.151	12.145	0.006	90	50582	4.00	
* 2 1,4-Difluorobenzene	114	14.268	14.256	0.012	90	198798	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.984	20.978	0.006	88	186396	4.00	
$ 4 1,2-Dichloroethane-d4 (Surr)	65	13.331	13.319	0.012	0	106008	4.05	
$ 5 Toluene-d8 (Surr)	100	17.632	17.620	0.012	89	129227	4.57	
$ 6 4-Bromofluorobenzene (Surr)	95	23.570	23.564	0.006	91	143654	3.87	
31 Acetone	43	7.436	7.442	-0.006	92	50321	1.28	
54 2-Butanone (MEK)	72	11.178	11.147	0.031	84	1786	0.2819	
58 Ethyl acetate	43	11.603	11.579	0.024	3	1730	0.0348	
68 Benzene	78	13.654	13.647	0.007	1	1739	0.0309	
72 1,4-Dioxane	88	15.838	15.831	0.007	33	3606	0.2969	
88 n-Octane	43	17.632	17.663	-0.031	1	1652	0.0285	

Report Date: 07-Apr-2014 09:32:40 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140404-11601.b\MS7040407.d				
Injection Date:	04-Apr-2014 17:58:30	Instrument ID:	ATMS7	Operator ID:	AO
Lims ID:	320-6903-A-9	Lab Sample ID:	320-6903-9	Worklist Smp#:	7
Client ID:	34002173				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	6
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

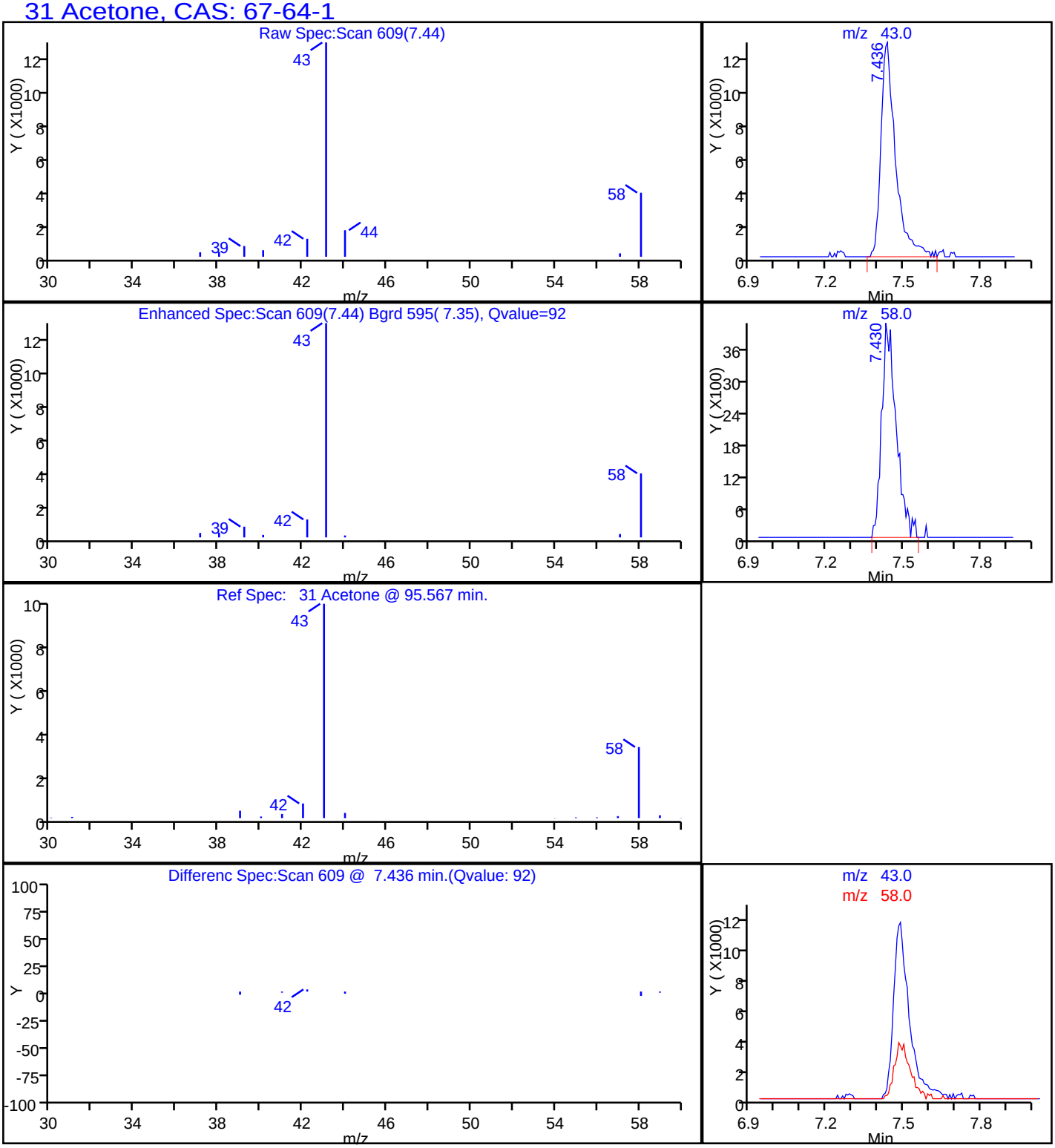


Report Date: 07-Apr-2014 09:32:40 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140404-11601.b\MS7040407.d				
Injection Date:	04-Apr-2014 17:58:30	Instrument ID:	ATMS7		
Lims ID:	320-6903-A-9	Lab Sample ID:	320-6903-9		
Client ID:	34002173				
Operator ID:	AO	ALS Bottle#:	6	Worklist Smp#:	7
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1

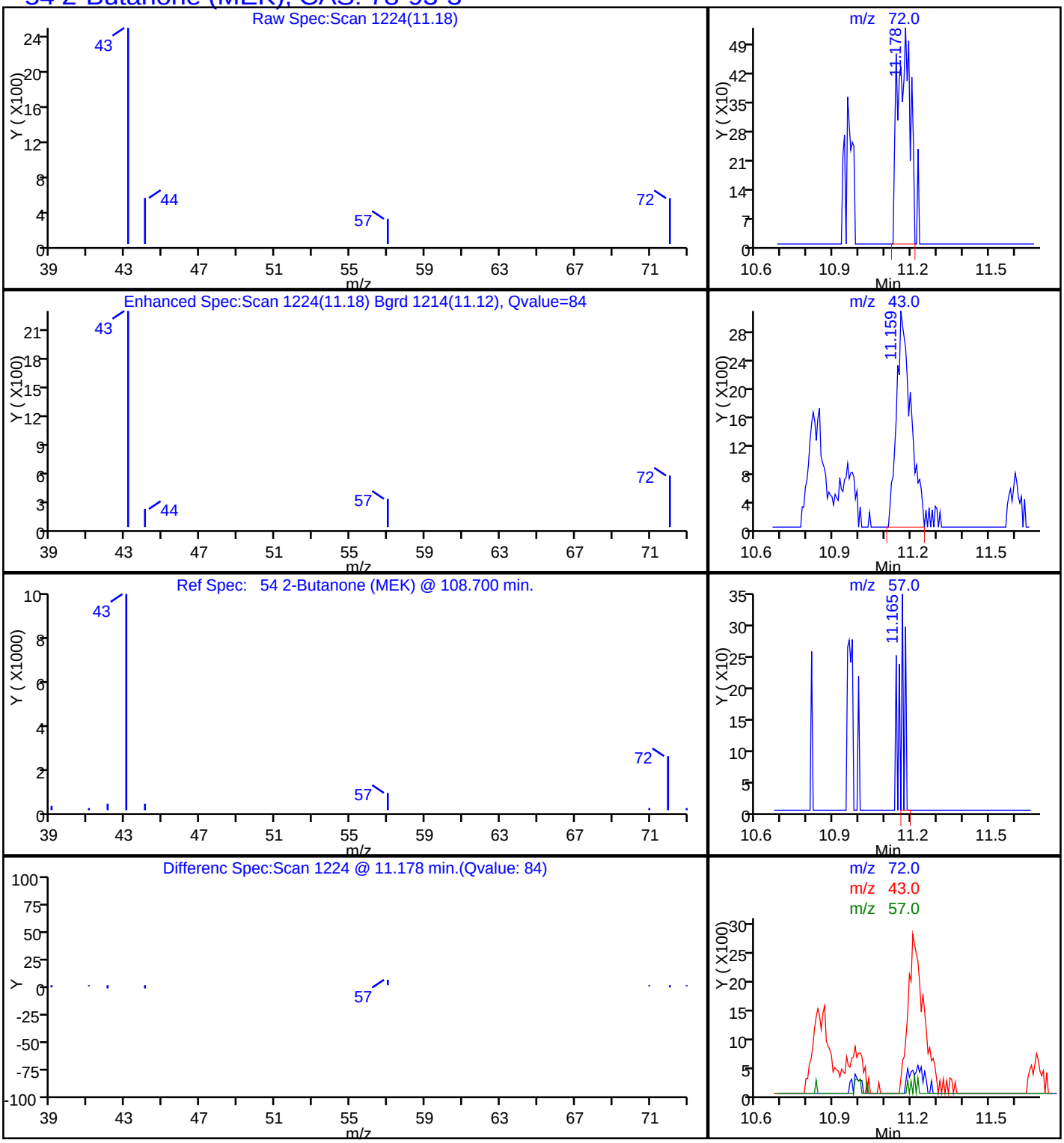


Report Date: 07-Apr-2014 09:32:40 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140404-11601.b\MS7040407.d				
Injection Date:	04-Apr-2014 17:58:30	Instrument ID:	ATMS7		
Lims ID:	320-6903-A-9	Lab Sample ID:	320-6903-9		
Client ID:	34002173				
Operator ID:	AO	ALS Bottle#:	6	Worklist Smp#:	7
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

54 2-Butanone (MEK), CAS: 78-93-3

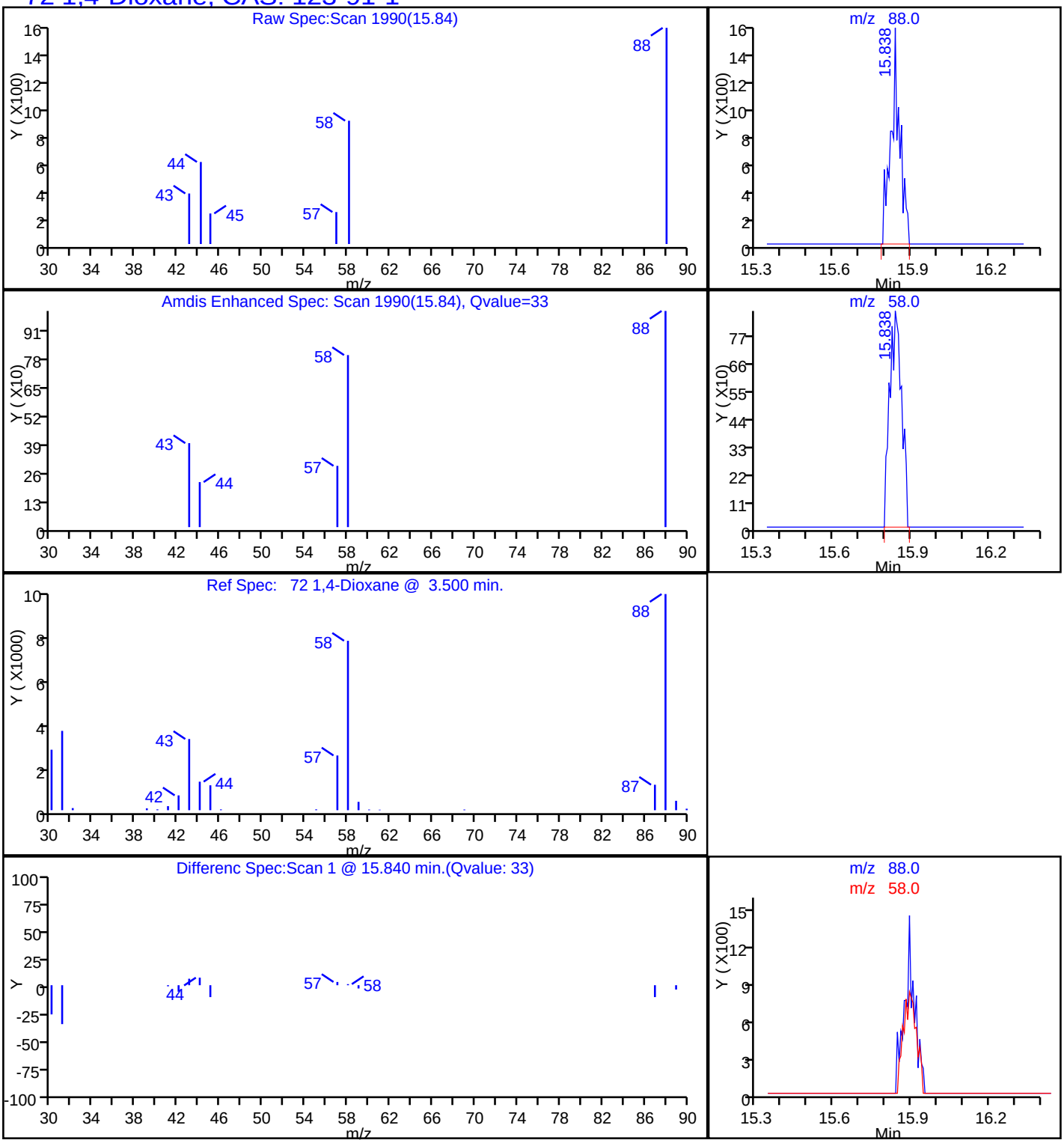


Report Date: 07-Apr-2014 09:32:40 Chrom Revision: 2.2 12-Mar-2014 11:19:24

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140404-11601.b\MS7040407.d				
Injection Date:	04-Apr-2014 17:58:30	Instrument ID:	ATMS7		
Lims ID:	320-6903-A-9	Lab Sample ID:	320-6903-9		
Client ID:	34002173				
Operator ID:	AO	ALS Bottle#:	6	Worklist Smp#:	7
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

72 1,4-Dioxane, CAS: 123-91-1



TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Tel: (916)373-5600

TestAmerica Job ID: 320-8185-1
Client Project/Site: Park-Euclid WQARF Site

For:
URS Corporation
8181 East Tufts Ave.
Denver, Colorado 80237

Attn: Mr. Robert Boudra

Authorized for release by:
7/11/2014 4:49:56 PM

Laura Turpen, Project Manager I
(916)373-5600
laura.turpen@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Cover Page 1
Table of Contents 2
Definitions/Glossary 3
Case Narrative 4
Detection Summary 5
Client Sample Results 7
Surrogate Summary 11
QC Sample Results 12
QC Association Summary 14
Lab Chronicle 15
Certification Summary 17
Method Summary 18
Sample Summary 19
Chain of Custody 20
Field Data Sheets 21
Receipt Checklists 28
Clean Canister Certification 29
Pre-Ship Certification 29
Clean Canister Data 30

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 320-8185-1

Laboratory: TestAmerica Sacramento

Narrative

Receipt
The samples were received on 6/27/2014 9:30 AM; the samples arrived in good condition.

Except:

The container label for the following samples did not match the information listed on the Chain-of-Custody (COC):
SG-1-06252014 (320-8185-1). The canister ID lists 3400365, while the COC lists 3400635.
SG-5-06252014 (320-8185-3). The canister ID lists 3400972, while the COC lists 34000927.

Air - GC/MS VOA
Method TO-15: The following sample was diluted due to the abundance of non-target analytes: SG-5-06252014 (320-8185-3). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

VOA Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Detection Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Client Sample ID: SG-1-06252014 ← VW-08 — Lab Sample ID: 320-8185-1

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	0.84		0.40	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	39		0.40	ppb v/v	1		TO-15	Total/NA
Trichloroethene	0.70		0.40	ppb v/v	1		TO-15	Total/NA
1,1-Difluoroethane	4.7		0.40	ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	3.3		1.6	ug/m3	1		TO-15	Total/NA
Tetrachloroethene	270		2.7	ug/m3	1		TO-15	Total/NA
Trichloroethene	3.8		2.1	ug/m3	1		TO-15	Total/NA
1,1-Difluoroethane	13		1.1	ug/m3	1		TO-15	Total/NA

Client Sample ID: SG-2-06252014 ← VW-09 — Lab Sample ID: 320-8185-2

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	0.88		0.40	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	45		0.40	ppb v/v	1		TO-15	Total/NA
Trichloroethene	0.75		0.40	ppb v/v	1		TO-15	Total/NA
1,1-Difluoroethane	4.6		0.40	ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	3.5		1.6	ug/m3	1		TO-15	Total/NA
Tetrachloroethene	300		2.7	ug/m3	1		TO-15	Total/NA
Trichloroethene	4.1		2.1	ug/m3	1		TO-15	Total/NA
1,1-Difluoroethane	12		1.1	ug/m3	1		TO-15	Total/NA

Client Sample ID: SG-5-06252014 ← VW-10 — Lab Sample ID: 320-8185-3

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	57		4.4	ppb v/v	11		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	390		30	ug/m3	11		TO-15	Total/NA

Client Sample ID: SG-6-06252014 ← VW-11 — Lab Sample ID: 320-8185-4

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	0.50		0.40	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	22		0.40	ppb v/v	1		TO-15	Total/NA
Trichloroethene	0.42		0.40	ppb v/v	1		TO-15	Total/NA
1,1-Difluoroethane	1.3		0.40	ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	2.0		1.6	ug/m3	1		TO-15	Total/NA
Tetrachloroethene	150		2.7	ug/m3	1		TO-15	Total/NA
Trichloroethene	2.3		2.1	ug/m3	1		TO-15	Total/NA
1,1-Difluoroethane	3.4		1.1	ug/m3	1		TO-15	Total/NA

Client Sample ID: SG-6-06252014-DUP ← VW-11 — Lab Sample ID: 320-8185-5

Analyte	Result	Qualifier	RL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	0.66		0.40	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	27		0.40	ppb v/v	1		TO-15	Total/NA
Trichloroethene	0.56		0.40	ppb v/v	1		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Detection Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Client Sample ID: SG-6-06252014-DUP (Continued) ← VW-11 — Lab Sample ID: 320-8185-5

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
1,1-Difluoroethane	1.3		0.40		ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	2.6		1.6		ug/m3	1		TO-15	Total/NA
Tetrachloroethene	190		2.7		ug/m3	1		TO-15	Total/NA
Trichloroethene	3.0		2.1		ug/m3	1		TO-15	Total/NA
1,1-Difluoroethane	3.5		1.1		ug/m3	1		TO-15	Total/NA

Client Sample ID: AMBIENT-06252014 — Lab Sample ID: 320-8185-6

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
1,1-Difluoroethane	0.72		0.40		ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
1,1-Difluoroethane	2.0		1.1		ug/m3	1		TO-15	Total/NA

Client Sample ID: SG-3-06252014 ← VW-12 — Lab Sample ID: 320-8185-8

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	0.43		0.40		ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	19		0.40		ppb v/v	1		TO-15	Total/NA
1,1-Difluoroethane	0.53		0.40		ppb v/v	1		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1.7		1.6		ug/m3	1		TO-15	Total/NA
Tetrachloroethene	130		2.7		ug/m3	1		TO-15	Total/NA
1,1-Difluoroethane	1.4		1.1		ug/m3	1		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Client Sample ID: SG-1-06252014 ← VW-08

Lab Sample ID: 320-8185-1
Matrix: Air

Date Collected: 06/25/14 14:55
Date Received: 06/27/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	0.84		0.40	ppb v/v			07/10/14 00:26	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			07/10/14 00:26	1
Tetrachloroethene	39		0.40	ppb v/v			07/10/14 00:26	1
Trichloroethene	0.70		0.40	ppb v/v			07/10/14 00:26	1
Vinyl chloride	ND		0.40	ppb v/v			07/10/14 00:26	1
1,1-Difluoroethane	4.7		0.40	ppb v/v			07/10/14 00:26	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	3.3		1.6	ug/m3			07/10/14 00:26	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			07/10/14 00:26	1
Tetrachloroethene	270		2.7	ug/m3			07/10/14 00:26	1
Trichloroethene	3.8		2.1	ug/m3			07/10/14 00:26	1
Vinyl chloride	ND		1.0	ug/m3			07/10/14 00:26	1
1,1-Difluoroethane	13		1.1	ug/m3			07/10/14 00:26	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*97*		*70 - 130*		*07/10/14 00:26*	*1*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*07/10/14 00:26*	*1*
Toluene-d8 (Surr)	*102*		*70 - 130*		*07/10/14 00:26*	*1*

Client Sample ID: SG-2-06252014 ← VW-09

Lab Sample ID: 320-8185-2
Matrix: Air

Date Collected: 06/25/14 14:38
Date Received: 06/27/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	0.88		0.40	ppb v/v			07/10/14 01:27	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			07/10/14 01:27	1
Tetrachloroethene	45		0.40	ppb v/v			07/10/14 01:27	1
Trichloroethene	0.75		0.40	ppb v/v			07/10/14 01:27	1
Vinyl chloride	ND		0.40	ppb v/v			07/10/14 01:27	1
1,1-Difluoroethane	4.6		0.40	ppb v/v			07/10/14 01:27	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	3.5		1.6	ug/m3			07/10/14 01:27	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			07/10/14 01:27	1
Tetrachloroethene	300		2.7	ug/m3			07/10/14 01:27	1
Trichloroethene	4.1		2.1	ug/m3			07/10/14 01:27	1
Vinyl chloride	ND		1.0	ug/m3			07/10/14 01:27	1
1,1-Difluoroethane	12		1.1	ug/m3			07/10/14 01:27	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*95*		*70 - 130*		*07/10/14 01:27*	*1*
1,2-Dichloroethane-d4 (Surr)	*90*		*70 - 130*		*07/10/14 01:27*	*1*
Toluene-d8 (Surr)	*102*		*70 - 130*		*07/10/14 01:27*	*1*

Client Sample Results

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Client Sample ID: SG-5-06252014 ← VW-10

Lab Sample ID: 320-8185-3
Matrix: Air

Date Collected: 06/25/14 15:12
Date Received: 06/27/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		4.4	ppb v/v			07/10/14 02:24	11
trans-1,2-Dichloroethene	ND		4.4	ppb v/v			07/10/14 02:24	11
Tetrachloroethene	**57**		4.4	ppb v/v			07/10/14 02:24	11
Trichloroethene	ND		4.4	ppb v/v			07/10/14 02:24	11
Vinyl chloride	ND		4.4	ppb v/v			07/10/14 02:24	11
1,1-Difluoroethane	ND		4.4	ppb v/v			07/10/14 02:24	11

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		17	ug/m3			07/10/14 02:24	11
trans-1,2-Dichloroethene	ND		17	ug/m3			07/10/14 02:24	11
Tetrachloroethene	**390**		30	ug/m3			07/10/14 02:24	11
Trichloroethene	ND		24	ug/m3			07/10/14 02:24	11
Vinyl chloride	ND		11	ug/m3			07/10/14 02:24	11
1,1-Difluoroethane	ND		12	ug/m3			07/10/14 02:24	11

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*95*		*70 - 130*		*07/10/14 02:24*	*11*
1,2-Dichloroethane-d4 (Surr)	*89*		*70 - 130*		*07/10/14 02:24*	*11*
Toluene-d8 (Surr)	*102*		*70 - 130*		*07/10/14 02:24*	*11*

Client Sample ID: SG-6-06252014 ← VW-11

Lab Sample ID: 320-8185-4
Matrix: Air

Date Collected: 06/25/14 15:32
Date Received: 06/27/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**0.50**		0.40	ppb v/v			07/10/14 03:33	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			07/10/14 03:33	1
Tetrachloroethene	**22**		0.40	ppb v/v			07/10/14 03:33	1
Trichloroethene	**0.42**		0.40	ppb v/v			07/10/14 03:33	1
Vinyl chloride	ND		0.40	ppb v/v			07/10/14 03:33	1
1,1-Difluoroethane	**1.3**		0.40	ppb v/v			07/10/14 03:33	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**2.0**		1.6	ug/m3			07/10/14 03:33	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			07/10/14 03:33	1
Tetrachloroethene	**150**		2.7	ug/m3			07/10/14 03:33	1
Trichloroethene	**2.3**		2.1	ug/m3			07/10/14 03:33	1
Vinyl chloride	ND		1.0	ug/m3			07/10/14 03:33	1
1,1-Difluoroethane	**3.4**		1.1	ug/m3			07/10/14 03:33	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*98*		*70 - 130*		*07/10/14 03:33*	*1*
1,2-Dichloroethane-d4 (Surr)	*88*		*70 - 130*		*07/10/14 03:33*	*1*
Toluene-d8 (Surr)	*105*		*70 - 130*		*07/10/14 03:33*	*1*

Client Sample Results

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Client Sample ID: SG-6-06252014-DUP ← VW-11

Lab Sample ID: 320-8185-5
Matrix: Air

Date Collected: 06/25/14 15:39
Date Received: 06/27/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**0.66**		0.40	ppb v/v			07/10/14 07:41	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			07/10/14 07:41	1
Tetrachloroethene	**27**		0.40	ppb v/v			07/10/14 07:41	1
Trichloroethene	**0.56**		0.40	ppb v/v			07/10/14 07:41	1
Vinyl chloride	ND		0.40	ppb v/v			07/10/14 07:41	1
1,1-Difluoroethane	**1.3**		0.40	ppb v/v			07/10/14 07:41	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**2.6**		1.6	ug/m3			07/10/14 07:41	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			07/10/14 07:41	1
Tetrachloroethene	**190**		2.7	ug/m3			07/10/14 07:41	1
Trichloroethene	**3.0**		2.1	ug/m3			07/10/14 07:41	1
Vinyl chloride	ND		1.0	ug/m3			07/10/14 07:41	1
1,1-Difluoroethane	**3.5**		1.1	ug/m3			07/10/14 07:41	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*07/10/14 07:41*	*1*
1,2-Dichloroethane-d4 (Surr)	*88*		*70 - 130*		*07/10/14 07:41*	*1*
Toluene-d8 (Surr)	*103*		*70 - 130*		*07/10/14 07:41*	*1*

Client Sample ID: AMBIENT-06252014

Lab Sample ID: 320-8185-6
Matrix: Air

Date Collected: 06/25/14 15:58
Date Received: 06/27/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			07/10/14 08:39	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			07/10/14 08:39	1
Tetrachloroethene	ND		0.40	ppb v/v			07/10/14 08:39	1
Trichloroethene	ND		0.40	ppb v/v			07/10/14 08:39	1
Vinyl chloride	ND		0.40	ppb v/v			07/10/14 08:39	1
1,1-Difluoroethane	**0.72**		0.40	ppb v/v			07/10/14 08:39	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			07/10/14 08:39	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			07/10/14 08:39	1
Tetrachloroethene	ND		2.7	ug/m3			07/10/14 08:39	1
Trichloroethene	ND		2.1	ug/m3			07/10/14 08:39	1
Vinyl chloride	ND		1.0	ug/m3			07/10/14 08:39	1
1,1-Difluoroethane	**2.0**		1.1	ug/m3			07/10/14 08:39	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*		*07/10/14 08:39*	*1*
1,2-Dichloroethane-d4 (Surr)	*86*		*70 - 130*		*07/10/14 08:39*	*1*
Toluene-d8 (Surr)	*100*		*70 - 130*		*07/10/14 08:39*	*1*

Client Sample Results

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Client Sample ID: SG-3-06252014 ← VW-12

Lab Sample ID: 320-8185-8

Date Collected: 06/25/14 16:27

Matrix: Air

Date Received: 06/27/14 09:30

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**0.43**		0.40		ppb v/v			07/10/14 09:39	1
trans-1,2-Dichloroethene	ND		0.40		ppb v/v			07/10/14 09:39	1
Tetrachloroethene	**19**		0.40		ppb v/v			07/10/14 09:39	1
Trichloroethene	ND		0.40		ppb v/v			07/10/14 09:39	1
Vinyl chloride	ND		0.40		ppb v/v			07/10/14 09:39	1
1,1-Difluoroethane	**0.53**		0.40		ppb v/v			07/10/14 09:39	1

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**1.7**		1.6		ug/m3			07/10/14 09:39	1
trans-1,2-Dichloroethene	ND		1.6		ug/m3			07/10/14 09:39	1
Tetrachloroethene	**130**		2.7		ug/m3			07/10/14 09:39	1
Trichloroethene	ND		2.1		ug/m3			07/10/14 09:39	1
Vinyl chloride	ND		1.0		ug/m3			07/10/14 09:39	1
1,1-Difluoroethane	**1.4**		1.1		ug/m3			07/10/14 09:39	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*		*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*99*		*70 - 130*			*07/10/14 09:39*	*1*
1,2-Dichloroethane-d4 (Surr)	*87*		*70 - 130*			*07/10/14 09:39*	*1*
Toluene-d8 (Surr)	*101*		*70 - 130*			*07/10/14 09:39*	*1*

Surrogate Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Matrix: Air **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		BFB	12DCE	TOL
Lab Sample ID	Client Sample ID	(70-130)	(70-130)	(70-130)
320-8185-1	SG-1-06252014	97	92	102
320-8185-2	SG-2-06252014	95	90	102
320-8185-3	SG-5-06252014	95	89	102
320-8185-4	SG-6-06252014	98	88	105
320-8185-5	SG-6-06252014-DUP	96	88	103
320-8185-6	AMBIENT-06252014	96	86	100
320-8185-8	SG-3-06252014	99	87	101
LCS 320-46822/5	Lab Control Sample	100	103	101
LCS 320-46822/6	Lab Control Sample	90	93	97
MB 320-46822/8	Method Blank	95	92	114

Surrogate Legend

BFB = 4-Bromofluorobenzene (Surr)

12DCE = 1,2-Dichloroethane-d4 (Surr)

TOL = Toluene-d8 (Surr)

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Lab Sample ID: MB 320-46822/8
Matrix: Air
Analysis Batch: 46822

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40		ppb v/v			07/09/14 20:30	1
trans-1,2-Dichloroethene	ND		0.40		ppb v/v			07/09/14 20:30	1
Tetrachloroethene	ND		0.40		ppb v/v			07/09/14 20:30	1
Trichloroethene	ND		0.40		ppb v/v			07/09/14 20:30	1
Vinyl chloride	ND		0.40		ppb v/v			07/09/14 20:30	1
1,1-Difluoroethane	ND		0.40		ppb v/v			07/09/14 20:30	1

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6		ug/m3			07/09/14 20:30	1
trans-1,2-Dichloroethene	ND		1.6		ug/m3			07/09/14 20:30	1
Tetrachloroethene	ND		2.7		ug/m3			07/09/14 20:30	1
Trichloroethene	ND		2.1		ug/m3			07/09/14 20:30	1
Vinyl chloride	ND		1.0		ug/m3			07/09/14 20:30	1
1,1-Difluoroethane	ND		1.1		ug/m3			07/09/14 20:30	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*95*		*70 - 130*		*07/09/14 20:30*	*1*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*07/09/14 20:30*	*1*
Toluene-d8 (Surr)	*114*		*70 - 130*		*07/09/14 20:30*	*1*

Lab Sample ID: LCS 320-46822/5
Matrix: Air
Analysis Batch: 46822

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
cis-1,2-Dichloroethene			20.0	17.5		ppb v/v		88	70 - 130		
trans-1,2-Dichloroethene			20.0	17.7		ppb v/v		88	70 - 130		
Tetrachloroethene			20.0	20.6		ppb v/v		103	70 - 130		
Trichloroethene			20.0	18.2		ppb v/v		91	70 - 130		
Vinyl chloride			20.0	17.4		ppb v/v		87	70 - 130		

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
cis-1,2-Dichloroethene			79	69.4		ug/m3		88	70 - 130		
trans-1,2-Dichloroethene			79	70.1		ug/m3		88	70 - 130		
Tetrachloroethene			140	140		ug/m3		103	70 - 130		
Trichloroethene			110	97.6		ug/m3		91	70 - 130		
Vinyl chloride			51	44.4		ug/m3		87	70 - 130		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*100*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*103*		*70 - 130*
Toluene-d8 (Surr)	*101*		*70 - 130*

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-46822/6
Matrix: Air
Analysis Batch: 46822

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
1,1-Difluoroethane			20.0	18.8		ppb v/v		94	70 - 130		

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
1,1-Difluoroethane			54	50.8		ug/m3		94	70 - 130		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*90*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*93*		*70 - 130*
Toluene-d8 (Surr)	*97*		*70 - 130*

QC Association Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Air - GC/MS VOA

Analysis Batch: 46822

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-8185-1	SG-1-06252014	Total/NA	Air	TO-15	
320-8185-2	SG-2-06252014	Total/NA	Air	TO-15	
320-8185-3	SG-5-06252014	Total/NA	Air	TO-15	
320-8185-4	SG-6-06252014	Total/NA	Air	TO-15	
320-8185-5	SG-6-06252014-DUP	Total/NA	Air	TO-15	
320-8185-6	AMBIENT-06252014	Total/NA	Air	TO-15	
320-8185-8	SG-3-06252014	Total/NA	Air	TO-15	
LCS 320-46822/5	Lab Control Sample	Total/NA	Air	TO-15	
LCS 320-46822/6	Lab Control Sample	Total/NA	Air	TO-15	
MB 320-46822/8	Method Blank	Total/NA	Air	TO-15	

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Client Sample ID: SG-1-06252014 ← VW-08

Lab Sample ID: 320-8185-1
Date Collected: 06/25/14 14:55
Matrix: Air
Date Received: 06/27/14 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	539 mL	250 mL	46822	07/10/14 00:26	TAD	TAL SAC

Client Sample ID: SG-2-06252014 ← VW-09

Lab Sample ID: 320-8185-2
Date Collected: 06/25/14 14:38
Matrix: Air
Date Received: 06/27/14 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	538 mL	250 mL	46822	07/10/14 01:27	TAD	TAL SAC

Client Sample ID: SG-5-06252014 ← VW-10

Lab Sample ID: 320-8185-3
Date Collected: 06/25/14 15:12
Matrix: Air
Date Received: 06/27/14 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		11	50 mL	250 mL	46822	07/10/14 02:24	TAD	TAL SAC

Client Sample ID: SG-6-06252014 ← VW-11

Lab Sample ID: 320-8185-4
Date Collected: 06/25/14 15:32
Matrix: Air
Date Received: 06/27/14 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	558 mL	250 mL	46822	07/10/14 03:33	TAD	TAL SAC

Client Sample ID: SG-6-06252014-DUP ← VW-11

Lab Sample ID: 320-8185-5
Date Collected: 06/25/14 15:39
Matrix: Air
Date Received: 06/27/14 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	542 mL	250 mL	46822	07/10/14 07:41	TAD	TAL SAC

Client Sample ID: AMBIENT-06252014

Lab Sample ID: 320-8185-6
Date Collected: 06/25/14 15:58
Matrix: Air
Date Received: 06/27/14 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	506 mL	250 mL	46822	07/10/14 08:39	TAD	TAL SAC

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Client Sample ID: SG-3-06252014 ← VW-12

Lab Sample ID: 320-8185-8

Date Collected: 06/25/14 16:27

Matrix: Air

Date Received: 06/27/14 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	566 mL	250 mL	46822	07/10/14 09:39	TAD	TAL SAC

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Certification Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Laboratory: TestAmerica Sacramento

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Arizona	State Program	9	AZ0708	08-11-15

Method Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Method	Method Description	Protocol	Laboratory
TO-15	Volatile Organic Compounds in Ambient Air	EPA	TAL SAC

Protocol References:

EPA = US Environmental Protection Agency

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Sample Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8185-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
320-8185-1	SG-1-06252014 VW-08	Air	06/25/14 14:55	06/27/14 09:30
320-8185-2	SG-2-06252014 VW-09	Air	06/25/14 14:38	06/27/14 09:30
320-8185-3	SG-5-06252014 VW-10	Air	06/25/14 15:12	06/27/14 09:30
320-8185-4	SG-6-06252014 VW-11	Air	06/25/14 15:32	06/27/14 09:30
320-8185-5	SG-6-06252014-DUP	Air	06/25/14 15:39	06/27/14 09:30
320-8185-6	AMBIENT-06252014	Air	06/25/14 15:58	06/27/14 09:30
320-8185-8	SG-3-06252014 VW-12	Air	06/25/14 16:27	06/27/14 09:30

TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
phone 916.374.4378 fax 916 372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc assumes no liability with respect to the collection and shipment of these samples

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact Information	Project Manager: Robert Bonura	Samples Collected By: Erin Lansey	COC No:
Company Name: URS corp.	Phone:		1 of 1 COCs
Address: 3333 Wetmore Rd	Email:		
City/State/Zip Tucson, Az. 85705			For Lab Use Only:
Phone: 520 887 1800	Site Contact:		Walk-in Client
FAX:	TA Contact:		Lab Sampling.
Project Name: Park/Enclid	Anaylsis Turnaround Time		
Site/Location:	Standard (Specific): X		Job / SDG No .
P O #	Rush (Specify)		(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID 3400-	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
* SG-1-06252014	6/25/14	1447	1455	25"	2"	10611	0635	X														
SG-2-06252014	6/25/14	1433	1438	26"	3"	10087	1227	X														
** SG-5-06252014	6/25/14	1505	1512	28"	3"	10694	0927	X														
SG-6-06252014	6/25/14	1526	1532	28"	4"	10957	1941	X														
SG-6-06252014-Dup	6/25/14	1532	1539	28"	3"	10900	0863	X														
Ambient-06252014	6/25/14	1550	1558	27"	1"	09575	1109	X														
SG-4-06252014	6/25/14	1555	1603	28"	4"	10937	1119	X														
SG-3-06252014	6/25/14	1620	1627	28"	3"	10245	0647	X														
Erin Lansey	EL 6/25/14																					

Temperature (Fahrenheit)			
Start	Interior	Ambient	
Stop			

Temperature (Fahrenheit)			
Start	Interior	Ambient	
Stop			

320-8185 Chain of Custody

Special Instructions/QC Requirements & Comments:
Tentively Identified Compound = 1,1-DFA

Samples Shipped by:	Date / Time: 6-26-14 1346	Samples Received by:
Samples Relinquished by:	Date / Time: 6-26-14 1500	Received by: Stephanie Edwards 6/27/14 9:30
Relinquished by:	Date / Time:	Received by:

Lab Use Only: Shipper Name: Opened by: Condition:

Form No: CA-C-WI-003, Rev. 1, dated 05/10/2013

* Canister ID wrong on COC @ 6/27/14 34000365

** Canister ID wrong on COC @ 6/27/14 34000977

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-8185
Sample # 1

Client/Project:		VFR ID:		
Canister Serial #:	34000365	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.57	07/07/14	EP for GG
FINAL PRESSURE (PSIA)	24.97	07/07/14	EP for GG
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.16			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.16		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

								Date	Instr.	File #	
								7/9/2014	MS7		
Canister DF =	2.16	X	Load DF =	0.4638219	X	Bag DF =	1	=		FINAL DF	1.001005415
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	539		Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-8185
Sample # 2

Client/Project:		VFR ID:		
Canister Serial #:	34001227	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.41	07/07/14	EP for GG
FINAL PRESSURE (PSIA)	24.59	07/07/14	EP for GG
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.16			

CANISTER REPRESSURIZATION					
Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.16		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							7/9/2014	MS7			
Canister DF =	2.16	X	Load DF =	0.464684	X	Bag DF =	1	=	FINAL DF 1.001453105		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	538		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.16	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-8185
Sample # 3

Client/Project:		VFR ID:		
Canister Serial #:	34000972	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.81	07/07/14	EP for GG
FINAL PRESSURE (PSIA)	25.92	07/07/14	EP for GG
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.19			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.19		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							7/9/2014	MS7			
Canister DF =	2.19	X	Load DF =	5	X	Bag DF =	1	=	FINAL DF 10.97375106		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	50		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.19	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.19	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-8185
Sample # 4

Client/Project:		VFR ID:		
Canister Serial #:	34001941	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.23	07/07/14	EP for GG
FINAL PRESSURE (PSIA)	25.09	07/07/14	EP for GG
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.23			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.23		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

Canister DF =	X	Load DF = / LVf (mLs) / LVi (mLs)	X	Bag DF = / BVf (mL) / Bvi (mLs)	Date / Instr. / File #	=	FINAL DF
2.23	X	0.4480287 / 250 / 558	X	1	7/9/2014 / MS7 /	=	1.00098303
2.23	X	#DIV/0!	X	1	/ /	=	#DIV/0!
2.23	X	#DIV/0!	X	1	/ /	=	#DIV/0!

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-8185
Sample # 5

Client/Project:		VFR ID:		
Canister Serial #:	34000863	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.52	07/07/14	EP for GG
FINAL PRESSURE (PSIA)	24.99	07/07/14	EP for GG
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.17			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.17		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							7/9/2014	MS7			
Canister DF =	2.17	X	Load DF =	0.4612546	X	Bag DF =	1	=	FINAL DF 1.000586178		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	542		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.17	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.17	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-8185
Sample # 6

Client/Project:		VFR ID:		
Canister Serial #:	34001109	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	12.46	07/07/14	EP for GG
FINAL PRESSURE (PSIA)	25.23	07/07/14	EP for GG
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.02			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.02		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

								Date	Instr.	File #	
								7/9/2014	MS7		
Canister DF =	2.02	X	Load DF =	0.4940711	X	Bag DF =	1	=		FINAL DF	1.000434592
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	506		Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.02	X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.02	X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-8185
Sample # 8

Client/Project:		VFR ID:		
Canister Serial #:	34000647	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.32	07/07/14	EP for GG
FINAL PRESSURE (PSIA)	25.64	07/07/14	EP for GG
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.27			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.27		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

Canister DF		Load DF		Bag DF		Date	Instr.	File #	FINAL DF
2.27	X	0.4416961	X	1	=	7/9/2014	MS7		1.0004495
		LVf (mLs) 250		BVf (mLs)					
		LVi (mLs) 566		Bvi (mLs)					

Canister DF		Load DF		Bag DF		Date	Instr.	File #	FINAL DF
2.27	X	#DIV/0!	X	1	=				#DIV/0!
		LVf (mLs)		BVf (mLs)					
		LVi (mLs)		Bvi (mLs)					

Canister DF		Load DF		Bag DF		Date	Instr.	File #	FINAL DF
2.27	X	#DIV/0!	X	1	=				#DIV/0!
		LVf (mLs)		BVf (mLs)					
		LVi (mLs)		Bvi (mLs)					

Login Sample Receipt Checklist

Client: URS Corporation

Job Number: 320-8185-1

Login Number: 8185

List Number: 1

Creator: Nelson, Kym D

List Source: TestAmerica Sacramento

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	False	Canister IDs wrong on COC
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

320-7258 Chain of Custody

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Canister QC Certification

Certification Type: TO-15 SCAN

Date Cleaned/Batch ID: 4/29/14 320-7258

Date of QC: 4/30/14

Data File Number: MSS 043004

CANISTER ID NUMBERS

39001119	34000865	
1708	0972	
0863	0624	
1109	1081	
0647		
1227		
1941		
1079*		

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

1st level Reviewed By: _____ Date: 5/1/14

2nd level Reviewed By: _____ Date: 5/2/14

Q:\FORMS\QA-814 CAN QC CERT 20130729.DOC
QA-814

ERS 7/29/2013

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-7258-1

SDG No.:

Client Sample ID: 34001079 | Lab Sample ID: 320-7258-8

Matrix: Air | Lab File ID: MS5043004.D

Analysis Method: TO-15 | Date Collected: 04/29/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 04/30/2014 18:16

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 41495 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	2.9	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	0.63	J	0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-7258-1

SDG No.:

Client Sample ID: 34001079 | Lab Sample ID: 320-7258-8

Matrix: Air | Lab File ID: MS5043004.D

Analysis Method: TO-15 | Date Collected: 04/29/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 04/30/2014 18:16

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 41495 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND		2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND		0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	0.22	J	0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND		2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-7258-1

SDG No.:

Client Sample ID: 34001079 Lab Sample ID: 320-7258-8

Matrix: Air Lab File ID: MS5043004.D

Analysis Method: TO-15 Date Collected: 04/29/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 04/30/2014 18:16

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 41495 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	97		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	98		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\SACCHROM\ChromData\ATMS5\20140430-12195.b\MS5043004.D
Lims ID: 320-7258-A-8 Lab Sample ID: 320-7258-8
Client ID: 34001079
Sample Type: Client
Inject. Date: 30-Apr-2014 18:16:30 ALS Bottle#: 5 Worklist Smp#: 4
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-7258-8
Misc. Info.: 500mL; 34001079
Operator ID: AO Instrument ID: ATMS5

Method: \\SACCHROM\ChromData\ATMS5\20140430-12195.b\TO15_ATMS5.m
Limit Group: MSA - TO15 - ICAL
Last Update: 01-May-2014 11:48:17 Calib Date: 30-Apr-2014 12:48:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\SACCHROM\ChromData\ATMS5\20140430-12195.b\MS5043002.D

Column 1 : Det: MS SCAN
Process Host: XAWRK016

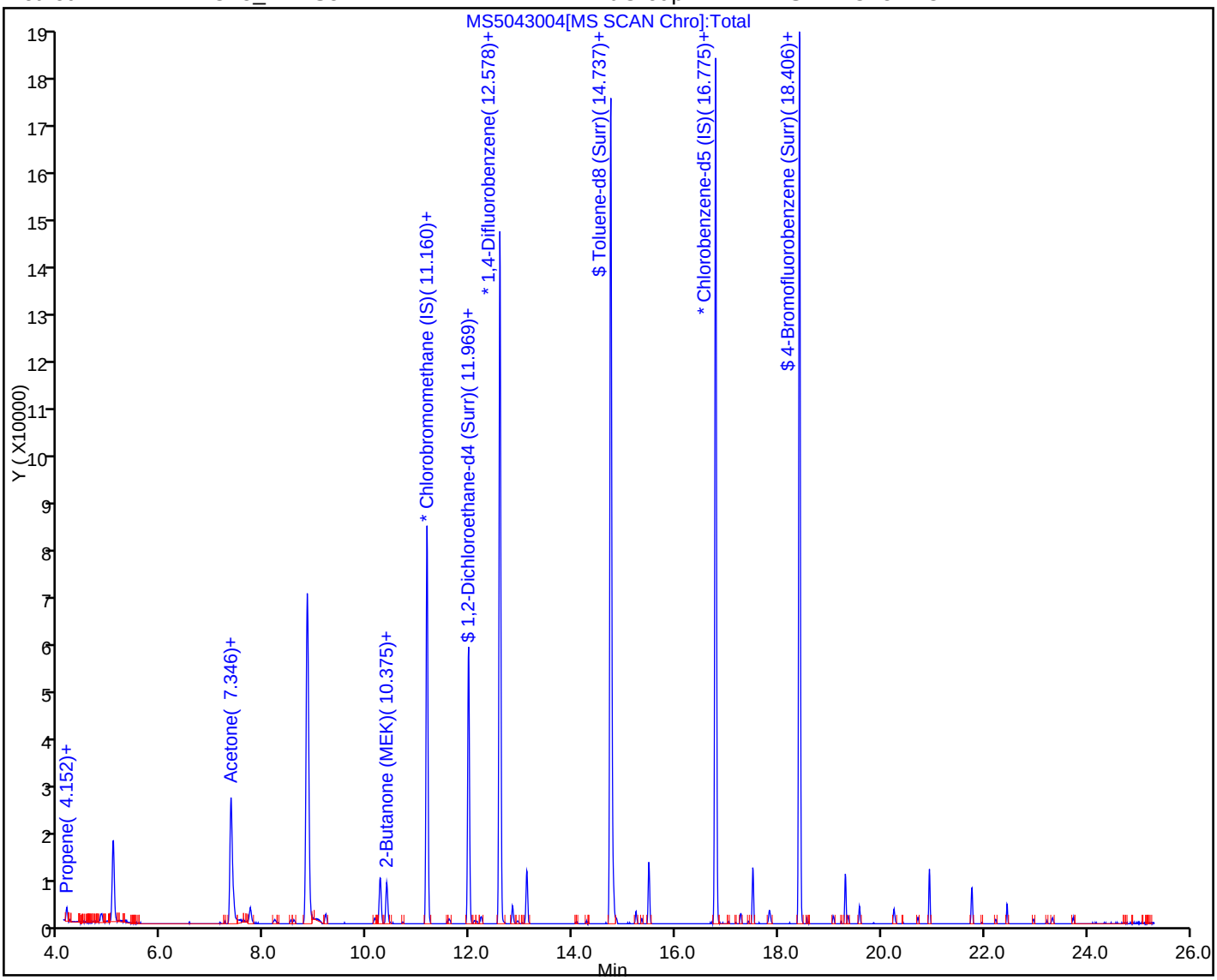
First Level Reviewer: shardaa Date: 01-May-2014 11:48:17

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	OnCol Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	11.160	11.160	0.000	92	39057	3.88	
* 2 1,4-Difluorobenzene	114	12.578	12.584	-0.006	93	160907	4.00	
* 3 Chlorobenzene-d5 (IS)	117	16.775	16.775	0.000	79	138428	4.00	
$ 4 1,2-Dichloroethane-d4 (Sur	65	11.969	11.969	0.000	0	48232	3.82	
$ 5 Toluene-d8 (Surr)	100	14.737	14.737	0.000	92	102499	3.96	
$ 6 4-Bromofluorobenzene (Surr	95	18.406	18.412	-0.006	86	90213	3.86	
11 Propene	41	4.146	4.158	-0.012	88	1929	0.2220	
33 Acetone	43	7.346	7.352	-0.006	98	54576	2.90	
49 2-Butanone (MEK)	72	10.382	10.388	-0.006	90	3915	0.6284	

Report Date: 01-May-2014 11:48:17 Chrom Revision: 2.2 14-Apr-2014 13:40:08

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140430-12195.b\MS5043004.D				
Injection Date:	30-Apr-2014 18:16:30	Instrument ID:	ATMS5		
Lims ID:	320-7258-A-8	Lab Sample ID:	320-7258-8		
Client ID:	34001079				
Operator ID:	AO	ALS Bottle#:	5	Worklist Smp#:	4
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		

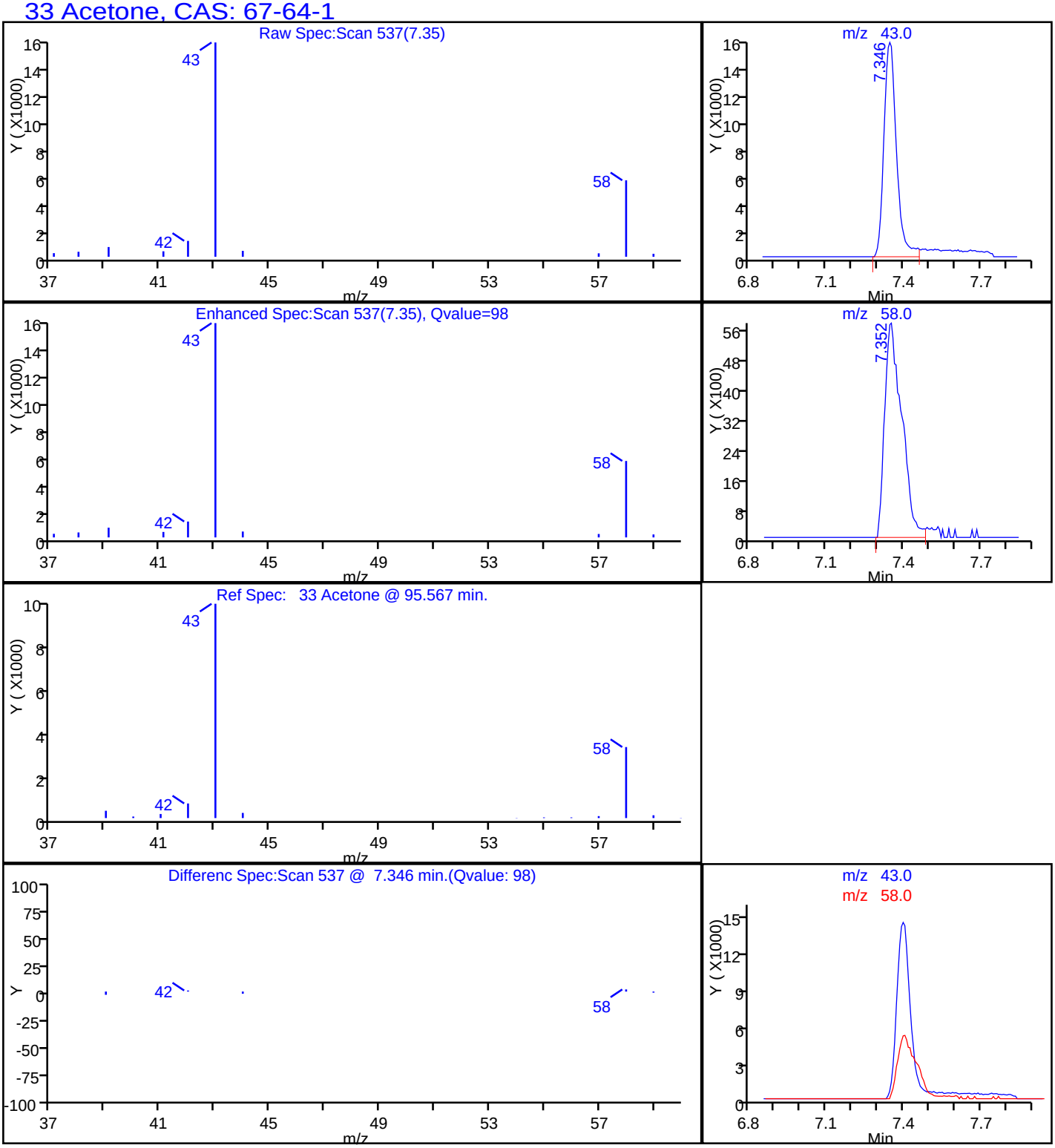


Report Date: 01-May-2014 11:48:17 Chrom Revision: 2.2 14-Apr-2014 13:40:08

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140430-12195.b\MS5043004.D				
Injection Date:	30-Apr-2014 18:16:30	Instrument ID:	ATMS5		
Lims ID:	320-7258-A-8	Lab Sample ID:	320-7258-8		
Client ID:	34001079				
Operator ID:	AO	ALS Bottle#:	5	Worklist Smp#:	4
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

33 Acetone, CAS: 67-64-1

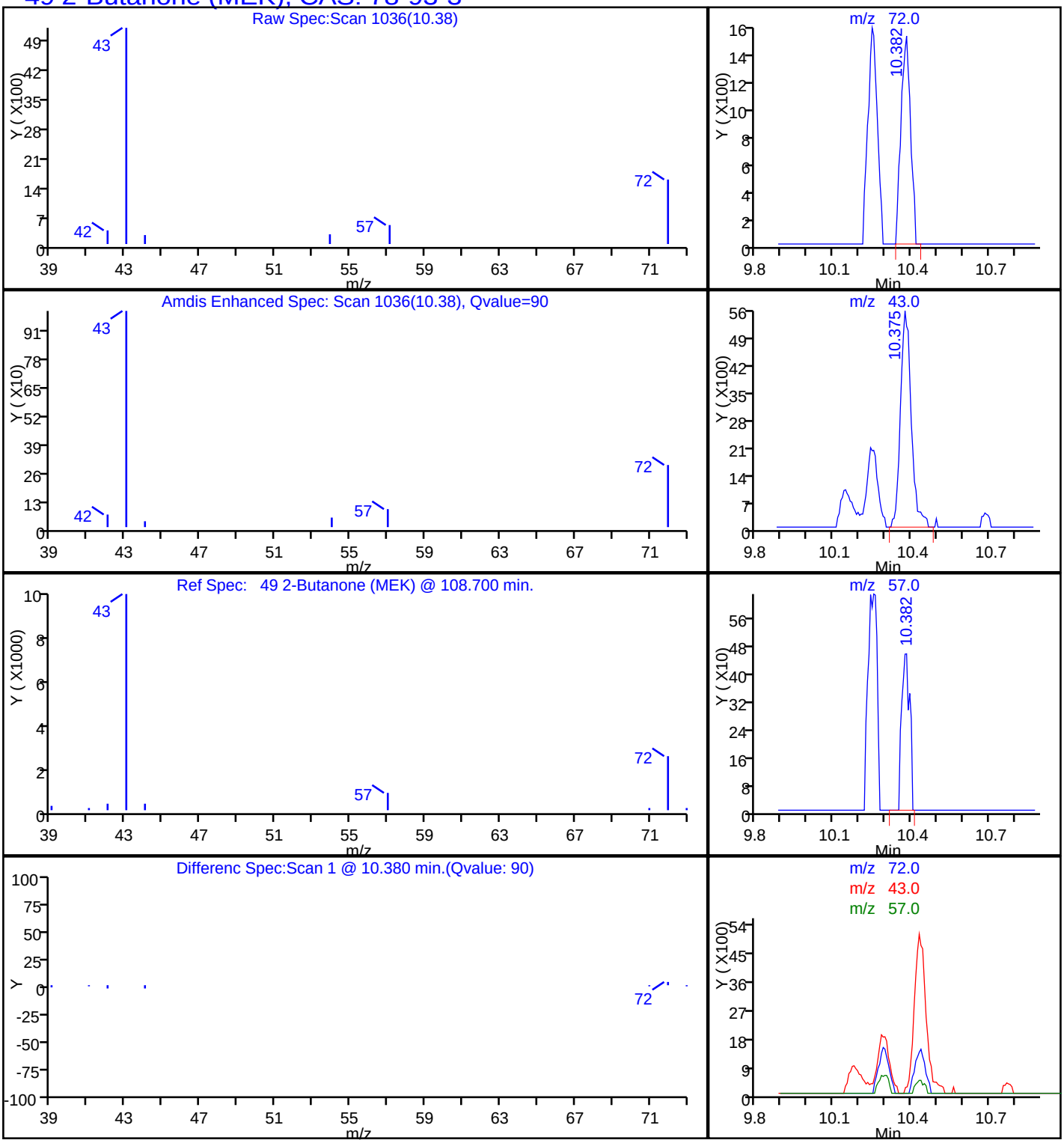


Report Date: 01-May-2014 11:48:17 Chrom Revision: 2.2 14-Apr-2014 13:40:08

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140430-12195.b\MS5043004.D				
Injection Date:	30-Apr-2014 18:16:30	Instrument ID:	ATMS5		
Lims ID:	320-7258-A-8	Lab Sample ID:	320-7258-8		
Client ID:	34001079				
Operator ID:	AO	ALS Bottle#:	5	Worklist Smp#:	4
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

49 2-Butanone (MEK), CAS: 78-93-3

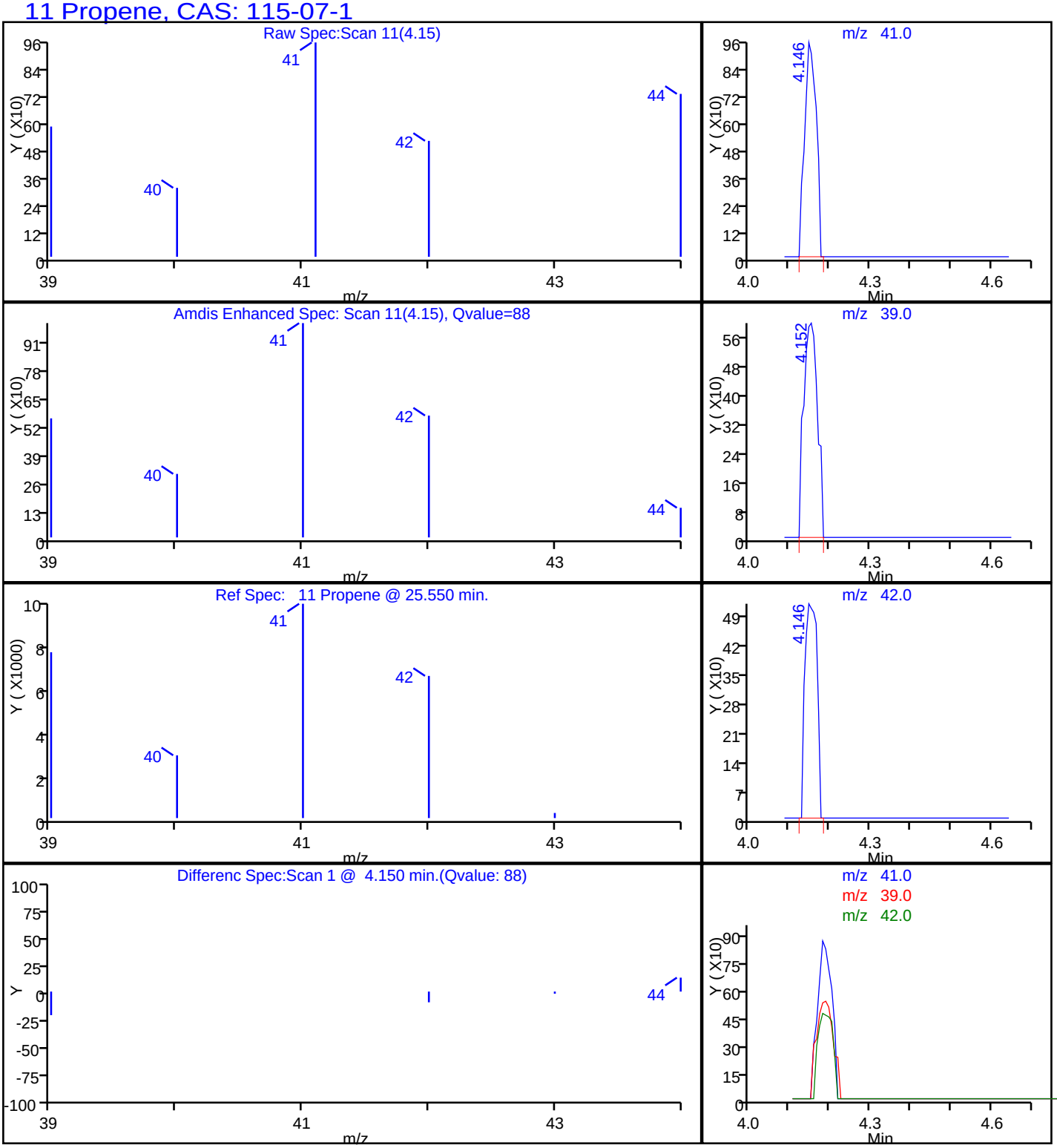


Report Date: 01-May-2014 11:48:17 Chrom Revision: 2.2 14-Apr-2014 13:40:08

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS5\20140430-12195.b\MS5043004.D				
Injection Date:	30-Apr-2014 18:16:30	Instrument ID:	ATMS5		
Lims ID:	320-7258-A-8	Lab Sample ID:	320-7258-8		
Client ID:	34001079				
Operator ID:	AO	ALS Bottle#:	5	Worklist Smp#:	4
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS5	Limit Group:	MSA - TO15 - ICAL		
Column:		Detector	MS SCAN		

11 Propene, CAS: 115-07-1



TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Tel: (916)373-5600

TestAmerica Job ID: 320-8396-1
Client Project/Site: Park-Euclid WQARF Site

For:
URS Corporation
8181 East Tufts Ave.
Denver, Colorado 80237

Attn: Mr. Robert Boudra

Authorized for release by:
7/22/2014 9:22:11 AM

Laura Turpen, Project Manager I
(916)373-5600
laura.turpen@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Cover Page 1
Table of Contents 2
Definitions/Glossary 3
Case Narrative 4
Detection Summary 5
Client Sample Results 6
Surrogate Summary 8
QC Sample Results 9
QC Association Summary 13
Lab Chronicle 14
Certification Summary 15
Method Summary 16
Sample Summary 17
Chain of Custody 18
Field Data Sheets 19
Receipt Checklists 21
Clean Canister Certification 22
Pre-Ship Certification 22
Clean Canister Data 23

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 320-8396-1

Laboratory: TestAmerica Sacramento

Narrative

Receipt
The samples were received on 7/11/2014 9:15 AM; the samples arrived in good condition.

Air - GC/MS VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

VOA Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Detection Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8396-1

Client Sample ID: SG-4-070914 ← VW-13 — Lab Sample ID: 320-8396-1

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	1.7		0.40		ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	59		0.40		ppb v/v	1		TO-15	Total/NA
Trichloroethene	1.1		0.40		ppb v/v	1		TO-15	Total/NA
1,1-Difluoroethane - DL	390		3.5		ppb v/v	8.73		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	6.9		1.6		ug/m3	1		TO-15	Total/NA
Tetrachloroethene	400		2.7		ug/m3	1		TO-15	Total/NA
Trichloroethene	5.9		2.1		ug/m3	1		TO-15	Total/NA
1,1-Difluoroethane - DL	1100		9.4		ug/m3	8.73		TO-15	Total/NA

Client Sample ID: EQ BLANK-070914 — Lab Sample ID: 320-8396-2

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	6.7		0.40		ppb v/v	1		TO-15	Total/NA
1,1-Difluoroethane - DL	140		1.8		ppb v/v	4.61		TO-15	Total/NA

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	45		2.7		ug/m3	1		TO-15	Total/NA
1,1-Difluoroethane - DL	390		5.0		ug/m3	4.61		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8396-1

Client Sample ID: SG-4-070914 ← VW-13

Lab Sample ID: 320-8396-1
Date Collected: 07/09/14 12:50
Matrix: Air
Date Received: 07/11/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**1.7**		0.40	ppb v/v			07/19/14 06:13	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			07/19/14 06:13	1
Tetrachloroethene	**59**		0.40	ppb v/v			07/19/14 06:13	1
Trichloroethene	**1.1**		0.40	ppb v/v			07/19/14 06:13	1
Vinyl chloride	ND		0.40	ppb v/v			07/19/14 06:13	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**6.9**		1.6	ug/m3			07/19/14 06:13	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			07/19/14 06:13	1
Tetrachloroethene	**400**		2.7	ug/m3			07/19/14 06:13	1
Trichloroethene	**5.9**		2.1	ug/m3			07/19/14 06:13	1
Vinyl chloride	ND		1.0	ug/m3			07/19/14 06:13	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*99*		*70 - 130*		*07/19/14 06:13*	*1*
1,2-Dichloroethane-d4 (Surr)	*96*		*70 - 130*		*07/19/14 06:13*	*1*
Toluene-d8 (Surr)	*97*		*70 - 130*		*07/19/14 06:13*	*1*

Method: TO-15 - Volatile Organic Compounds in Ambient Air - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,1-Difluoroethane	**390**		3.5	ppb v/v			07/20/14 21:54	8.73

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,1-Difluoroethane	**1100**		9.4	ug/m3			07/20/14 21:54	8.73

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*100*		*70 - 130*		*07/20/14 21:54*	*8.73*
1,2-Dichloroethane-d4 (Surr)	*94*		*70 - 130*		*07/20/14 21:54*	*8.73*
Toluene-d8 (Surr)	*100*		*70 - 130*		*07/20/14 21:54*	*8.73*

Client Sample ID: EQ BLANK-070914

Lab Sample ID: 320-8396-2
Date Collected: 07/09/14 13:01
Matrix: Air
Date Received: 07/11/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			07/19/14 07:07	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			07/19/14 07:07	1
Tetrachloroethene	**6.7**		0.40	ppb v/v			07/19/14 07:07	1
Trichloroethene	ND		0.40	ppb v/v			07/19/14 07:07	1
Vinyl chloride	ND		0.40	ppb v/v			07/19/14 07:07	1

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			07/19/14 07:07	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			07/19/14 07:07	1
Tetrachloroethene	**45**		2.7	ug/m3			07/19/14 07:07	1
Trichloroethene	ND		2.1	ug/m3			07/19/14 07:07	1
Vinyl chloride	ND		1.0	ug/m3			07/19/14 07:07	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*98*		*70 - 130*		*07/19/14 07:07*	*1*

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8396-1

Client Sample ID: EQ BLANK-070914

Lab Sample ID: 320-8396-2

Date Collected: 07/09/14 13:01
Matrix: Air
Date Received: 07/11/14 09:15
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	92		70 - 130		07/19/14 07:07	1
Toluene-d8 (Surr)	100		70 - 130		07/19/14 07:07	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,1-Difluoroethane	140		1.8	ppb v/v			07/20/14 22:44	4.61

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,1-Difluoroethane	390		5.0	ug/m3			07/20/14 22:44	4.61

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	99		70 - 130		07/20/14 22:44	4.61
1,2-Dichloroethane-d4 (Surr)	93		70 - 130		07/20/14 22:44	4.61
Toluene-d8 (Surr)	99		70 - 130		07/20/14 22:44	4.61

Surrogate Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8396-1

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Matrix: Air **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		BFB	12DCE	TOL
Lab Sample ID	Client Sample ID	(70-130)	(70-130)	(70-130)
320-8396-1	SG-4-070914	99	96	97
320-8396-1 - DL	SG-4-070914	100	94	100
320-8396-2	EQ BLANK-070914	98	92	100
320-8396-2 - DL	EQ BLANK-070914	99	93	99
LCS 320-47678/5	Lab Control Sample	105	101	104
LCS 320-47678/6	Lab Control Sample	100	95	103
LCS 320-47700/3	Lab Control Sample	107	100	104
LCS 320-47700/5	Lab Control Sample	99	94	103
LCSD 320-47700/19	Lab Control Sample Dup	107	99	103
LCSD 320-47700/20	Lab Control Sample Dup	101	93	102
MB 320-47678/8	Method Blank	109	97	98
MB 320-47700/7	Method Blank	111	92	100

Surrogate Legend

BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)
TOL = Toluene-d8 (Surr)

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Lab Sample ID: MB 320-47678/8
Matrix: Air
Analysis Batch: 47678

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40		ppb v/v			07/19/14 00:06	1
trans-1,2-Dichloroethene	ND		0.40		ppb v/v			07/19/14 00:06	1
Tetrachloroethene	ND		0.40		ppb v/v			07/19/14 00:06	1
Trichloroethene	ND		0.40		ppb v/v			07/19/14 00:06	1
Vinyl chloride	ND		0.40		ppb v/v			07/19/14 00:06	1
1,1-Difluoroethane	ND		0.40		ppb v/v			07/19/14 00:06	1

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6		ug/m3			07/19/14 00:06	1
trans-1,2-Dichloroethene	ND		1.6		ug/m3			07/19/14 00:06	1
Tetrachloroethene	ND		2.7		ug/m3			07/19/14 00:06	1
Trichloroethene	ND		2.1		ug/m3			07/19/14 00:06	1
Vinyl chloride	ND		1.0		ug/m3			07/19/14 00:06	1
1,1-Difluoroethane	ND		1.1		ug/m3			07/19/14 00:06	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*109*		*70 - 130*		*07/19/14 00:06*	*1*
1,2-Dichloroethane-d4 (Surr)	*97*		*70 - 130*		*07/19/14 00:06*	*1*
Toluene-d8 (Surr)	*98*		*70 - 130*		*07/19/14 00:06*	*1*

Lab Sample ID: LCS 320-47678/5
Matrix: Air
Analysis Batch: 47678

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
cis-1,2-Dichloroethene			20.0	18.7		ppb v/v		94	70 - 130		
trans-1,2-Dichloroethene			20.0	18.3		ppb v/v		91	70 - 130		
Tetrachloroethene			20.0	19.1		ppb v/v		95	70 - 130		
Trichloroethene			20.0	18.7		ppb v/v		93	70 - 130		
Vinyl chloride			20.0	19.3		ppb v/v		97	70 - 130		

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
cis-1,2-Dichloroethene			79	74.2		ug/m3		94	70 - 130		
trans-1,2-Dichloroethene			79	72.5		ug/m3		91	70 - 130		
Tetrachloroethene			140	129		ug/m3		95	70 - 130		
Trichloroethene			110	100		ug/m3		93	70 - 130		
Vinyl chloride			51	49.4		ug/m3		97	70 - 130		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*101*		*70 - 130*
Toluene-d8 (Surr)	*104*		*70 - 130*

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-47678/6 — **Client Sample ID: Lab Control Sample**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 47678

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Difluoroethane	20.0	16.7		ppb v/v		84	70 - 130

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Difluoroethane	54	45.1		ug/m3		84	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*100*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*95*		*70 - 130*
Toluene-d8 (Surr)	*103*		*70 - 130*

Lab Sample ID: MB 320-47700/7 — **Client Sample ID: Method Blank**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 47700

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.40	ppb v/v			07/20/14 21:04	1
trans-1,2-Dichloroethene	ND		0.40	ppb v/v			07/20/14 21:04	1
Tetrachloroethene	ND		0.40	ppb v/v			07/20/14 21:04	1
Trichloroethene	ND		0.40	ppb v/v			07/20/14 21:04	1
Vinyl chloride	ND		0.40	ppb v/v			07/20/14 21:04	1
1,1-Difluoroethane	ND		0.40	ppb v/v			07/20/14 21:04	1

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		1.6	ug/m3			07/20/14 21:04	1
trans-1,2-Dichloroethene	ND		1.6	ug/m3			07/20/14 21:04	1
Tetrachloroethene	ND		2.7	ug/m3			07/20/14 21:04	1
Trichloroethene	ND		2.1	ug/m3			07/20/14 21:04	1
Vinyl chloride	ND		1.0	ug/m3			07/20/14 21:04	1
1,1-Difluoroethane	ND		1.1	ug/m3			07/20/14 21:04	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*111*		*70 - 130*		*07/20/14 21:04*	*1*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*07/20/14 21:04*	*1*
Toluene-d8 (Surr)	*100*		*70 - 130*		*07/20/14 21:04*	*1*

Lab Sample ID: LCS 320-47700/3 — **Client Sample ID: Lab Control Sample**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 47700

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	20.0	19.0		ppb v/v		95	70 - 130
trans-1,2-Dichloroethene	20.0	18.3		ppb v/v		92	70 - 130
Tetrachloroethene	20.0	19.6		ppb v/v		98	70 - 130
Trichloroethene	20.0	19.1		ppb v/v		96	70 - 130
Vinyl chloride	20.0	19.9		ppb v/v		99	70 - 130

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-47700/3 — **Client Sample ID: Lab Control Sample**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 47700

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	79	75.3		ug/m3		95	70 - 130
trans-1,2-Dichloroethene	79	72.7		ug/m3		92	70 - 130
Tetrachloroethene	140	133		ug/m3		98	70 - 130
Trichloroethene	110	103		ug/m3		96	70 - 130
Vinyl chloride	51	50.8		ug/m3		99	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*107*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*
Toluene-d8 (Surr)	*104*		*70 - 130*

Lab Sample ID: LCS 320-47700/5 — **Client Sample ID: Lab Control Sample**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 47700

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Difluoroethane	20.0	16.0		ppb v/v		80	70 - 130

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Difluoroethane	54	43.3		ug/m3		80	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*99*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*94*		*70 - 130*
Toluene-d8 (Surr)	*103*		*70 - 130*

Lab Sample ID: LCSD 320-47700/19 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 47700

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene	20.0	19.5		ppb v/v		97	70 - 130	2	25
trans-1,2-Dichloroethene	20.0	19.0		ppb v/v		95	70 - 130	3	25
Tetrachloroethene	20.0	19.6		ppb v/v		98	70 - 130	0	25
Trichloroethene	20.0	19.0		ppb v/v		95	70 - 130	1	25
Vinyl chloride	20.0	19.9		ppb v/v		99	70 - 130	0	25

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
cis-1,2-Dichloroethene	79	77.2		ug/m3		97	70 - 130	2	25
trans-1,2-Dichloroethene	79	75.2		ug/m3		95	70 - 130	3	25
Tetrachloroethene	140	133		ug/m3		98	70 - 130	0	25
Trichloroethene	110	102		ug/m3		95	70 - 130	1	25
Vinyl chloride	51	50.8		ug/m3		99	70 - 130	0	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*107*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*99*		*70 - 130*

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-47700/19
Matrix: Air
Analysis Batch: 47700

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Toluene-d8 (Surr)	*103*		*70 - 130*

Lab Sample ID: LCSD 320-47700/20
Matrix: Air
Analysis Batch: 47700

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,1-Difluoroethane			20.0	16.5		ppb v/v		83	70 - 130	3	25

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,1-Difluoroethane			54	44.6		ug/m3		83	70 - 130	3	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*101*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*93*		*70 - 130*
Toluene-d8 (Surr)	*102*		*70 - 130*

QC Association Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8396-1

Air - GC/MS VOA

Analysis Batch: 47678

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-8396-1	SG-4-070914	Total/NA	Air	TO-15	
320-8396-2	EQ BLANK-070914	Total/NA	Air	TO-15	
LCS 320-47678/5	Lab Control Sample	Total/NA	Air	TO-15	
LCS 320-47678/6	Lab Control Sample	Total/NA	Air	TO-15	
MB 320-47678/8	Method Blank	Total/NA	Air	TO-15	

Analysis Batch: 47700

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-8396-1 - DL	SG-4-070914	Total/NA	Air	TO-15	
320-8396-2 - DL	EQ BLANK-070914	Total/NA	Air	TO-15	
LCS 320-47700/3	Lab Control Sample	Total/NA	Air	TO-15	
LCS 320-47700/5	Lab Control Sample	Total/NA	Air	TO-15	
LCSD 320-47700/19	Lab Control Sample Dup	Total/NA	Air	TO-15	
LCSD 320-47700/20	Lab Control Sample Dup	Total/NA	Air	TO-15	
MB 320-47700/7	Method Blank	Total/NA	Air	TO-15	

Lab Chronicle

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8396-1

Client Sample ID: SG-4-070914 ← VW-13

Lab Sample ID: 320-8396-1

Date Collected: 07/09/14 12:50
Matrix: Air
Date Received: 07/11/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	737 mL	250 mL	47678	07/19/14 06:13	TAD	TAL SAC
Total/NA	Analysis	TO-15	DL	8.73	250 mL	250 mL	47700	07/20/14 21:54	TAD	TAL SAC

Client Sample ID: EQ BLANK-070914

Lab Sample ID: 320-8396-2

Date Collected: 07/09/14 13:01
Matrix: Air
Date Received: 07/11/14 09:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	545 mL	250 mL	47678	07/19/14 07:07	TAD	TAL SAC
Total/NA	Analysis	TO-15	DL	4.61	250 mL	250 mL	47700	07/20/14 22:44	TAD	TAL SAC

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Certification Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8396-1

Laboratory: TestAmerica Sacramento

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Arizona	State Program	9	AZ0708	08-11-15

Method Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8396-1

Method	Method Description	Protocol	Laboratory
TO-15	Volatile Organic Compounds in Ambient Air	EPA	TAL SAC

Protocol References:

EPA = US Environmental Protection Agency

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Sample Summary

Client: URS Corporation
Project/Site: Park-Euclid WQARF Site

TestAmerica Job ID: 320-8396-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
320-8396-1	SG-4-070914 VW-13	Air	07/09/14 12:50	07/11/14 09:15
320-8396-2	EQ BLANK-070914	Air	07/09/14 13:01	07/11/14 09:15

TestAmerica Sacramento
880 Riverside Parkway

West Sacramento, CA 95605
phone 916.374.4378 fax 916 372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact Information	Project Manager: Bob Boudrea	Samples Collected By: Erin Lancey	COC No
Company Name: URS	Phone:		1 of 1 COCs
Address 333 Wetmore Rd	Email: Robert.Boudrea@URS.com		
City/State/Zip Tucson AZ 85705			For Lab Use Only:
Phone 520 887 1800	Site Contact:		Walk-in Client
FAX:	TA Contact:		Lab Sampling
Project Name Park/Euclid	Anaylsis Turnaround Time		
Site/Location:	Standard (Specific)_____		Job / SDG No.:
P O #	Rush (Specify) _____		(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
SG-4-070914	7/9/14	1233	1250	26"	8"	7264	34001011	X											X			
EQ Blank - 070914	7/9/14	1257	1301	16"	2"	7178	34001618	X											X			

320-8396 Chain of Custody

	Temperature (Fahrenheit)			
Start	Interior	Ambient		
Stop				

	Temperature (Fahrenheit)			
Start	Interior	Ambient		
Stop				

Special Instructions/QC Requirements & Comments:

1,1-DFA is a Tenitively Idenified Compound

Samples Shipped by:	Date / Time:	Samples Received by:	
Samples Relinquished by:	Date / Time: 7-10-14 1435	Received by:	
Relinquished by:	Date / Time: 7-10-14 1530	Received by:	7/11/14 915
Lab Use Only: Shipper Name:	Opened by:	Condition:	

20°

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-8396
Sample # 1

Client/Project:		VFR ID:		
Canister Serial #:	34001011	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	7.38	07/14/14	EP for AO
FINAL PRESSURE (PSIA)	21.76	07/14/14	EP for AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.95			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
07/20/14	6.53	19.33	2.95	srs	8.73
			8.73		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #	
							7/18/2014	ATMS2		
Canister DF =	2.95	X	Load DF =	0.339213	X	Bag DF =	1	=	FINAL DF	1.000172824
			LVf (mLs)	250		BVf (mLs)				
			LVi (mLs)	737		Bvi (mLs)				
							Date	Instr.	File #	
							7/20/2014	ATMS2		
Canister DF =	8.73	X	Load DF =	1	X	Bag DF =	1	=	FINAL DF	8.728129915
			LVf (mLs)	250		BVf (mLs)				
			LVi (mLs)	250		Bvi (mLs)				
							Date	Instr.	File #	
Canister DF =	2.95	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)				
			LVi (mLs)			Bvi (mLs)				

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 320-8396
Sample # 2

Client/Project:		VFR ID:		
Canister Serial #:	34001618	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.50	07/14/14	EP for AO
FINAL PRESSURE (PSIA)	25.10	07/14/14	EP for AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.18			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
07/20/14	11.22	23.71	2.18		4.61
			4.61		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							7/18/2014	ATMS2			
Canister DF =	2.18	X	Load DF =	0.4587156	X	Bag DF =	1	=	FINAL DF 1.001196649		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	545		Bvi (mLs)					
							Date	Instr.	File #		
							7/20/2014	ATMS2			
Canister DF =	4.61	X	Load DF =	1	X	Bag DF =	1	=	FINAL DF 4.612268465		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	250		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.18	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

Login Sample Receipt Checklist

Client: URS Corporation

Job Number: 320-8396-1

Login Number: 8396

List Source: TestAmerica Sacramento

List Number: 1

Creator: Edwards, Stephanie N

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

320-7379 Chain of Custody

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Canister QC Certification

Certification Type: TO15 SCAN

Date Cleaned/Batch ID: 5/7/14 320-7379

Date of QC: 5/7/14

Data File Number: MS705071 1

CANISTER ID NUMBERS

34001946	34001047	
0807	0805	
0332	0680	
1073	1011	
1099	1618	
1067	0319	
1077	8318	
0904 ★	34000739	

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

1st level Reviewed By: [signature] Date: 5/8/14

2nd level Reviewed By: [signature] Date: 5/8/2014

Q:\FORMS\QA-814 CAN QC CERT 20130729.DOC
QA-814

ERS 7/29/2013

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-7379-1

SDG No.:

Client Sample ID: 34000904 | Lab Sample ID: 320-7379-8

Matrix: Air | Lab File ID: MS7050711.d

Analysis Method: TO-15 | Date Collected: 05/07/2014 00:00

Sample wt/vol: 500(mL) | Date Analyzed: 05/07/2014 22:06

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 41910 | Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
67-64-1	Acetone	0.35	J	5.0
107-02-8	Acrolein	ND		2.0
107-13-1	Acrylonitrile	ND		2.0
107-05-1	Allyl chloride	ND		0.80
71-43-2	Benzene	ND		0.40
100-44-7	Benzyl chloride	ND		0.80
75-27-4	Bromodichloromethane	ND		0.30
75-25-2	Bromoform	ND		0.40
74-83-9	Bromomethane	ND		0.80
106-99-0	1,3-Butadiene	ND		0.80
106-97-8	n-Butane	ND		0.40
78-93-3	2-Butanone (MEK)	ND		0.80
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0
104-51-8	n-Butylbenzene	ND		0.40
135-98-8	sec-Butylbenzene	ND		0.40
98-06-6	tert-Butylbenzene	ND		0.80
75-15-0	Carbon disulfide	ND		0.80
56-23-5	Carbon tetrachloride	ND		0.80
108-90-7	Chlorobenzene	ND		0.30
75-45-6	Chlorodifluoromethane	ND		0.80
75-00-3	Chloroethane	ND		0.80
67-66-3	Chloroform	ND		0.30
74-87-3	Chloromethane	ND		0.80
95-49-8	2-Chlorotoluene	ND		0.40
110-82-7	Cyclohexane	ND		0.40
124-48-1	Dibromochloromethane	ND		0.40
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80
74-95-3	Dibromomethane	ND		0.40
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40
95-50-1	1,2-Dichlorobenzene	ND		0.40
541-73-1	1,3-Dichlorobenzene	ND		0.40
106-46-7	1,4-Dichlorobenzene	ND		0.40
75-71-8	Dichlorodifluoromethane	ND		0.40
75-34-3	1,1-Dichloroethane	ND		0.30
107-06-2	1,2-Dichloroethane	ND		0.80
75-35-4	1,1-Dichloroethene	ND		0.80

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento
Job No.: 320-7379-1
SDG No.:
Client Sample ID: 34000904
Lab Sample ID: 320-7379-8
Matrix: Air
Lab File ID: MS7050711.d
Analysis Method: TO-15
Date Collected: 05/07/2014 00:00
Sample wt/vol: 500(mL)
Date Analyzed: 05/07/2014 22:06
Soil Aliquot Vol:
Dilution Factor: 1
Soil Extract Vol.:
GC Column: RTX-Volatiles ID: 0.32(mm)
% Moisture:
Level: (low/med) Low
Analysis Batch No.: 41910
Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
156-59-2	cis-1,2-Dichloroethene	ND		0.40
156-60-5	trans-1,2-Dichloroethene	ND		0.40
78-87-5	1,2-Dichloropropane	ND		0.40
10061-01-5	cis-1,3-Dichloropropene	ND		0.40
10061-02-6	trans-1,3-Dichloropropene	ND		0.40
123-91-1	1,4-Dioxane	ND		0.80
141-78-6	Ethyl acetate	ND		0.30
100-41-4	Ethylbenzene	ND		0.40
622-96-8	4-Ethyltoluene	ND		0.40
142-82-5	n-Heptane	ND		0.80
87-68-3	Hexachlorobutadiene	ND	*	2.0
110-54-3	n-Hexane	ND		0.80
591-78-6	2-Hexanone	ND		0.40
98-82-8	Isopropylbenzene	ND		0.80
99-87-6	4-Isopropyltoluene	ND		0.80
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80
80-62-6	Methyl methacrylate	ND		0.80
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40
75-09-2	Methylene Chloride	ND		0.40
98-83-9	alpha-Methylstyrene	ND		0.40
91-20-3	Naphthalene	ND	*	0.80
111-65-9	n-Octane	ND		0.40
109-66-0	n-Pentane	ND		0.80
115-07-1	Propylene	ND		0.40
103-65-1	N-Propylbenzene	ND		0.40
100-42-5	Styrene	ND		0.40
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40
127-18-4	Tetrachloroethene	ND		0.40
109-99-9	Tetrahydrofuran	ND		0.80
108-88-3	Toluene	ND		0.40
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40
120-82-1	1,2,4-Trichlorobenzene	ND	*	2.0
71-55-6	1,1,1-Trichloroethane	ND		0.30
79-00-5	1,1,2-Trichloroethane	ND		0.40
79-01-6	Trichloroethene	ND		0.40
75-69-4	Trichlorofluoromethane	ND		0.40

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-7379-1

SDG No.:

Client Sample ID: 34000904 Lab Sample ID: 320-7379-8

Matrix: Air Lab File ID: MS7050711.d

Analysis Method: TO-15 Date Collected: 05/07/2014 00:00

Sample wt/vol: 500(mL) Date Analyzed: 05/07/2014 22:06

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 41910 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL
96-18-4	1,2,3-Trichloropropane	ND		0.40
95-63-6	1,2,4-Trimethylbenzene	ND		0.80
108-67-8	1,3,5-Trimethylbenzene	ND		0.40
540-84-1	2,2,4-Trimethylpentane	ND		0.40
108-05-4	Vinyl acetate	ND		0.80
593-60-2	Vinyl bromide	ND		0.80
75-01-4	Vinyl chloride	ND		0.40
179601-23-1	m,p-Xylene	ND		0.80
95-47-6	o-Xylene	ND		0.40

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	90		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	92		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File:	\\SACCHROM\ChromData\ATMS7\20140507-12335.b\MS7050711.d				
Lims ID:	320-7379-A-8	Lab Sample ID:	320-7379-8		
Client ID:	34000904				
Sample Type:	Client				
Inject. Date:	07-May-2014 22:06:30	ALS Bottle#:	4	Worklist Smp#:	29
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Sample Info:	320-7379-A-8				
Misc. Info.:	500mL;34000904				
Operator ID:	SRS	Instrument ID:	ATMS7		
Method:	\\SACCHROM\ChromData\ATMS7\20140507-12335.b\TO15_ATMS7N.m				
Limit Group:	MSA - TO15 - ICAL				
Last Update:	08-May-2014 07:49:50	Calib Date:	25-Apr-2014 07:43:30		
Integrator:	RTE	ID Type:	Deconvolution ID		
Quant Method:	Internal Standard	Quant By:	Initial Calibration		
Last ICal File:	\\SACCHROM\ChromData\ATMS7\20140425-12096.b\MS7042120.d				
Column 1 :	RTX Volatiles (0.32 mm)		Det: MS SCAN		
Process Host:	XAWRK027				
First Level Reviewer: ortizam		Date:	08-May-2014 09:28:56		

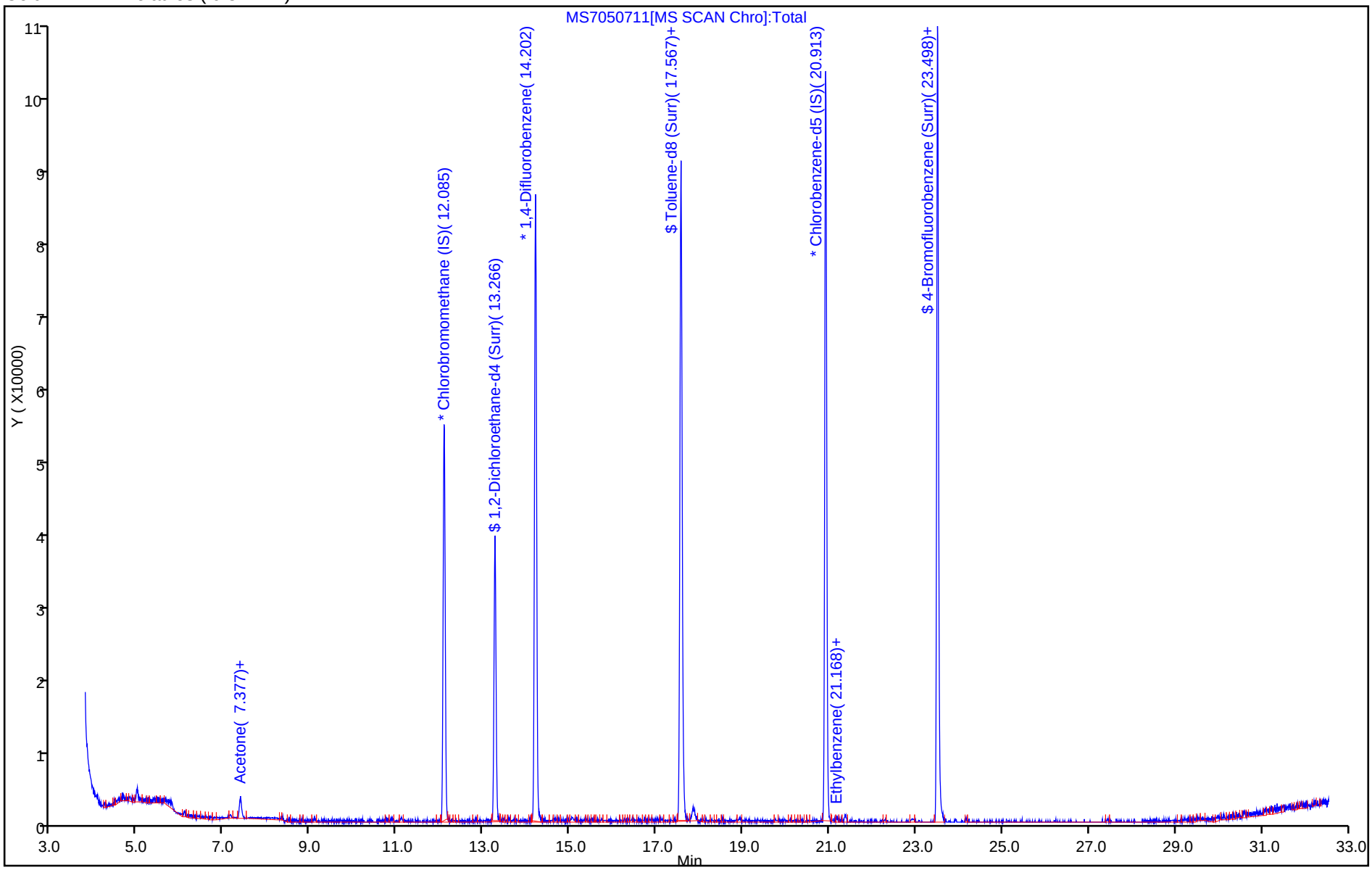
Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	OnCol Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.091	12.128	-0.037	89	30579	4.00	
* 2 1,4-Difluorobenzene	114	14.202	14.233	-0.031	87	125648	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.913	20.937	-0.024	80	103129	4.00	
$ 4 1,2-Dichloroethane-d4 (Sur	65	13.266	13.302	-0.036	92	45248	3.67	
$ 5 Toluene-d8 (Surr)	100	17.567	17.597	-0.030	87	75103	3.96	
$ 6 4-Bromofluorobenzene (Surr	95	23.498	23.516	-0.018	87	68820	3.60	
31 Acetone	43	7.377	7.340	0.037	70	7064	0.3463	
97 Ethylbenzene	91	21.174	21.198	-0.024	1	1101	0.0222	

Report Date: 08-May-2014 09:28:57 Chrom Revision: 2.2 14-Apr-2014 13:40:08

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140507-12335.b\MS7050711.d				
Injection Date:	07-May-2014 22:06:30	Instrument ID:	ATMS7	Operator ID:	SRS
Lims ID:	320-7379-A-8	Lab Sample ID:	320-7379-8	Worklist Smp#:	29
Client ID:	34000904				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	4
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)

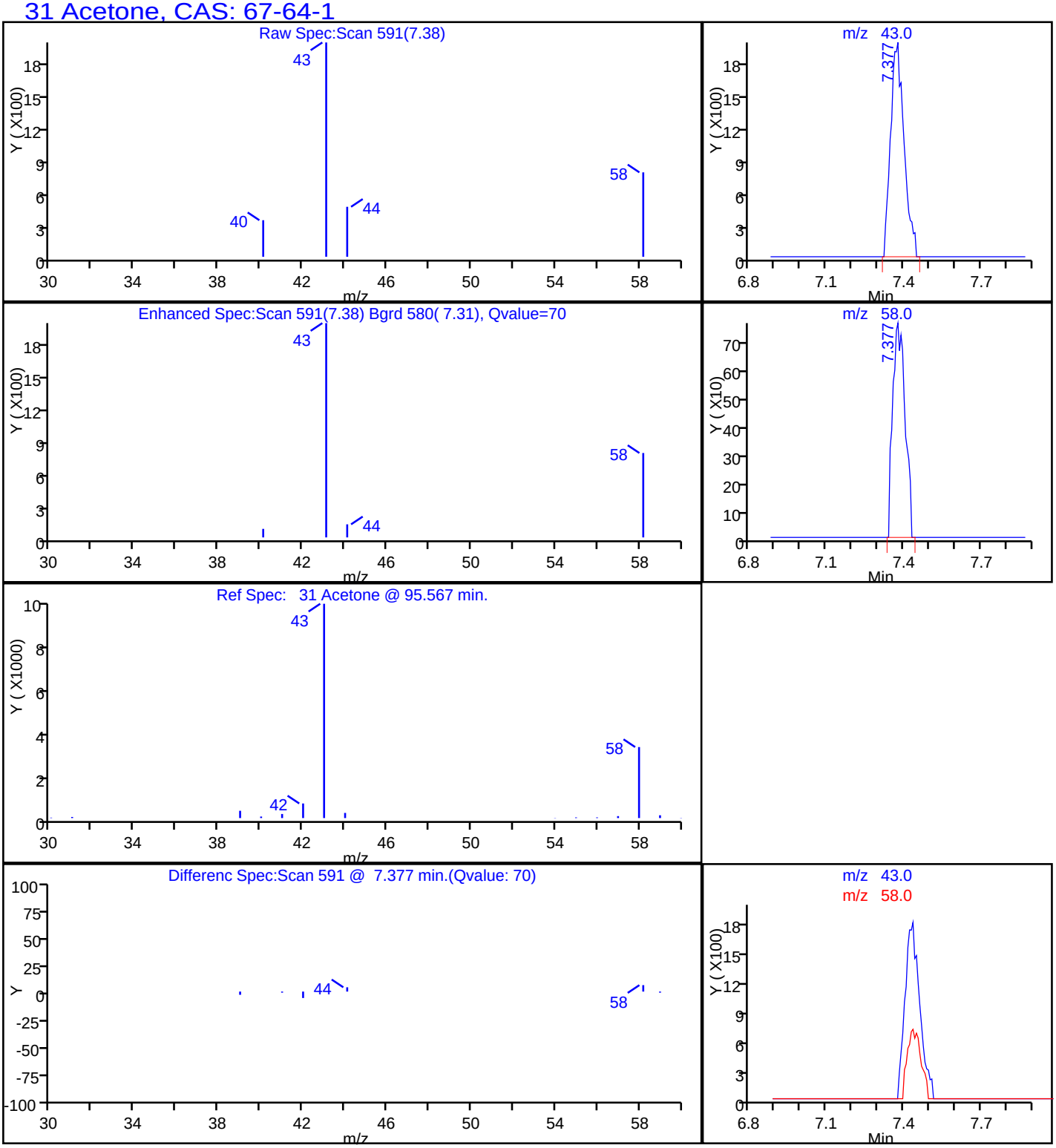


Report Date: 08-May-2014 09:28:57 Chrom Revision: 2.2 14-Apr-2014 13:40:08

TestAmerica Sacramento

Data File:	\\SACCHROM\ChromData\ATMS7\20140507-12335.b\MS7050711.d				
Injection Date:	07-May-2014 22:06:30	Instrument ID:	ATMS7		
Lims ID:	320-7379-A-8	Lab Sample ID:	320-7379-8		
Client ID:	34000904				
Operator ID:	SRS	ALS Bottle#:	4	Worklist Smp#:	29
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

31 Acetone, CAS: 67-64-1



A D D E N D U M

HUMAN HEALTH RISK ASSESSMENT FOR THE FEASIBILITY STUDY AND ASSOCIATED ACTIVITIES

PARK-EUCLID WQARF SITE TUCSON, ARIZONA

Prepared for

Park-Euclid Group

June 25, 2015

URS

URS Corporation
8181 E. Tufts Avenue
Denver, CO 80237

Project No. 22241866

TABLE OF CONTENTS

Section 1 **Introduction** **1-1**

Section 2 **Selection of COPCs** **2-1**

2.1 Step 1: Screening Level Analysis of Soil Gas Concentrations 2-1
2.2 Step 2: Screening Level Analysis of Predicted Indoor Air Concentrations 2-1

Section 3 **Summary and Conclusions** **3-1**

Section 4 **References** **4-1**

List of Tables

Table 1a Commercial/Industrial Screening Level Analysis of Soil Gas Concentrations

Table 1b Residential Screening Level Analysis of Soil Gas Concentrations

Table 3a Comparison of Predicted Concentrations of PCE in Indoor Air to RSLs for Industrial Indoor Air

List of Acronyms

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
COPC	chemical of potential concern
CR	cancer risk
FS	Feasibility Study
the Group	The Park – Euclid Group
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
J&E	Johnson & Ettinger
mg/m^3	milligrams per cubic meter
November 2014 HHRA	*Human Health Risk Assessment for the Feasibility Study and Associated Activities Park-Euclid WQARF Site Tucson, Arizona* (URS 2014)
PCE	tetrachloroethene
RSL	Regional Screening Level
Site	Park-Euclid WQARF Site
TCE	trichloroethene
URS	URS Corporation
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WQARF	Water Quality Assurance Revolving Fund

This document is an Addendum to the November 17, 2014 *Human Health Risk Assessment for the Feasibility Study and Associated Activities Park-Euclid WQARF Site Tucson, Arizona* (November 2014 HHRA) (URS 2014).

This Addendum updates the vapor intrusion human health risk assessment (HHRA) that had been conducted in support of the Feasibility Study (FS) and associated activities for the Park-Euclid Water Quality Assurance Revolving Fund (WQARF) Site (Site) in Tucson, Arizona. This Addendum was developed in accordance with the requirements of the Arizona Administrative Code (AAC) Title 18, Chapter 16, Section 407. This brief Addendum provides only information that is different from that in the November 2014 HHRA; the reader is referred to the November 2014 HHRA for information about the Site, the overall approach and process followed, and historical data. Tables and appendices follow those by the same designation in the 2014 HHRA unless described otherwise.

This Addendum was prepared to supplement the human health risks reported in the November 2014 HHRA using the newly-acquired soil gas data collected from the Site on February 3 and 4, 2015. The sample locations are shown in Figure 2-2 of the Feasibility Study Report. Land use was considered in this Addendum rather than all soil gas data being compared to residential risk-based criteria to provide a more realistic estimate of Site risks (i.e., the sample locations were generally grouped as residential or commercial/industrial according to the following land use types):

- Commercial/industrial (Table 2a: samples VW-01-05, VW-02-05, VW-04-05, VW-05-05, and VW-07-05)
- Residential or on commercial/industrial property but providing a conservative estimate of potential concentrations in residential areas (Table 2b: samples VW-03-05 and VW-06-05)

The data evaluation procedures were the same as those described in Section 2.2 of the November 2014 HHRA. Additionally, chemicals of potential concern (COPCs) were selected following the same screening-level approach as outlined in Section 2.3.1 of the 2014 HHRA.

2.1 STEP 1: SCREENING LEVEL ANALYSIS OF SOIL GAS CONCENTRATIONS

As described in the November 2014 HHRA:

> Maximum detected concentrations of [volatile organic compounds] VOCs in soil gas across the entire Site were multiplied by an attenuation factor of 0.01 as a conservative approach to account for the estimated decrease in concentrations of VOCs in soil gas versus the concentrations in indoor air. In this screening level analysis, the attenuated values were compared to [U.S. Environmental Protection Agency] USEPA Regional Screening Levels (RSLs) for residential indoor air protective to a hazard quotient (HQ) of 0.1 or a cancer risk (CR) of 1 x 10-6, whichever is more protective (USEPA 2014a) … The target HQ of 0.1 is used in the initial screening level analysis to minimize the likelihood of eliminating chemicals as COPCs whose cumulative non-cancer hazard index (HI) may add up to more than 1.0. It is common to use conservative assumptions (such as an HQ of 0.1) in the derivation of initial screening levels, because the exceedance of a screening level does not indicate that the chemicals pose an unacceptable risk. Rather, the exceedance of a screening level indicates that further evaluation of the chemical is necessary.

However, for this Addendum, results for sample locations identified as commercial/industrial land use are evaluated by comparing with January 2015 USEPA RSLs for industrial indoor air (Table 1a), whereas results for sample locations identified as residential land use are compared with January 2015 USEPA RSLs for residential indoor air (Table 1b). For the commercial/industrial data set, tetrachloroethene (PCE) was the only analyte for which the attenuated maximum concentration exceeded the screening level; PCE was selected for further evaluation. For the residential data set, no detected analytes had attenuated maximum detected concentrations greater than the screening levels; therefore, no analytes were identified for further evaluation in the residential data set.

2.2 STEP 2: SCREENING LEVEL ANALYSIS OF PREDICTED INDOOR AIR CONCENTRATIONS

For PCE in the commercial/industrial data set, further evaluation was conducted, consistent with Section 2.3.2 of the 2014 HHRA. For this Addendum, the same Johnson & Ettinger (J&E) modelling inputs were used in the 2004 SG-SCREEN version of the model, except that only PCE was modeled and the maximum PCE concentration from the 2015 commercial/industrial data set was used. The J&E-predicted indoor air concentration of 0.2 milligrams per cubic meter (mg/m^3) was compared with USEPA's January 2015 industrial indoor air RSLs for both cancer and non-cancer endpoints. The resulting ratios provide estimated of cancer and non-cancer risk, as shown in Table 3a. The implied HQ for the commercial/industrial worker is 1; in other words, current conditions are protective of workers to an HW of 1. The implied CR for commercial/industrial workers is 4×10^{-6}, which is within the target range for commercial/industrial workers. Therefore, PCE was not selected as a COPC.

Soil gas collected at seven locations was analyzed for PCE, trichloroethene (TCE), cis-1,2-dichlorethene, trans-1,2-dichloroethene, and vinyl chloride. These data were sorted into two data sets based on the land use represented by the sample locations: residential or commercial/industrial.

In the first step of selection of COPCs (screening level analysis of soil gas concentrations), maximum detected concentrations of VOCs in soil gas in each data set were multiplied by an attenuation factor of 0.01 for comparison to USEPA RSLs for industrial or residential indoor air protective to an HQ of 0.1 and a CR of 1×10^{-6} (USEPA 2015). trans-1,2-Dichloroethene and vinyl chloride were not detected at any sampling locations at the Site, and therefore, were not evaluated further in the HHRA. cis-1,2-Dichloroethene was detected in 50% of the samples in the residential data set and 40% of the samples in the commercial/industrial data set. However, there are no toxicity values or screening levels for inhalation of cis-1,2-dichloroethene in air. Therefore, cis-1,2-dichloroethene could not be evaluated in the screening level analysis of soil gas concentrations. TCE was not detected in the residential data set and the attenuated concentration of TCE in the commercial/industrial data set did not exceed the screening level. Attenuated concentrations of PCE in the commercial/industrial data set did exceed the RSL for industrial indoor air protective to an HQ of 0.1 and a CR of 1×10^{-6} (USEPA 2015), but did not exceed the residential RSL. Therefore, PCE in the commercial/industrial data set was evaluated further in the HHRA.

In the next step of the selection of COPCs (screening level analysis of predicted indoor air concentrations), indoor air concentrations of PCE were predicted with the J&E model using the maximum detected soil gas concentration in the commercial/industrial data set. The predicted indoor air concentration of PCE was compared with USEPA industrial indoor air RSLs to develop (by a ratio approach) an implied HQ and CR. The implied HQ was 1 (the target is less than or equal to 1) and the implied CR was 4×10^{-6}, which is within the target range for commercial/industrial workers. (ADEQ uses a target of 10^{-5} for workers.) Therefore, no COPCs were selected at the Site based on the screening level analysis of soil gas concentrations and the screening level analysis of predicted indoor air concentrations.

Because no COPCs were selected, it was not necessary to perform further quantitative estimates of CR and HI beyond the screening stage for residents and commercial/industrial workers exposed to indoor air impacted by VOCs in soil and groundwater at the Site. Based on the soil gas sampling results and HHRA performed at the Site, potential exposure of residents or commercial/industrial workers to trans-1,2-dichloroethene (not detected), vinyl chloride (not detected), TCE (not detected in the residential data set and attenuated indoor air concentration in the commercial/industrial data set less than industrial RSL), and PCE (attenuated concentration in the residential data set less than the residential RSL) would not pose an unacceptable threat to human health. Likewise, the predicted indoor air concentration for PCE in the commercial/industrial data set yields implied HQ and CR within target ranges that do not indicate an unacceptable threat to human health. Because there are no indoor air RSLs for cis-1,2-dichloroethene, there is uncertainty associated with potential impacts from human exposure to cis-1,2-dichloroethene in indoor air impacted by groundwater and soil at the Site.

In conclusion, the available soil gas data suggest that there are no indoor air hazards posed by VOCs to residents or workers that were grouped within the residential scenario. The available soil gas data also indicate that the predicted indoor air concentrations in the commercial/industrial data set yields HQ and CR within target ranges which also suggests that VOCs would not pose an unacceptable human health threat to workers.

URS Corporation (URS). 2014. Human Health Risk Assessment for the Feasibility Study and Associated Activities Park-Euclid WQARF Site Tucson, Arizona. November 17.

U.S. Environmental Protection Agency (USEPA). 2015. USEPA Master Regional Screening Level (RSL) Table. (TR=1E-6, HQ=0.1). January.

Table 1a
Commercial/Industrial
Screening Level Analysis of Soil Gas Concentrations

Analyte	CAS Number	Number of Samples	Number of Detections	Frequency of Detection	Maximum Detected Concentration (mg/m^3)	Maximum Detected Concentration with Attenuation Factor of 0.01 Applied (mg/m^3)[1]	Industrial Indoor Air RSL (USEPA 2015) (mg/m^3)[2]	Basis for RSL	Maximum Detected Concentration > RSL?
cis-1,2-Dichloroethene	156-59-2	5	2	40%	2.40E+00	2.40E-02	NV	-	NV
Tetrachloroethene	127-18-4	5	5	100%	1.36E+02	1.36E+00	1.80E-02	n	**Yes**
trans-1,2-Dichloroethene	156-60-5	5	0	0%	ND	ND	NV	-	ND
Trichloroethene	79-01-6	5	1	20%	5.10E-03	5.10E-05	8.80E-04	n	No
Vinyl chloride	75-01-4	5	0	0%	ND	ND	2.80E-03	c*	ND

[1] An attenuation factor of 0.01 is a conservative approach to account for the potential decrease in concentrations of VOCs in soil gas versus the concentrations in indoor air.
[2] RSLs are based on a target HQ of 0.1 or a target CR of 1×10^{-6}. For chemicals that had RSLs both for an HQ of 0.1 and a CR of 1×10^{-6}, the lower of the two resulting RSLs was selected.

Acronyms:
c* - cancer risk; * = where: n SL < 100X c SL
CR - cancer risk
HQ - hazard quotient
mg/m^3 - milligrams per cubic meter
n - noncancer hazard
ND - not detected (at the site)
NV - no value (no Residential Indoor Air RSL for this analyte)
RSL - Regional Screening Level
USEPA - U.S. Environmental Protection Agency
VOC - volatile organic compound

References:
U.S. Environmental Protection Agency (USEPA). 2015. USEPA Summary Regional Screening Level (RSL) Table (TR = 1E-6, THQ=0.1). January.

Table 1b
Residential
Screening Level Analysis of Soil Gas Concentrations

Analyte	CAS Number	Number of Samples	Number of Detections	Frequency of Detection	Maximum Detected Concentration (mg/m^3)	Maximum Detected Concentration with Attenuation Factor of 0.01 Applied (mg/m^3)[1]	Residential Indoor Air RSL (USEPA 2015) (mg/m^3)[2]	Basis for RSL	Maximum Detected Concentration > RSL?
cis-1,2-Dichloroethene	156-59-2	2	1	50%	2.10E-03	2.10E-05	NV	-	NV
Tetrachloroethene	127-18-4	2	2	100%	3.50E-02	3.50E-04	4.20E-03	n	No
trans-1,2-Dichloroethene	156-60-5	2	0	0%	ND	ND	NV	-	ND
Trichloroethene	79-01-6	2	0	0%	ND	ND	2.10E-04	n	ND
Vinyl chloride	75-01-4	2	0	0%	ND	ND	1.70E-04	c*	ND

[1] An attenuation factor of 0.01 is a conservative approach to account for the potential decrease in concentrations of VOCs in soil gas versus the concentrations in indoor air.
[2] RSLs are based on a target HQ of 0.1 or a target CR of 1×10^{-6}. For chemicals that had RSLs both for an HQ of 0.1 and a CR of 1×10^{-6}, the lower of the two resulting RSLs was selected.

Acronyms:
c* - cancer risk; * = where: n SL < 100X c SL
CR - cancer risk
HQ - hazard quotient
mg/m^3 - milligrams per cubic meter
n - noncancer hazard
ND - not detected (at the site)
NV - no value (no Residential Indoor Air RSL for this analyte)
RSL - Regional Screening Level
USEPA - U.S. Environmental Protection Agency
VOC - volatile organic compound

References:
U.S. Environmental Protection Agency (USEPA). 2015. USEPA Summary Regional Screening Level (RSL) Table (TR = 1E-6, THQ=0.1). January.

Table 3a
Comparison of Predicted Concentrations of PCE in Indoor Air to RSLs for Industrial Indoor Air

Analyte	Maximum Detected Concentration in Soil Gas (mg/m^3)	Predicted Concentration in Indoor Air (mg/m^3)	Industrial Indoor Air RSL (USEPA 2015) (mg/m^3)	Basis for Industrial Indoor Air RSL	Predicted Indoor Air Concentration > Industrial Indoor Air RSL?	Ratio of Exceedence (1)	Implied HQ or CR
Noncancer Hazard Evaluation	1.36E+02	2.0E-01	1.8E-02	HQ = 0.1	Yes	1.1E+00	HQ = 1
Cancer Risk Evaluation	1.36E+02	2.0E-01	4.7E-02	CR = 1×10^{-6}	Yes	4.3E+00	CR = 4×10^{-6}

(1) Ratio of exceedence calculated for the noncancer hazard evaluation using the following equation: (Predicted Concentration in Indoor Air) / ([Industrial Indoor Air RSL] * 10).
Ratio of exceedence calculated for the cancer risk evaluation using the following equation: (Predicted Concentration in Indoor Air) / (Industrial Indoor Air RSL).

Acronyms:
CR - cancer risk
HQ - hazard quotient
mg/m3 - milligrams per cubic meter
RSL - Regional Screening Level
USEPA - U.S. Environmental Protection Agency

References:
U.S. Environmental Protection Agency (USEPA). 2015. USEPA Summary Regional Screening Level (RSL) Table (TR = 1E-6, THQ=0.1). January.

Appendix E

Evaluation of Future Vapor Intrusion Risk Tech Memo

M E M O R A N D U M

TO: Geoffrey Uhlemann (AECOM-Denver)
Project 22241866

FROM: Bart Eklund (AECOM-Austin)

DATE: January 7, 2015

RE: Evaluation of Vapor Intrusion for the Park-Euclid Site

The Park-Euclid Water Quality Assurance Revolving Fund (WQARF) Site is located east of downtown Tucson, Arizona. Dry-cleaning operations using tetrachloroethylene (PCE) took place at this location for several decades, ending in 1985. During that time period there were releases of PCE to the subsurface. Various steps have been taken to address the subsurface contamination including soil vapor extraction (SVE) in the upper vadose zone (during the years 2000 – 2002 and 2004 – 2006) and multiphase extraction (MPE) in the perched aquifer (during the years 2008 – 2009, and 2011 – 2014).

The vapor intrusion (VI) pathway for PCE and its biological breakdown products was evaluated as part of a recent human health risk assessment (i.e., URS Technical Memorandum dated November 17, 2014). The primary line of evidence used in that VI evaluation was soil-gas data collected in 2014 at a depth of 1.5m (5 ft.) below ground surface (bgs) from 13 locations (seven permanent soil vapor monitoring points and six temporary soil gas probes). A conservative approach was used to estimate potential indoor air exposures and it was determined that predicted indoor air concentrations due to potential VI would all be below US EPA Regional Screening Levels (RSLs) for either residential air or industrial air (based on a 1E-06 cancer risk and a Hazard Quotient [HQ] of 1 for non-cancer effects).

The 2014 VI evaluation is the best estimate of <u>current</u> VI risk at the site and it is the best estimate of <u>future</u> VI risk at the site for areas outside the zone of influence of the SVE and MPE systems during their former operation. Now that the MPE system has been turned off, however, the soil-gas concentrations of PCE and other volatile organic compounds (VOCs) within the zone of influence are expected to increase. This “rebound” in VOC concentrations is due to the relatively slow kinetics of reaching a new steady-state as partitioning from the dissolved phase to the gas phase occurs at the vapor source and the slow rate of vapor transport to shallower soil depths from contaminant mass in the source area contained within the diesel product and perched aquifer groundwater.

OBJECTIVE

This memorandum summarizes the results of an evaluation of potential future vapor intrusion at the site for areas within the zone of influence of the MPE system based on numerical modeling of contaminant mass present in the perched aquifer groundwater and product.

CONCEPTUAL SITE MODEL

The vadose zone at this site is approximately 60m (200 ft.) thick and divided into an upper and lower zone on either side of a perched aquifer water table present about 27m (90 ft.) bgs. The perched aquifer is present due to an underlying clay layer, and this combination effectively seals off any upward migration of vapors from the lower vadose zone. The breakdown products of PCE that have been detected in the perched aquifer are:

- Trichloroethylene (TCE);
- cis-1,2-Dichloroethylene (cis-1,2-DCE);
- trans-1,2-Dichloroethylene (trans-1,2-DCE); and
- Vinyl Chloride (VC).

The perched aquifer is only about 1m thick on average. A layer of free-phase diesel product is present floating atop the perched aquifer beneath the Plant area and partially extending north of the Plant. The diesel originated from an up-gradient release unrelated to Site operations. PCE releases from the Plant area migrated vertically and dissolved into the diesel layer and perched aquifer groundwater. The diesel layer averages about 0.5m in thickness.

The soils in the upper vadose zone are primarily fine to coarse sands, with varying amounts of gravel, clayey sands, silty sands, and sandy clays. The part of the site within the zone of influence of the MPE system is the block bounded by E 13th St. and E. Manlove St. to the north and south, and S. Fremont Ave. and S. Park Ave. to the east and west. This block contains a parking lot, loading docks, and a large slab-on-grade building used for industrial laundry and linen supply services. Future residential use is unlikely but there are no administrative controls limiting such future use.

TIME TO REACH STEADY STATE

Any releases of PCE ended in 1985 and steady-state conditions were established at some point. Perturbations to the system, such as turning on the MPE or SVE systems or shutting them off, will cause the system to move towards a new steady state. In the vadose zone, the dominant transport process now is assumed to be diffusion of vapors from the perched aquifer towards the ground surface.[1] Diffusion, however, is a slow process and it may take years to reach a new

[1] Advective (pressure-driven) transport is expected to be significant only in the top 1m or so of the soil column at this site.

steady-state condition (i.e., for soil-gas concentrations within the soil column overlying the perched aquifer to stop increasing). The time will be longest for shallower soils due to their distance from the source of vapors. The time to reach steady-state can be calculated as follows:[2]

$$t = (L)^2 / D_a \qquad \text{(Eq. 1)}$$

where: t = time (sec);
L = length (cm); and
Da = diffusivity in air (cm2/sec)

The tortuosity of the soil pathways typically is assumed to increase the distance by a factor of 3x (i.e., the effective length is 3x the actual length). Most VOCs have a diffusivity in air of about 0.1 cm^2/s. The physical properties of interest for the compounds under consideration are shown in Table 1.

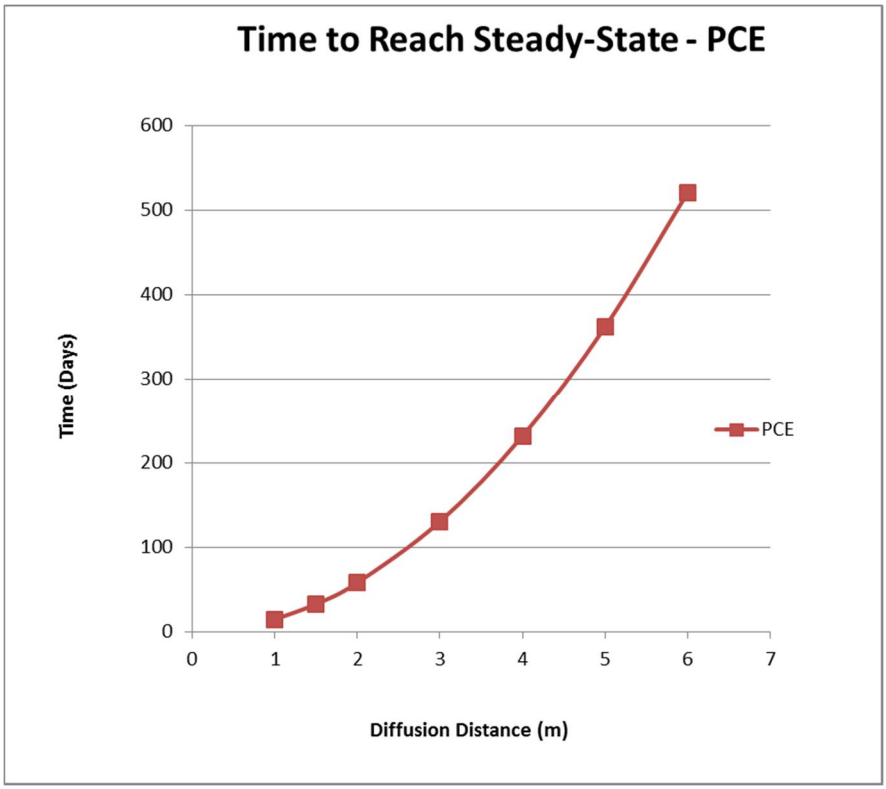
Table 1. Physical Properties for VOCs of Interest

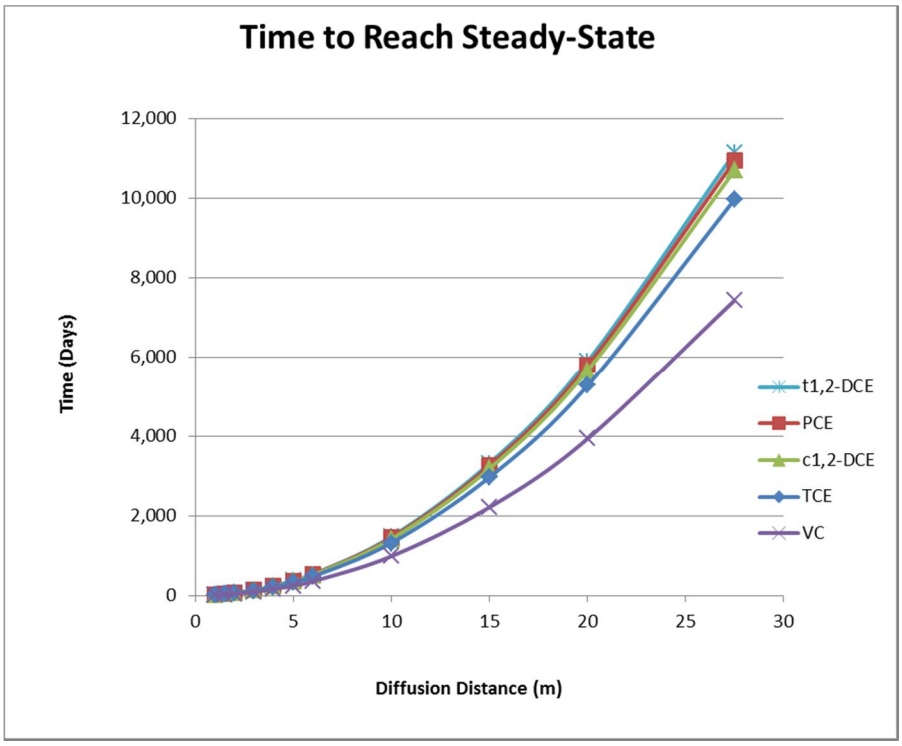
Compound	CAS #	Molecular Weight (g/mol)	Diffusivity in Air (cm2/s)	Diffusivity in Water (cm2/s)	Conversion Factor at Room Temperature
PCE	127-18-4	165.8	7.20E-02	8.20E-06	1 ppbv = 6.78 µg/m3
TCE	79-01-6	131.4	7.90E-02	9.10E-06	1 ppbv = 5.37 µg/m3
cis-1,2-DCE	156-59-2	96.9	7.36E-02	1.13E-05	1 ppbv = 3.97 µg/m3
trans-1,2-DCE	156-60-5	96.9	7.07E-02	1.19E-05	1 ppbv = 3.97 µg/m3
VC	75-01-4	62.5	1.06E-01	1.23E-05	1 ppbv = 2.56 µg/m3

Using the diffusivity in air values from Table 1, the time to reach steady-state conditions was calculated for distances up to and including the 27.5m (90 ft) distance between the perched aquifer and the ground surface (the calculations do not take into account any time lag due to diffusion from the bulk liquid to the boundary layer at the top of the perched aquifer). The results are shown in Figures 1 and 2.

Figure 1 shows predicted times for PCE over relatively short distances (up to 6m [20 ft.]). While steady-state conditions may be reached in about two weeks for a distance of 1m, it can take more than one year for a distance of 6m. Figure 2 shows results for all five compounds in Table 1 for

[2] Devitt, D.A., R.B. Evans, W.A. Jury, T.H. Starks, B. Eklund, and A. Gholson. Soil Gas Sensing for Detection and Mapping of Volatile Organics. EPA/600/8-87/036. 1987.





Figures 1 and 2. Estimated Time to Reach Steady-State Conditions

distances up to 27.5m. Vinyl chloride moves somewhat faster than the other compounds, but the results for all five compounds are roughly similar. For PCE, it is estimated to take 4 years to reach steady-state for a 10m distance. **For a 27.5m (90 ft.) distance, it is estimated that it will take 30 years for PCE to reach steady-state conditions**. In reality, the times may be shorter if transport occurs via processes other than diffusion.

The potential for a source of PCE and other VOCs to be present in the soils above the perched aquifer was considered, but there is no evidence for that type of source based on vertical soil-gas profiles from multiple locations at 5, 30, 55 and 85 ft. bgs. The vertical profile data were collected in 2004 – 2005 and again from 2011 – 2014. In addition to the mass of PCE and other VOCs in the soil gas, there is – of course – some additional mass partitioned into soil pore water and organic matter in the vadose zone. There is not, however, any evidence for a source of vapors other than the aquifer. If there were, we would expect to see much higher soil-gas concentrations at depths near the source and a concentration gradient leading away from the source.

ESTIMATED FUTURE VI

The source of PCE vapors is the perched aquifer. The most recent data on dissolved VOC concentrations in the aquifer is from 23 separate samples collected during April 2014. The frequency of detection and the median concentration for the detected values are shown in Table 2.

Table 2. Perched Aquifer Data for VOCs of Interest

Compound	Frequency of Detection[a]	Median Groundwater Conc.[b] (µg/L)	Comments
PCE	26%	33	
TCE	39%	37	
cis-1,2-DCE	61%	8,150	
trans-1,2-DCE	43%	220	
VC	48%	110	No VC was detected in shallow soil gas

a – The total number of locations sampled was 23

b – Based on detected values only. For the full set of 23 measured values, the median was ND for the four VOCs with a frequency of detection of <50%.

The concentrations were variable, with the higher dissolved phase concentrations generally at locations with an overlying layer of free-phase diesel product. The spatial variability was greatest for cis-1,2-DCE. For PCE, for example, the maximum concentration was 75 µg/L in areas without free-phase diesel product and 83 µg/L in areas with free-phase diesel product.

Indoor air concentrations were predicted using the EPA spreadsheets that contain the Johnson & Ettinger (J&E) model (USEPA, 2004). The most recent publicly available version of the J&E model was used (February 2004 version of the groundwater screening model).[3] The EPA spreadsheet version of the J&E model incorporates soil lithology, and building parameters to estimate indoor air concentrations. The model is designed to be conservative and the model predictions are likely to grossly over-predict the amount of vapor intrusion.

The median groundwater concentrations in Table 2 were used as the basis for the model inputs as these represent a realistic, worst-case scenario. The median was selected instead of the mean as being a better representation of a reasonable, worst-case average concentration within the aquifer (using the mean would tend to give undue weighting to any small "hot spots" that may be present). Using maximum groundwater values would yield an absolute worst-case, but given the amount of spatial variability seen in the groundwater data, this would be overly conservative.

As seen in Table 1, the diffusivity in water for a given chemical is typically about 10,000x smaller than the diffusivity in air for the same compound. In other words, mixing and transport due to diffusion are much, much slower in the dissolved phase than in the gas phase. This is consistent with real world experience (e.g., measured air emissions from wastewater treatment lagoons increase as a function of wind speed, due to the greater mixing within the water with higher wind speeds). The free-product diesel layer atop the perched aquifer will add another layer of resistance to vapor transport (any dissolved volatiles that migrate to the top of the water table must then migrate through the diesel layer before volatilization can occur). Vadose zone concentrations above the diesel layer are expected to be several orders of magnitude lower than if the diesel layer were not present. To account for this added attenuation, the input groundwater concentrations were decreased by a factor of 10x.

The model assumptions used are shown in the attached spreadsheet page from the PCE modeling in Attachment A. Overall, the level of conservativeness is comparable to that used in the 2014 vapor intrusion evaluation. The 2014 modeling assumed a clay loam soil based on the soil type at the 1.5m sampling depths. For the current modeling, the soil column was assumed to be primarily sand, with relatively thin layers of sandy clay near the ground surface and at the perched aquifer (see Attachment A).

[3] http://www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm

The results of the modeling using current conditions (April 2014) are shown in Table 3 below. Note that these are the indoor air concentrations predicted to occur under steady-state conditions (after the time lag depicted in Figures 1 and 2). The predicted indoor air concentrations are below conservative risk-based screening levels for all compounds.

Table 3. Predicted Indoor Air Concentrations for VOCs of Interest

Compound	Predicted Indoor Air Conc. (µg/m3)	USEPA RSL Residential Air (µg/m3)	USEPA RSL Industrial Air (µg/m3)
PCE	0.02	11	47
TCE	0.02	0.48	3.0
cis-1,2-DCE	2.5	N/A	N/A
trans-1,2-DCE	0.10	N/A	N/A
VC	0.12	0.17	2.8

Note: There are no RSLs established for cis- or trans-1,2-DCE.

One uncertainty is the amount of additional chemical or bio- degradation that will occur in the coming years. The amount of PCE and TCE in the perched aquifer is expected to decrease over time but the concentration of vinyl chloride may increase. Therefore, the J&E model was also used to back-calculate the necessary groundwater median concentrations that would need to be present to result in an exceedance of RSLs at steady-state conditions. These values are presented in Table 4. If the diesel product layer ceased to exist, the values are decreased by a factor of 10x (e.g., PCE would be 2,070 µg/L).

Table 4. Trigger Levels for VOCs of Interest

Compound	Allowable Average Groundwater Concentration (µg/L)		Comment
	Without Diesel Present	With Overlying Diesel	
PCE	2,070	20,700	
TCE	115	1,150	
cis-1,2-DCE	N/A	N/A	No value can be calculated because no RSL exists
trans-1,2-DCE	N/A	N/A	
VC	16	158	

The J&E modeling assumes an infinite source of groundwater contamination. In reality, the perched aquifer is shallow and contains a finite amount of PCE and other chlorinated VOCs. The mass of PCE in the perched aquifer, for example, is not sufficient to support decades of indoor air impacts at levels equal to or exceeding the RSLs.[4] Therefore, a mass-limited scenario applies to this site. This increases the likelihood that the actual long-term indoor air impacts will be less than the predicted concentrations shown in Table 3.

SUMMARY AND CONCLUSIONS

Conditions will change at the area of the site formerly influenced by the MPE system. The soil-gas concentrations immediately above the perched aquifer will increase as VOCs migrate through the aquifer (or diesel layer) to the boundary layer (i.e., the interface between the liquid phase and the air-filled soil pore spaces. Soil-gas concentrations gradually will increase in the overlying soil column as vapors diffuse from areas of relatively high concentration to areas of lower concentration. This process, however, may take years or even decades to complete given the depth to the perched aquifer. Based on the available lines of evidence, vapor intrusion is not expected to pose an unacceptable risk or hazard in the future. The potential for future VI risk can be assessed by comparing future perched aquifer groundwater monitoring results against the predicted groundwater concentrations needed to result in RSL exceedances, as shown in Table 4.

[4] For a 10m x 10m x 2.44m building, with 0.25 ACH, the rate of air flow through the building is 60.8 m3/hr or 533,000 m3/yr. If that air had 11 ug/m3 (the residential RSL concentration), a total mass of 5.9 g/yr of PCE would be vented through the building. Over 30 years, this would be 176 g. The underlying perched aquifer has a volume of 10m x 10m x 1m = 100 m3 = 100,000 L. Based on the median PCE concentration of 33 ug/L, the total mass in the perched aquifer underlying the building is 3.3 g. In other words, there is not enough mass in the perched aquifer to lead to an exceedance of the RSL for one year even if all the mass entered the building. The diesel layer contains some additional mass of PCE and other chlorinated VOCs, but this mass is not known with certainty and is assumed to be insignificant.

ATTACHMENT A

INPUT VALUES for J&E MODELING

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
127184	3.30E+00	Tetrachloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	10	2750	250	2250	250	A	SC			1.00E-08

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	S	1.66	0.375	0.054	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Appendix F

Allowable Vapor Concentrations Back-Calculations

F-1 Using SRLs in the UVZ

F-2 Using GPLs in the LVZ

OBJECTIVE

To assess whether a Declaration of Environmental Use Restriction (DEUR) would be needed for the Mission Plant area due to soil concentrations exceeding residential soil remediation levels (SRLs). A few soil samples collected in association with the RI exceeded residential SRLs, but were below non-residential SRLs. However, no soil samples have been collected following the implementation of the soil vapor extraction (SVE) and multiphase extraction (MPE) early response actions (ERAs), which have likely reduced soil concentrations. Therefore, present soil conditions can be estimated using recent soil vapor concentrations, assuming equilibrium/steady-state conditions.

PROCESS

Per A.A.C. R18-7-203(C), soil vapor concentrations may be used to estimate the contaminant concentration in soil; therefore, allowable soil vapor concentrations were back-calculated from residential SRLs to estimate vapor concentrations for which residential SRLs would be met assuming equilibrium conditions. These allowable vapor concentrations were compared to April 2014 and February 2015 upper vadose zone (UVZ) vapor concentrations. This process is detailed below.

Instead of estimating soil concentrations from observed vapor concentrations for each event, maximum allowable vapor concentrations were back-calculated from the residential and non-residential RSLs assuming equilibrium conditions using the three-phase partitioning equation shown in the graphic below taken from page 17 of ADEQ's *Soil Vapor Sampling Guidance* (Revised May 19, 2011).

$$C_t = \frac{C_g\,[K_{oc} f_{oc} \rho_b / H_o + \theta_w / H_o + (\theta_t - \theta_w)]}{\rho_b}$$

where,

C_t – Total concentration in soil (µg/kg)

C_g – Concentration in soil vapor (µg/L)

f_{oc} – Mass fraction of natural soil organic carbon content (g-organic carbon/g-soil)

K_{oc} – Soil organic carbon-water partitioning coefficient (ml/g)

ρ_b – Dry Bulk Density (kg/L)

H_o – Henry's Law Constant (dimensionless)

θ_t – Total soil porosity (volume of voids/volume total)

θ_w – Volumetric Water Content (volume of water/volume of soil)

Ref: ADEQ 2011

Values used in the above equation are shown in the table below (Table 1) and generally utilize the default values list in ADEQ's guidance (2011).

Table 1 – Partitioning Parameters

Parameter	Units	Soil Value				
f_{oc}	g-c/g-soil	0.006				
ρ_b	kg/L	1.5				
θ_t	-	0.43				
θ_w	-	0.15				
COC Specific			PCE	TCE	cDCE	VC
K_{oc}	L/kg (ml/g)	NA	1.55E+02	1.66E+02	3.55E+01	1.86E+01
H_o	-		7.54E-01	4.22E-01	1.67E-01	1.11E+00
MW	g/mol		1.66E+02	1.31E+02	9.70E+01	6.25E+01

Using these partitioning parameters, allowable vapor concentrations were back-calculated from residential and non-residential SRLs and compared to UVZ vapor concentrations, as shown in Table 2 below.

Table 2 – Comparison of UVZ Vapor Concentrations to Back-Calculated Allowable Vapor Concentrations

Parameter		Unit	PCE	TCE	cDCE	VC
SRLs	Residential	mg/kg	0.51	3	43	0.085
	Industrial	mg/kg	13	65	150	0.75
Allowable Vapor Concentrations	Residential	ppmv	47.5	196.8	5,165.0	86.5
	Industrial	ppmv	1,211.7	4,264.7	18,017.5	763.3
Maximum April 2014 Vapor Concentrations	Upper 5 feet	ppmv	0.94	0.013	0.026	ND
	Whole UVZ	ppmv	23	10	11	0.0014
Maximum February 2015 Vapor Concentrations	Upper 5 feet	ppmv	20	0.00095	0.6	ND
	Whole UVZ	ppmv	330	20	86	0.95

CONCLUSION

April 2014 UVZ vapor concentrations met the back-calculated residential allowable vapor concentrations at all locations and depth intervals for the contaminants of concern (COCs). If April 2014 conditions were representative of equilibrium conditions, this would suggest that soils would have met residential SRLs; however, the vapor samples were collected shortly after cessation of MPE activities and likely did not represent equilibrium conditions.

February vapor concentrations at 26 of the 28 individual wells indicate that soils would likely meet residential SRLs, if equilibrium had been established. Vapor concentrations at the lower two depth intervals of VW-07 exceeded residential SRLs; however, at these depths (e.g., greater than 50 feet) exposure pathways to soil would be eliminated and a DEUR would not be needed.

Therefore, it is reasonable to assume that a DEUR is not needed for properties outside of the Mission Plant (source area), as vapor concentrations are in equilibrium, being located beyond the anticipated zone of influence from the MPE ERA. However, vapor concentrations may still be equilibrating within the MPE zone of influence and are likely cannot be used to accurately

estimate soil concentrations in the source area. It is likely that soil concentrations meet non-residential SRLs (as they did during the RI), but a DEUR may be needed to restrict residential land use. Future soil vapor monitoring data will assist in further evaluating source area conditions.

OBJECTIVE

Per A.A.C. R18-7-203, soil concentrations must be protective of surface water and aquifer water quality, not resulting in a violation of water quality standards. Based on the ROs, the potential additional water quality impacts from UVZ contamination leaching to the PA are not of concern for reasons described in Section 3.4.2 of the Feasibility Study (FS). However, contamination in the lower vadose zone (LVZ) is believed to serve as a source to RA groundwater, necessitating the LVZ SVE ERA. Because residential and non-residential SRLs do not apply in the LVZ, only groundwater protection levels (GPLs) were evaluated.

PROCESS

As a reference for LVZ remediation, allowable vapor concentrations were back-calculated from GPLs that would likely be protective of Regional Aquifer (RA) groundwater, preventing a violation of aquifer water quality standards. These allowable vapor concentrations could be used as an action threshold for when to stop or resume active remediation in the LVZ.

GPLs were derived from ADEQ's spreadsheet model (created in November 2008), which attempts to replicate the GPL model and methodology described in the ADEQ document *A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality* (September 1996). During this exercise, the following three types of GPLs were considered:

1. Minimum GPLs as listed in the spreadsheet model (*there is not one for vinyl chloride [VC]*);
2. Calculated "conservative" GPLs using the default model assumptions to result in lower (more stringent) GPLs; and
3. Calculated "likely" GPLs using model assumptions that are most likely to represent Site conditions, which tend to result in higher (less stringent) GPLs.

Table 1 is a summary of these three different GPLs for the LVZ COCs. As there was no minimum specified GPL for VC, a hypothetical minimum GPL was estimated for VC using an average of the ratios between the default (conservative) calculated GPL and minimum GPL for the other COCs.

Table 1 – Summary of GPLs for LVZ COCs

GPL Type	Unit	PCE	TCE	cDCE	VC
Minimum	mg/kg	0.80	0.76	5.30	*0.23*
Conservative	mg/kg	1.53	1.41	10.15	0.44
Likely	mg/kg	12.36	6.84	36.41	5.41

"Conservative" GPLs were calculated using model defaults for each of the COCs. As these default values applied to soil/material assumptions and did not change between chemicals, the screenshot below (Figure 1) of cDCE is shown as a representative example for each of the COCs. Figure 2 is a screenshot presenting the calculation of the likely GPL for cDCE using estimate site-specific values.

Figure 1 – cDCE GPL Calculation Using Default Parameters

Select chemical name from drop down list			cis-1,2-Dichloroethylene
Ct = Initial total soil contamination, ug/kg (ug/kg = (ug/l)/Pb)		1	1
Kh (dimensionless)		0.167	0.754
S (water solubility, mg/l)		3500	200
Koc (L/Kg)		35.5	155
T1/2 (d) (vadose zone)	(enter 100,000 if no biodegradation, 1000 for BTEX)	10000	10000
T1/2 (d) (groundwater zone)	(enter 100,000 if no biodegradation, 1000 for BTEX)	10000	10000
Select Soil Type from drop down list			Sandy Clay
Φ(total porosity)	(minimum GPL default = .25)	0.385	0.375
Pb (g/cm^3) (dry bulk density)	(minimum GPL default = 1.5	1.63	1.5
foc (vadose zone)	(minimum GPL default = .001)	0.001	0.001
foc (aquifer)		0.001	0.001
Dg$^{a\ (cm2/d)}$ (gaseous diffusion coefficient)	(7000 = default)	7000	7000
D1$^{w(cm2/d)}$ (liquid diffusion coefficient)	(.7 = default)	0.7	0.7
d(diffusion layer thickness,cm)	(.5 = default)	0.5	0.5
θ (vol/vol)= moisture content	(minimum GPL default = .15)	0.197	0.15
Jw (water flux- cm/d)	(minimum GPL default = .007)	0.007	0.007
time step (days) vary until output graphs shows complete curve, Jury 1 solution)		10	10
L (cm)(depth of incorporation- Jury 1 solution)		1000	1000
Z -cm(depth to water, or depth of interest, Jury 1 solution)		1000	1000
depth profile time (d), Jury 2 solution)		3650	3650
total vadose zone depth (cm, Jury 2 solution)		3000	3000
Distance to compliance point (Sc) (meters)	(minimum GPL default = 30)	30.5	30.5
Release width (w) (meters)	(minimum GPL default = 10)	10	10
Well screen interval (s) (meters)	(minimum GPL default = 8.2)	8.2	8.2
Water Quality Standard (ug/l)- see note regarding standard		70	70
Groundwater velocity (cm/d) (actual velocity not Darcy velocity)	(minimum GPL default = 10)	10	10
Infiltration rate outside of source area (cm/d)	(minimum GPL default = .007)	0.007	0.007

Run GPL

cis-1,2-Dichloroethylene

GPL (mg/kg) = 10.15

Figure 2 – cDCE GPL Calculation Using Estimated Site-Specific Parameters

Select chemical name from drop down list			cis-1,2-Dichloroethylene
Ct = Initial total soil contamination, ug/kg (ug/kg = (ug/l)/Pb)		1	1
Kh (dimensionless)		0.167	0.754
S (water solubility, mg/l)		3500	200
Koc (L/Kg)		35.5	155
T1/2 (d) (vadose zone)	(enter 100,000 if no biodegradation, 1000 for BTEX)	10000	10000
T1/2 (d) (groundwater zone)	(enter 100,000 if no biodegradation, 1000 for BTEX)	10000	10000
Select Soil Type from drop down list			Sandy Clay
Φ(total porosity)	(minimum GPL default = .25)	0.385	0.375
Pb (g/cm^3) (dry bulk density)	(minimum GPL default = 1.5	1.63	1.5
foc (vadose zone)	(minimum GPL default = .001)	0.001	0.001
foc (aquifer)		0.001	0.001
Dg$^{a\ (cm2/d)}$ (gaseous diffusion coefficient)	(7000 = default)	7000	7000
D1$^{w(cm2/d)}$ (liquid diffusion coefficient)	(.7 = default)	0.7	0.7
d(diffusion layer thickness,cm)	(.5 = default)	0.5	0.5
θ (vol/vol)= moisture content	(minimum GPL default = .15)	0.197	0.15
Jw (water flux- cm/d)	(minimum GPL default = .007)	0.0035	0.0035
time step (days) vary until output graphs shows complete curve, Jury 1 solution)		417.1231714	417.1231714
L (cm)(depth of incorporation- Jury 1 solution)		300	300
Z -cm(depth to water, or depth of interest, Jury 1 solution)		600	600
depth profile time (d), Jury 2 solution)		3650	3650
total vadose zone depth (cm, Jury 2 solution)		3000	3000
Distance to compliance point (Sc) (meters)	(minimum GPL default = 30)	0	0
Release width (w) (meters)	(minimum GPL default = 10)	30	30
Well screen interval (s) (meters)	(minimum GPL default = 8.2)	10	10
Water Quality Standard (ug/l)- see note regarding standard		70	70
Groundwater velocity (cm/d) (actual velocity not Darcy velocity)	(minimum GPL default = 10)	10.02082192	10.02082192
Infiltration rate outside of source area (cm/d)	(minimum GPL default = .007)	0.0035	0.0035

Run GPL

cis-1,2-Dichloroethylene

GPL (mg/kg) = 36.41

Once these GPLs were calculated for each parameter (Table 1), allowable soil vapor concentrations were back-calculated from each GPL using the same approach presented in Appendix F-1 per A.A.C. R18-7-203(C). Table 2 presents the partitioning parameters used, which are identical to those used in Appendix F-1 (default values from ADEQ's 2008 guidance document) with the exception of decreasing f_{oc} from 0.006 to 0.001 to match the default value used in the GPL spreadsheet model.

Table 2 – Partitioning Parameters

Parameter	Units	Soil Value				
f_{oc}	g-c/g-soil	0.001				
ρ_b	kg/L	1.5				
θ_t	-	0.43				
θ_w	-	0.15				
COC Specific			PCE	TCE	cDCE	VC
K_{oc}	L/kg (ml/g)	NA	1.55E+02	1.66E+02	3.55E+01	1.86E+01
H_o	-		7.54E-01	4.22E-01	1.67E-01	1.11E+00
MW	g/mol		1.66E+02	1.31E+02	9.70E+01	6.25E+01

Using these partitioning parameters, allowable vapor concentrations were back-calculated from GPLs and compared to LVZ vapor concentrations, as shown in Table 3 below.

Table 3 – Comparison of LVZ Vapor Concentrations to Back-Calculated Allowable Vapor Concentrations

Parameter		Unit	PCE	TCE	cDCE	VC
Allowable Vapor Concentrations from GPLs	Minimum	ppmv	220.6	169.9	1,314.6	303.9
	Conservative	ppmv	421.9	315.2	2,517.6	575.7
	Likely	ppmv	3,408.2	1,529.2	9,031.0	7,078.1
Maximum April 2014 Vapor Concentration	190 feet bgs	ppmv	240	29	260	ND
	Whole LVZ	ppmv	690	53	260	ND
Maximum January 2015 Vapor Concentration	190 feet bgs	ppmv	910	90	410	ND
	Whole LVZ	ppmv	910	90	410	ND

CONCLUSION

The maximum vapor concentrations in the LVZ during the April 2014 and January 2015 events were below the estimated allowable vapor concentrations for TCE, cDCE, and VC. However, PCE vapor concentrations in the LVZ suggest that soil concentrations exceed GPLs, which justifies implementing SVE as an ERA. The allowable vapor concentrations calculated from the minimum GPL (e.g., approximately 220 ppmv for PCE) could be used as action thresholds for whether to resume SVE following cessation and rebound monitoring.

Appendix G

Regional Aquifer Groundwater Modeling Report

REGIONAL AQUIFER GROUNDWATER MODELING REPORT

PARK-EUCLID WQARF SITE, TUCSON, ARIZONA

Prepared for

The Park – Euclid Group

April 2016

URS Corporation
6200 South Quebec Street
Greenwood Village, CO 80111

Project No. 60405285

Table of Contents

1.0 INTRODUCTION 1
1.1 Objectives of Groundwater Modeling for Regional Aquifer 1
1.2 Previous Regional Aquifer Groundwater Modeling 1
1.3 Report Organization 1
2.0 GROUNDWATER FLOW CONDITIONS IN THE REGIONAL AQUIFER 3
2.1 Geology 3
2.2 Groundwater Flow 3
2.3 Groundwater Production Wells 3
2.4 Groundwater Recharge 4
2.5 Aquifer Hydraulic Properties 4
3.0 OVERVIEW OF CONTAMINANT CONCEPTUAL SITE MODEL 5
3.1 Hydrostratigraphy 5
3.2 Contamination History 5
3.3 Changes in Contaminant Conditions 6
3.4 Groundwater PCE Plume in Regional Aquifer 6
4.0 NUMERICAL MODEL SETUP 8
4.1 Model Domain and Orientation 8
4.2 Model Grid 8
4.3 Model Layers 8
4.4 Boundary Conditions 8
4.5 Groundwater Recharge 9
4.6 Groundwater Extraction 9
5.0 GROUNDWATER FLOW MODEL CALIBRATION AND VERIFICATION 10
5.1 2013 Steady State Flow Model Calibration 10
5.1.1 Calibration Targets and Method 10
5.1.2 Simulated Groundwater Potentiometric Surfaces 11
5.1.3 Simulated Vertical Hydraulic Gradients 11
5.1.4 Estimated Hydraulic Conductivity Distribution 12
5.2 Steady State Flow Model Calibrations/Verifications 13
5.3 Transient Flow Model Calibrations/Verifications 14
5.3.1 Short-Term Pumping Test 14
5.3.2 Long-Term Pumping Test 14

6.0 GROUNDWATER SOLUTE TRANSPORT MODEL 15
6.1 History Matching Simulation of Regional Aquifer PCE Plume 15
6.1.1 PCE Source to Regional Aquifer 15
6.1.2 Flow Model for History Matching Simulation 16
6.1.3 Transport Parameters 16
6.2 Simulated Historical PCE Plume Migration 17
7.0 MODEL PREDICTIONS 18
7.1 Future Production Pumping Plan 18
7.2 Prediction Assumptions 18
7.3 Monitored Natural Attenuation 19
7.4 Groundwater Extraction 19
7.5 PlumeStop™ 19
7.5.1 Concentration Knockdown Efficiency 20
7.5.2 Injection and Extraction Wells for Distribution of PlumeStop™ 20
7.6 In Situ Chemical Oxidation 21
7.7 Enhanced Reductive Dechlorination 21
7.8 Uncertainty of Monitored Natural Attenuation 21
7.9 Groundwater Extraction and Re-Injection 21
8.0 SUMMARY 23
9.0 REFERENCES 25

List of Tables

Table 2-1 Historical University of Arizona Production Well Information

Table 2-2 Five-Year Average and Maximum Pumping Rates of University of Arizona (2008 to 2013)

Table 4-1 Model Layers

Table 4-2 Average Pumping Rates of University of Arizona in Model Calibration and Verifications

Table 5-1 Simulated and Observed Groundwater Elevations in Model Calibration and Verifications

Table 5-2 Statistics of Steady State Flow Model Calibration and Verifications

Table 6-1 Model Assumptions for History Matching Simulation

Table 6-2 Average Pumping Rates used in History Matching Simulation of PCE Plume Migration

Table 6-3 Transport Parameters

Table 7-1 University of Arizona Proposed Future Production Pumping Rates

Table 7-2 PlumeStop™: Simulated Concentration Reduction Efficiency and Remedial Effect

Table 7-3 University of Arizona Six-Year Average Production Pumping Rates of 2008 - 2014

List of Figures

Figure 2-1 Regional Aquifer Well Locations

Figure 2-2 Select Regional Groundwater Hydrographs

Figure 3-1 Contamination Migration Conceptual Site Model

Figure 3-2 2014 Groundwater PCE Plume in Regional Aquifer and PCE Concentrations Temporal Trends

Figure 4-1 Regional Aquifer Model Domain

Figure 4-2 Regional Aquifer Model Grid and Boundary Conditions

Figure 5-1 Simulated Regional Groundwater Potentiometric Surface in Project Area, August 2013, Layer 1

Figure 5-2 Simulated Regional Groundwater Potentiometric Surface in Project Area, August 2013, Layer 2

Figure 5-3 Simulated Regional Groundwater Potentiometric Surface in Project Area, August 2013, Layer 3

Figure 5-4 Simulated Regional Groundwater Potentiometric Surface in Project Area, August 2013, Layer 4

Figure 5-5 Comparison of Simulated and Observed Hydraulic Heads for 2013 Groundwater Flow Model Calibration

Figure 5-6 Estimated Hydraulic Conductivity Distribution in Project Area, Layer 1

Figure 5-7 Estimated Hydraulic Conductivity Distribution in Project Area, Layer 2

Figure 5-8 Estimated Hydraulic Conductivity Distribution in Project Area, Layer 3

Figure 5-9 Estimated Hydraulic Conductivity Distribution in Project Area, Layer 4

Figure 5-10 Simulated Vertical Groundwater Equipotential Lines along Model Column 159, August 2013

Figure 5-11 Simulated Drawdown Hydrographs for Short-Term Pumping Test

Figure 5-12 Simulated Drawdown Hydrographs for Long-Term Pumping Test

Figure 6-1 Simulated Historical Regional Aquifer PCE Plume Migration over Time

Figure 7-1 MNA: Predicted Regional Aquifer PCE Plume Assuming UA Pumping Plan

Figure 7-2 MNA: Predicted PCE Concentration Trends at Production Wells Assuming UA Pumping Plan

Figure 7-3 Groundwater Extraction: Predicted Regional Aquifer PCE Plume Assuming UA Pumping Plan

Figure 7-4 Groundwater Extraction: Predicted PCE Concentration Assuming UA Pumping Plan

Figure 7-5 PlumeStop™: Predicted Regional Aquifer PCE Plume Assuming UA Pumping Plan

Figure 7-6 PlumeStop™: Estimated Well Spacing of Injection and Extraction Wells for Distribution of PlumeStop™

Figure 7-7 ISCO: Assumed Initial PCE Concentrations and Predicted PCE Plume by Year 30

Figure 7-8 ERD: Assumed ERD Injection Lines and Predicted PCE Plume by Year 30

Figure 7-9 MNA: Predicted Regional Aquifer PCE Plume Assuming UA Six-Year Average Pumping Rates of 2008 – 2014

Figure 7-10 Re-injection Upgradient from the Plume

Figure 7-11 Re-Injection Cross-gradient from the Plume along 8th Street

Figure 7-12 Re-Injection Downgradient from the Plume along 7th Street

Figure 7-13 Re-Injection in a Deep Layer (Layer 4) at the Extraction Location

Figure 7-14 Simulated PCE Concentrations at Extraction Well EW-1

List of Appendices

Appendix A University of Arizona Pumping Records

1.0 INTRODUCTION

The Park-Euclid Water Quality Assurance Fund (WQARF) Site (the Site) is located south of 8th Street, north of 14th Street, west of Mountain Avenue, and east of Park Avenue in Tucson, Arizona. Former dry-cleaning operations (1964 – 1985) at the 301 South Park Avenue plant (the Mission Plant) resulted in releases of tetrachloroethene (PCE) into the subsurface and ultimately groundwater contamination in the Regional Aquifer through previously existing supply wells at the Mission Plant.

This Regional Aquifer groundwater modeling report was prepared to support the evaluation in the feasibility study (FS) of various remedial alternatives to mitigate the Regional Aquifer groundwater contaminant plume at the Site.

The Regional Aquifer groundwater flow and transport models were developed based on review of the site hydrogeological conceptual model (URS, 2011; TTG, 2011; URS, 2013) and review of the previous numerical groundwater flow and transport models (GeoTrans, 2008).

1.1 Objectives of Groundwater Modeling for Regional Aquifer

The objectives of groundwater modeling for the Regional Aquifer are to:

- Further improve the understanding of the conceptual site model, i.e., the groundwater flow conditions of the Regional Aquifer and the history of the regional groundwater PCE plume; and
- Evaluate various potential remedial alternatives to support the FS.

Note that the numerical groundwater modeling was only applied for the Regional Aquifer, even though the discussion in the report involves the contaminant conditions in the multiple media observed at the Site.

1.2 Previous Regional Aquifer Groundwater Modeling

GeoTrans developed a groundwater model for the Regional Aquifer (GeoTrans, 2008) based on review of two earlier modeling reports by Malcolm Pirnie, Inc. and Miller Brooks as well as earlier pumping tests. The design and assumptions of the GeoTrans model are considered by URS to be generally reasonable, including model domain, model layer setup, boundary conditions, groundwater extraction, and groundwater recharge. GeoTrans conducted two steady state flow model calibrations for the Regional Aquifer, which provided a reasonable groundwater flow field for capture zone design and for transport model simulations. The GeoTrans model also included two transient flow model calibrations to simulate the two pumping test processes, which improved the estimation of hydraulic conductivities that were initially estimated by analytical solutions.

1.3 Report Organization

This report includes the following sections:

- Section 2.0 – Groundwater Flow Conditions in the Regional Aquifer
- Section 3.0 – Overview of Contaminant Conceptual Site Model

- Section 4.0 – Numerical Model Setup
- Section 5.0 – Groundwater Flow Model Calibration and Verification
- Section 6.0 – Groundwater Solute Transport Model
- Section 7.0 – Model Predictions
- Section 8.0 – Summary
- Section 9.0 – References

2.0 GROUNDWATER FLOW CONDITIONS IN THE REGIONAL AQUIFER

2.1 Geology

The Regional Aquifer, composed of interbedded sands and clays, is the principal aquifer of the Tucson Basin, which is approximately 1,000 square miles in size. The Regional Aquifer produces most drinking water for the City of Tucson and for other water providers throughout the Tucson Basin. The saturated thickness is estimated to be several thousand feet, with an uncertain total depth at many locations (Davidson, 1973).

2.2 Groundwater Flow

At the Site, the groundwater table of the Regional Aquifer is currently approximately 200 feet (ft) below ground surface (bgs). The total thickness of the Regional Aquifer is undetermined.

The groundwater flow direction (**Figure 2-1**) is primarily to the northeast, based on the groundwater level measurements at the Site. North of the Site, the groundwater flow conditions are influenced by groundwater extraction at the University of Arizona production wells, also shown on **Figure 2-1**.

Most of the monitoring wells at the Site extend into the uppermost portion of the Regional Aquifer, except for PER-14, which is screened to a depth of 523 ft bgs.

The groundwater levels at the monitoring wells have fluctuated in the past. The available historical groundwater hydrographs for the monitoring wells (MLR-1, MLR-2, MLR-3, and MLR-7) in the vicinity of the source area of the PCE plume indicate that the Regional Aquifer groundwater elevations in 1991 were approximately 20 ft higher than the present elevations (**Figure 2-2**). The decline of the groundwater levels in the past and the recent recovery of groundwater levels are primarily related to the regional use of groundwater.

According to GeoTrans (2008), the hydraulic gradient across the Site was relatively steep in the previous years prior to 2000 and more flat in recent years. Comparison of hydrographs between the MLR wells and UAM-2 (**Figure 2-2**) confirms that after 2000, the hydraulic gradient across the Site is flatter.

2.3 Groundwater Production Wells

University of Arizona is the primary local groundwater user of the Regional Aquifer. The production wells are located downgradient of the Site (**Figure 2-1**). Most of the production wells are screened through shallow and deeper portions of the Regional Aquifer.

The historical production well information and groundwater pumping records are summarized in GeoTrans (page 5 to 6 of GeoTrans, 2008) and presented in **Table 2-1**. The groundwater pumping daily records from 2006 to 2013 are available from University of Arizona and are provide in **Appendix A**. Among eight production wells, data are not available for two wells prior to November 2008 and not available for one well prior to mid-2009. During November 2008 to November 2013, the daily records are complete. The five-year average pumping rates and the maximum pumping rates from 2008 to 2013 are included in **Table 2-2.** The pumping rates at each of these wells vary significantly from zero to a maximum of 659 gallons per minute (gpm).

2.4 Groundwater Recharge

No net recharge as result of precipitation is anticipated. There is very little precipitation in this area, and most is expected to evaporate or run off. The recharge to the Regional Aquifer is primarily from the mountain ranges surrounding the Tucson Groundwater Basin.

2.5 Aquifer Hydraulic Properties

Two pumping tests were conducted in the vicinity of the Site:

- A 24-hour pumping test conducted at monitoring well PER-15 at a rate of 15 gpm, conducted by Golder Associates (Golder) in 2001 (Golder, 2001), and
- An aquifer test based on a 56-day period when the University of Arizona Martin Street well was pumped in 2001 (including subsequent recovery), conducted by Hydro Geo Chem (2002)

Based on these pumping tests, the hydraulic conductivity (K) was estimated using analytical solutions. GeoTrans (2008) indicated that the estimated hydraulic conductivity values were unreasonably high either due to the limitation of the analytical solutions, or conceptual flaws in the estimation.

GeoTrans re-estimated the hydraulic conductivities using the developed numerical model by simulating the two pumping test processes. Their estimates for hydraulic conductivity at the two pumping test locations are:

- PER-15 – 10 ft/day
- Martin Street – 8 ft/day

3.0 OVERVIEW OF CONTAMINANT CONCEPTUAL SITE MODEL

This section provides a brief overview of the contaminant conceptual site model based on URS' review of the Remedial Investigation (RI) report (TTG, 2011) and the findings in the follow-up long-term monitoring program (URS, 2011). The discussions below include the source of the contamination, distribution of the contamination, changes to contaminant concentrations due to remediation and biodegradation, and the recent status of the PCE plume in the Regional Aquifer. **Figure 3-1** was developed to depict this conceptual site model in simple graphics. The contaminant conceptual site model provides the basis for making assumptions in the groundwater transport model development in Section 6.0.

3.1 Hydrostratigraphy

Figure 3-1 depicts a vertical cross-section of the subsurface beneath the Site from south to the north. The depicted portion of the subsurface covers a vertical cross-section from ground surface (2,400 ft in elevation) to the bottom of the Regional Aquifer groundwater model (1,400 ft in elevation). The geological materials are variable, including sands, silty sand, clayey sand, gravel, and interbedded clay. The current surface of the Regional Aquifer water table is located at approximately 200 ft bgs. The total thickness of the aquifer is undetermined.

The historical declining of the Regional Aquifer resulted in five distinguish hydrostratigraphic zones beneath the Site (**Figure 3-1**):

- Upper Vadose Zone
- Perched Aquifer
- Upper Aquitard
- Lower Vadose Zone
- Regional Aquifer

3.2 Contamination History

Based on the RI report (TTG, 2011), the original sources of contamination were PCE solvent spills, discharges, and disposal at the Haskell/Mission Linen Facility and at the vacant lot to the east. The former dry-cleaning operations (1964 – 1985) also resulted in releases of PCE solvent from wastewater pipes, sanitary sewer lines, storage tank spills, spills in the dry-cleaning area, and releases from dry-cleaning machines into the subsurface (**Figure 3-1**).

The spilled/released PCE moved downward through the Upper Vadose Zone (**Figure 3-1**) into the Perched Aquifer as dense non-aqueous phase liquid (DNAPL) and dissolved into a layer of diesel fuel present atop the Perched Aquifer as a result of an off-site unidentified source, the PCE then dissolved into water within the Perched Aquifer.

Within the Perched Aquifer, the dissolved PCE primarily moves along with groundwater laterally downgradient but does not move downward as the Perched Aquifer is impeded by the Upper Aquitard (**Figure 3-1**).

The vertical transport of the contaminants from the Perched Aquifer to the Lower Vadose Zone and the Regional Aquifer appear to follow two pathways over different time periods:

- Historical movement of contamination down the incompetent well annulus of Old Well and MP-1. The Old Well was installed around 1938 and abandoned in 1992. MP-1 was installed in 1973 and abandoned in 1994. The exact well construction details for the Old Well are not known. The top of screen in MP-1 was 332 ft bgs and the total depth was 511 ft bgs (TTG, 2011).
- Adsorbed contaminants on soils and soil vapors in the vicinity of the former MP-1 and Old Well annuli in the Lower Vadose Zone could be a continuous low-concentration source to the Regional Aquifer.

3.3 Changes in Contaminant Conditions

In the Upper Vadose Zone and the Perched Aquifer, the contaminant conditions have undergone substantial changes in the past, as evidenced by comparison of the interpreted groundwater PCE plumes in the Perched Aquifer in July 2011 (Figure 13 of URS, 2011) and in April 2014 (Figure 12 of URS, 2014b). In 2011, the maximum PCE concentrations in the Perched Aquifer were greater than 1,000 micrograms per liter (µg/L), while in April 2014, the maximum observed PCE concentration decreased to less than 100 µg/L.

The significant decline in the PCE concentrations in the Perched Aquifer has resulted from:

- Remedial activities, and
- Reductive biodegradation of PCE due to presence of the diesel product on the Perched Aquifer.

The remedial activities include:

- Abandonment of Old Well in 1992 and MP-1 in 1994;
- Soil vapor extraction (SVE) in the Upper Vadose Zone during 2000 to 2002 and 2004 to 2006;
- Abandonment of the sanitary sewer line beneath the Mission Plant in 2006; and
- Multiple phase extraction (MPE) in the Perched Aquifer during 2008, 2009, and 2011 to 2014.

In the Lower Vadose Zone, the contaminant conditions have also changed substantially due to reductive biodegradation of PCE with diesel product (TTG, 2011; URS, 2015). As a result, the continuous low-concentration source to the Regional Aquifer from the Lower Vadose Zone may be decreasing over time.

Currently, SVE is being performed in the Lower Vadose Zone in accordance with URS (2014a), and therefore, the remaining low-concentration source to the Regional Aquifer may be further reduced in the near future.

3.4 Groundwater PCE Plume in Regional Aquifer

The groundwater PCE plume in the Regional Aquifer has been investigated since early 1990 (TTG, 2011). The regional groundwater PCE plume is approximately 3,000 ft long and 800 ft wide and is present in the shallow portion of the Regional Aquifer as depicted on **Figure 3-1**.

The interpreted 2014 groundwater PCE plume in the Regional Aquifer and the historical PCE concentration temporal trends at monitoring wells are shown on **Figure 3-2**.

As shown on **Figure 3-2**, there are two high concentration zones in the interpreted 2014 PCE plume; one is around the source area in the vicinity of PER-14A, and one is around PER-26 in the center of the PCE plume. The PCE concentrations at PER-14A increased to a maximum of 400 micrograms per liter (µg/L) from 2011 to 2012 and then decreased to less than 150 µg/L from 2013 to 2014. The PCE concentration at PER-26 has fluctuated between 100 to 200 µg/L over time with a gradual decreasing trend in 2013 and 2014. The interpreted 10 µg/L concentration contour lines disconnect immediately downgradient of the source zone. These observations indicate that the PCE source concentration to the Regional Aquifer has been variable over time.

One of the explanations to the variation of the source concentration is that the contaminated soils and soil vapors in the Lower Vadose Zone act as a continuous low-concentration source to the Regional Aquifer (Section 3.3). The variation of groundwater elevation in the Regional Aquifer (**Figure 2-2**) in the source area may also introduce variable amounts of PCE to the Regional Aquifer over time.

The PCE concentration temporal trends at most of monitoring wells are decreasing over time in recent years, except for MLR-7 and PER-23. The recent increase of PCE concentrations at MLR-7 may be result of water table fluctuation in the source area (**Figure 2-2**). The increase of PCE concentrations at PER-23 may be related to the decrease of PCE concentrations at PER-25, which is located on the other side of the core of the PCE plume. A possible explanation for the changes at the two wells is that the distribution of the PCE concentrations within the plume may be influenced by variations in the pumping schedule at the University of Arizona water supply wells potentially causing an eastward shift in the groundwater flow direction.

There is no evidence of DNAPL present in the Regional Aquifer based on the final RI (TTG, 2011) and based on the discussions above. A rule of thumb by EPA (1992) regarding potential presence of DNAPL in an aquifer is that the dissolved concentration is equal to or greater than 1% of the solubility of the contaminant. The solubility of PCE in water is 150,000 µg/L. The historical PCE concentrations in the Regional Aquifer were typically less than 400 µg/L with a maximum concentration of 630 µg/L at MLR-7 in 1994. PER-14 (**Figure 3-1**) is a deep well screened from 473 ft to 523 ft bgs and located next to the historical water supply wells MP-1 and the Old Well. The results of analysis of groundwater samples collected from PER-14 have consistently shown PCE concentrations below the reporting limit since 2000 (**Figure 3-2**).

4.0 NUMERICAL MODEL SETUP

The numerical groundwater model was setup based on the GeoTrans model with some modifications. The modeling software includes MODFLOW, MODPATH, MT3DMS, and Groundwater Vistas version 5, which are the same as used by GeoTrans. The details of model setup are discussed below.

4.1 Model Domain and Orientation

The model domain covers an area of approximately 37 square miles (**Figure 4-1**). This model domain is substantially larger than the Regional Aquifer PCE plume and the downgradient groundwater production area. As the PCE plume migration direction is highly sensitive to groundwater extraction, and may be sensitive to potential remedial activities involving extraction, a large model domain was used to effectively reduce the potential impact of boundary effects on model results.

The model orientation is designed to follow the plume migration direction to the northeast, with an approximate 20° angle from north (GeoTrans model is orientated straight northward). This offsite from north reduces the potential for numerical dispersion in the transport model. As the model y-direction is aligned with the groundwater flow direction, the entire model domain is active so the effective model domain is increased, further reducing the potential impact of boundary effects on model results.

4.2 Model Grid

The model includes 385 rows and 291 columns, with the smallest cells having dimensions of 25 ft by 25 ft in the plume area and increased cells dimensions up to 200 ft by 200 ft in the buffer zone (**Figure 4-2**). A refined grid (smaller grid spacing) in the area of interest allows the model to better simulate actual conditions in the plume area. A larger grid spacing outside of the immediate area of interest allows optimization of model simulations.

4.3 Model Layers

The model includes four layers for a total saturated thickness of 800 ft. The layer setup is the same as that used by GeoTrans (2008). **Figure 3-1** depicts the layer setup in the regional model, as Layers 1 to 4. The rationale for layer discretization is summarized in **Table 4-1**. The specification of Layer 2 is particularly designed for simulation of the observed clay layer in the vicinity of PER-14 (**Figure 3-1**). Note, the observed clay layer is only present in the vicinity of PER-14; further downgradient, Layer 2 has been assigned the same hydraulic properties as layers above and below.

4.4 Boundary Conditions

The northern and southern model boundaries are assumed to be constant head boundaries (**Figure 4-2**). The constant head values were approximated according to the extrapolated hydraulic gradient based on the available observed hydraulic heads across the project area. Constant heads were assigned the same values in each of the model layers.

The model east and west boundaries along the flow direction are assumed to be no-flow boundaries. As the model domain is significantly larger than the project area, the boundary effect on simulation result is negligible.

4.5 Groundwater Recharge

The vertical groundwater recharge from the surface to the regional aquifer is assumed to be negligible as there is very little precipitation in this area, and most of the precipitation that does occur is expected to evaporate (GeoTrans, 2008). Recharge to the aquifer is simulated through constant head boundaries along the southern and northern boundaries of the model as noted above in Section 4.4.

4.6 Groundwater Extraction

Table 4-2 presents the average pumping rates used for the steady state model calibration or verification (Section 5). The pumping rates for October 2000 and December 2007 are obtained from GeoTrans (2008). The pumping rates for July 2011 and July 2013 are the 30-day average pumping rates from the daily pumping records provided by the University of Arizona (**Appendix A**), prior to groundwater level measurements.

5.0 GROUNDWATER FLOW MODEL CALIBRATION AND VERIFICATION

The groundwater flow model was calibrated through an iterative process of six model calibrations and verifications using available recent and historical data sets. The focus of the model calibration was on re-estimating K distribution in the plume area, especially for the deeper layers. The six simulations are:

- Steady state flow model using 2013 data
- Steady state flow model using 2011 data
- Steady state flow model using 2000 data
- Steady state flow model using 2007 data
- Transient flow model of short-term pumping test
- Transient flow model of long-term pumping test

The first two models used the recent data sets, and the last four models used the historical data sets that were used by GeoTrans. The K distribution was iteratively adjusted and verified for these models. The final K-distribution is applied in each of these models.

5.1 2013 Steady State Flow Model Calibration

The 2013 steady state flow model calibration focused on estimation of K distribution. Nineteen observed groundwater elevations of August 2013 were used as the calibration targets, including two observations in model layer 2 and one observation in model layer 4 (**Table 5-1**).

The average July 2013 pumping rates for the production wells (**Table 4-2**), based on the University of Arizona records included in **Appendix A**, were applied in the model.

5.1.1 Calibration Targets and Method

The steady state flow model calibration focused on:

- Matching horizontal groundwater flow patterns in the project area, including flow direction and hydraulic gradient;
- Matching vertical groundwater flow patterns in the project area, including the vertical hydraulic gradient;
- Estimating K distribution to be consistent with the aquifer test results and geologic conditions; and
- Providing a reasonable flow field for matching PCE plume migration direction and pathway in the transport model.

Model calibration was conducted using manual adjustment following the hydraulic gradient comparison method (Guo and Zhang, 2000), which is conceptually consistent with Darcy's law and mass balance. This calibration method promoted efficiency in calibration and flexibility for incorporating various types of site-specific information into the model calibration.

During the flow model calibration, particle tracking simulations were frequently applied for comparison of the simulated flow path versus the 2011/2013 regional groundwater PCE plume (URS, 2011; 2013) to better simulate the groundwater flow direction.

Note that the observed groundwater elevations at WR-347B were not used in the model calibration or verifications, as the water level at this well is unreasonably low when compared to water levels in the surrounding wells - even lower than the water levels at the well-cluster PER-15, which is about 500 ft downgradient.

5.1.2 Simulated Groundwater Potentiometric Surfaces

The simulated regional groundwater potentiometric surface from August 2013 for model Layers 1, 2, 3, and 4 in the project area are presented in **Figures 5-1** to **5-4**. Observed groundwater elevations at the monitoring wells are posted on the figures for comparison. The estimated constant head values at the southern and northern boundaries are 2,250.0 ft and 2,171.7 ft, respectively. The simulated average horizontal hydraulic gradient over the entire model domain is 0.00238.

The simulated and observed groundwater elevations are also compared in **Table 5-1** and in **Figure 5-5**. As shown in **Table 5-1**, all calibration residuals (differences between the observed and computed hydraulic heads) of 2013 are decimals, no more than 0.5 ft. This is an improvement from the GeoTrans steady state model calibration, where the residual at UAM-3 was 2.72 ft (GeoTrans, 2008).

The model calibration statistics are presented in **Table 5-2**. For the 2013 calibration, the scaled absolute mean is only 1.0%, which is substantially lower than those (2.6% and 3.8%) in the GeoTrans model, that were already well below the commonly accepted value of 5% (GeoTrans, 2008).

5.1.3 Simulated Vertical Hydraulic Gradients

As shown in **Table 5-1**, there is a strong upward vertical hydraulic gradient at well-cluster PER-14A/PER-14, which is near the PCE source location. The observed groundwater elevations in August 2013 are 2,213.83 ft at the shallow well PER-14A and 2,231.46 ft at the deeper well PER-14. The head difference is 17.63 ft over a vertical distance of 285 ft. The vertical hydraulic gradient is 0.062, a very strong upward hydraulic gradient. The model simulated head difference between the two wells is 17.78 ft, which results in a simulated upward vertical hydraulic gradient of 0.062, exactly the same as the observed one. In contrast, the GeoTrans model calibration excluded the observation at PER-14 based on the statement that “it has strange pattern of water levels over time relative to other regional aquifer wells” (GeoTrans, 2008).

At a distance of 760 ft downgradient from PER-14A/PER-14, the vertical hydraulic gradient at well-cluster PER-15/PER-22/PER-21 is slightly downward as shown in Table 2. The observed hydraulic heads in August 2013 were 2,211.20 ft, 2,210.83 ft, and 2,210.82 ft, at PER-15, PER-22, and PER-21, respectively. The downward vertical hydraulic gradient is 0.0028 for the head difference of 0.38 ft over a vertical distance of 138 ft. The model simulated a slightly upward vertical hydraulic gradient (0.0011) (between PER-15 and PER-21) at the well-cluster. However, immediately downgradient of PER-15 well-cluster, the simulated vertical gradient between Layers 1 and 2 is slightly downward at model cell (Row 262, Column 161), which is 75 ft downgradient from PER-15.

It is important to simulate the upward vertical hydraulic gradient in the source area so that the simulated contaminant movement behaves in a similar manner to observed conditions where there is no evidence of downward contaminant transport, and it is important to simulate the slight downward vertical hydraulic gradient in the PER-15 well-cluster area to allow contaminant to spread downward into deep layers as observed.

The simulation of the vertical hydraulic gradients improved the understanding of the vertical hydrostratigraphy in the source zone and immediately downgradient. The illustration of the simulated transition from strong upward to minor downward vertical hydraulic gradient can be found in the simulated equipotential lines on the cross-section figure (**Figure 5-10**).

5.1.4 Estimated Hydraulic Conductivity Distribution

The estimated K distributions in the project area are presented in **Figures 5-6** to **5-9** for Layers 1 to 4. The cross-section figure (**Figures 5-10**) presents the vertical distribution of the estimated K (1) from the southern boundary to the northern boundary (upper figure), and (2) in the local area through PER-14 and PER-15 (lower figure). The estimated K values are in the same range as estimated in the GeoTrans model, while the zonation of the K values was adjusted and/or refined, especially in the deeper layers.

The match of the strong upward hydraulic gradient at PER-14 well-cluster is due to the adjustment of the K distribution in the deeper layers in the project area. The estimated horizontal and vertical K distribution in the vicinity was based on the understanding of the geologic conditions, the contaminant source conditions, and the observed PCE concentrations in the history, in addition to matching the observed hydraulic heads.

The three dimensional K distribution and the rational of the estimation are described as follows:

- Layer 1. The estimated K_x (K_y) is 8 ft/d (K_z is 0.08 ft/d) for the southern portion of Layer 1, primarily in the monitoring well area, and is 10 ft/d (K_z is 1 ft/d) in the production well area, or the northern portion of Layer 1 (**Figure 5-6**). Only a small zone of K_x (K_y) of 10 ft/d is located in the southern portion of the model in the vicinity of PER-27 and PBR-10.
- Layers 3 and 4, beneath the source zone. As shown in **Figures 5-8, 5-9** and **5-10**, the K_x (K_y) of Layers 3 and 4 is estimated to be 8 ft/d (K_z is 0.08 ft/d) in the source zone where PER-14A/-14 and abandoned production wells MP-1/Old Well are located. This is based on consideration that the old production wells (MP-1 and Old Well) should be located in the relatively permeable zone with available groundwater coming from upgradient.
- Layer 2, beneath the source zone and MLR wells. As shown in **Figure 5-7**, Layer 2 is simulated as an aquitard with K_x (K_y) to be 0.01 ft/d (K_z is 0.0001 ft/d) in the PCE source area and in the area beneath the MLR wells. This estimation is based on the observations that (1) there is a strong upward vertical hydraulic gradient between PER-14A and PER-14 (Section 5.1.3), (2) a thick high-plasticity clay unit was observed in the boring log of PER-14 (URS, 2011), and (3) no elevated PCE concentration was detected in the deep well. The observed clay unit is approximately 62 ft long and extends almost continuously from a depth of 348 ft bgs to 410 bgs. The simulated aquitard mimics the hydraulic separation between the upper and lower regional aquifer beneath the source zone and results in a locally confined condition beneath Layer 2 in the source area.

- Layer 2, downgradient of MLR wells. As shown in **Figure 5-7**, the simulated aquitard in Layer 2 is not continuous beyond the source zone and MLR wells. A small low-K zone (K_x (K_y) is 1 ft/d and K_z is 0.01 ft/d) in the area north of the source zone and MLR wells is estimated in the local areas of PER-21.
- Layer 3, beneath the low-K zone in Layer 2. As shown on **Figure 5-8**, a low-K zone (1 ft/d) is estimated immediately downgradient of old production wells Old Well/MP-1, which is used to represent the clay layer vertically extending from Layer 2 to Layer 3. But this low-K zone is limited with a width of approximately 500 ft. Further downgradient, the K value of Layer 3 is increased to the north. Combination of the low-K zone in Layers 2 and 3 simulates a transition from aquitard to a low-K zone and then to higher-K zones to the north, which allowed the simulation of transition of vertical hydraulic gradient from upward to downward as shown on **Figure 5-10**.
- Layer 4. As shown in **Figure 5-9**, the low-K zone (1 ft/d) simulated in Layers 2 and 3 is extended to Layer 4 immediately downgradient of PER-14 and in the entire northern section of Layer 4. This thick low-K zone in the northern portion of Layer 4 causes slowing of the groundwater discharge out of the northern model boundary. With the simulated relative higher groundwater flux coming from the southern model boundary, the model created the strong vertical upward hydraulic gradient as observed at PER-14A/PER-14.

The estimated K distribution in the project area, especially in the source area, indicates that the geologic conditions and hydrostratigraphy of the Regional Aquifer in the project area is complicated. The model only simulated the possible hydrostratigraphic conditions following the available data. However, such detailed estimation of K distribution in the source area was not conducted in the GeoTrans model.

Even though the estimated K distribution reasonably simulated observed hydraulic heads, observed horizontal and vertical hydraulic gradients, and is consistent with the observed boring logs and the observed PCE concentrations in the project area, the estimated K distribution may not be unique. In addition, it should be noted that, the outside area surrounding the project area should be considered as buffer zone. As there is no any information available in the buffer zone, the estimated K distribution in the buffer zone is only for supporting the estimation in the project area.

5.2 Steady State Flow Model Calibrations/Verifications

For the purpose of making the estimated K distribution robust under different groundwater extraction conditions during different time periods, repeated model calibration/verification was conducted among the four steady state models and the two transient flow models.

Three sets of historical groundwater elevation data were used for calibration/verification of the K distribution in the three steady state models, including data from 2000, 2007, and 2011 (**Table 5-1**). The pumping rates at the production wells for each of the steady state flow models are presented in **Table 4-2**.

In the calibration/verification of each steady state flow model, the constant head values at the northern and southern model boundaries were adjusted according to the observations in the

project area. The simulated and observed groundwater elevations compared well for each model calibration as presented in **Table 5-1**.

The calibration/verification statistics for the three models are presented in **Table 5-2**. These statistics indicate good model calibrations/verifications for each model. The scaled absolute mean values range from 1.0% to 2.3%, which are also better than those achieved (2.6% and 3.8%) in the GeoTrans model. It should also be noted, that the observed data sets available for use in the 2011 and 2013 models are significantly greater than those available for use with the 2000 and 2007 models.

5.3 Transient Flow Model Calibrations/Verifications

The estimated K distribution was further evaluated and adjusted using transient flow model to simulate the two pumping tests.

5.3.1 Short-Term Pumping Test

GeoTrans developed a short-term transient flow model to simulate a 24-hour pumping test performed in 2001 to refine the estimation of the K value in the vicinity of the plume area (GeoTrans, 2008). The pumping test was conducted at PER-15 at a rate of 15 gpm.

The URS transient model setup for the short-term pumping test is the same as described in GeoTrans (2008). During the calibration, the K distribution was further adjusted, especially for the extent of the low-K zone (1 ft/d) in Layer 2. The specific yield (S_y) for Layer 1 was increased slightly from 0.0005 to 0.0006. The simulated drawdown hydrographs closely match the observed ones at MLR-7, WR-347B, and WR-345B as shown in **Figure 5-11**.

5.3.2 Long-Term Pumping Test

GeoTrans developed a long-term transient flow model to simulate a 56-day pumping test and the recovery period that was performed at the University of Arizona's Martin Street well in 2001 for the purpose of estimating the K in the production well area.

The URS transient model setup for the long-term pumping test is the same as described in GeoTrans (2008). The simulated drawdown hydrographs closely match the observed ones at UAM-2 and UAM-3 as shown in **Figure 5-12**.

6.0 GROUNDWATER SOLUTE TRANSPORT MODEL

The groundwater solute transport model for the Regional Aquifer was developed using a 42-year history matching simulation for regional groundwater PCE plume migration from 1973 through 2014. This simulation process allowed further understanding of the PCE source conditions and the PCE concentration spatial and temporal variations.

6.1 History Matching Simulation of Regional Aquifer PCE Plume

6.1.1 PCE Source to Regional Aquifer

As discussed in Section 2.0, the introduction of PCE to the Regional Aquifer is thought to have occurred through two pathways (TTG, 2011):

- The incompetent well annuli of the Old Well and MP-1 allowed contamination from the Perched Aquifer to migrate into the Lower Vadose Zone and the Regional Aquifer until 1992 and 1994, respectively, when the Old Well and MP-1 were abandoned; and
- After abandonment of the Old Well in 1992 and MP-1 in 1994, the remaining contaminated soils and soil vapors in the Lower Vadose Zone may have continued acting as a secondary source of contaminants to the Regional Aquifer.

Based on the above understanding, the PCE source condition in the model was assumed as following:

- A constant concentration source of PCE is assumed in Layer 1 at one model cell (25 ft by 25 ft) where MP-1 was located.
- The PCE concentration at the source cell was assumed variable over time, according to the understanding of the contaminant history and according the observed PCE concentration in the source area. Seven stress periods from 1973 to 2014 were specified (**Table 6-1**). The source concentration in each stress period was adjusted to allow the simulated PCE plume and the simulated concentration trends to approximately match the observed ones.
- As shown in **Table 6-1**, the source PCE concentration was assumed 8,000 µg/L during 1973 to 1975 when MP-1 was installed.
- Before MP-1 was abandoned in 1994, the source PCE concentration was assumed to be 800 µg/L for 18 years from 1976 to 1993.
- After MP-1 was abandoned in 1994, the source PCE concentration was assumed at 230 µg/L for six years.
- During 2000 to 2009, it was assumed that there was no release of PCE mass from the source location. This assumption was based on the observed temporal trends of the PCE concentrations at MLR-7 (**Figure 3-2**), which is located immediately downgradient of the source. The observed PCE concentrations at MLR-7 decreased to a much lower level (typically less than 10 µg/L) from 2004 to 2010.
- During the recent five years from 2010 to 2014, elevated PCE concentrations have been observed at PER-14A, which was installed in 2008 (**Figure 3-2**). During this period

(2010 to 2014), the PCE source constant was assumed to be 100 µg/L which reflects the recently increased PCE concentrations at PER-14A and MLR-7.

- Note, the actual source concentration variation over time is unknown, which may be much more complex than was assumed.

6.1.2 Flow Model for History Matching Simulation

The groundwater flow model used in the history matching simulation of 42 years includes seven stress periods following the setup for the time-variable source concentration (**Table 6-1**).

As shown in **Table 6-1**, during the first five stress periods (1973 to 1999), the pumping rates at the production wells are the approximate rates derived by GeoTrans (2008). For the 6th period (2000 to 2009), the pumping rates were adjusted following the discussion in GeoTrans (2008). For the 7th stress period (2010 to 2014), the five-year average pumping rates of daily records of University of Arizona from 2008 to 2013 were applied. **Table 6-2** presents the average pumping rates at individual wells used for these stress periods.

The General Head boundary conditions were specified for two periods (**Table 6-1**): prior to 2000 (Period 1 to 5) and post of 2000 (Period 6 to 7). This was based on the observed groundwater hydrographs: prior to 2000, the hydraulic gradient cross the site is steeper, while post of 2000, the hydraulic gradient is flatter.

6.1.3 Transport Parameters

The transport parameters in the groundwater solute transport model were estimated, including:

- Effective porosity
- PCE soil-water distribution coefficient
- Dispersion coefficient
- Biodegradation half-life

The selected values for these parameters are included in **Table 6-3**. The basis for selection of these parameters is discussed below and also included in **Table 6-3**.

The effective porosity is assumed to be 10% for the Regional Aquifer, based on description of the geologic materials in comparison to the published mobile porosity that was estimated based on 15 field tracer tests in various aquifer materials (Payne et al., 2008).

The PCE soil-water distribution coefficient (Kd) (0.11 liters per kilogram [L/kg]) was estimated based on the site-specific fraction of organic carbon content (0.04%) in the saturated soil of the Regional Aquifer and the typical PCE partition coefficient to organic carbon (Koc) (263 L/kg) in the literature (Knox, et al. 1993). Based on these parameters, the retardation factor for groundwater contaminant velocity is 2.87.

The longitudinal, transverse, and vertical dispersivity values (10 ft, 8 ft, and 0.001 ft, respectively) were estimated through the history matching simulations in comparison to the observed conditions. The relatively higher transverse dispersivity (8 ft) is based on observation that the width of PCE plume is increased substantially downgradient of the narrower source area. The variation of the pumping rates and pumping locations from production wells in the history could be the reason for the wider plume as observed.

Biodegradation is assumed not occurring in the Regional Aquifer, based on the RI study (TTG, 2011) and based on review of the recent sampling results in the long-term monitoring program. The most important feature in the Regional Aquifer PCE plume is lack of evidence of biodegradation.

6.2 Simulated Historical PCE Plume Migration

The simulated historical PCE plume transport process over time is presented in **Figure 6-1**. The simulated PCE plume in Layers 1 and 2 are presented for 1993 (21 years of migration), 2005 (33 years of migration), 2009 (37 years of migration), and 2014 (42 years of migration). The interpreted 2014 regional groundwater PCE plume is posted for comparison.

The simulated PCE plume over time has the following features:

- The simulated groundwater hydraulic gradient is greater in 1993 than the later years, which reflects the difference between the hydraulic gradients as observed by GeoTrans (2008).
- The simulated PCE plume extent is smaller but the concentrations are higher in 1993 compared to the later years.
- The simulated PCE concentrations in 2005 and 2009 are less than 5 µg/L in the source area, which reflects the observed low PCE concentrations at MLR-7 during this period.
- The simulated PCE plume extent in 2014 approximately matches the interpreted 2014 PCE plume with smaller a hot spot of concentrations greater than 100 µg/L.
- The simulated PCE plume in Layer 2 reflects the observed PCE concentrations at PER-21 (**Figure 3-2**). There is no additional information to verify whether the simulated PCE plume extent in Layer 2 is reasonable.

7.0 MODEL PREDICTIONS

The objective of remediation for the Regional Aquifer is to protect water quality at the University of Arizona production wells. The potential remedial alternatives that were evaluated in the model include five:

- Monitored natural attenuation (MNA)
- Groundwater extraction
- PlumeStop™
- In situ chemical oxidation (ISCO)
- Enhanced reductive dechlorination (ERD)

For evaluation of the potential effect of the remedial alternatives, an assumed criterion was used, that is the simulated maximum PCE concentration at the production wells should be less than or equal to 2.5 µg/L in extracted groundwater.

7.1 Future Production Pumping Plan

University of Arizona proposed to expand the campus facilities from the current 10.7 gross square feet to approximately 20.6 M square feet in the next 20 years (University of Arizona 2015). Accordingly, the groundwater production rate was proposed to be increased annually in the next 20 years (GLHN 2015). Afterward, the total rate was assumed to remain constant, which is approximately double of the 2014 total pumping rate. The number of production wells will remain the same, but two wells will be re-developed. The locations of CRB well and North Hospital well will be moved in the vicinity and the well screens will be located in deeper portion of the aquifer only.

The future five-year average pumping rates for five periods from 2015 to 2039 at the production wells are presented in **Table 7-1**, which were derived from the proposed annual rates by GLHN (2015). In the model, the locations of CRB well and North Hospital well are moved accordingly and they are placed in Layer 4 only.

7.2 Prediction Assumptions

Model predictions for the first three remedial scenarios (MNA, groundwater extraction, and PlumeStop™) are based on the following assumptions:

- The future pumping rates at UA production wells are assumed following UA expansion plan (**Table 7-1**); the pumping rates are increased every five years until 2040 and then remain constant.
- The future PCE source concentration is assumed to be 10 µg/L, which represents the possible remaining PCE concentration in the source area after soil vapor extraction in the Lower Vadose Zone and reflects the recently observed decreasing concentration trends at PER-14A.
- The initial PCE concentrations for the predictions are the simulated concentrations at the end of 2014 as a result of history matching during model calibration.

7.3 Monitored Natural Attenuation

The prediction simulation for MNA was conducted for future 250 years, starting in 2015.

Figure 7-1, Sheet 1 of 3, presents the predicted PCE plume in both Layers 1 and 2, for 5 years later (2019), 10 years later (2024), 20 years later (2034), and 30 years later (2044).

The model predicts that within the next 30 years, the PCE plume will move to the northeast into the zone of the production wells, expanding to larger extent with a shrinking hot spot.

Figure 7-1, Sheet 2 of 2 (year 50, 100, and 150), shows that the simulated PCE plume continuously moves toward northeast in both Layers 1 and 2 with further reduced PCE concentrations.

Figure 7-1, Sheet 3 of 3 (year 10, 20, 30, 50, 100, and 150 in Layer 3. Only by year 100, PCE plume (> 5 µg/L) moving into Layer 3, as the result of deep well pumping.

Figure 7-2 presents the predicted PCE concentrations in the extracted groundwater at eight production wells. The predicted future PCE concentrations are greater than 2.5 µg/L at Agriculture well by year 50 and greater than 3.5 µg/L at S. Hospital well by year 150.

Figures 7-1 and **7-2** indicate that under MNA, the Regional Aquifer PCE plume will migrate to downgradient with very limited attenuation, because there is no areal groundwater recharge, no biodegradation, slow advection, and limited dispersion. In the model, adsorption and desorption is simulated as a reversible numerical process, which only slows down the plume migration, stretches the plume, without destruction of PCE mass in the aquifer. The results also indicate that the plume migration direction is influenced by the pumping pattern of University of Arizona (Section 7.8).

7.4 Groundwater Extraction

A groundwater extraction well, EW-1, is assumed to be pumped at 50 gpm for 30 years near the distal end of the current PCE plume (**Figure 7-3**). The location of the pumping well and its pumping rate were adjusted with intention of removing as much PCE mass as possible to prevent the high-concentration PCE plume from moving downgradient.

The simulated PCE plume over 30 years and groundwater PCE concentration trends at production wells are presented in **Figures 7-3** and **7-4**. As shown on **Figure 7-4**, pumping at EW-1 has effectively contained the major portion of the plume from moving forward and reduced the PCE concentrations from approximately 80 µg/L to less than 7 µg/L by year 25. The simulated remaining PCE plume extent in Layer 1 by year 20 becomes small and by year 30 disappears. The predicted PCE concentrations at the production wells are well below 1 µg/L for the next 180 years.

The simulated pumping at EW-1 in Layer 1 also has created an upward hydraulic gradient, which effectively reduces the PCE concentrations in Layer 2 and slows down the remaining PCE plume migration in Layer 2. This can be seen by comparing to **Figure 7-1**, Sheet 1 of 2.

7.5 PlumeStop™

PlumeStop™ is a sorption-based new remedial technology by Regenesis (http://regenesis.com/products/plumestop-colloidal-biomatrix/). Application of PlumeStop™ is

to prevent high PCE concentrations from moving downgradient. PlumeStop™ is assumed to be injected along 8th street (**Figure 7-5**), for convenience of installation of a subsurface barrier of PlumeStop™. The length of the barrier is 775 ft long, which is similar to the width of the simulated 2014 PCE plume. The width of the barrier is approximately 60 ft, covering two or three model cells; each cell is 25 ft by 25 ft. Uneven numbers of model cells along the barrier is due to the fact that 8th St is not oriented perpendicular to the groundwater flow direction, thus having an angle with the orientation of model grid.

7.5.1 Concentration Knockdown Efficiency

The effectiveness of the PlumeStop™ barrier is dependent on the homogeneity of the PlumeStop™ material distribution within the target interval. Knowing that complete and homogenous distribution is unlikely, this inefficiency was simulated in the model as equivalent to contaminant degradation for convenience. The required half-life of the barrier was tested in the model with an intention that the maximum PCE concentration at the production wells not exceeding 2.5 µg/L. The half-life of the barrier was tested for 10 days, 15 days, and 30 days. The simulated maximum PCE concentrations before and after the barrier, the calculated concentration reduction efficiency of the barrier, and the simulated maximum PCE concentrations at the production wells are compared in **Table 7-2**. The concentration reduction efficiency is calculated using the following equation:

$$Concentration\ K\ Reduction\ Efficiency = \frac{concentration\ befor\ the\ barrier - concentration\ after\ the\ wall}{concentration\ before\ the\ barrier}$$

The simulated PCE plume with a PlumeStop™ barrier assuming a concentration knockdown efficiency of 83% (half-life of 15 days) is presented on **Figures 7-5** for the next 30 years. The predicted PCE concentrations from the extracted groundwater at all production wells in the next 150 years are well below 1.0 µg/L.

7.5.2 Injection and Extraction Wells for Distribution of PlumeStop™

To support the FS to estimate potential cost for distribution of PlumeStop™ in the saturated Layer 1 along the desired zone, model testing was conducted to estimate the required:

- Number of injection and extraction wells
- Well spacing between injection and extraction wells; and
- Injection and pumping rates

The assumption for the simulation is that the operation for injection and extraction is only for one week. Steady state flow model simulation and particle tracking simulation were used to represent the potential spreading (distribution) of PlumeStop™ over one week.

Figure 7-6 presents the model testing results. Eight injection wells and eight extraction wells are installed along a zone of approximately 800 ft long and 60 ft wide. The injection wells are located approximately 25 ft behind the extraction wells, which allows injected fluid to move following the enhanced hydraulic gradients toward extraction wells. The average well spacing is approximately 70 ft. The uneven well spacing is due to limitation of model cell size; each is 25 ft by 25 ft.

The rate of injection is 100 gpm per well and the rate of extraction is 100 gpm per well. Therefore, the total injection rate and the total extraction rate is 800 gpm, respectively.

7.6 In Situ Chemical Oxidation

In Situ Chemical Oxidation (ISCO) is assumed in the hot-spot within the simulated 2014 PCE plume. The ISCO is assumed to effectively reduce the PCE concentrations within the treated area to 10 µg/L (**Figure 7-7**).

With the modified initial PCE concentration, the model was run for 150 years. The predicted PCE plume over time in the next 30 years is presented on **Figure 7-7**.

7.7 Enhanced Reductive Dechlorination

ERD was simulated in preventing the major portion of the PCE plume from moving downgradient. ERD was simulated using a single line of or multiple lines of injection. A biodegradation half-life of 20 days was assumed at the model cells of 25 ft by 25 ft, based on a treatability study results of laboratory test (CH2M Hill, 2010).

A single line of injection was not adequate to reduce the high concentrations of the PCE plume from moving forward. The simulation results, assuming three lines of injection are presented in **Figure 7-8**.

7.8 Uncertainty of Monitored Natural Attenuation

The remedial effect of MNA is influenced by the uncertainty of the future pumping rates of production wells. To demonstrate this point, the predictive simulation for MNA was conducted assuming that the UA pumping rates were the same as the six-year average rates from 2008 – 2014 without increases (**Table 7-3**).

Figure 7-9 (three sheets) presents the prediction results of MNA assuming six-year average pumping rates of 2008 – 2014. Compared to **Figure 7-1**, the major differences of the predicted plumes are in later years when the plumes moving into the production well zone as shown on Sheet 2 and 3.

7.9 Groundwater Extraction and Re-Injection

In conjunction with the option for groundwater extraction described in Section 7.4, one of the potential beneficial uses of extracted groundwater is to re-inject the treated water back into the regional aquifer. This section discusses the modeling results for evaluation of this option.

The evaluation focused on the optimal selection of a re-injection location and/or depth based on impacts to capture efficiency, assuming extracted groundwater of 50 gpm is completely re-injected. More than ten possible reinjection configurations were evaluated. Options deemed potentially viable include:

- Re-injection upgradient from the plume
- Re-injection cross-gradient from the plume along 8th Street
- Re-injection downgradient from the plume along 7th Street
- Re-injection in a deeper interval (Layer 4) adjacent to the extraction location

The evaluation criteria used to select a re-injection location are:

- Minimizing the re-injection impact to plume containment and plume cleanup
- Minimizing the additional cost of re-injection, as appropriate, but leaving final cost evaluation to FS

The evaluations of re-injection impacts are compared from two aspects:

- Comparing the model simulated PCE plumes with the groundwater extraction option without re-injection (Section 7.4) (**Figure 7-10**) as base case to each of the four re-injection options (**Figures 7-10** to **7-13**)
- Comparing the model simulated PCE concentrations at EW-1 among the five options (**Figure 7-14**)

The locations or depth of the re-injection wells for these options are presented on the respective figures (**Figures 7-10** to **7-13**).

8.0 SUMMARY

The groundwater flow and transport models for the Regional Aquifer at Park Euclid WQARF Site were developed based on the conceptual understanding of the site conditions described in the RI report (TTG, 2011) and the URS studies (URS, 2011; 2012; 2013;2014) and based on the numerical groundwater model developed by GeoTrans (2008).

The groundwater flow model developed in this study further improved the groundwater flow model that was developed by GeoTrans (2008), in the following aspects:

- Used enlarged data sets of groundwater elevations and sampling results as well as recent pumping records of University of Arizona,
- Modified model orientation to be aligned with the plume migration direction,
- Calibrated both horizontal and vertical hydraulic gradients,
- Improved estimation of K distribution, especially in deeper layers,
- Further improved model calibration results.

The groundwater solute transport model reasonably mimics the likely contaminant source history and simulated the regional PCE plume migration for 42 years from 1973 to 2014. The simulated PCE plume extent and the simulated PCE concentration temporal trends are approximately comparable and relatively conservative, compared to the interpreted PCE plume.

The developed groundwater flow and transport models were used as a tool to help evaluate six potential remedial alternatives for the Regional Aquifer. The specific remedial goal is to protect groundwater quality at the University of Arizona production wells. The PCE concentrations in the extracted groundwater from the wells should not exceed and assumed criteria of 2.5 µg/L (1/2 of the Arizona Water Quality Standard for PCE). The six potential remedial alternatives evaluated include:

- Monitored natural attenuation (MNA)
- Groundwater extraction
- PlumeStop™
- In situ chemical oxidation (ISCO)
- Enhanced reductive dechlorination (ERD)
- Groundwater extraction and re-injection

The model evaluation results indicate that:

- MNA is difficult to achieve the objective of remediation, mainly due to that the natural attenuation mechanisms at the Site are very limited, as there is neither areal groundwater recharge nor anaerobic biodegradation.
- Groundwater extraction can intercept and remove majority mass of the PCE plume in an estimated time period of 30 years or less. In addition, Groundwater extraction will be less impacted by the future variation of University of Arizona pumping schedules and pumping patterns.

- PlumeStop™ can be protective of the University of Arizona's supply wells, as long as the barrier of PlumeStop™ can obtain a distribution efficiency greater than 80%, or the PCE concentrations in groundwater after passing through the barrier are less than 30 µg/L. Uncertainties associated with this alternative are that the plume migration path may change due to variation in pumping schedules and pumping patterns at the University of Arizona or that adequate distribution of the material will not be achieved within the target zone.
- ISCO was initially evaluated based on an assumption that the current PCE concentrations in the PCE plume could be effectively treated to be less than 10 µg/L for initial consideration of FS. No further evaluation was conducted as it was screened out in the FS.
- ERD was initially evaluated based on assumed biodegradation half-life of 20 days for initial consideration of FS. No further evaluation was conducted as it was screened out in the FS.
- Groundwater extraction with re-injection can be implemented without significant impact to plume containment or PCE mass removal using any of the proposed options. Selection of most appropriate re-injection option based on all appropriate factors well is performed in the FS.

9.0 REFERENCES

CH2M Hill. 2008. *McGaffey and Main Ground Water Plume Site: Feasibility Study Report.* Roswell, New Mexico, August.

Davidson, E.S. 1973. Geohydrology and Water Resources of the Tucson Basin, Arizona, U.S. Geological Survey Water-Supply Paper 1939-E.

GeoTrans, Inc. 2008. Groundwater Modeling Report, Park-Euclid WQARF Site, Tucson, Arizona, Prepared for Arizona Department of Environmental Quality, June 30.

Golder Associates Inc. 2001. Park Euclid Well Redevelopment and Aquifer Testing (dated June 14, 2001).

GLHN Architects & Engineers. 2015. Memorandum, Projected Groundwater Withdrawals, Park-Euclid WQARF University of Arizona Water System, June 22.

Guo, X and C.-M. Zhang. 2000. Hydraulic Gradient Comparison Method to Estimate Aquifer Hydraulic Parameters under Steady-State Conditions, Ground Water, Vol. 38, No. 6, pp. 801-960.

Hydro Geo Chem, Inc. 2002. Park Euclid Sentinel Well Hydraulic Analysis (dated July 22, 2002).

Knox, R.C., D.A. Sabatini, and L.W. Canter. 1993. *Subsurface Transport and Fate Processes*, Lewis Publishers, 430 pages.

Payne, Fred C., Joseph A. Quinnan, and Scott T. Potter. 2008. Remediation Hydraulics, CRC Press, 408 pages.

Tetra Tech GEO (TTG). 2011. Final Remedial Investigation Report, Park-Euclid WQARF Site, Tucson, Arizona, Volume I – Text, Tables, and figures. November 15.

University of Arizona. 2015. University of Arizona Main Campus Water System Survey and Planning, April.

URS. 2011. Final Baseline Report for Long-Term Monitoring and Remedial System Performance, park –Euclid WQARF Site, Tucson, Arizona, December, 22.

URS. 2013. Work Plan, Feasibility Study and Associated Activities, Park-Euclid WQARF Site, Tucson, Arizona, June 21.

URS. 2014a. Lower Vadose Zone Soil Vapor Extraction Early Response Action, Park-Euclid WQARF Site, Tucson, Arizona, June 4.

URS. 2014b. 2014 Annual Report for Long-Term Monitoring, Park-Euclid WQARF Site, Tucson, Arizona, July 28.

TABLES

Table 2-1
Historical University of Arizona Production Well Information

Well Name	UTM Easting (feet)	UTM Northing (feet)	Total Borehole Depth (feet bgs)	Approx Ground Surface (feet)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Average Pumping Rate (gpm)	Notes
Architecture	997215	450547	601	2437	190-290 297-600	601	78	Generally Active
CRB	998299	451500	700	2447	328	700	174	Generally Active
N. Hospital	999797	453699	460	2433	150-440	460	50	Generally Active
S. Hospital	999665	452572	600	2443	N/A	N/A	52	Generally Active
Agriculture (Aggie)	997814	449191	480	2424	122	480	16	Inactive from 2002 to 2008
Huachuca	996785	448669	614	2418	180	592	93	Taken offline in 2004
Martin Street	1000352	448034	600	2436	170 [1] 300 [2] 390 [3]	225 [1] 590 [2] 510 [3]	119	Offline from 2001 thorough 2007 – Reinstalled with new screen in 2008
Optical	999875	449070	N/A	2447	480 540	600 680	54 [4]	Record begins in 2004
Library [5]	999087	448715	N/A	N/A	N/A	N/A	Data not Available	Taken off-line between 1998 and 2001
Student Union [5]	998294	449754	N/A	N/A	N/A	N/A	32	Abandoned 1999

Notes:
UTM = Universal Transverse Mercator
bgs = below ground surface
gpm = gallons per minute
[1] Upper screened interval prior to 2007
[2] Lower screened interval prior to 2007
[3] Approximate new screened interval starting in 2008
[4] Average pumping rate calculated for 2007
[5] Abandoned wells included due to historical pumping

Table 2-2
Five-Year Average and Maximum Pumping Rates of University of Arizona (2008 to 2013)

Well Name	Model Layer	Five-Year Average (2008 - 2013) (gpm)	Five-Year Max. (2008 - 2013) (gpm)
Agriculture (Aggie)	1, 2, 3	92.33	380
Architecture	1,2,3,4	77.51	486
CRB	1,2,3,4	17.55	332
Martin St.	1,2,3,4 (pre-2008) 2,3 (post-2008)	120.35	496
N. Hospital	1,2,3	71.20	406
S. Hospital	1,2,3	61.17	425
Optical	3,4	45.27	428
Park	4	99.17	659
Total Pumping Rate		585	

Notes:
gpm = gallons per minute

Table 4-1
Model Layers

Model Layer	Bottom Elevation (ft, msl)	Saturated Thickness (ft)	MODFLOW Layer Type	Remark
1	2,080	about 130 ft near Park-Euclid Site	1 - Unconfined	Saturated thickness variable based on water table elevation
2	2,040	40	3- Convertible	Simulation of clay layer that is present in the vicinity of PER-14A
3	1900	140	3- Convertible	Screen intervals for most of the UA production wells extends into or through this layer
4	1,400	500	3- Convertible	Screen intervals for a few production wells extends into this layer

Notes:
ft = feet
MODFLOW = Modular Three-Dimensional Finite Difference Groundwater Flow Model
msl = mean sea level

Table 4-2
Average Pumping Rates of University of Arizona in Model Calibration and Verifications

Well Name	Model Layer	Monthly Average Pumping Rates (gpm)			
		2000_Oct	2007_Dec	2011_July	2013_July
Agriculture (Aggie)	1, 2, 3	0	0	165	88
Architecture	1,2,3,4	91	68	116	55
CRB	1,2,3,4	189	163	0	0
Martin St.	1,2,3,4 (pre-2008) 2,3 (post-2008)	165	0	162	146
N. Hospital	1,2,3	50	64	51	99
S. Hospital	1,2,3	52	70	59	140
Optical	3,4	0	54	0	27
Huachuca	1,2,3,4	77	0	NA	NA
Park	4	NA	NA	7	182
Total Pumping Rate		624	419	559	737

Notes:
gpm = gallons per minute
Huachuca pumping was terminated after 2000. Park is located in the same location of Huachuca, but screened deeper between 540 to 780 feet bgs.

Table 5-1
Simulated and Observed Groundwater Elevations in Model Calibration and Verifications

Name	Model_X	Model_Y	Model Layer	2013 August Observed (ft)	2013 Computed (ft)	2013 Residual (ft)	2011 July Observed (ft)	2011 Computed (ft)	2011 Residual (ft)	2007 July Observed (ft)	2007 Computed (ft)	2007 Residual (ft)	2000 Dec Observed (ft)	2000 Dec Computed (ft)	2000 Dec Residual (ft)
MLR-1	997350.9	444336.7	1	2214.37	2214.66	-0.29	2212.08	2212.41	-0.33	2211.43	2211.72	-0.29	2217.00	2217.09	-0.09
MLR-2	997162.2	444637.4	1	2213.33	2213.70	-0.37	2210.85	2211.49	-0.64	2210.54	2210.86	-0.32	2215.70	2215.72	-0.02
MLR-3	997378.7	444718.4	1	2213.09	2213.10	-0.01	2210.69	2210.91	-0.22	2210.18	2210.35	-0.17	2215.06	2215.02	0.04
MLR-7	997369.2	444634	1	2213.51	2213.46	0.05	2211.45	2211.25	0.20	2210.71	2210.66	0.05	2216.11	2215.49	0.62
PBR-10	997368.1	446447.9	1	2205.78	2205.96	-0.18	2204.02	2203.93	0.09	2204.38	2204.06	0.32			
PER-14	997328.5	444542.3	4	2231.46	2231.16	0.30	2229.53	2229.39	0.14						
PER-14A	997336.4	444553.8	1	2213.83	2213.82	0.01	2211.71	2211.60	0.11						
PER-15	997653.4	445216.2	1	2211.20	2210.71	0.49	2209.03	2208.57	0.46	2208.78	2208.27	0.51			
PER-21	997637.9	445223.5	2	2210.82	2210.83	-0.01	2208.61	2208.76	-0.15	2208.00	2208.45	-0.45			
PER-22	997664.3	445224	1	2210.83	2210.66	0.17	2208.79	2208.53	0.26	2208.42	2208.23	0.19			
PER-23	997909.2	445684.3	1	2208.84	2208.44	0.40	2206.87	2206.34	0.53	2206.65	2206.31	0.34			
PER-25	997439.5	445718.2	1	2208.58	2208.85	-0.27	2206.66	2206.77	-0.11	2206.73	2206.62	0.11			
PER-26	997801.5	446046.6	1	2207.43	2207.07	0.36	2205.32	2205.00	0.32	2205.54	2205.10	0.44			
PER-27	996954.9	446083.7	1	2207.21	2207.76	-0.55	2205.41	2205.74	-0.33	2205.84	2205.59	0.25			
UAM-1	997377.6	447505.6	1	2200.92	2201.65	-0.73	2198.76	2199.48	-0.72	2200.19	2200.18	0.01	2199.08	2199.47	-0.39
UAM-2	998240	446983.8	1	2202.98	2202.63	0.35	2200.63	2200.46	0.17	2201.66	2201.26	0.40	2201.88	2201.42	0.46
UAM-2B	998239.7	447003.8	2	2203.20	2203.04	0.16	2200.85	2200.95	-0.10						
UAM-3	999434.1	447532.7	1	2199.02	2198.39	0.63	2196.34	2196.15	0.19	2197.53	2197.97	-0.44	2196.31	2196.39	-0.08
WR-345B	997885.2	445201.6	1	2209.85	2210.47	-0.62	2207.86	2208.34	-0.48	2207.21	2208.08	-0.87	2211.31	2211.72	-0.41

Notes:
ft = feet

Table 5-2
Statistics of Steady State Flow Model Calibration and Verifications

	2013 Model	2011 Model	2007 Model	2000 Model
Residual Mean (ft)	-0.005	-0.032	0.004	0.015
Abs. Res. Mean (ft)	0.313	0.292	0.323	0.264
Res. Std. Dev. (ft)	0.379	0.344	0.380	0.341
Sum of Squares	2.733	2.265	2.315	0.933
RMS Error (ft)	0.379	0.345	0.380	0.341
Min. Residual (ft)	-0.728	-0.716	-0.870	-0.412
Max. Residual (ft)	0.629	0.526	0.506	0.617
Number of Observations	19	19	16	8
Range in Observations (ft)	32.440	33.190	13.900	20.690
Scaled Std. Dev. (%)	0.012	0.010	0.027	0.016
Scaled Abs. Mean (%)	0.010	0.010	0.023	0.013
Scaled RMS (%)	0.012	-0.001	0.027	0.017

Notes:
ft = feet
% = percent

Table 6-1
Model Assumptions for History Matching Simulation

Stress Period	Length of Stress Period (year)	Duation of Stress Period	Assumed Source Concentration (µg/L)	General Head at Boundaries	Historical Well Pumping Rates
1	3	1973 - 1975	8,000	Prior to 2000, steeper hydraulic gradient across model domain	Following average pumping rates summarized in Geo Trans (2008)
2	6	1976 - 1981	800		
3	6	1982 - 1987	800		
4	6	1988 - 1993	800		
5	6	1994 - 1999	230		
6	10	2000 - 2009	0	Post 2000, flatter hydraulic gradient across model domain	Folliwng average pumping rates discussed in Geo Trans (2008)
7	5	2010 - 2014	100		Five-year average pumping rates of daily production rates of University of Arizona from 2008 to 2013 (Table 2-1)

Notes:
µg/L = micrograms per liter

Table 6-2
Average Pumping Rates used in History Matching Simulation of PCE Plume Migration

Well Name	Model Layer	Average Pumping Rates (gpm)				Notes (based on Geo Trans Modeling Report)
		Period 1-4	Period 5	Period 6	Period 7	
		1973 - 1993	1994 - 1999	2000 - 2009	2010 - 2014	
Agriculture (Aggie)	1, 2, 3	16	16	0	92.33	Inactive from 2002 to 2008
Architecture	1,2,3,4	78	78	78	77.51	Generally active
CRB	1,2,3,4	174	174	174	17.55	Generally active
Martin St.	1,2,3,4 (pre-2008) 2,3 (post-2008)	119	119	0	120.35	Off line from 2001 through 2007; Reinstalled with new screen in 2008
N. Hospital	1,2,3	50	50	50	71.20	Generally active
S. Hospital	1,2,3	52	52	52	61.17	Generally active
Optical	3,4	0	0	54	45.27	Record begins in 2004
Huachuca	1,2,3,4	93	93	0	0.00	Taken offline in 2004
Park	4	0	0	0	99.17	Replacement of Huachuca, started operation in 2009
Total Pumping Rate		582	582	408	584.55	

Notes:
gpm = gallons per minute

Table 6-3
Transport Parameters

Parameter	Value	Basis
Effective Porosity	10%	Based on published mobile porosity values that were estimated based on 15 field tracer tests in various aquifer materials (Payne et al., 2008)
Longitudinal Dispersivity	10 ft	Calibrated through history matching simulation
Transverse Dispersivity	12 ft	Calibrated through history matching simulation
Vertical Dispersivity	0.001 ft	Calibrated through history matching simulation
PCE partition coefficient to organic carbon (Koc)	263 L/kg	Knox, et al. 1993.
Fraction of organic carbon in regenal aquifer	0.04%	Based on site-specific data measured during the RI by Miller Brooks (2004)
Soil Bulk density	1.7 kg/L	Reference: Geo Trans (2008)
PCE soil-water distribution coefficient (Kd)	0.11 L/kg	Kd = foc x Koc
Biodegradation	None	Based on site-specific studies that the TCE concentrations in regional aquifer is very low within the plume, and ORP and dissolved oxygen reported in the RI suggest that aerobic conditions are present and reductive dechlorination is not occurring.

Notes:
% = percent
ft = feet
kg/L = kilograms per liter
L/kg = liters per kilogram
ORP = oxidation reduction potential
PCE = perchloroethylene
RI = Remedial Investigation
TCE = trichloroethylene

Table 7-1
University of Arizona Proposed Future Production Pumping Rates (gallons per minute)

Well	Model Layer	Year	Period 1	Period 2	Period 3	Period 4	Period 5	After Period 5
		2014	2015-2019	2020-2024	2025-2029	2030-2034	2035-2039	>2040
Agriculture (Aggie)	1, 2, 3	78	79	81	83	85	87	89
Architectural	1,2,3,4	111	116	128	141	156	172	182
CRB-R	1,2,3,4	0	75	203	232	272	327	367
Martin Street	2,3	136	136	136	137	137	137	138
North Hospital	1,2,3	33	7	0	0	0	0	0
North-R	4	0	102	140	154	170	188	200
South Hospital	1,2,3	89	97	126	129	132	135	137
Optical Sciences	3,4	87	88	91	94	97	100	102
Park	4	120	122	130	148	173	208	234
	Total	**654**	**821**	**1035**	**1118**	**1223**	**1354**	**1448**

Table 7-2

PlumeStop™: Simulated Concentration Reduction Efficiency and Remedial Effect

Model Assumed Equivalent Degradation Half-Life	Equivalent Half-Life = 10 days PCE Concentration (ug/L)	Equivalent Half-Life = 15 days PCE Concentration (ug/L)	Equivalent Half-Life = 30 days PCE Concentration (ug/L)
PCE Concentration Before PlumeStop Barrier	130	130	130
PCE Concentration After PlumeStop Barrier	11	22	37
Concentration Reduction Efficiency (%)	0.92	0.83	0.72
Max. PCE Concentration At Production Wells	1.4	2.2	2.9

Notes:
µg/L = micrograms per liter
% = percent
PCE = perchloroethylene

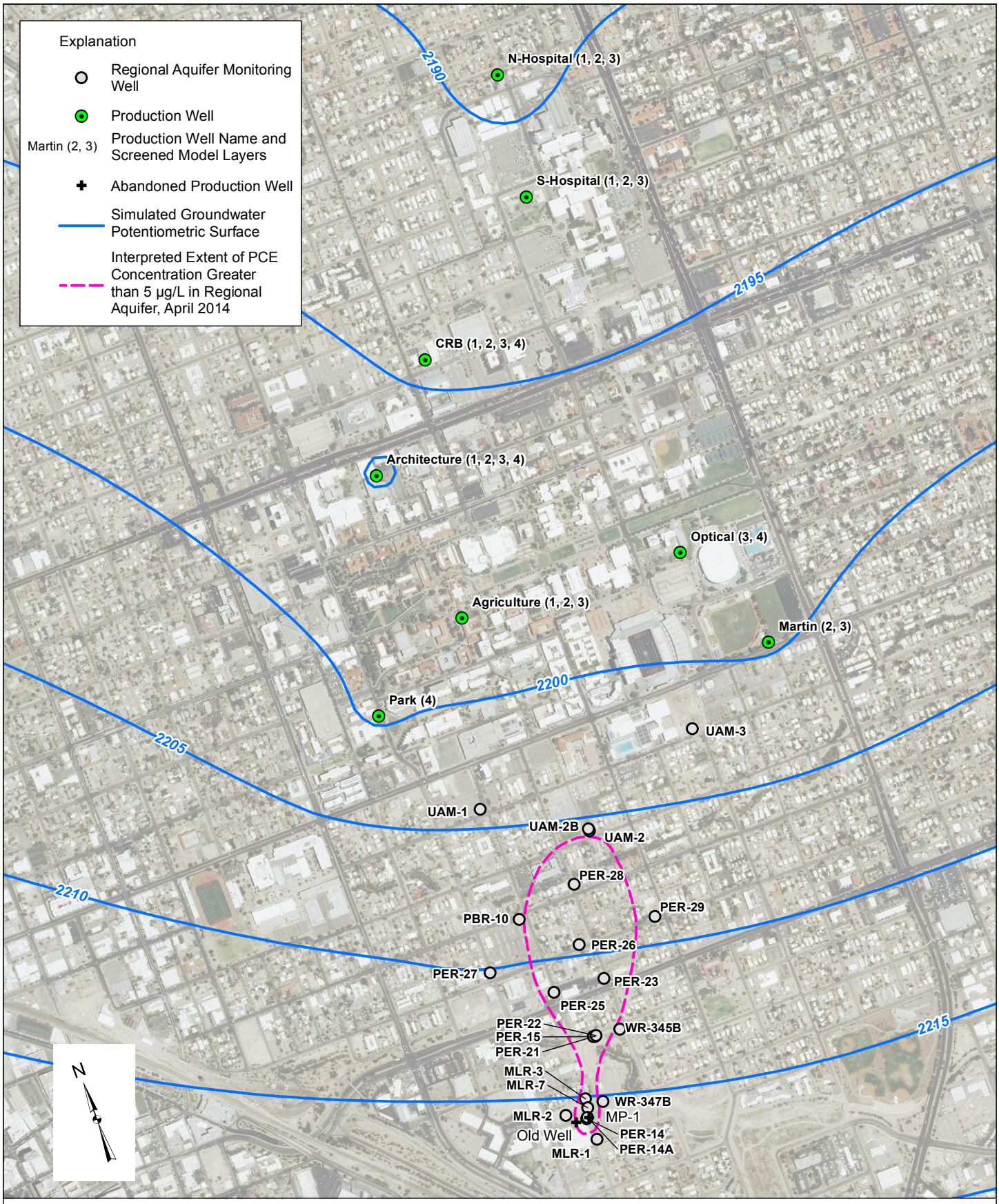
Table 7-3
University of Arizona Six-Year Average Production Pumping Rates of 2008 - 2014

Production Well	Model Layer	2014 (gpm)	Six-Year Average (2008-2014) (gpm)
Agriculture	1, 2, 3	78	90
Architectural	1,2,3,4	111	83
CRB	4	0	15
Martin Street	2,3	136	123
N. Hospital	4	33	65
S. Hospital	1,2,3	89	66
Optical Sciences	3,4	86	52
Park	4	120	103
	Total	**654**	**596**

Notes:
Six-year average pumping rate was calculated using time-weighted average of the five-year average rate (Table 2-2) and 2014 pumping rate.

gpm = gallons per minute

FIGURES



URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

Date: June 2015

Regional Aquifer Well Locations

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 2-1

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig2-01 Simulated RA Groundwater.mxd

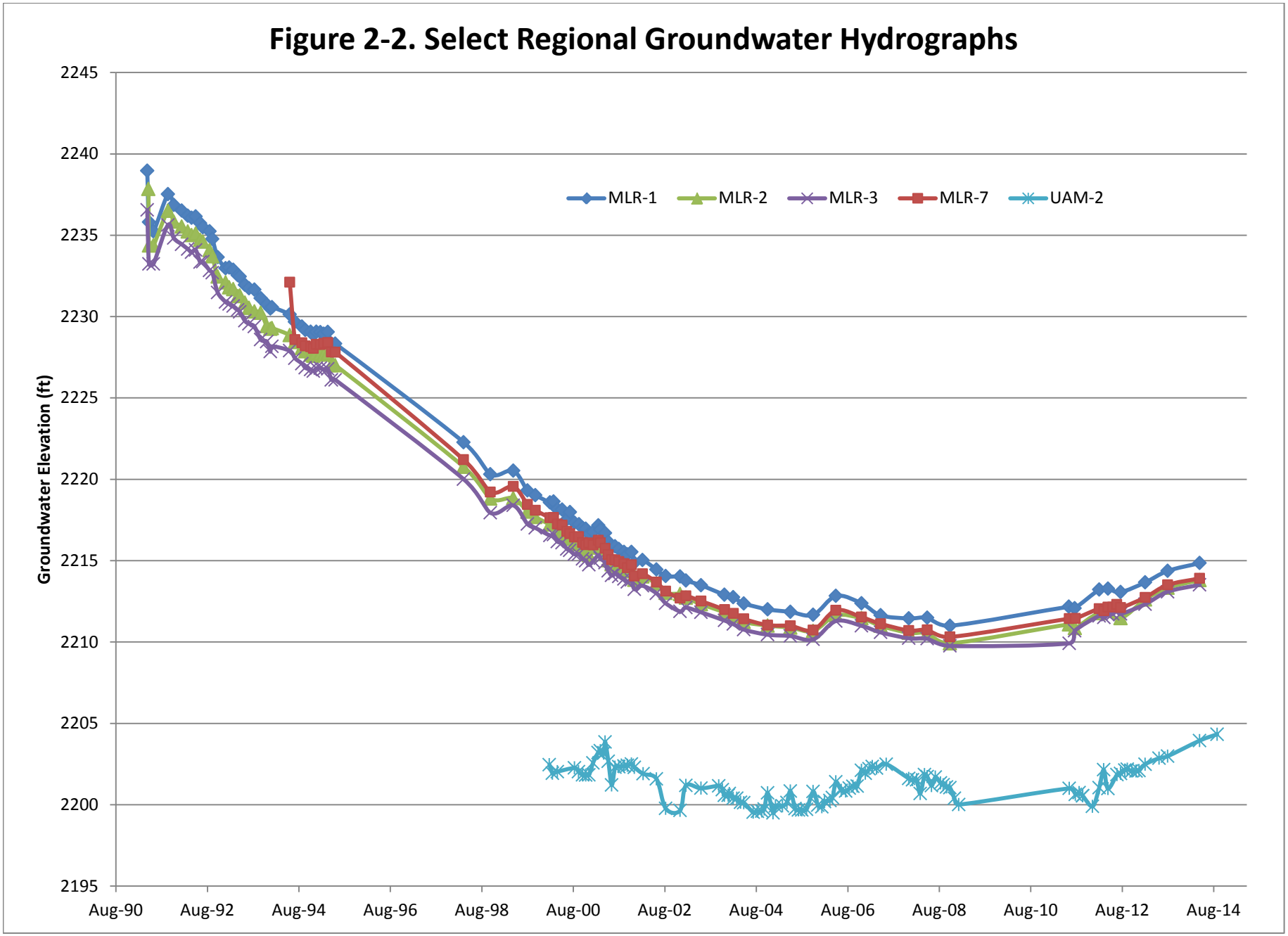
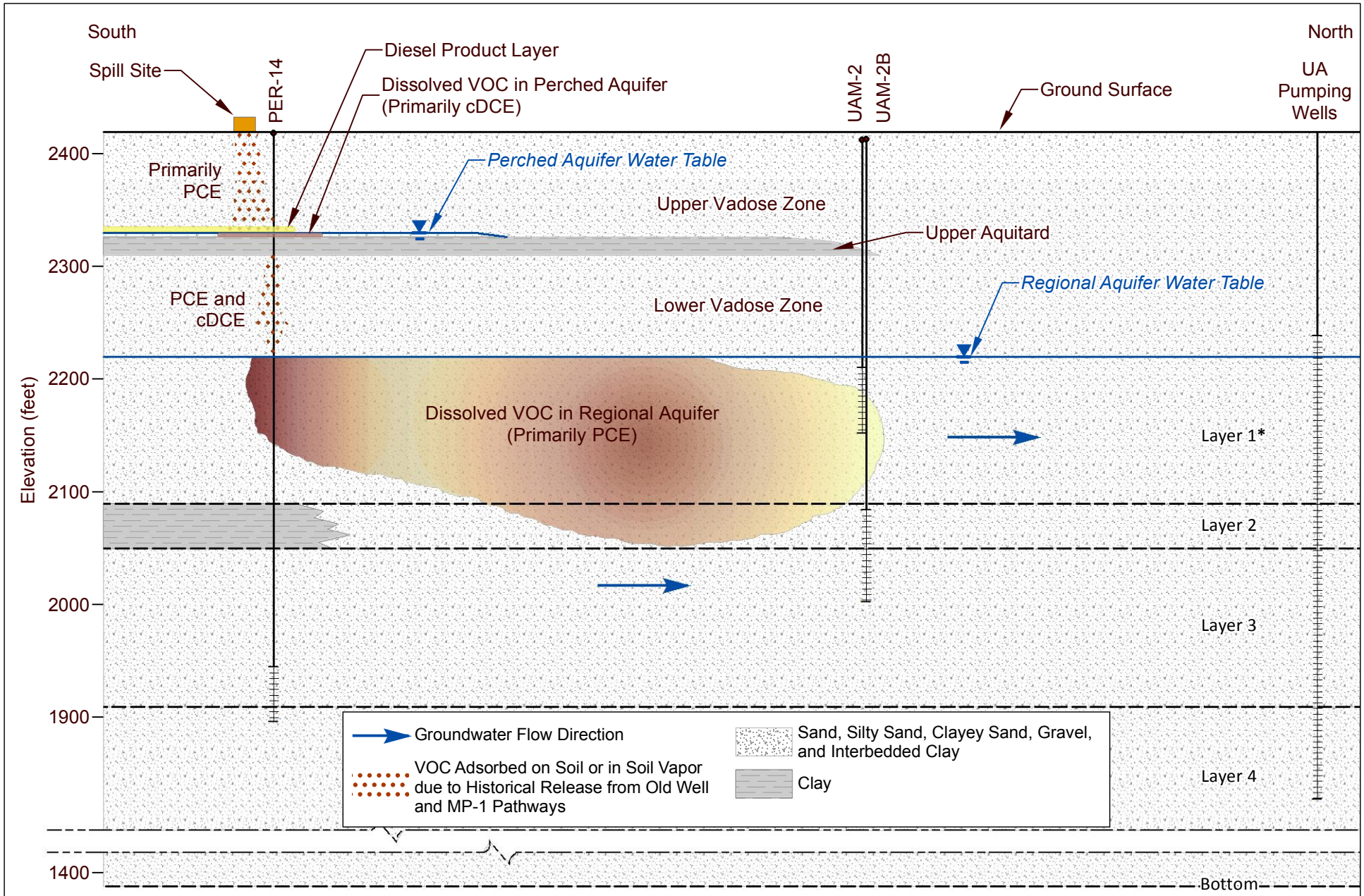


Figure 2-2. Select Regional Groundwater Hydrographs
Groundwater Elevation (ft)
2245
2240
2235
2230
2225
2220
2215
2210
2205
2200
2195
Aug-90
Aug-92
Aug-94
Aug-96
Aug-98
Aug-00
Aug-02
Aug-04
Aug-06
Aug-08
Aug-10
Aug-12
Aug-14
MLR-1
MLR-2
MLR-3
MLR-7
UAM-2



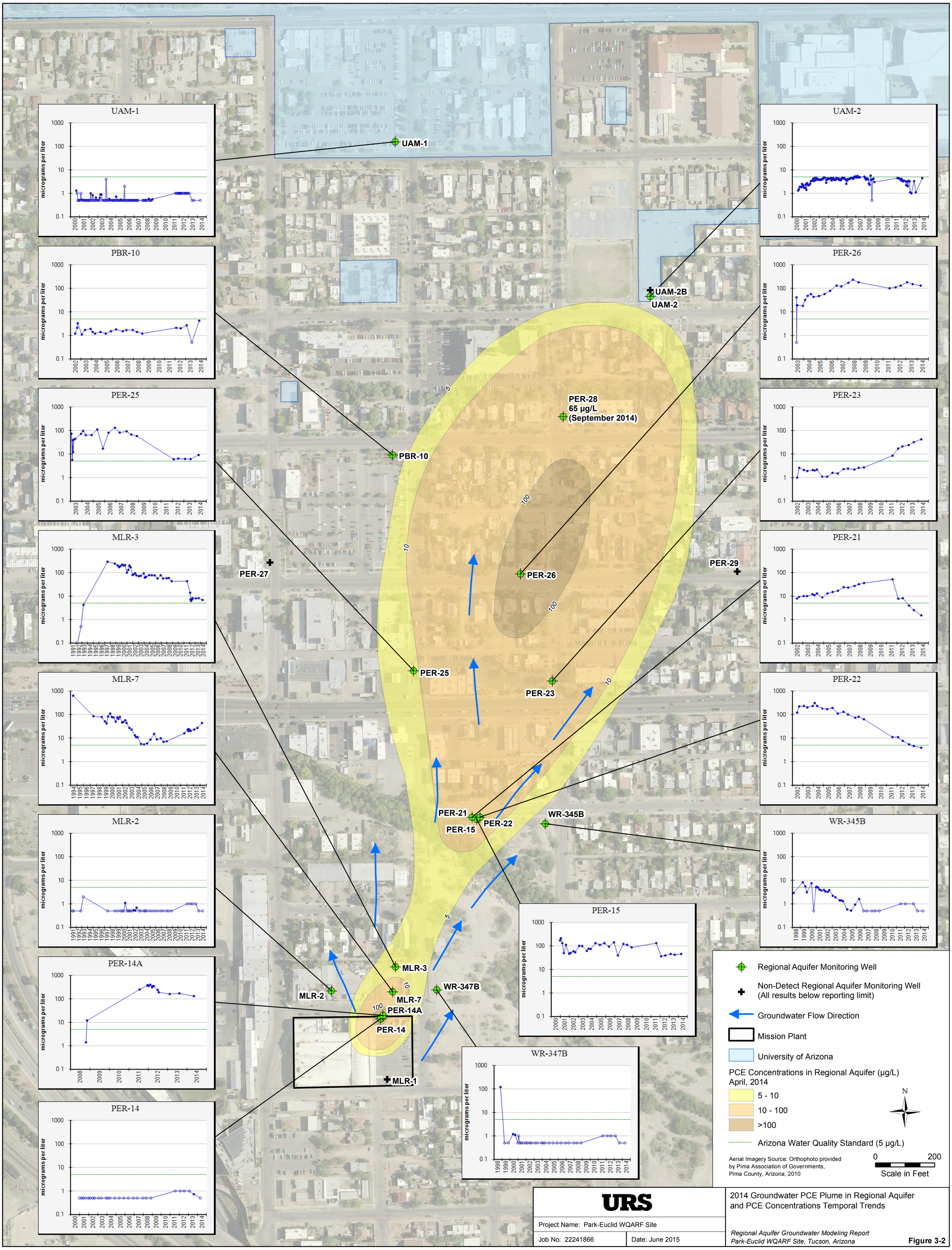
0 600 1,200

Horizontal Scale in Feet

*Layers presented are from Goundwater Model in Appendix G

URS	Contamination Migration Conceptual Site Model
Project Name: Park-Euclid WQARF Site	*Regional Aquifer Groundwater Modeling Report*
Job No: 22241866 / Date: June 2015	*Park-Euclid WQARF Site, Tucson, Arizona* **Figure 3-1**

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig3-01 Conceptual Model.mxd



URS

Project Name: Park-Euclid WQARF Site

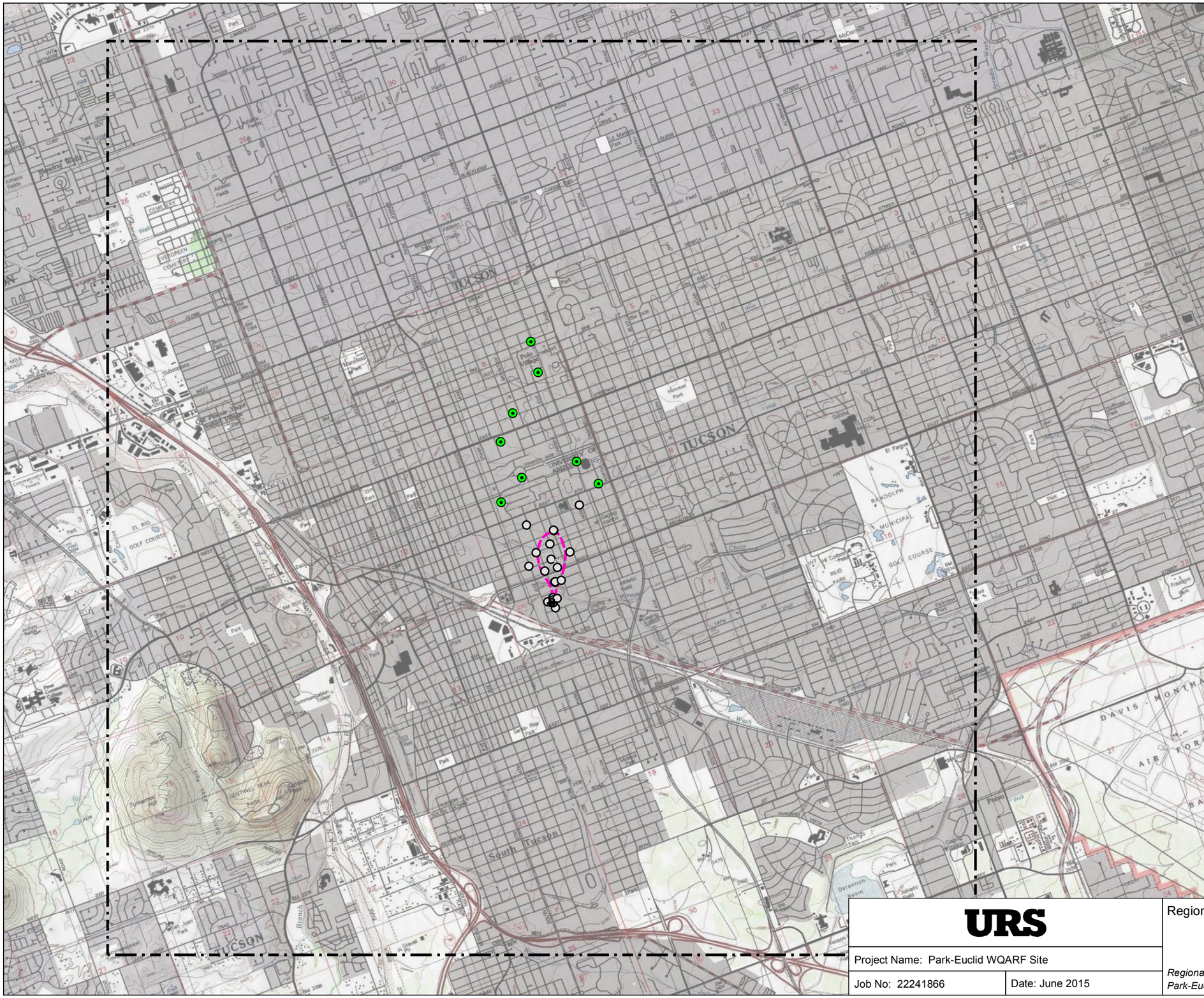
Job No: 22241866 | Date: June 2015

2014 Groundwater PCE Plume in Regional Aquifer and PCE Concentrations Temporal Trends

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 3-2

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig3-02 Observed PCE Trends.mxd



Explanation

- Regional Aquifer Monitoring Well
- Production Well
- Abandoned Production Well
- Interpreted Extent of PCE Concentration Greater than 5 µg/L in Regional Aquifer, April 2014
- Model Domain

N

0 3,500 Feet

Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

URS

Project Name: Park-Euclid WQARF Site

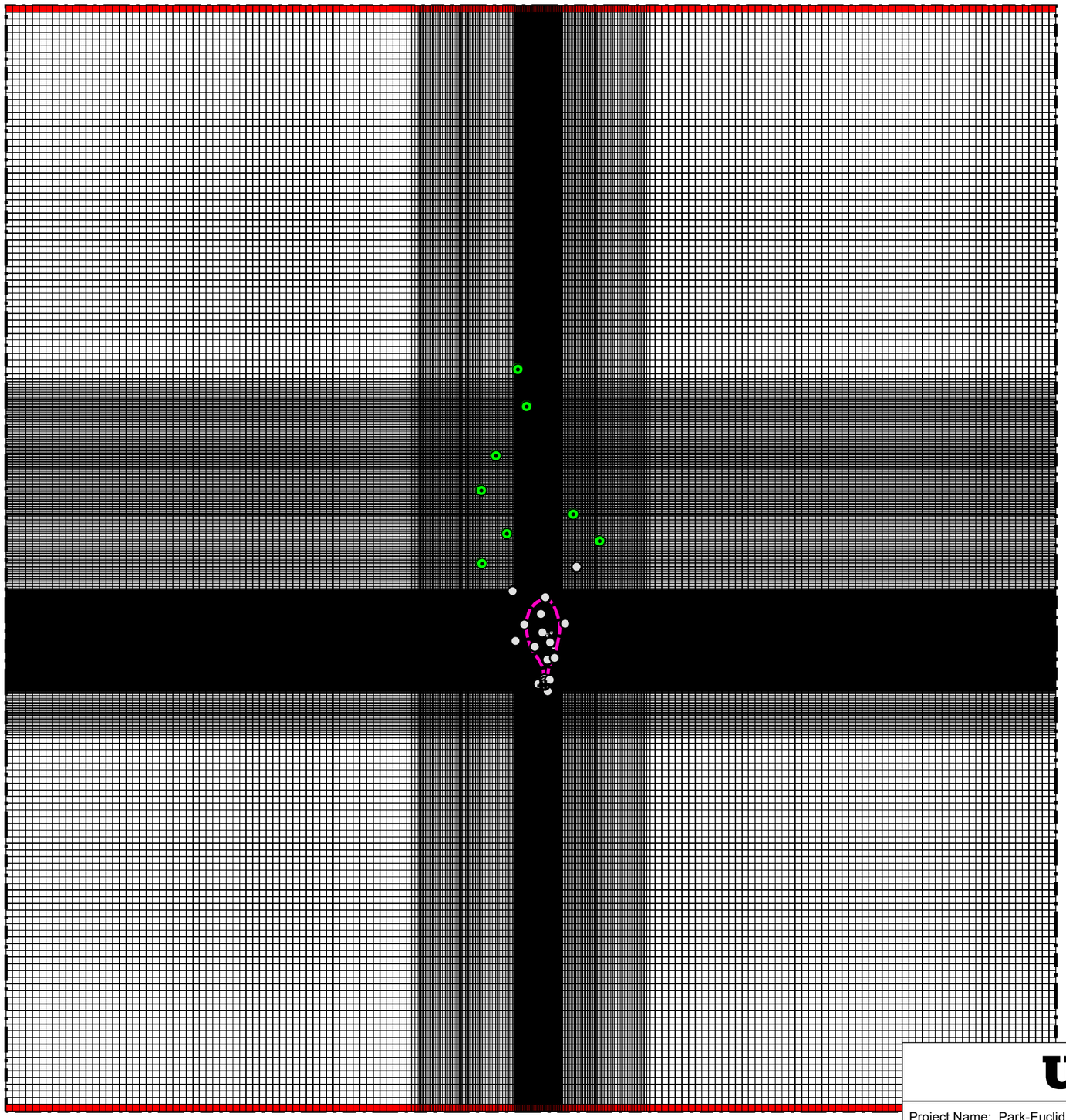
Job No: 22241866 | Date: June 2015

Regional Aquifer Model Domain

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 4-1

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig4-01 Model Domain.mxd



Explanation

- Regional Aquifer Monitoring Well
- Production Well
- Abandoned Production Well
- Interpreted Extent of PCE Concentration Greater than 5 µg/L in Regional Aquifer, April 2014
- Model Domain
- Model Grid
- Constant Head boundary

N

0 3,500 Feet

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

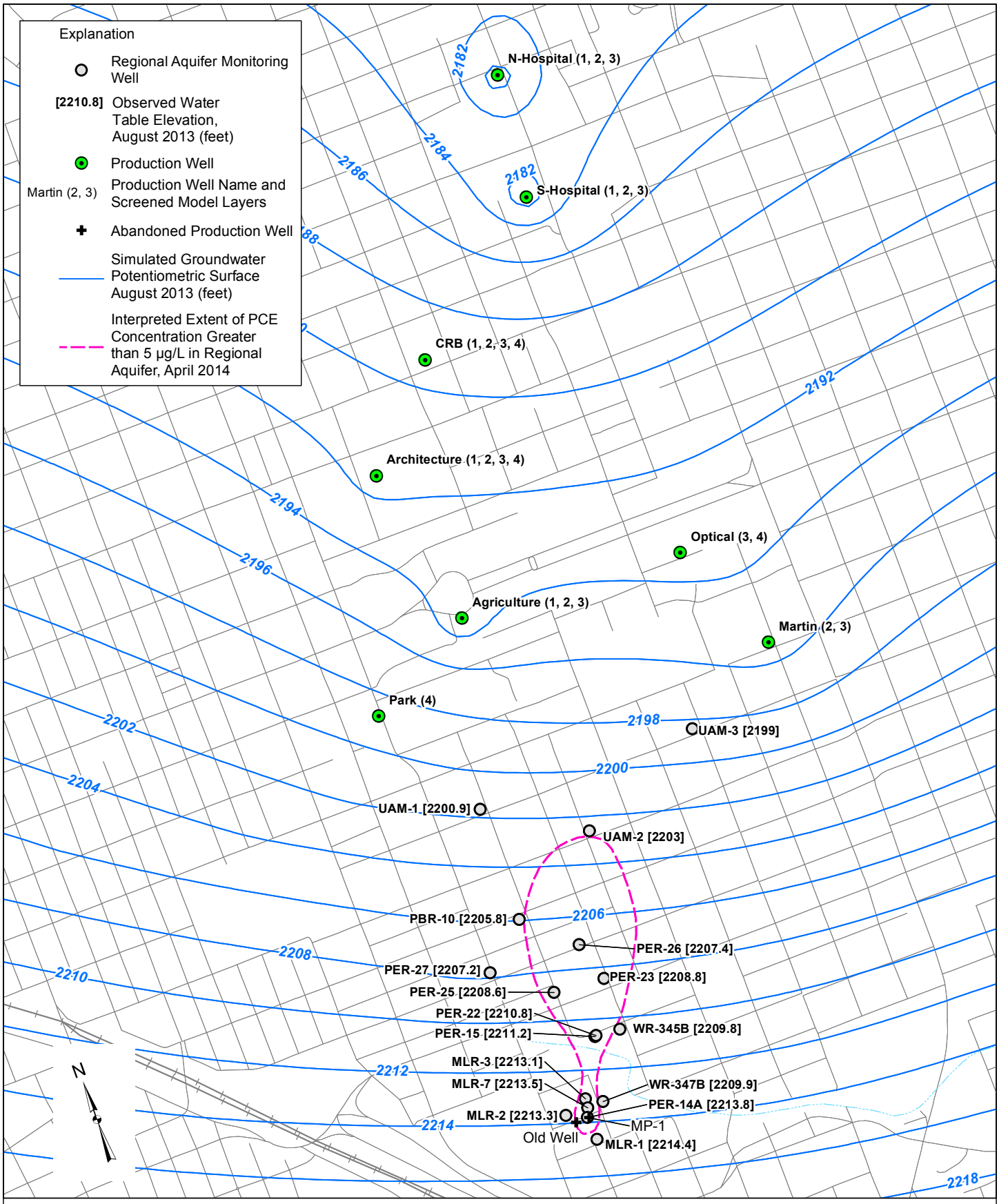
Date: June 2015

Regional Aquifer Model Grid and Boundary Conditions

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 4-2

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig4-02 Model Grid.mxd



0 1,200 Feet

URS

Project Name: Park-Euclid WQARF Site

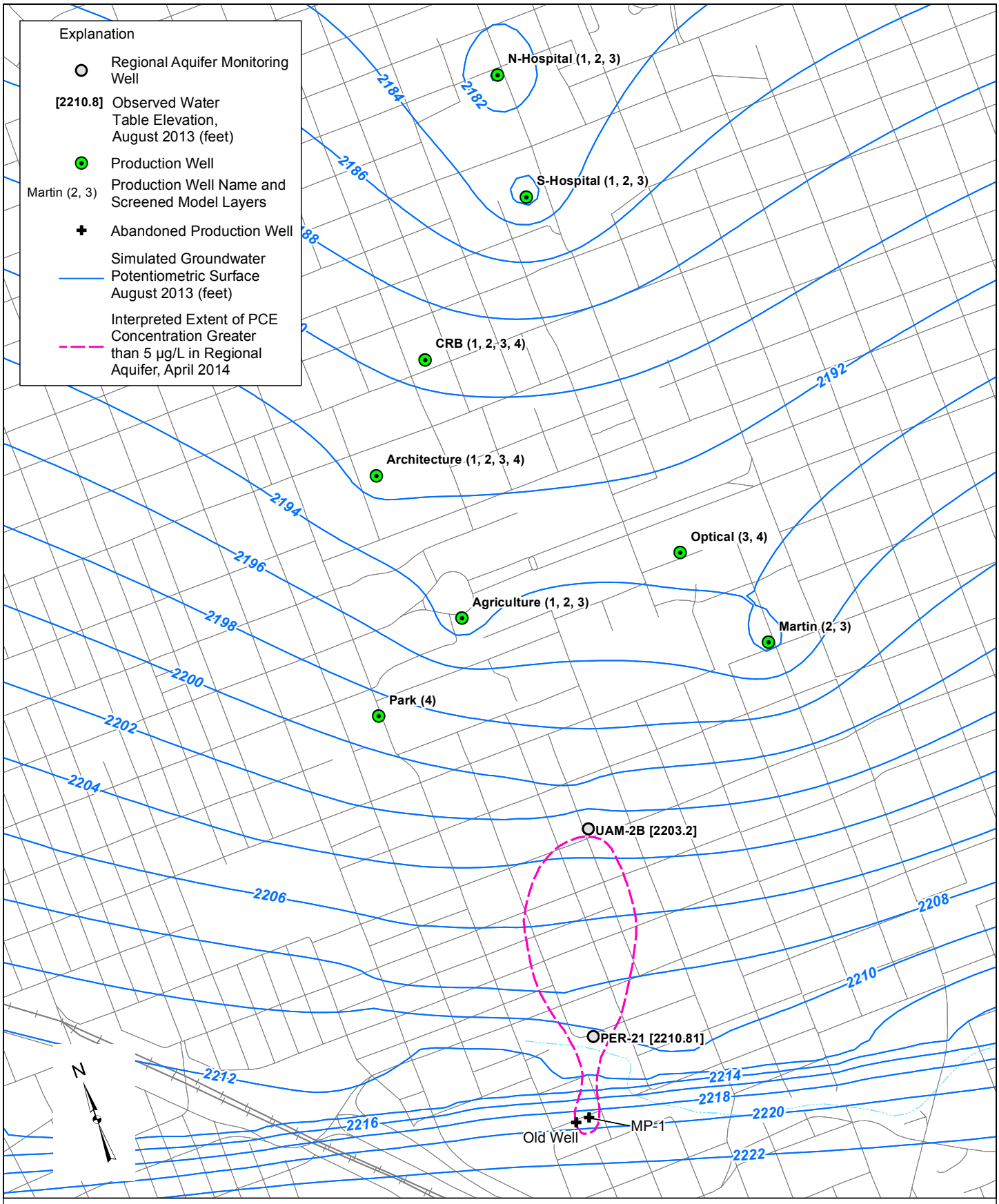
Job No: 22241866 | Date: June 2015

Simulated Regional Groundwater Potentiometric Surface in Project Area, August 2013, Layer 1

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 5-1

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig5-01 Simulated Head L1.mxd



0 1,200 Feet

URS

Project Name: Park-Euclid WQARF Site

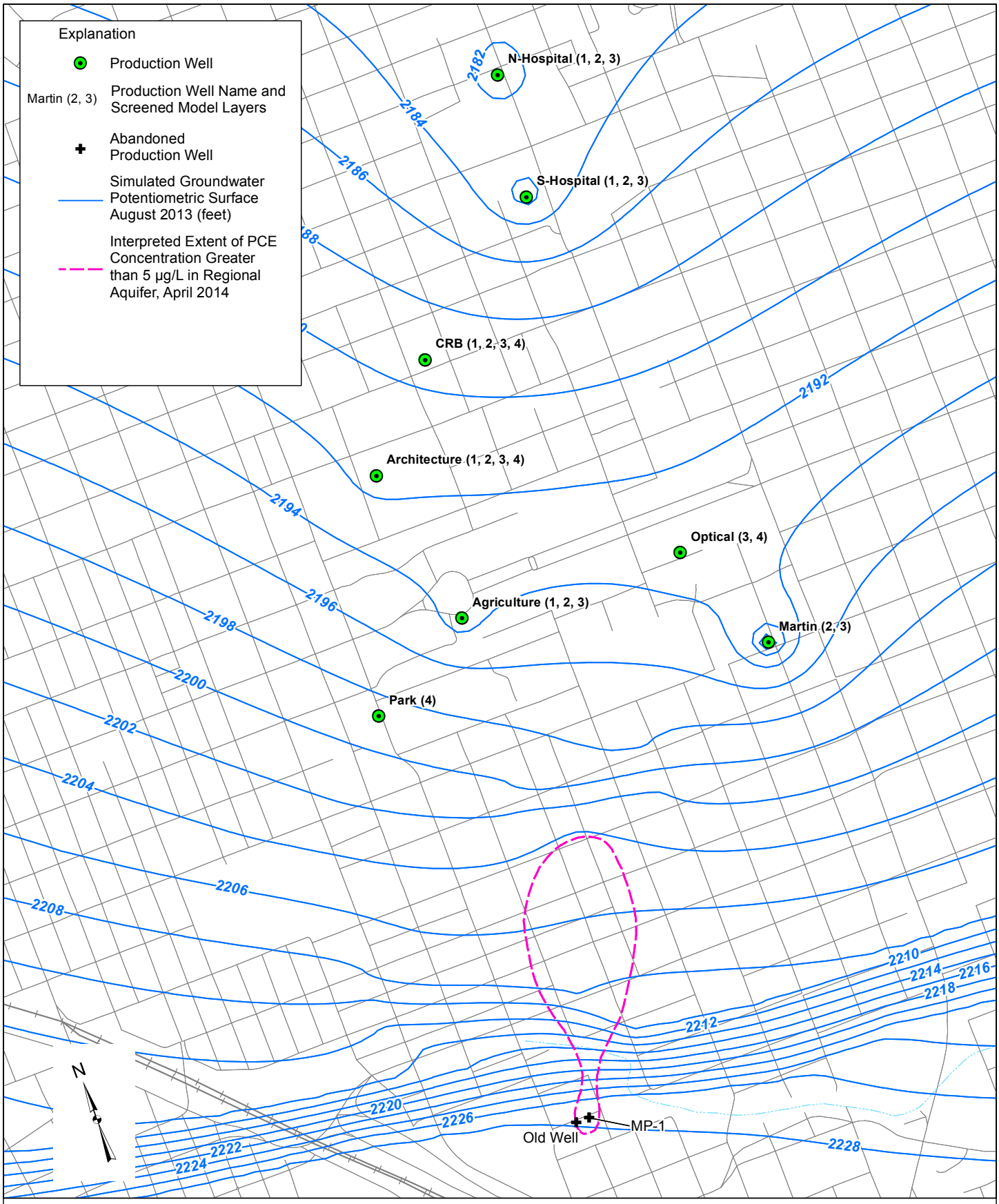
Job No: 22241866 | Date: June 2015

Simulated Regional Groundwater Potentiometric Surface in Project Area, August 2013, Layer 2

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 5-2

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig5-02 Simulated Head L2.mxd



0 1,200 Feet

URS

Project Name: Park-Euclid WQARF Site

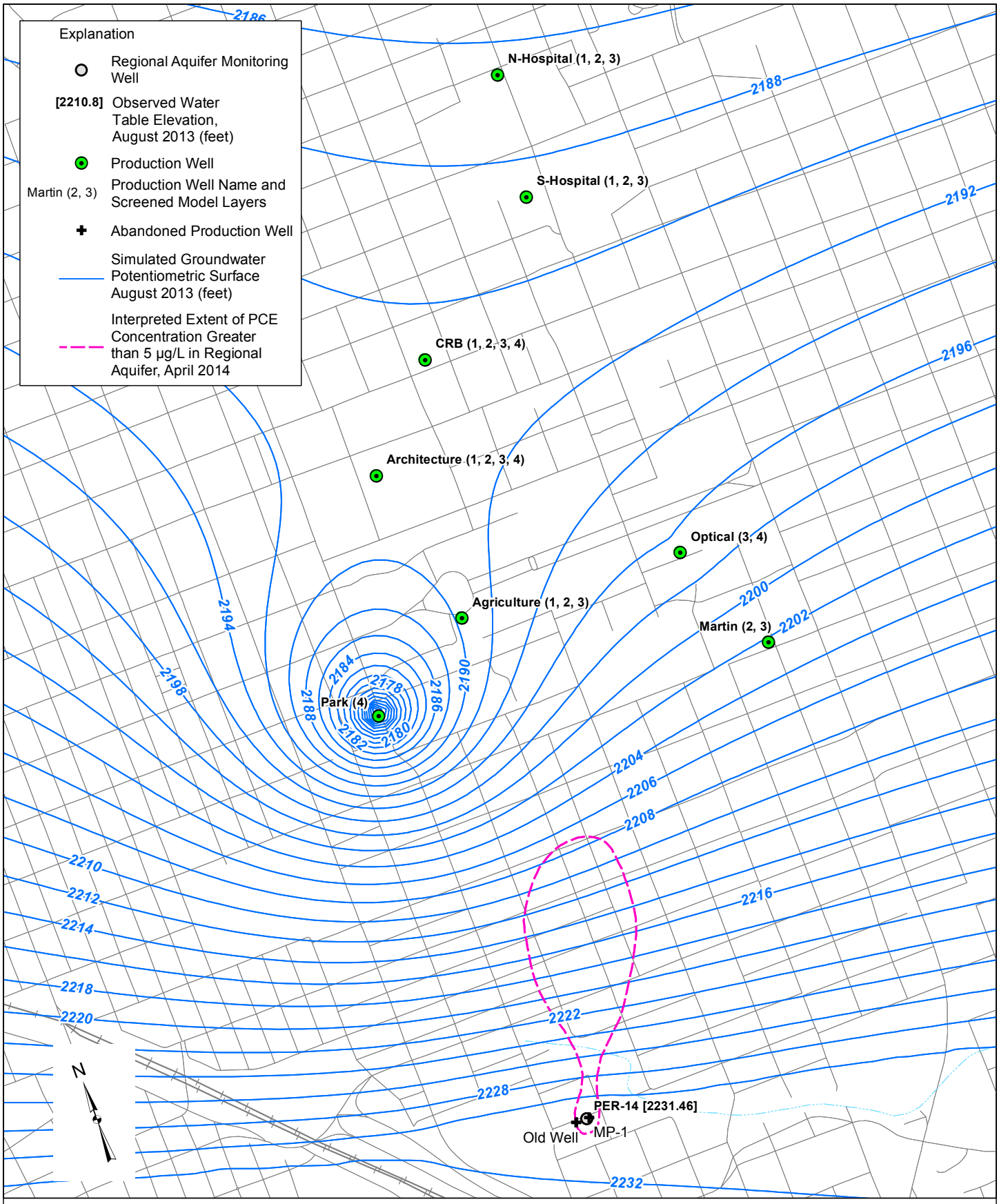
Job No: 22241866 | Date: June 2015

Simulated Regional Groundwater Potentiometric Surface in Project Area, August 2013, Layer 3

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 5-3

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig5-03 Simulated Head L3.mxd



0 1,200 Feet

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866 | Date: June 2015

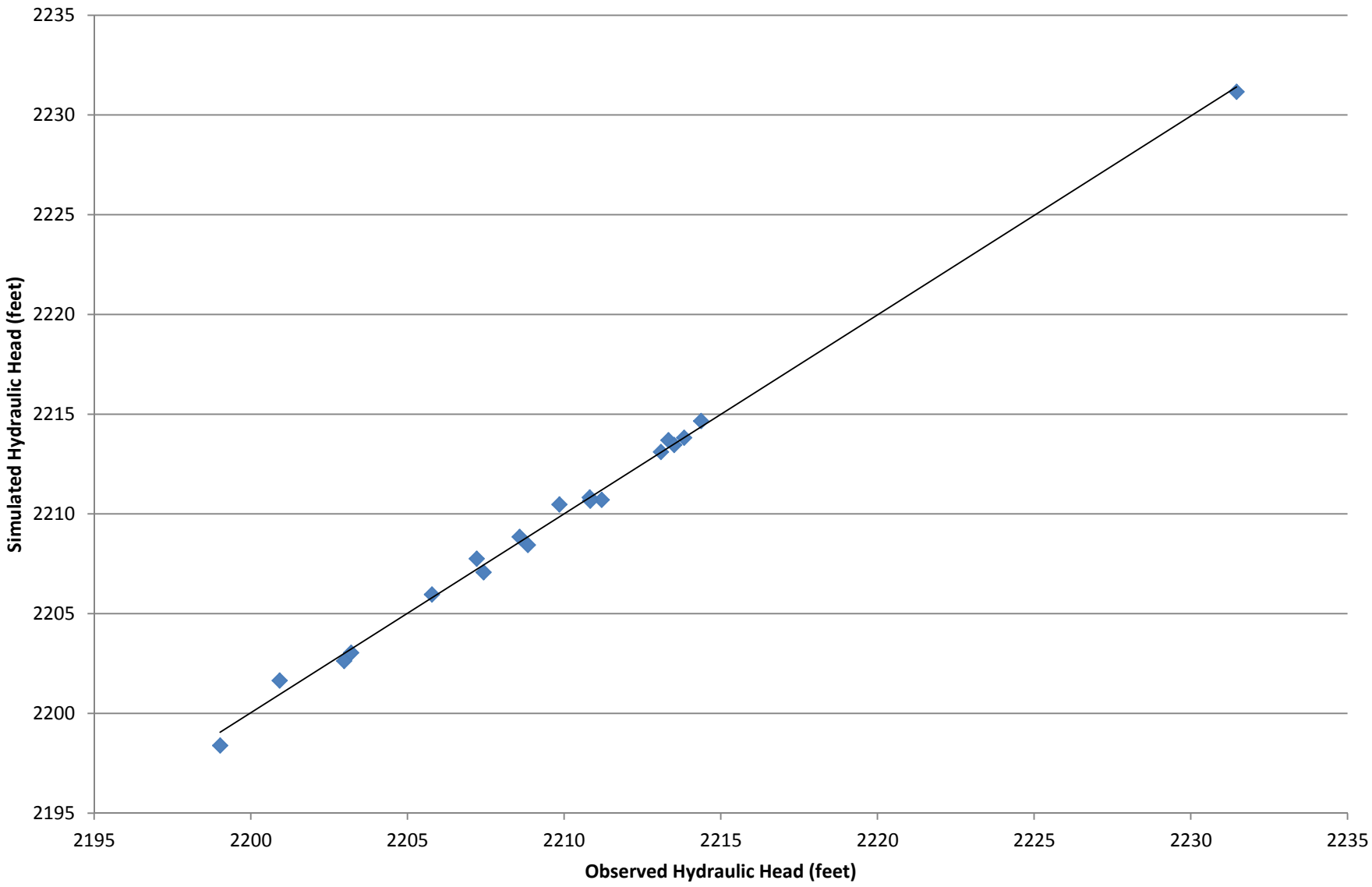
Simulated Regional Groundwater Potentiometric Surface in Project Area, August 2013, Layer 4

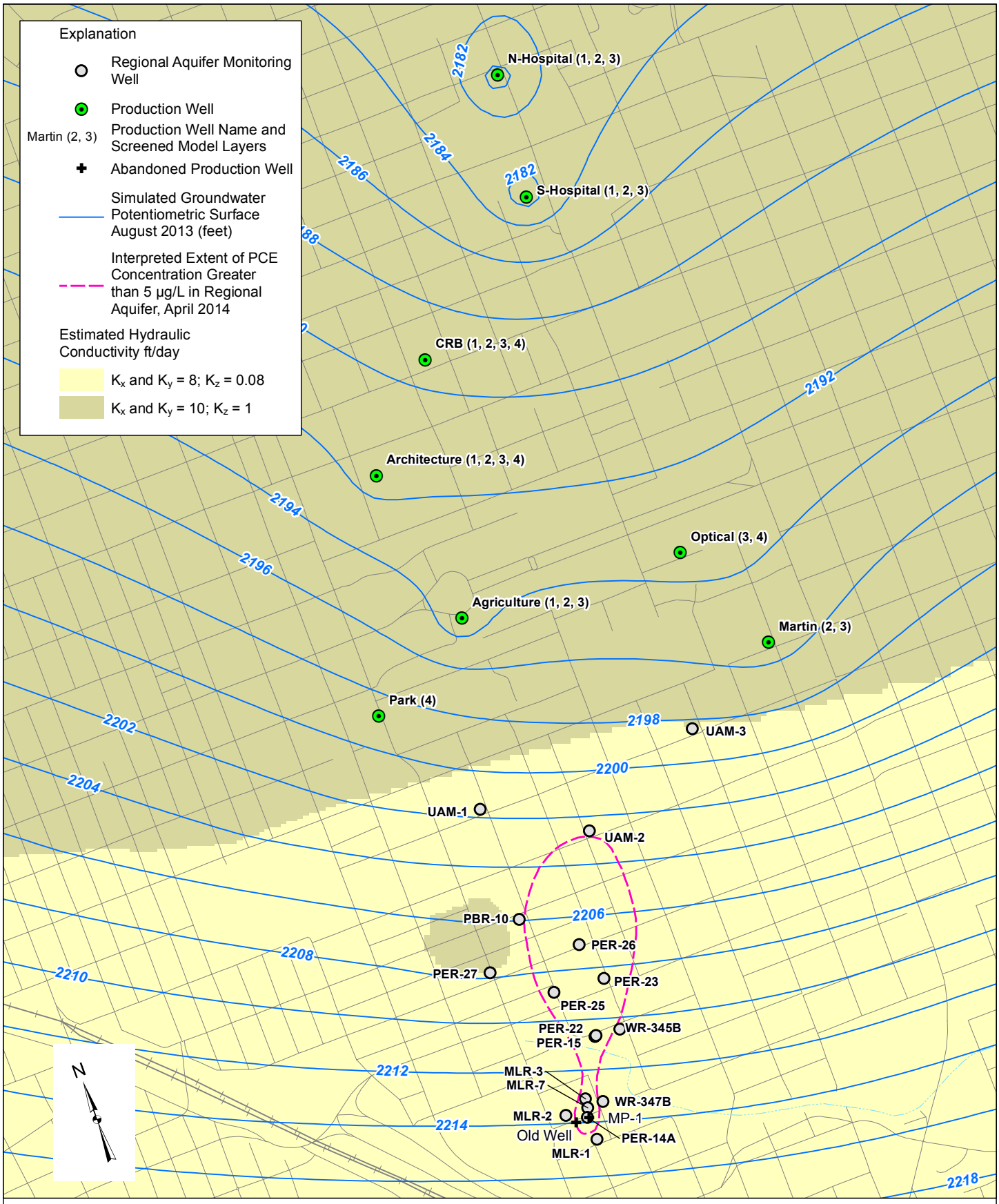
Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 5-4

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig5-04 Simulated Head L4.mxd

Figure 5-5 Comparison of Simulated and Observed Hydraulic Heads for 2013 Groundwater Flow Model Calibration





0 1,200 Feet

URS

Project Name: Park-Euclid WQARF Site

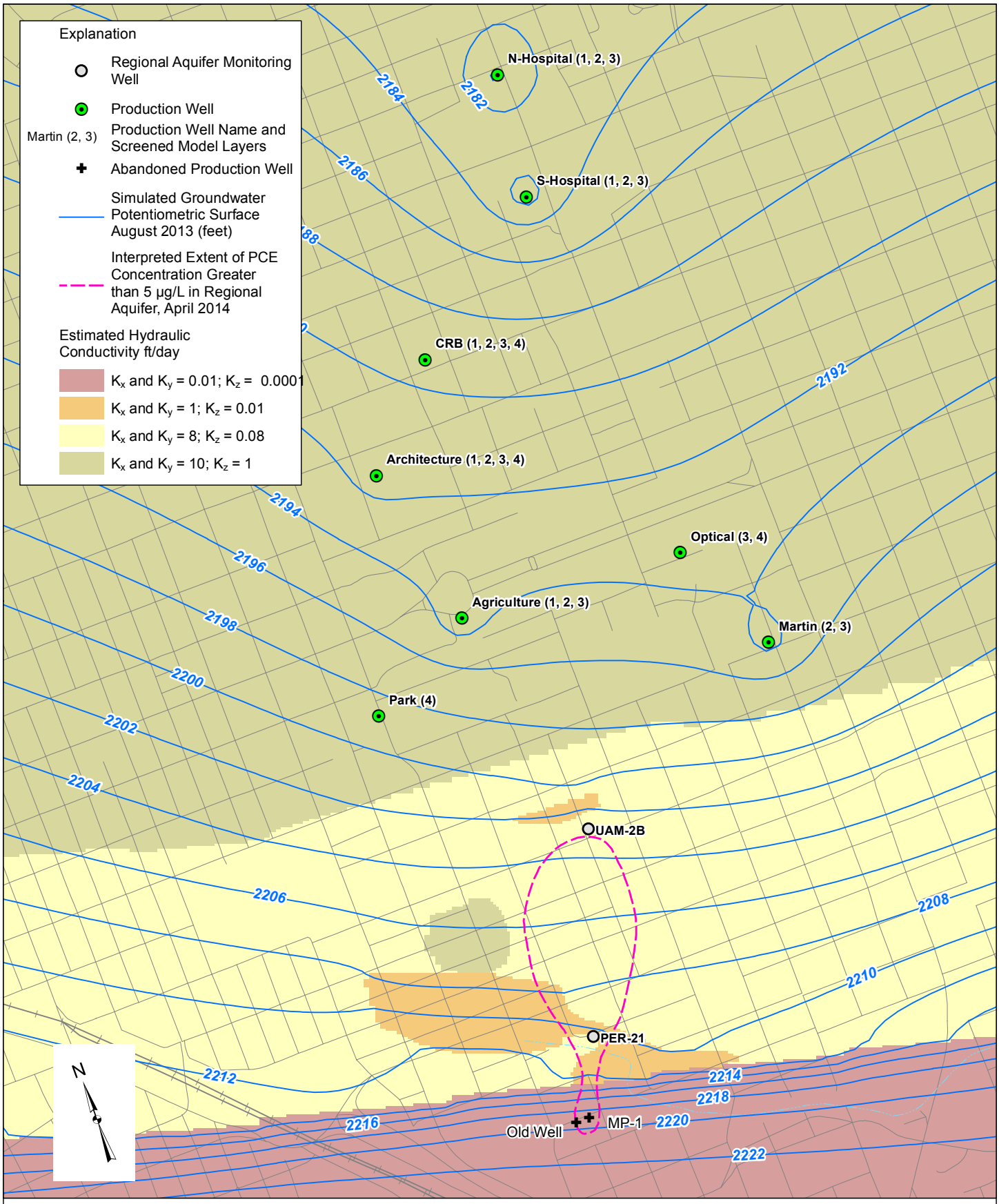
Job No: 22241866 | Date: June 2015

Estimated Hydraulic Conductivity Distribution in Project Area, Layer 1

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 5-6

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig5-06 Hydraulic Conductivity L1.mxd



0 1,200 Feet

URS

Project Name: Park-Euclid WQARF Site

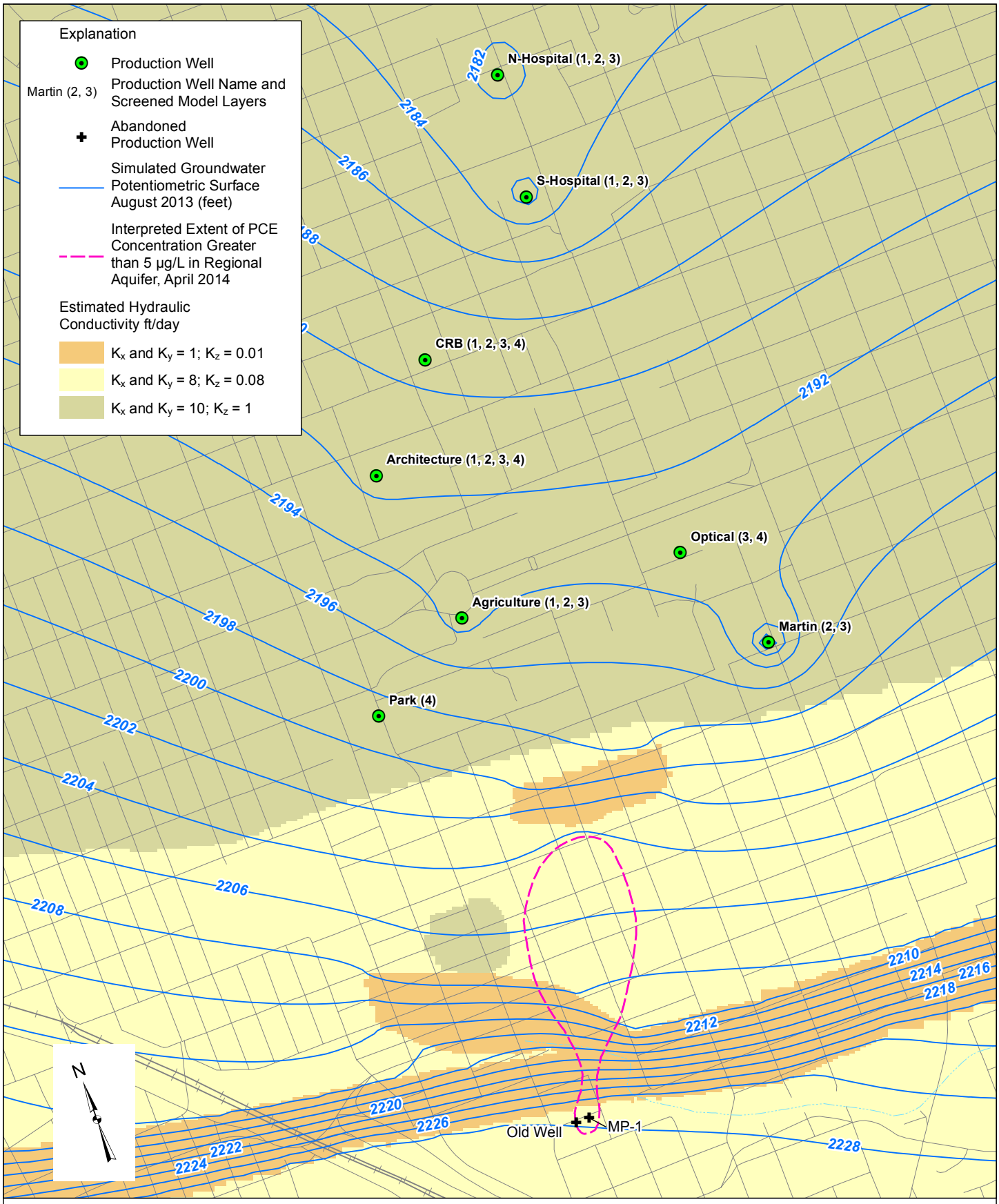
Job No: 22241866 | Date: June 2015

Estimated Hydraulic Conductivity Distribution in Project Area, Layer 2

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 5-7

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig5-07 Hydraulic Conductivity L2.mxd



0 1,200 Feet

URS

Project Name: Park-Euclid WQARF Site

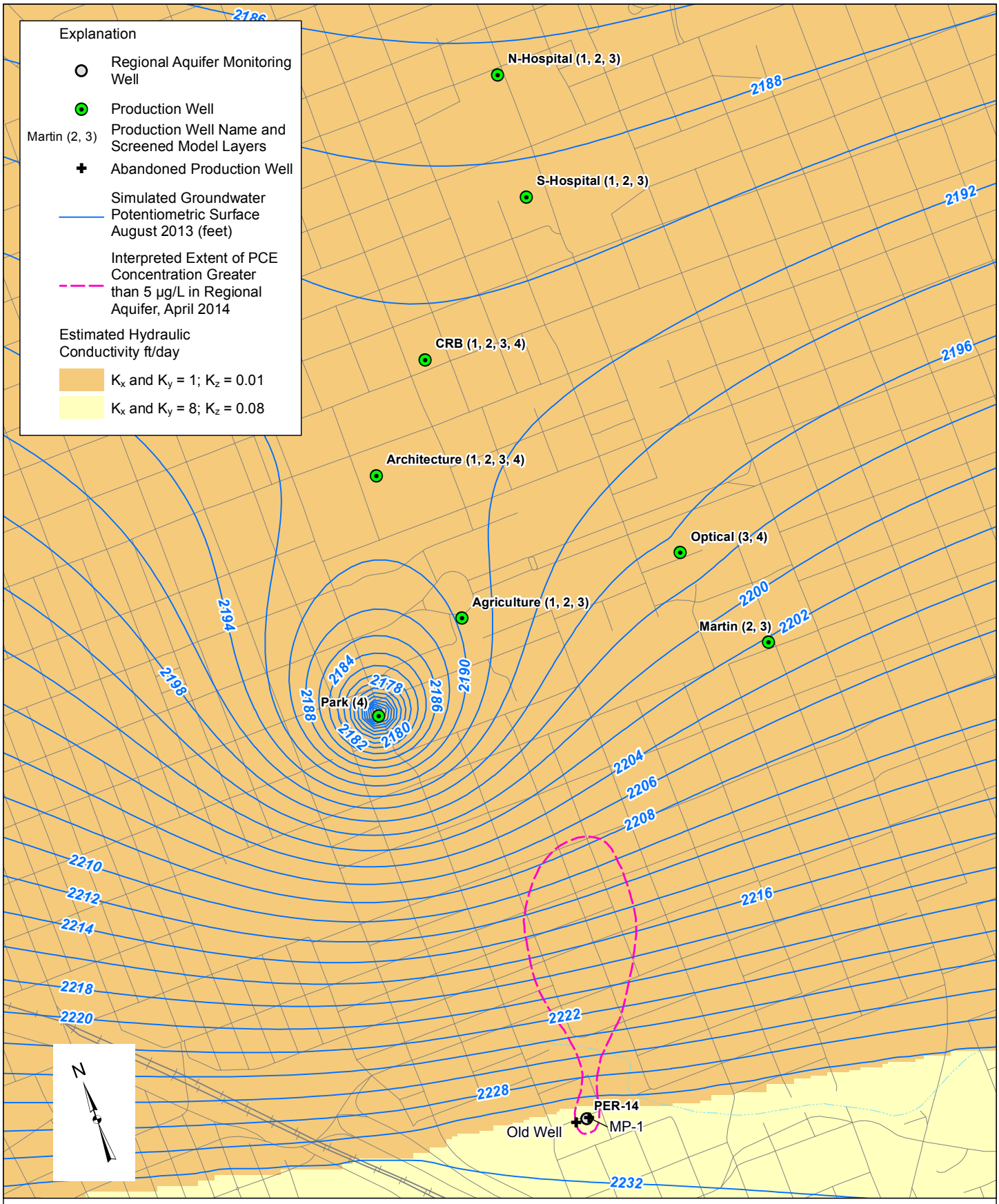
Job No: 22241866 | Date: June 2015

Estimated Hydraulic Conductivity Distribution in Project Area, Layer 3

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 5-8

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig5-08 Hydraulic Conductivity L3.mxd



0 1,200 Feet

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

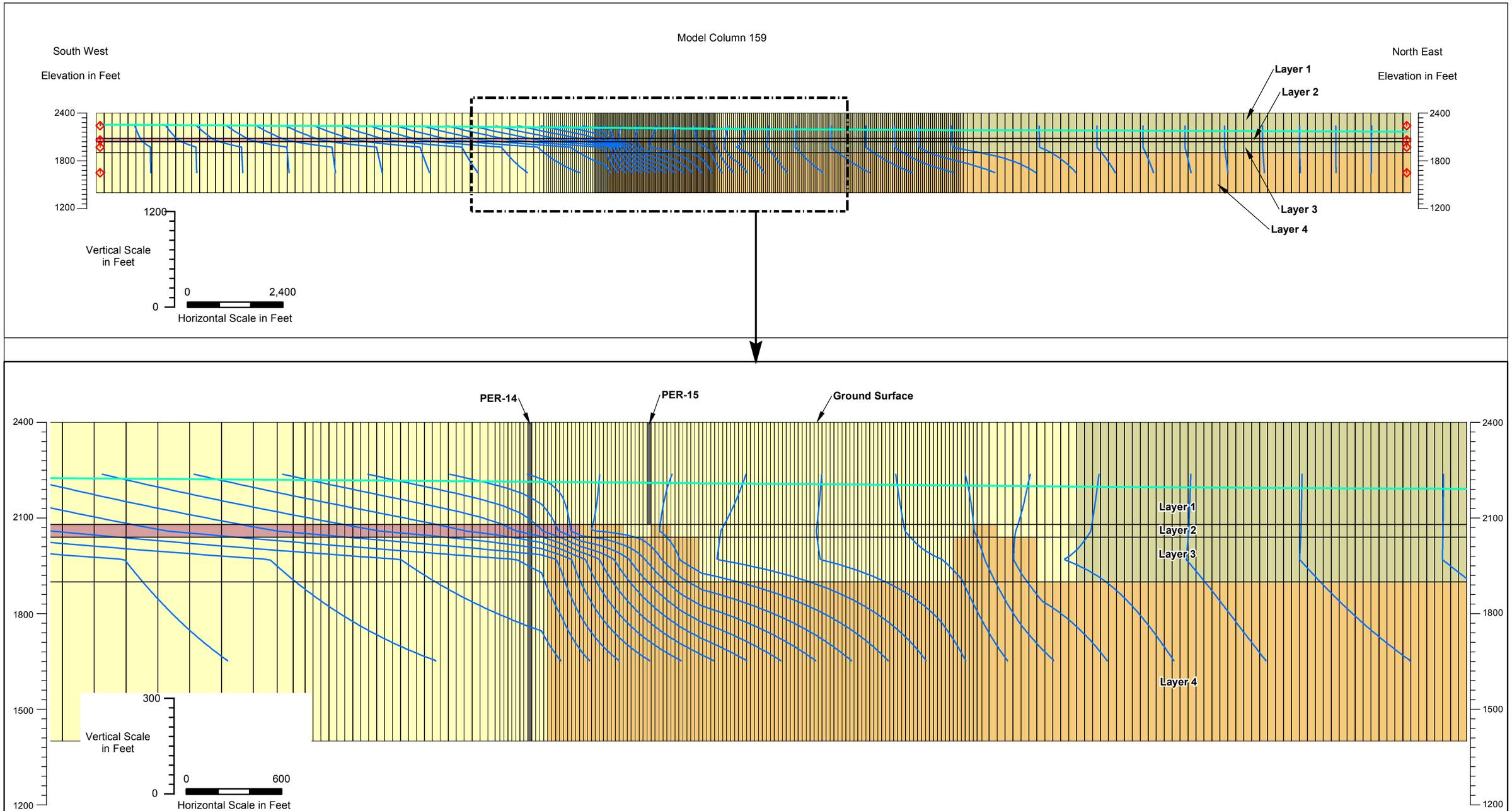
Date: June 2015

Estimated Hydraulic Conductivity Distribution in Project Area, Layer 4

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 5-9

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig5-09 Hydraulic Conductivity L4.mxd



Explanation

- Constant Head Cell
- Model Grid
- Simulated Vertical Groundwater Equipotential Lines Contour Interval = 2'
- Simulated Groundwater Table

Estimated Hydraulic Conductivity ft/day

- K_x and K_y = 0.01; K_z = 0.0001
- K_x and K_y = 1; K_z = 0.01
- K_x and K_y = 8; K_z = 0.08
- K_x and K_y = 10; K_z = 1

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866 | Date: June 2015

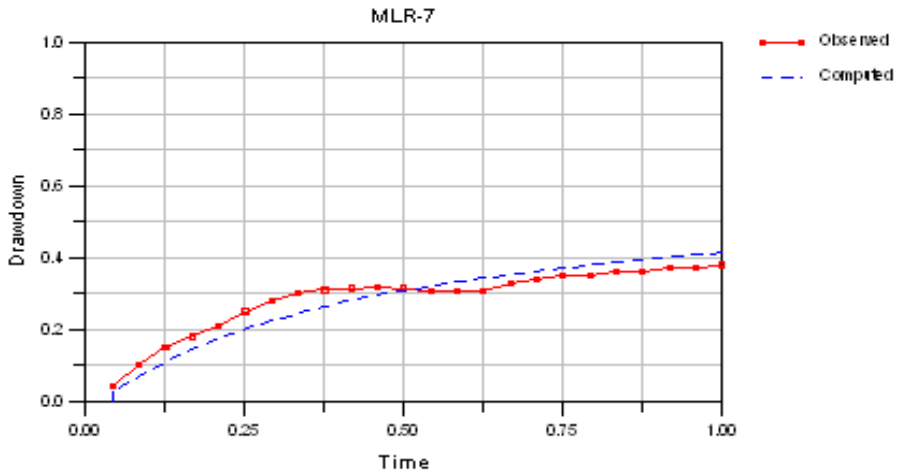
Simulated Vertical Groundwater Equipotential Lines Along Model Colunm 159, August 2013

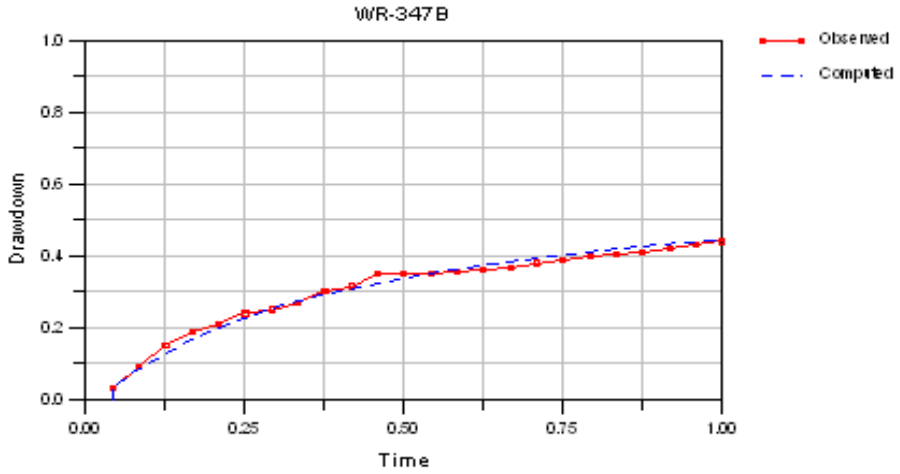
Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 5-10

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig5-10 Xsection GW Contours .mxd

Figure 5-11. Simulated Drawdown Hydrographs for Short-Term Pumping Test





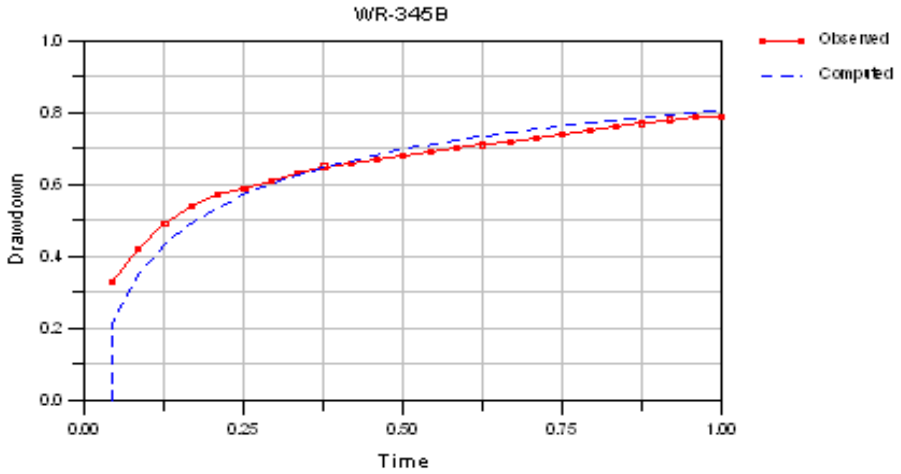
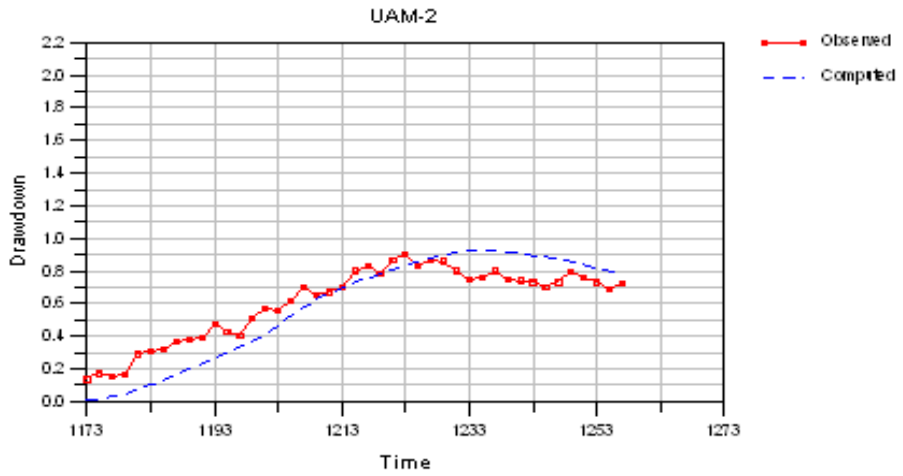
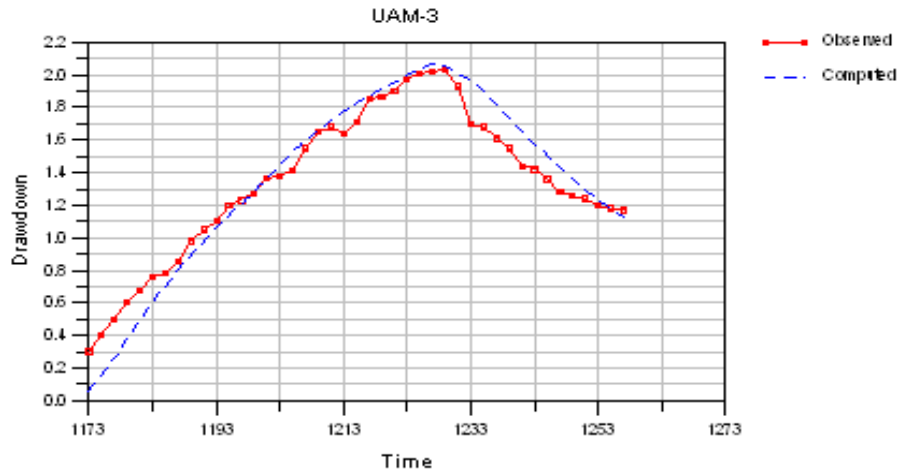
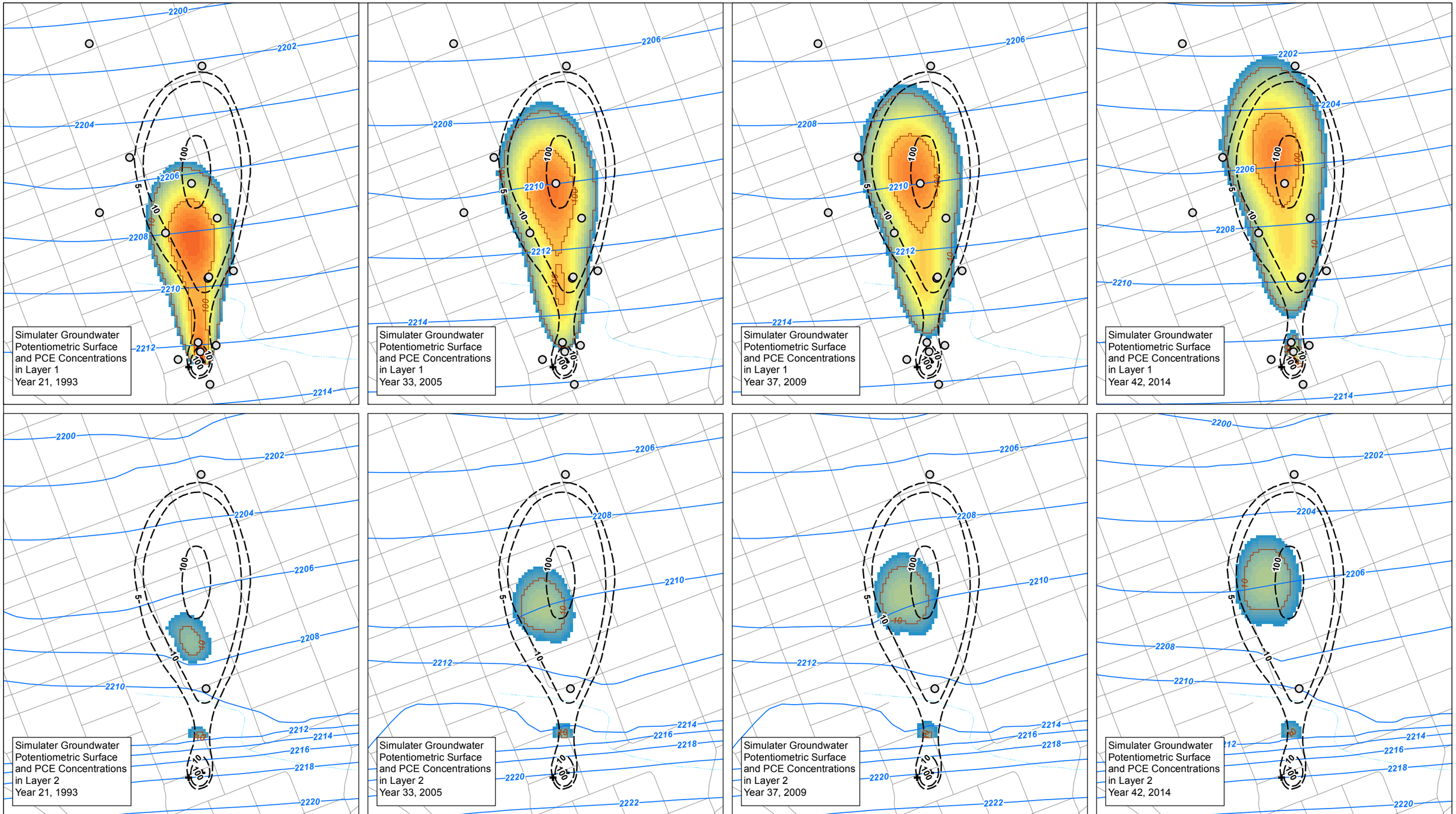


Figure 5-12. Simulated Drawdown Hydrographs for Long-Term Pumping Test







Regional Aquifer Monitoring Well

Abandoned Production Well

Simulated Groundwater Potentiometric Surface (feet)

Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L) (Modified geometrical scale)

5 10 100 800

Simulated PCE Concentration Contour at 10 and 100 µg/L

0 800 Feet

N

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

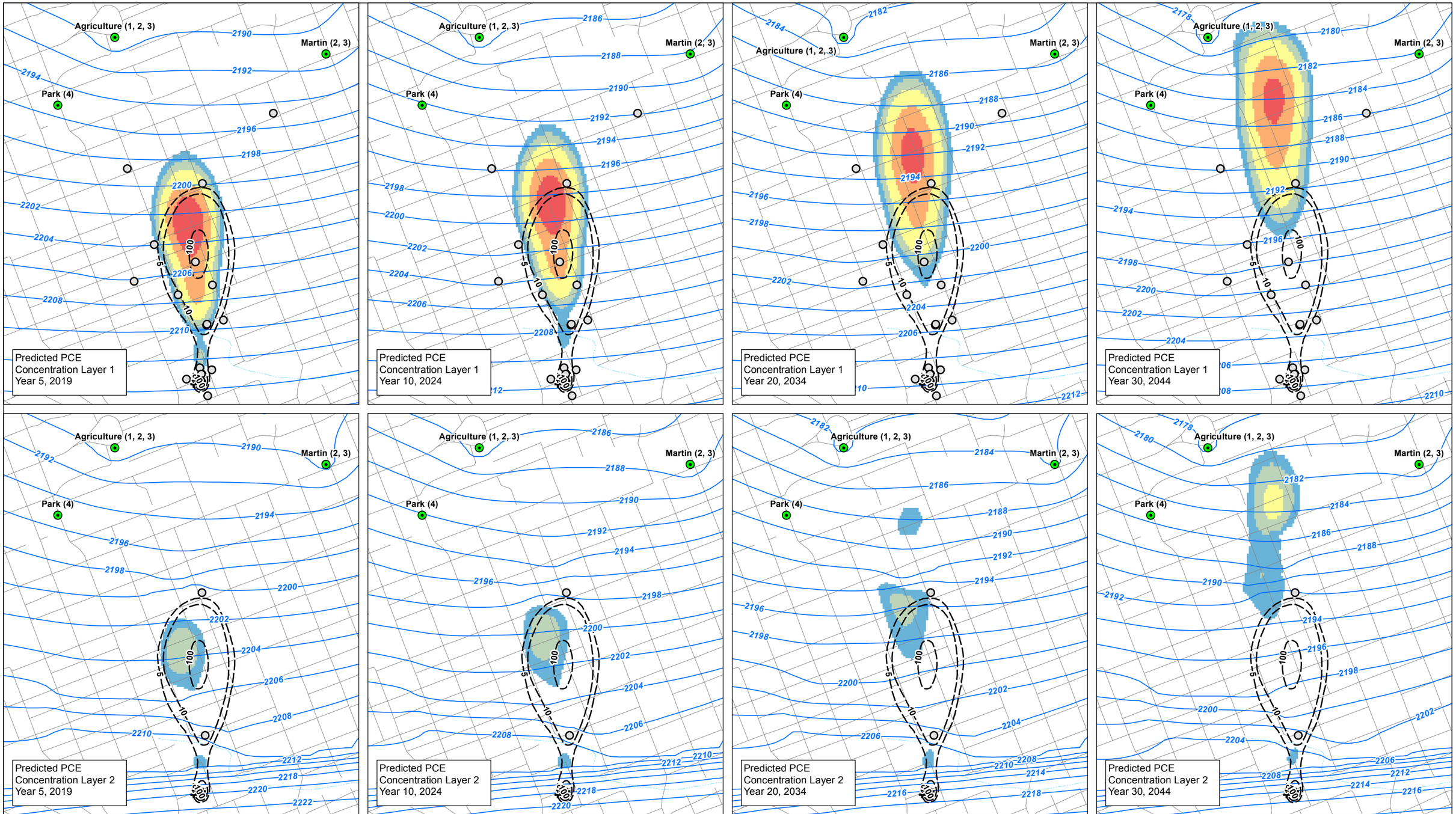
Date: June 2015

Simulated Historical Regional Aquifer PCE Plume Migration over Time

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 6-1

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig6-01 Simulated PCE Over Time.mxd



Regional Aquifer Monitoring Well

Production Well

Martin (2, 3) Production Well Name and Screened Model Layers

Abandoned Production Well

Simulated Groundwater Potentiometric Surface (feet)

Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L)

- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200

0 1,200 Feet

N

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

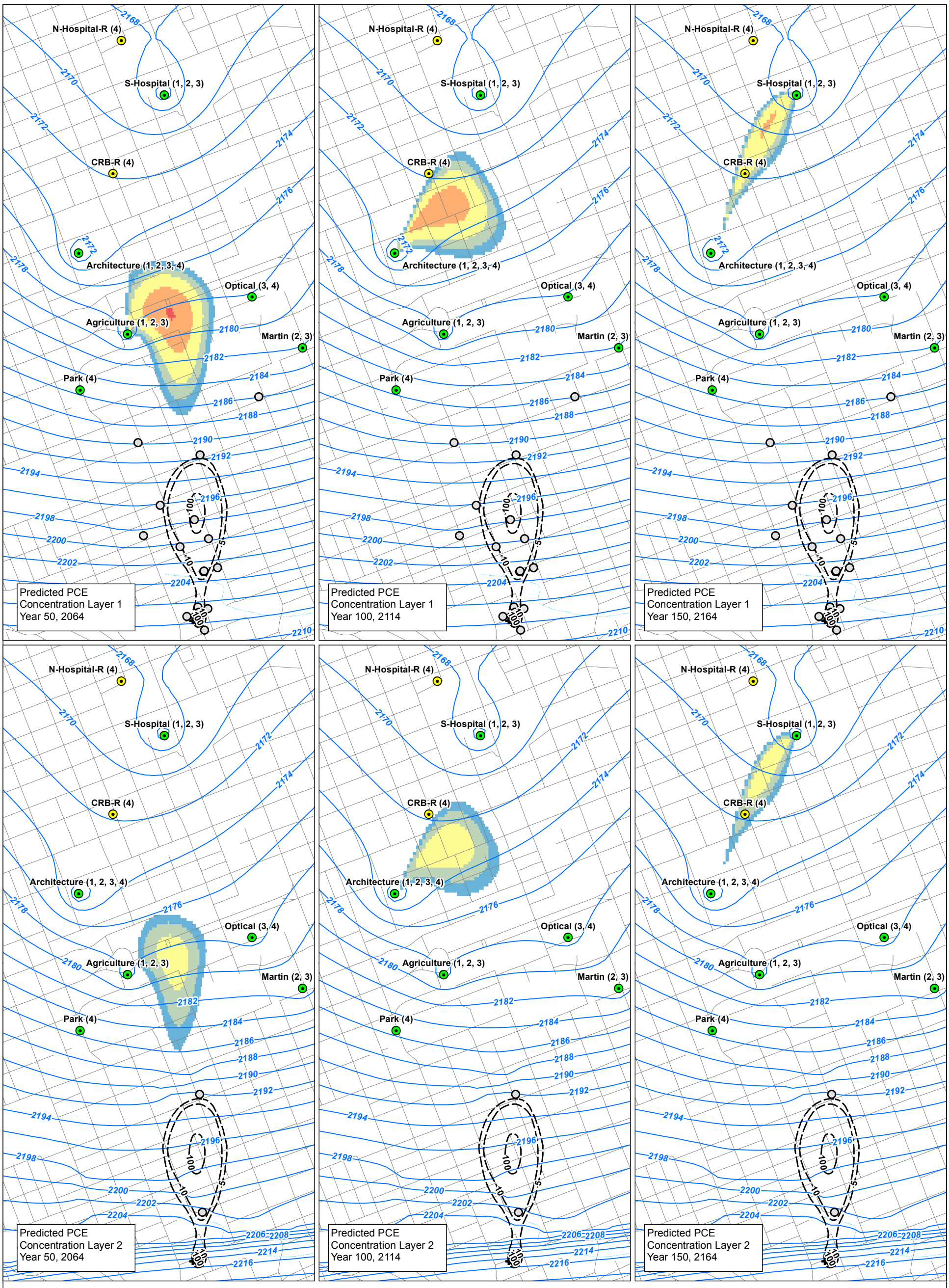
Date: July 2015

MNA: Predicted Regional Aquifer PCE Plume Assuming UA Pumping Plan
Sheet 1 of 3

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 7-1

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig7-01 PCE UA Plan MNA 1 of 3.mxd



Regional Aquifer Monitoring Well

Production Well

Replacement Production Well

Martin (2, 3) Production Well Name and Screened Model Layers

Abandoned Production Well

Simulated Groundwater Potentiometric Surface (feet)

Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L)

5 - 10

10 - 20

20 - 50

50 - 100

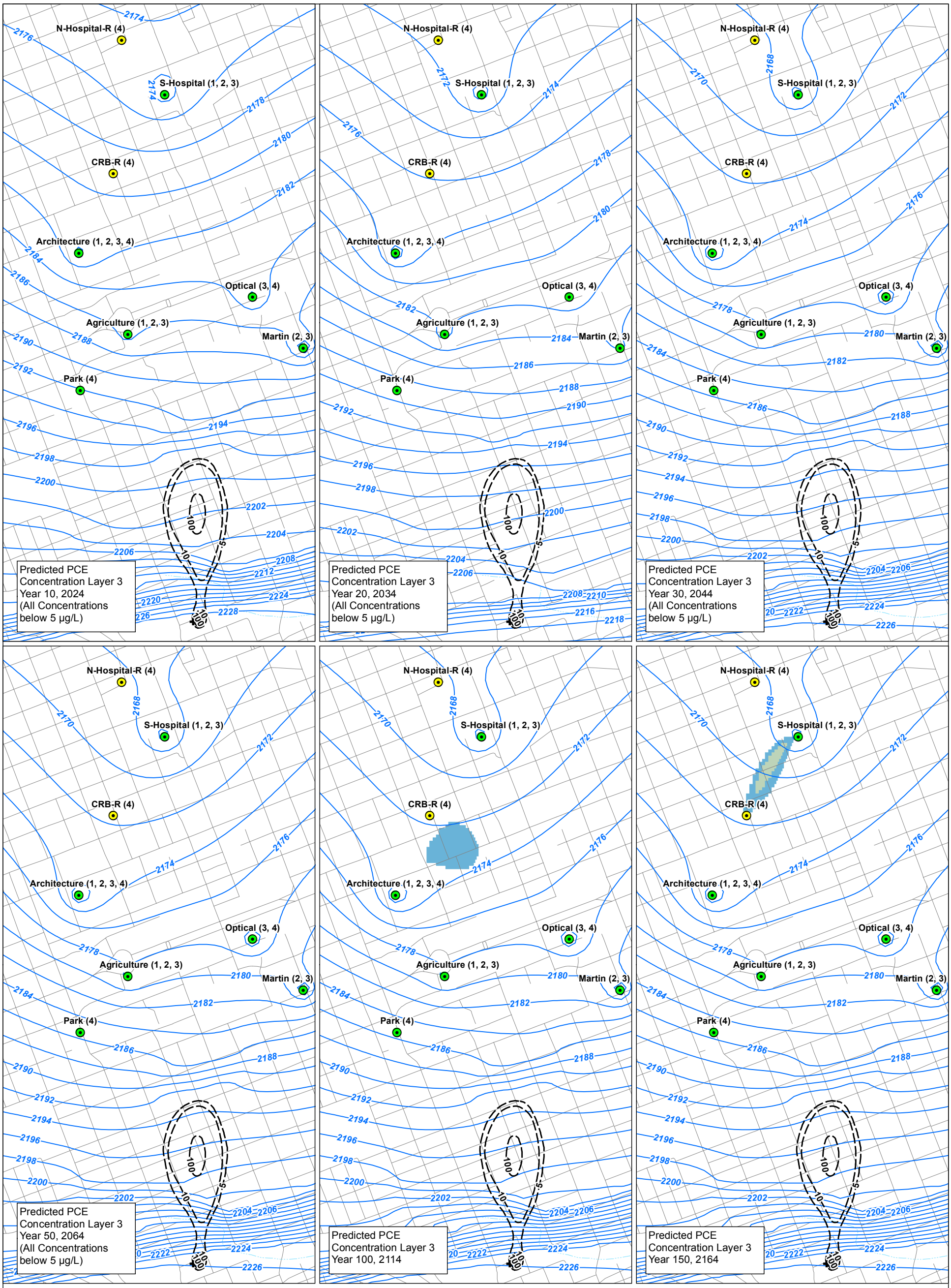
100 - 200

0 1,500 Feet

N

URS	MNA: Predicted Regional Aquifer PCE Plume Assuming UA Pumping Plan Sheet 2 of 3
Project Name: Park-Euclid WQARF Site	*Regional Aquifer Groundwater Modeling Report* *Park-Euclid WQARF Site, Tucson, Arizona*
Job No: 22241866 Date: July 2015	**Figure 7-1**

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig7-01 PCE UA Plan MNA 2 of 3.mxd



Production Well

Replacement Production Well

Martin (2, 3) Production Well Name and Screened Model Layers

Abandoned Production Well

Simulated Groundwater Potentiometric Surface (feet)

Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L)

- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200

0 1,500 Feet

N

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866 | Date: July 2015

MNA: Predicted Regional Aquifer PCE Plume Assuming UA Pumping Plan
Sheet 3 of 3

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 7-1

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig7-01 PCE UA Plan MNA 3 of 3.mxd

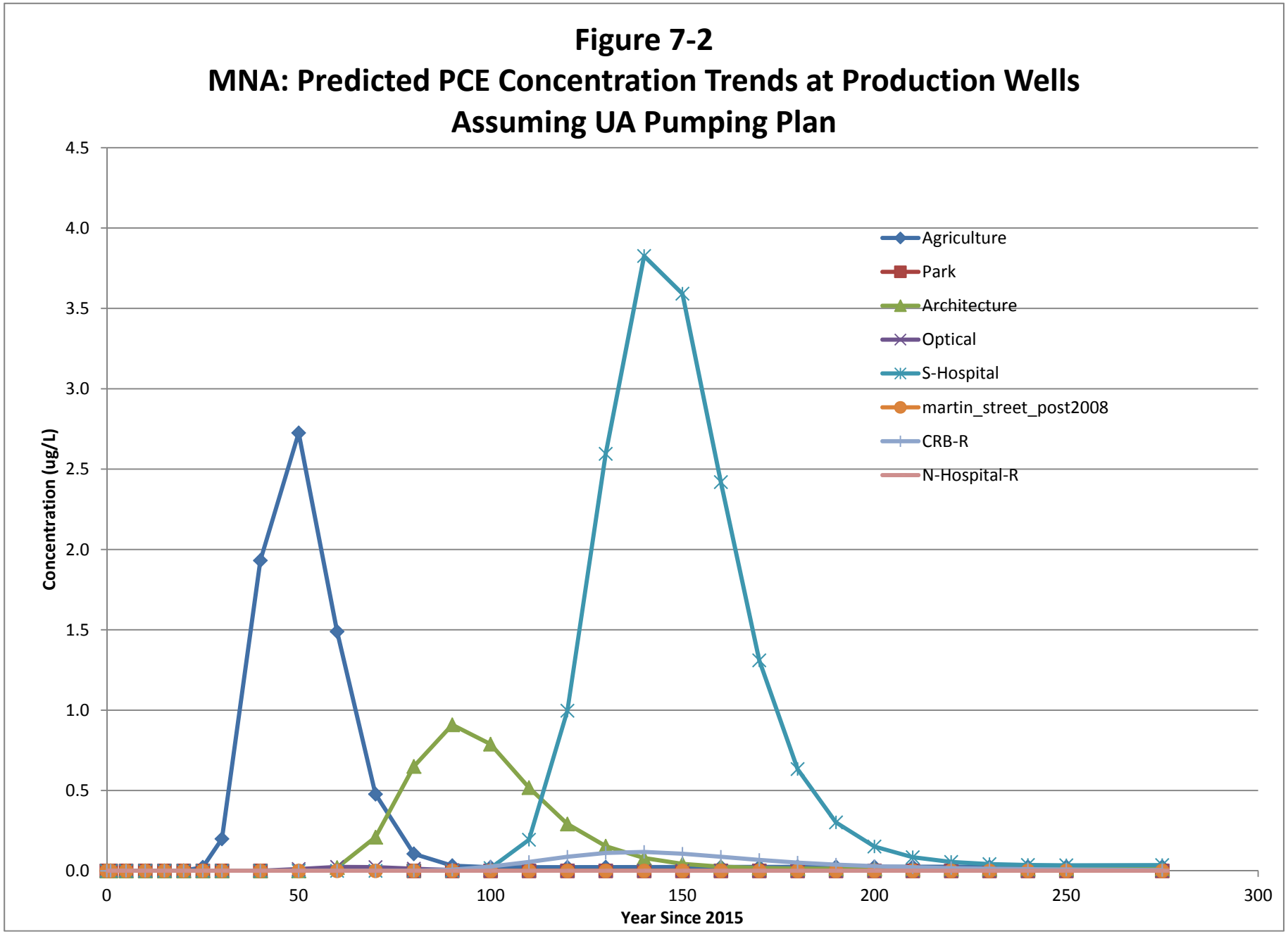
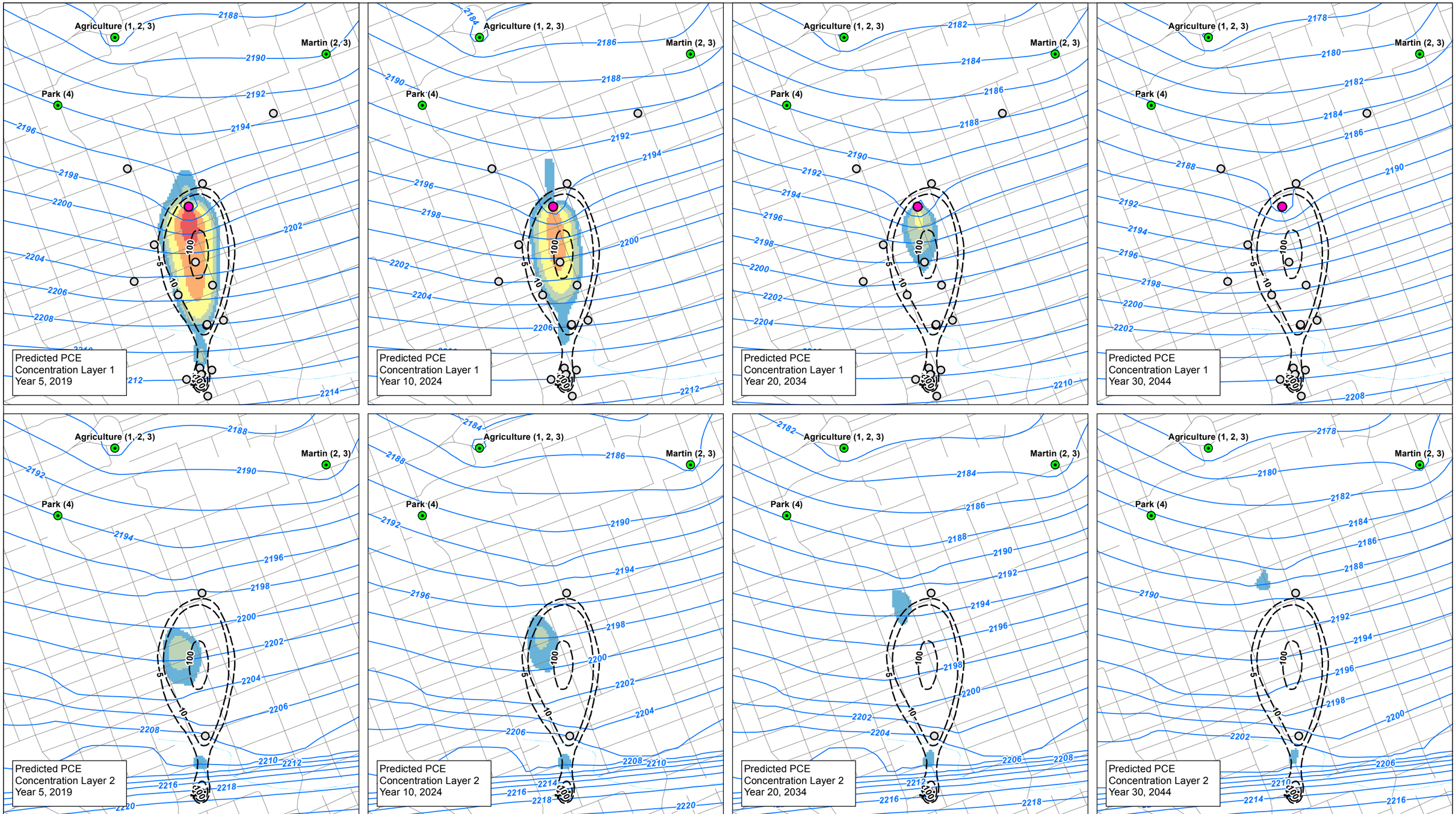


Figure 7-2
MNA: Predicted PCE Concentration Trends at Production Wells
Assuming UA Pumping Plan
Concentration (ug/L)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
50
100
150
200
250
300
Year Since 2015
Agriculture
Park
Architecture
Optical
S-Hospital
martin_street_post2008
CRB-R
N-Hospital-R



URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

Date: July 2015

Groundwater Extraction: Predicted Regional Aquifer PCE Plume Assuming UA Pumping Plan

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 7-3

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig7-03 PCE UA Plan Extraction.mxd

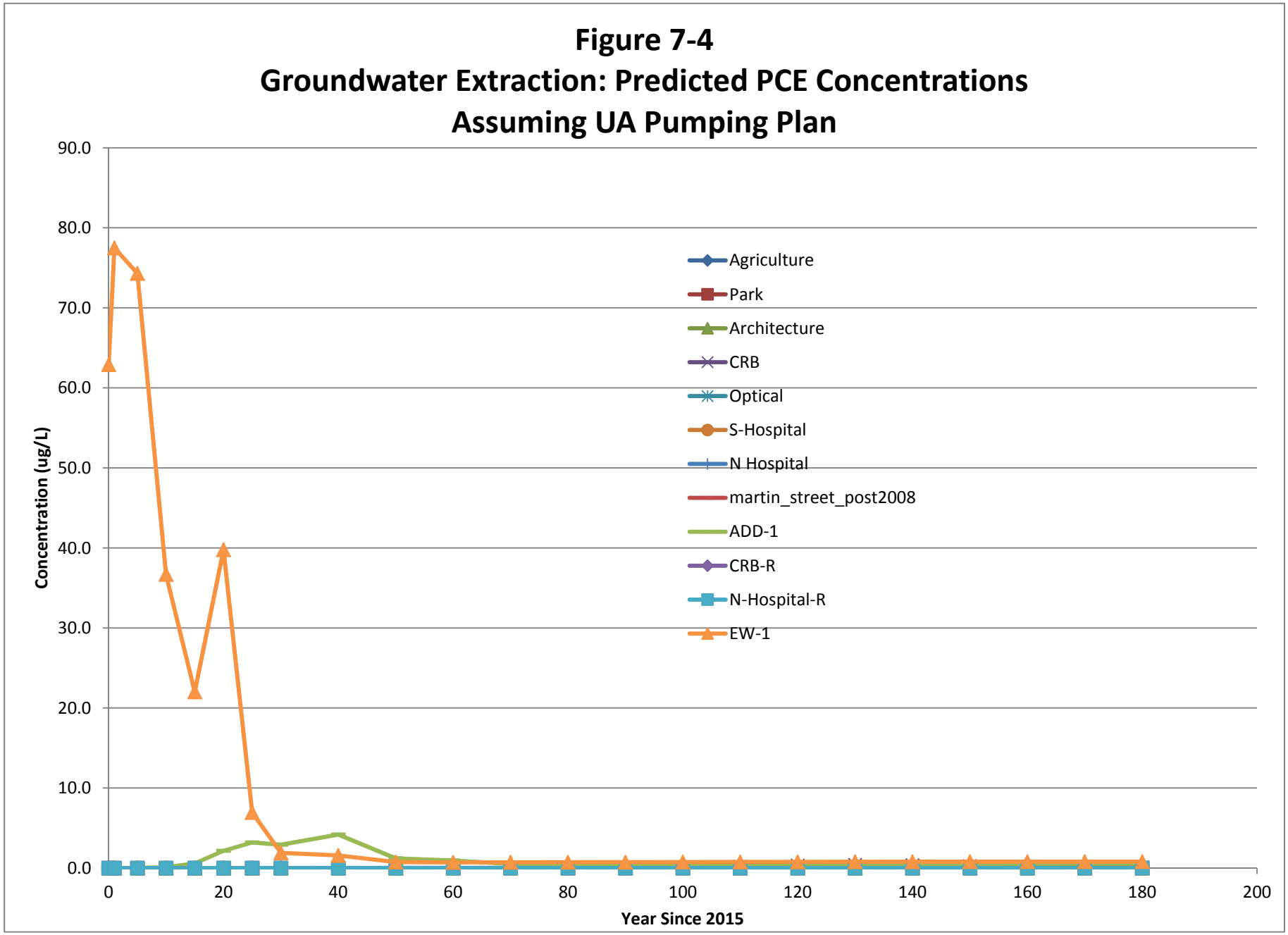
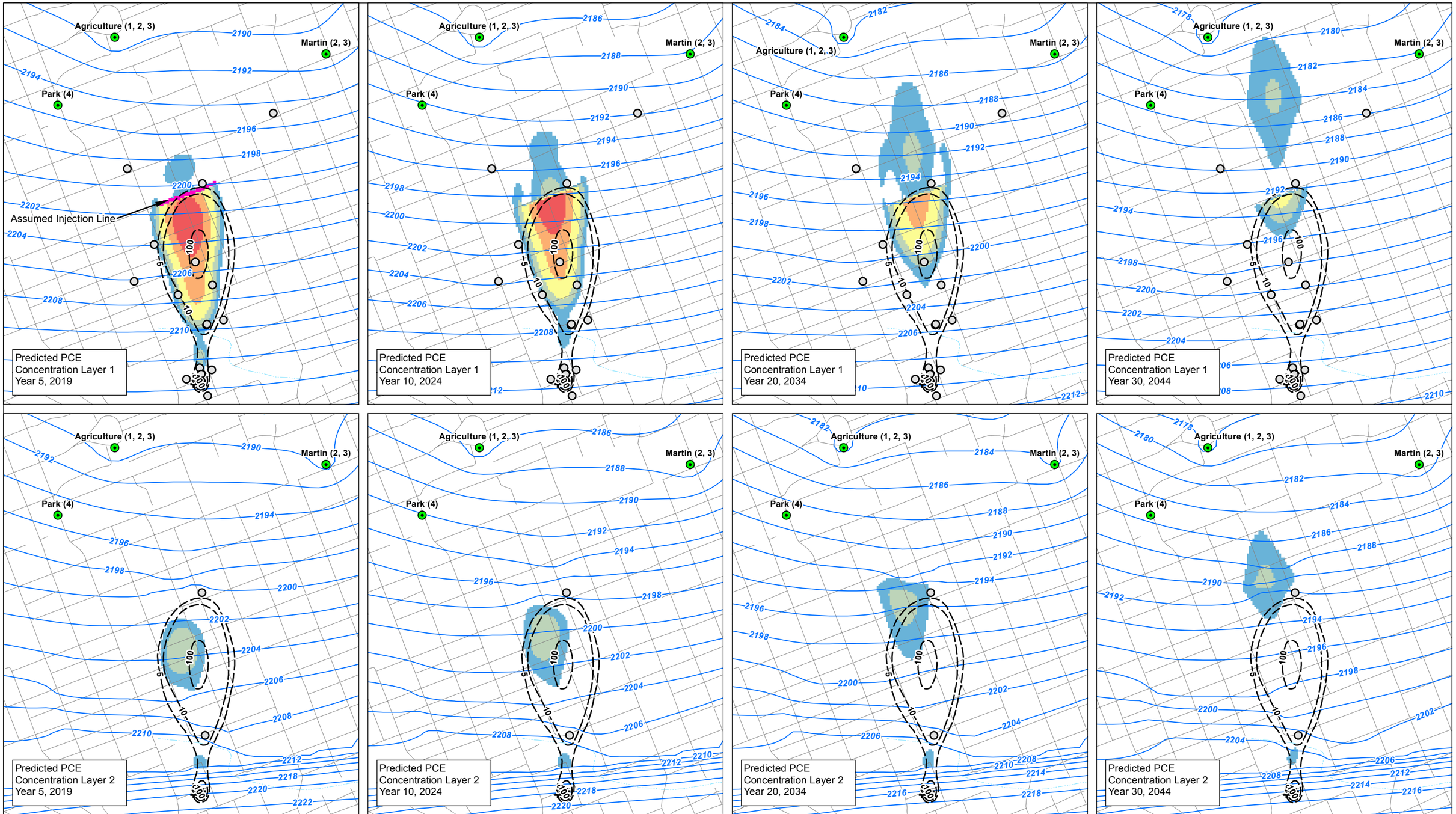


Figure 7-4
Groundwater Extraction: Predicted PCE Concentrations
Assuming UA Pumping Plan
Concentration (ug/L)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Year Since 2015
Agriculture
Park
Architecture
CRB
Optical
S-Hospital
N Hospital
martin_street_post2008
ADD-1
CRB-R
N-Hospital-R
EW-1



Regional Aquifer Monitoring Well

Production Well

Martin (2, 3) Production Well Name and Screened Model Layers

Abandoned Production Well

Assumed Injection Line

Simulated Groundwater Potentiometric Surface (feet)

Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L)

- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200

0 1,200 Feet

N

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

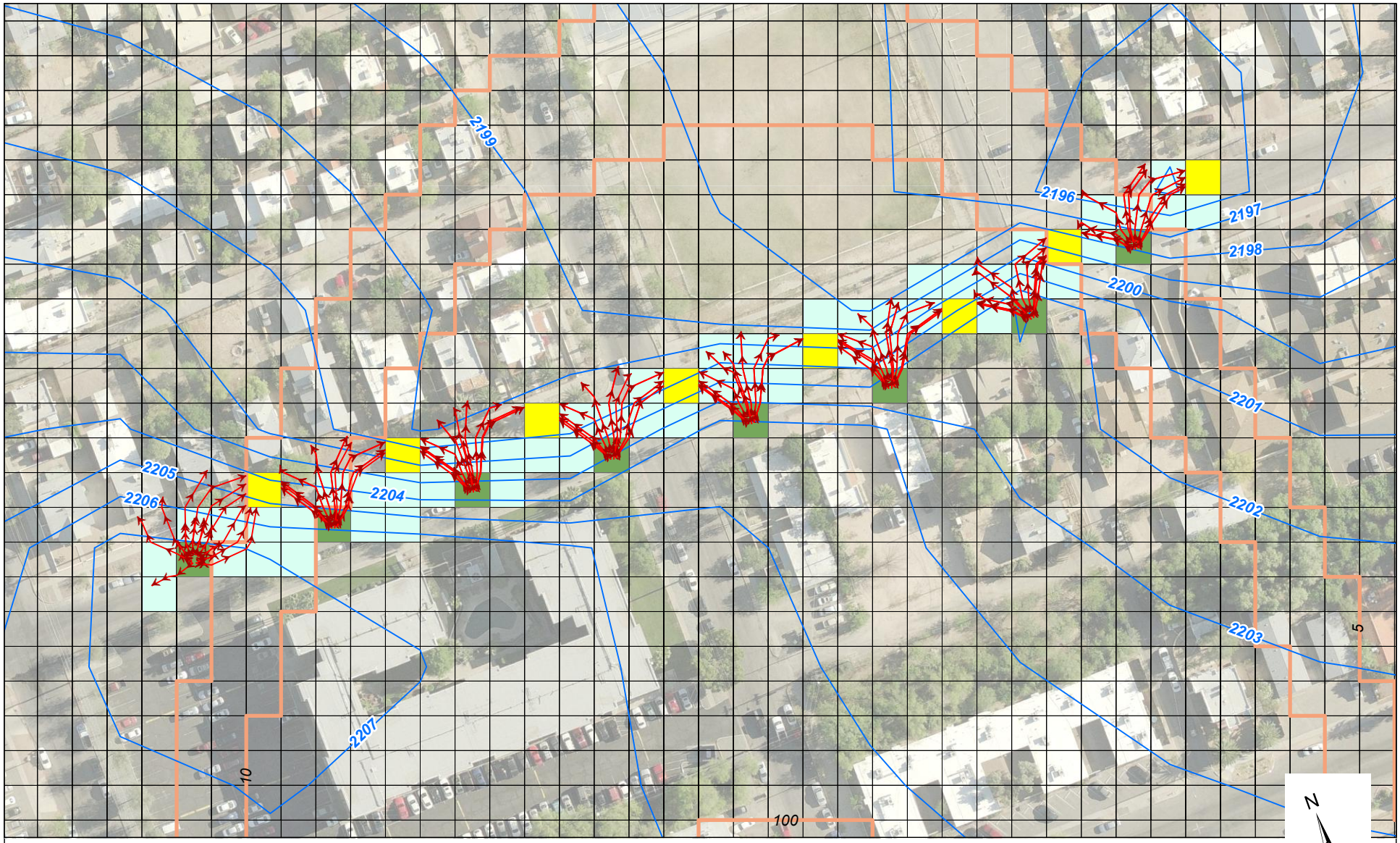
Date: July 2015

PlumeStop™: Predicted Regional Aquifer PCE Plume Assuming UA Pumping Plan

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 7-5

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig7-05 PCE UA Plan PlumeStop.mxd



Simulated PCE Concentration Contour at 5, 10 and 100 µg/L

Simulated Groundwater Potentiometric Surface (feet)

Simulated Groundwater Flow Pathways (Particle Tracks) in Layer 1

Extraction Location

Injection Location

Assumed Biodegredation Zone

Model Grid

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

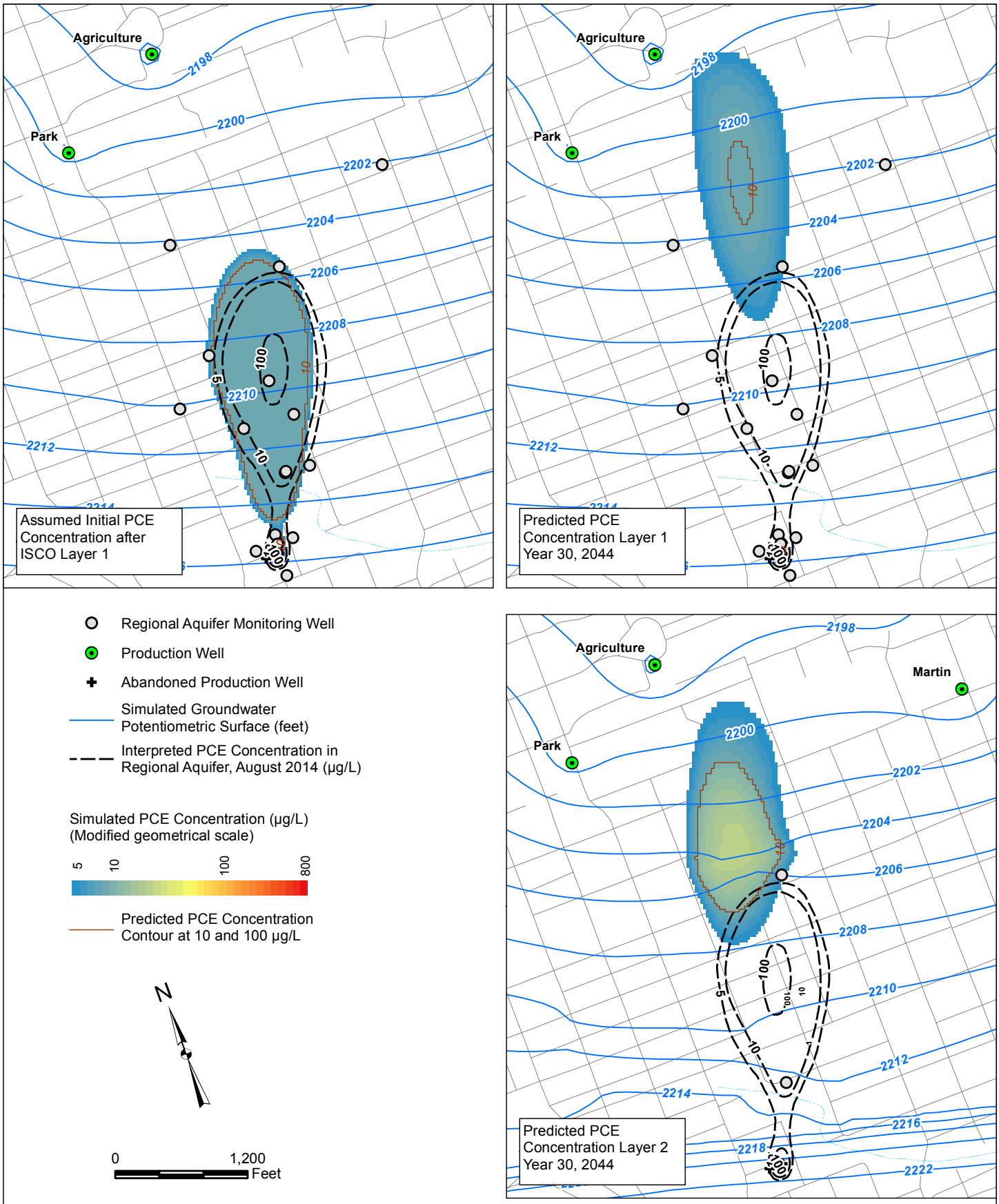
Date: July 2015

PlumeStop: Estimated Well Spacing of Injection and Extraction Wells for Distribution of PlumeStop™

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

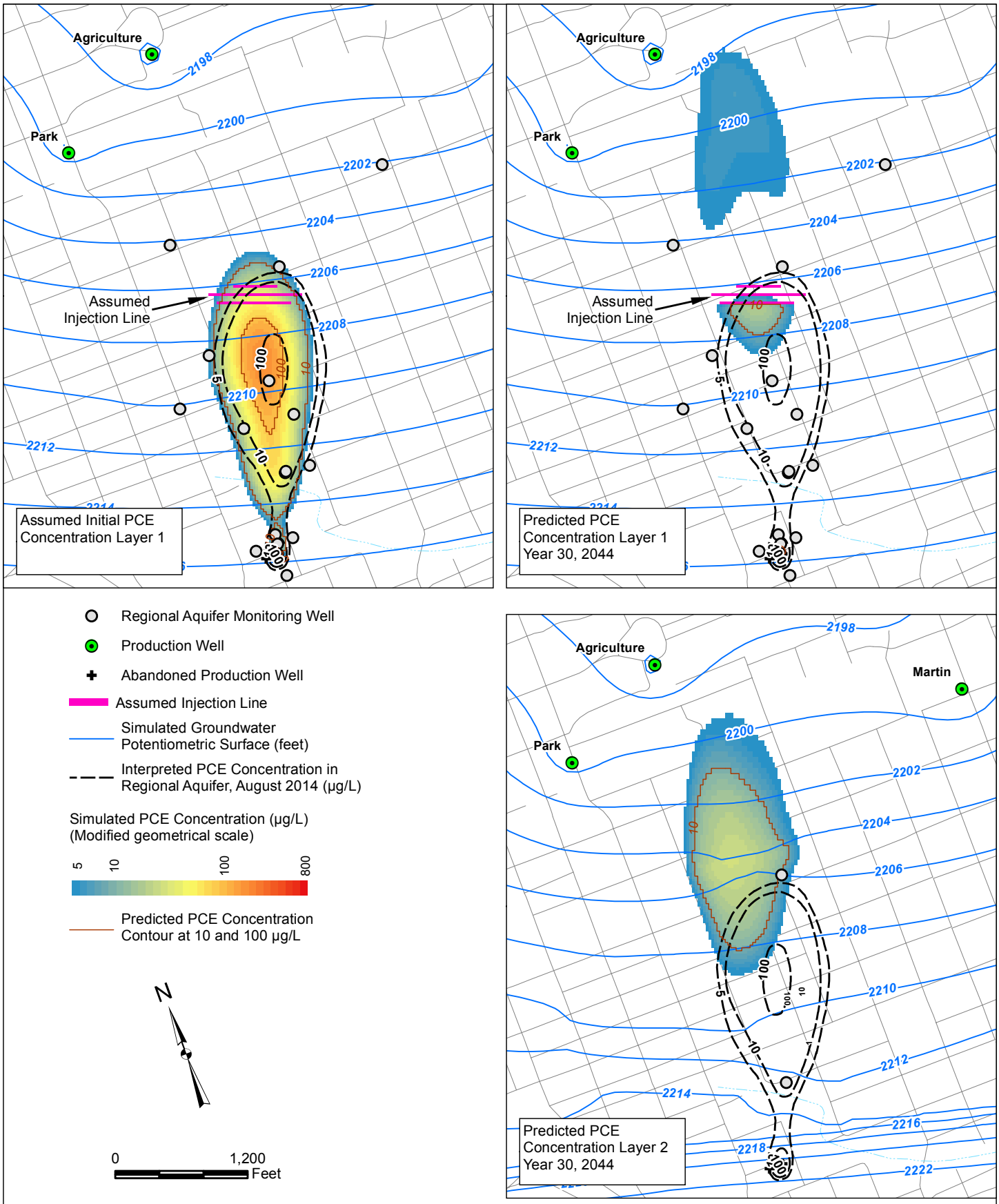
Figure 7-6

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig7-09 PlumeStop Well Spacing.mxd



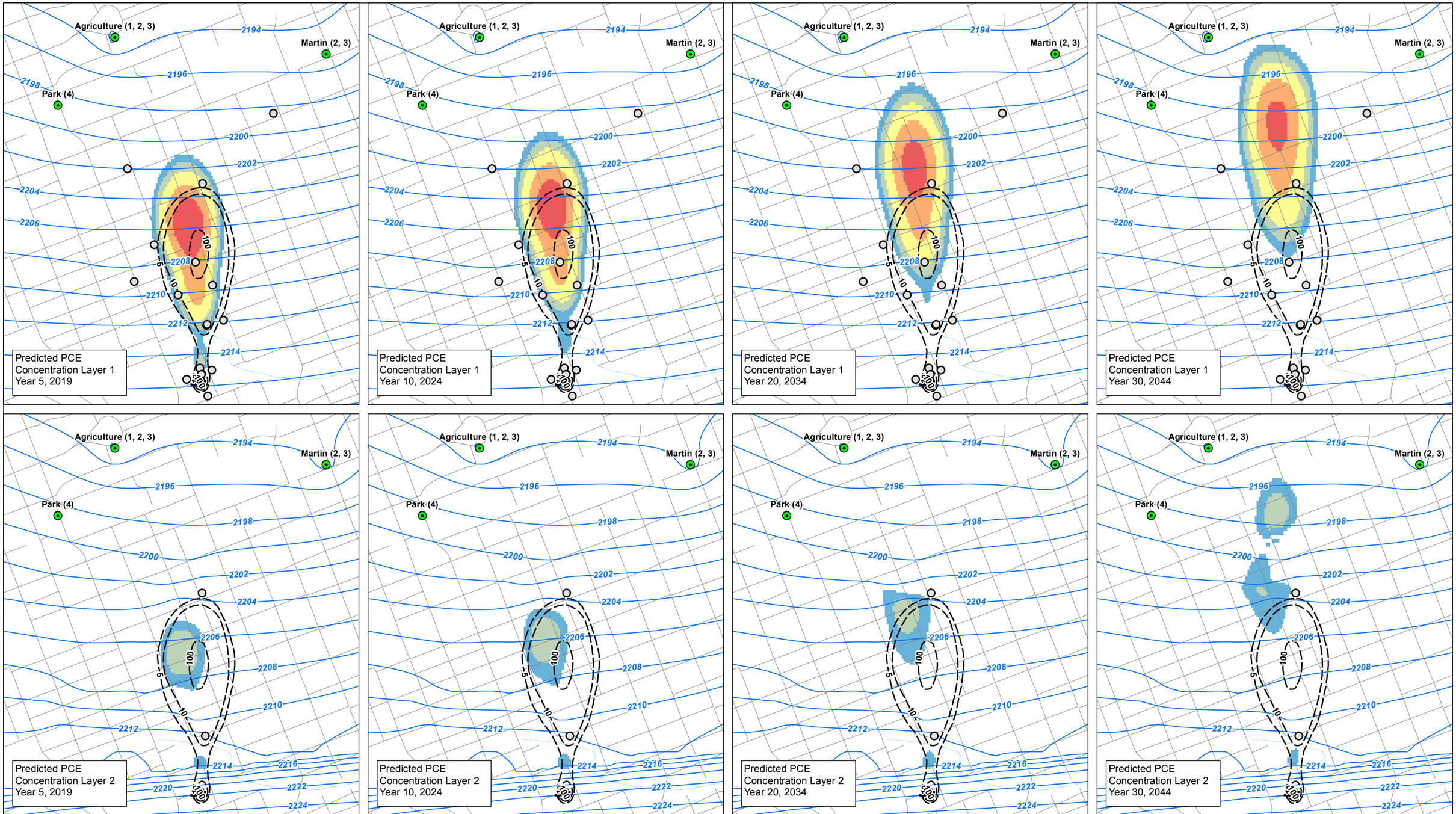
URS	ISCO: Assumed Initial PCE Concentrations and Predicted PCE Plume by Year 30
Project Name: Park-Euclid WQARF Site	*Regional Aquifer Groundwater Modeling Report*
Job No: 22241866 / Date: July 2015	*Park-Euclid WQARF Site, Tucson, Arizona* **Figure 7-7**

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig7-10 Predicted ISCO.mxd



URS	ERD: Assumed ERD Injection Lines and Predicted PCE Plume by Year 30
Project Name: Park-Euclid WQARF Site	*Regional Aquifer Groundwater Modeling Report*
Job No: 22241866 / Date: July 2015	*Park-Euclid WQARF Site, Tucson, Arizona* **Figure 7-8**

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig7-11 Predicted ERD.mxd



Regional Aquifer Monitoring Well

Production Well

Martin (2, 3) Production Well Name and Screened Model Layers

Abandoned Production Well

Simulated Groundwater Potentiometric Surface (feet)

Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L)

- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200

0 1,200 Feet

N

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

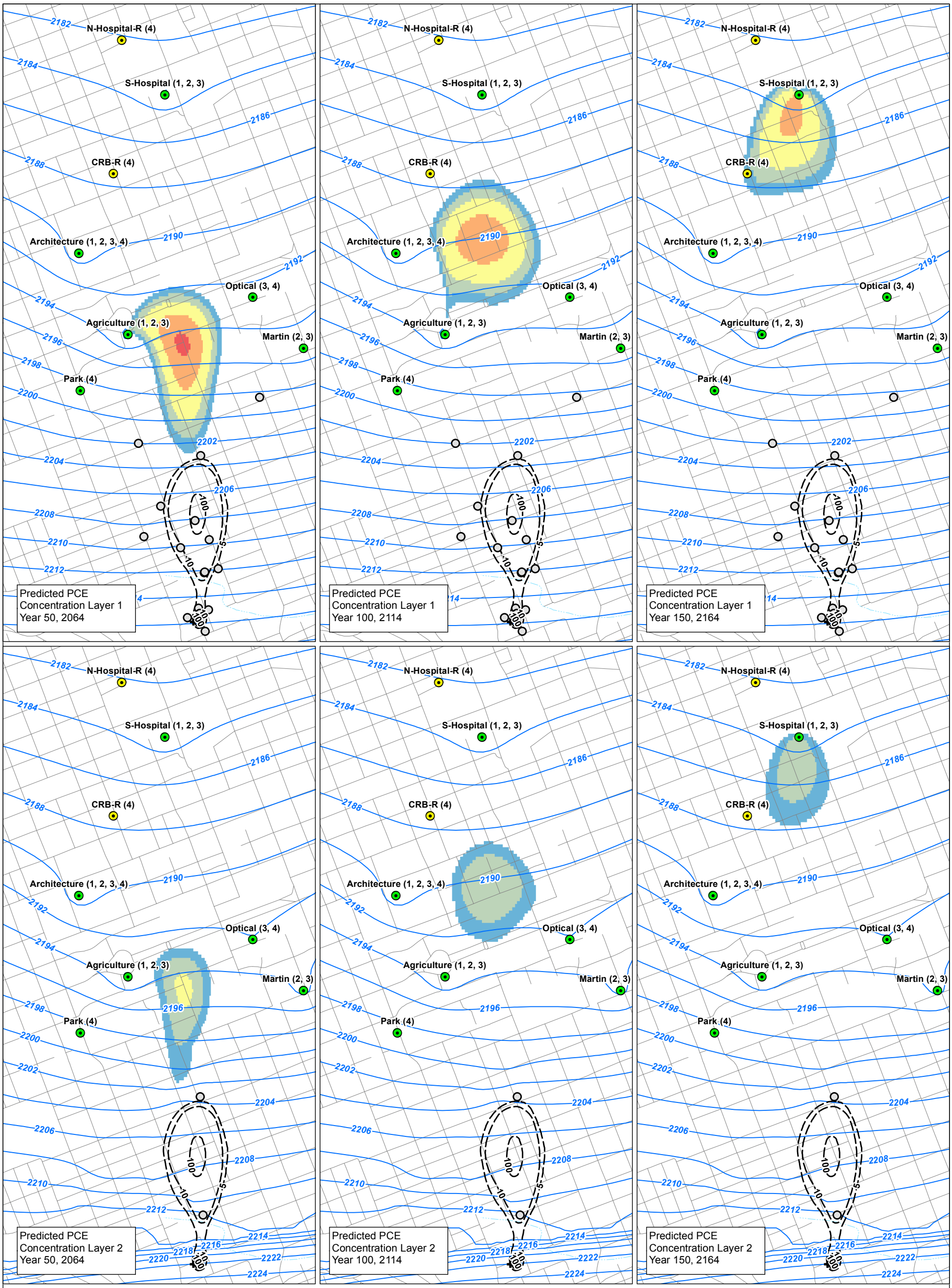
Date: July 2015

MNA: Predicted Regional Aquifer PCE Plume Assuming UA Six-Year Average Pumping Rates of 2008 – 2014
Sheet 1 of 3

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 7-9

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig7-09 PCE Average Pumping 2008-2014 MNA 1 of 3.mxd



Regional Aquifer Monitoring Well

Production Well

Replacement Production Well

Martin (2, 3) Production Well Name and Screened Model Layers

Abandoned Production Well

Simulated Groundwater Potentiometric Surface (feet)

Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L)

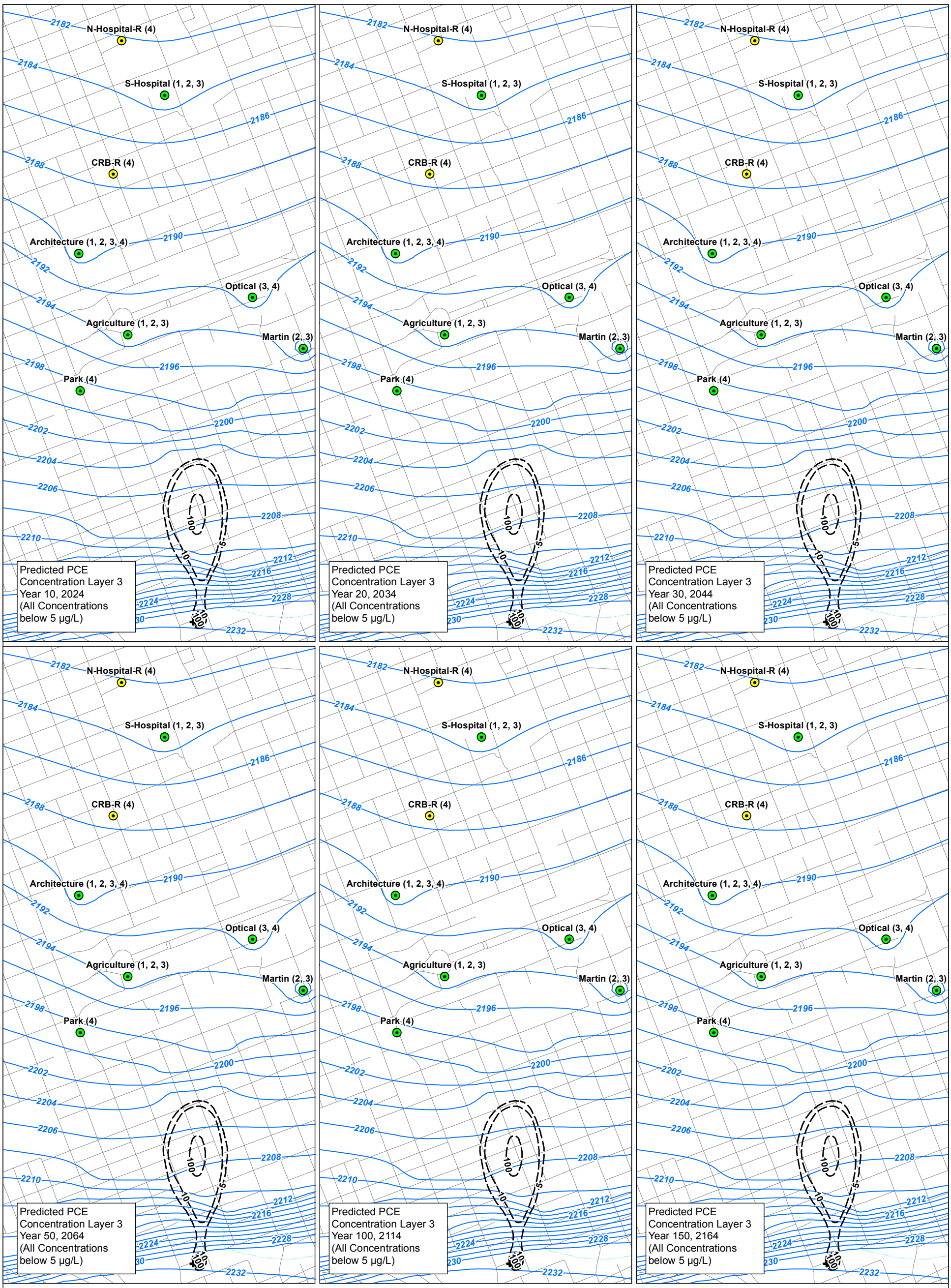
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200

0 1,500 Feet

N

URS	MNA: Predicted Regional Aquifer PCE Plume Assuming UA Six-Year Average Pumping Rates of 2008 – 2014 Sheet 2 of 3
Project Name: Park-Euclid WQARF Site	*Regional Aquifer Groundwater Modeling Report* *Park-Euclid WQARF Site, Tucson, Arizona*
Job No: 22241866 / Date: July 2015	**Figure 7-9**

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig7-09 PCE Average Pumping 2008-2014 MNA 2 of 3.mxd



Production Well

Replacement Production Well

Martin (2, 3) Production Well Name and Screened Model Layers

Abandoned Production Well

Simulated Groundwater Potentiometric Surface (feet)

Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L)

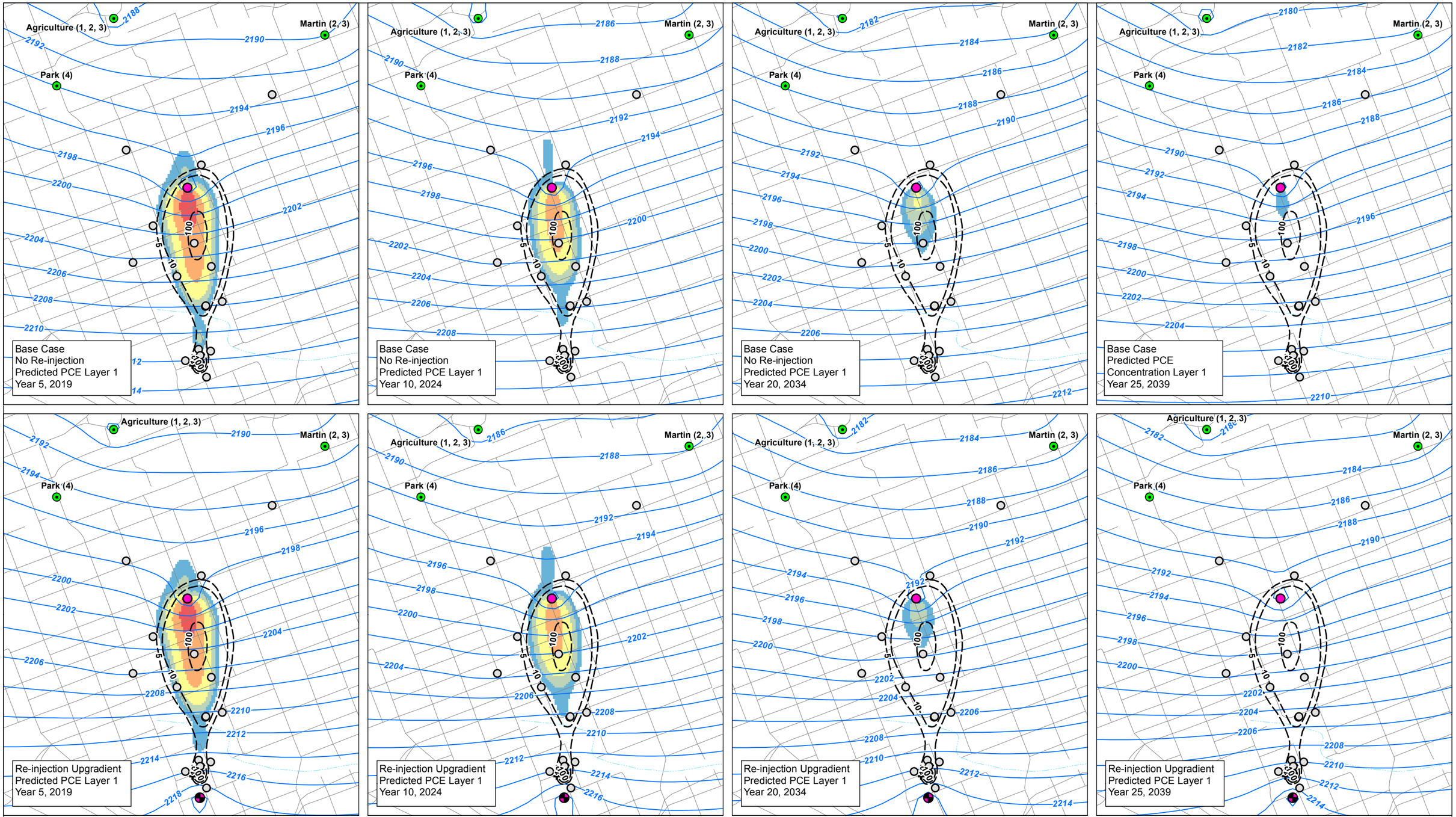
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200

0 1,500 Feet

N

URS	MNA: Predicted Regional Aquifer PCE Plume Assuming UA Six-Year Average Pumping Rates of 2008 – 2014 Sheet 3 of 3
Project Name: Park-Euclid WQARF Site	*Regional Aquifer Groundwater Modeling Report* *Park-Euclid WQARF Site, Tucson, Arizona*
Job No: 22241866 / Date: July 2015	**Figure 7-9**

Y:\GIS\Projects\Mission_Linen\Park_Euclid_modeling\maps\2015\Draft Modeling Report\Fig7-09 PCE Average Pumping 2008-2014 MNA 3 of 3.mxd



Groundwater Extraction Well
Re-injection Well
Production Well
Martin (2, 3) Production Well Name and Screened Model Layers
Regional Aquifer Monitoring
Abandoned Production Well
Simulated Groundwater Potentiometric Surface (feet)
Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L)
5 - 10
10 - 20
20 - 50
50 - 100
100 - 200

0 1,200 Feet

N

URS

Project Name: Park-Euclid WQARF Site

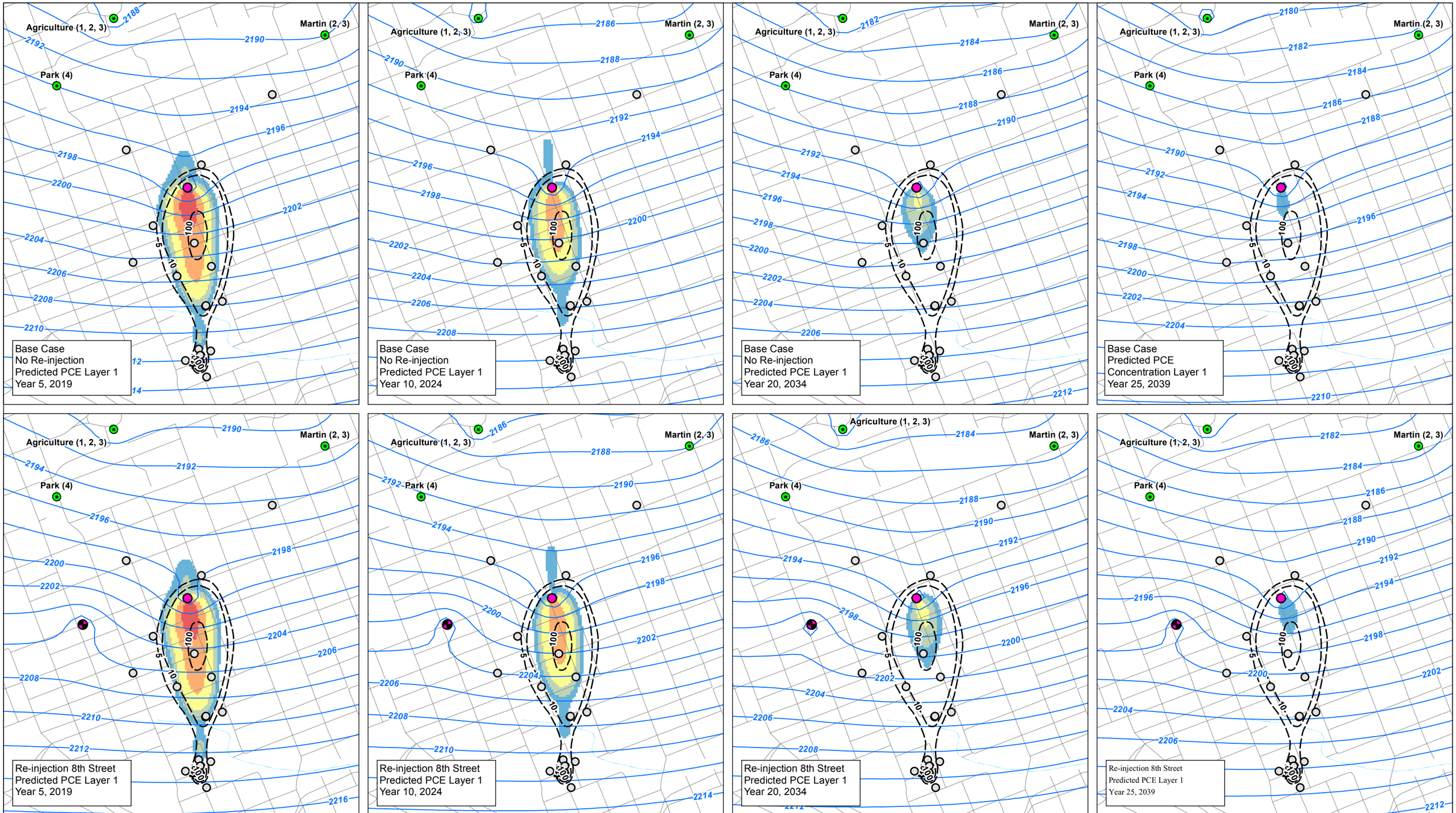
Job No: 22241866 | Date: March 2016

Re-injection Upgradient from the Plume

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 7-10

M:\DCS\Projects\ENV_Legacy\GIS\Mission_Linen\Park_Euclid_modeling\maps\2016\Modeling Report\Fig7-10 PCE EX Reinj Upgradient.mxd



Groundwater Extraction Well
Re-injection Well
Production Well
Martin (2, 3) Production Well Name and Screened Model Layers
Regional Aquifer Monitoring Well
Abandoned Production Well
Simulated Groundwater Potentiometric Surface (feet)
Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L)
5 - 10
10 - 20
20 - 50
50 - 100
100 - 200

0 1,200 Feet

N

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

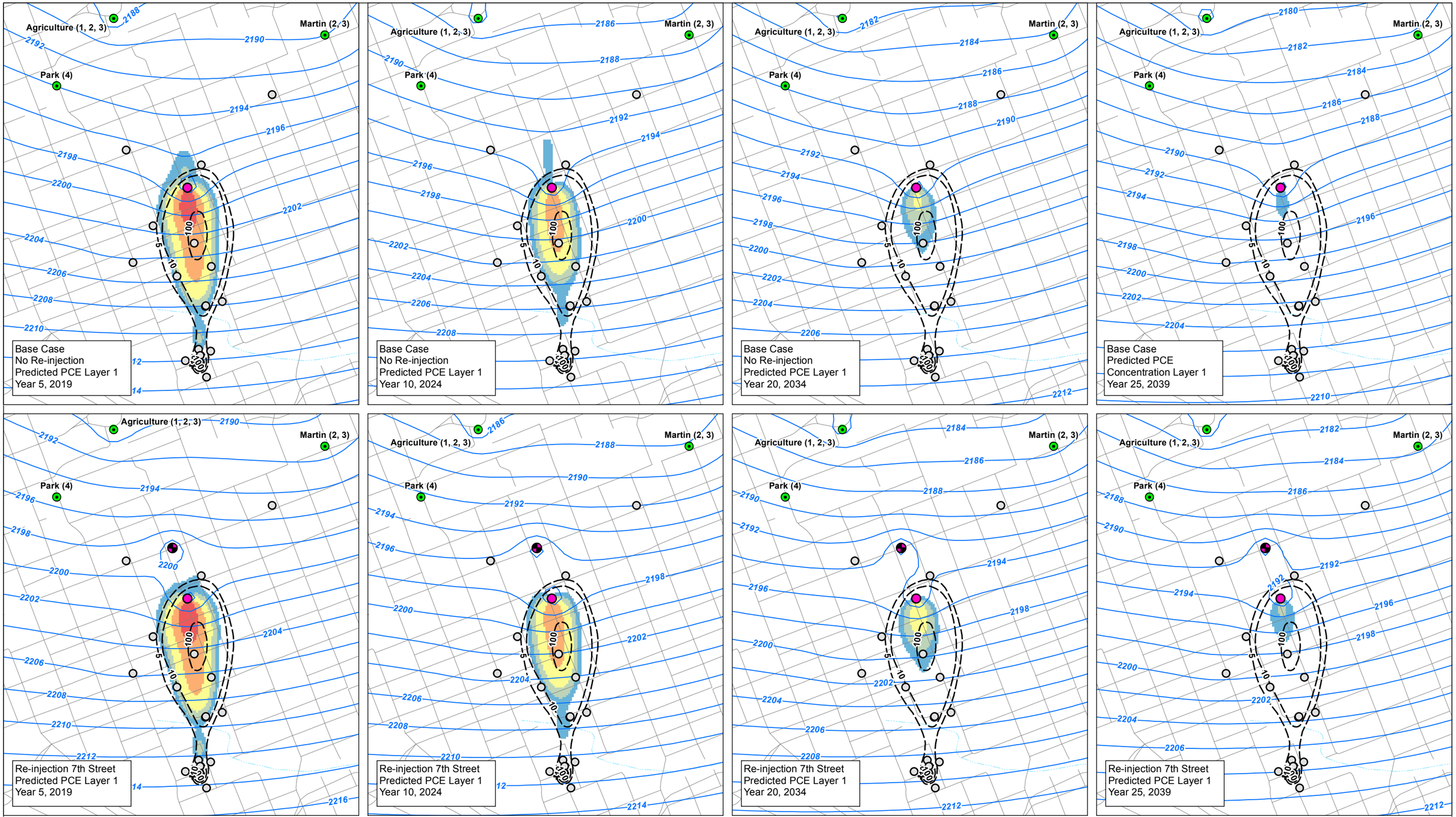
Date: March 2016

Re-Injection Crossgradient from the Plume along 8th Street

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 7-11

M:\DCS\Projects\ENV_Legacy\GIS\Mission_Linen\Park_Euclid_modeling\maps\2016\Modeling Report\Fig7-11 PCE EX Reinj 8th St.mxd



Groundwater Extraction Well
Re-injection Well
Production Well
Martin (2, 3) Production Well Name and Screened Model Layers
Regional Aquifer Monitoring Well
Abandoned Production Well
Simulated Groundwater Potentiometric Surface (feet)
Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L)
5 - 10
10 - 20
20 - 50
50 - 100
100 - 200

0 1,200 Feet

N

URS

Project Name: Park-Euclid WQARF Site

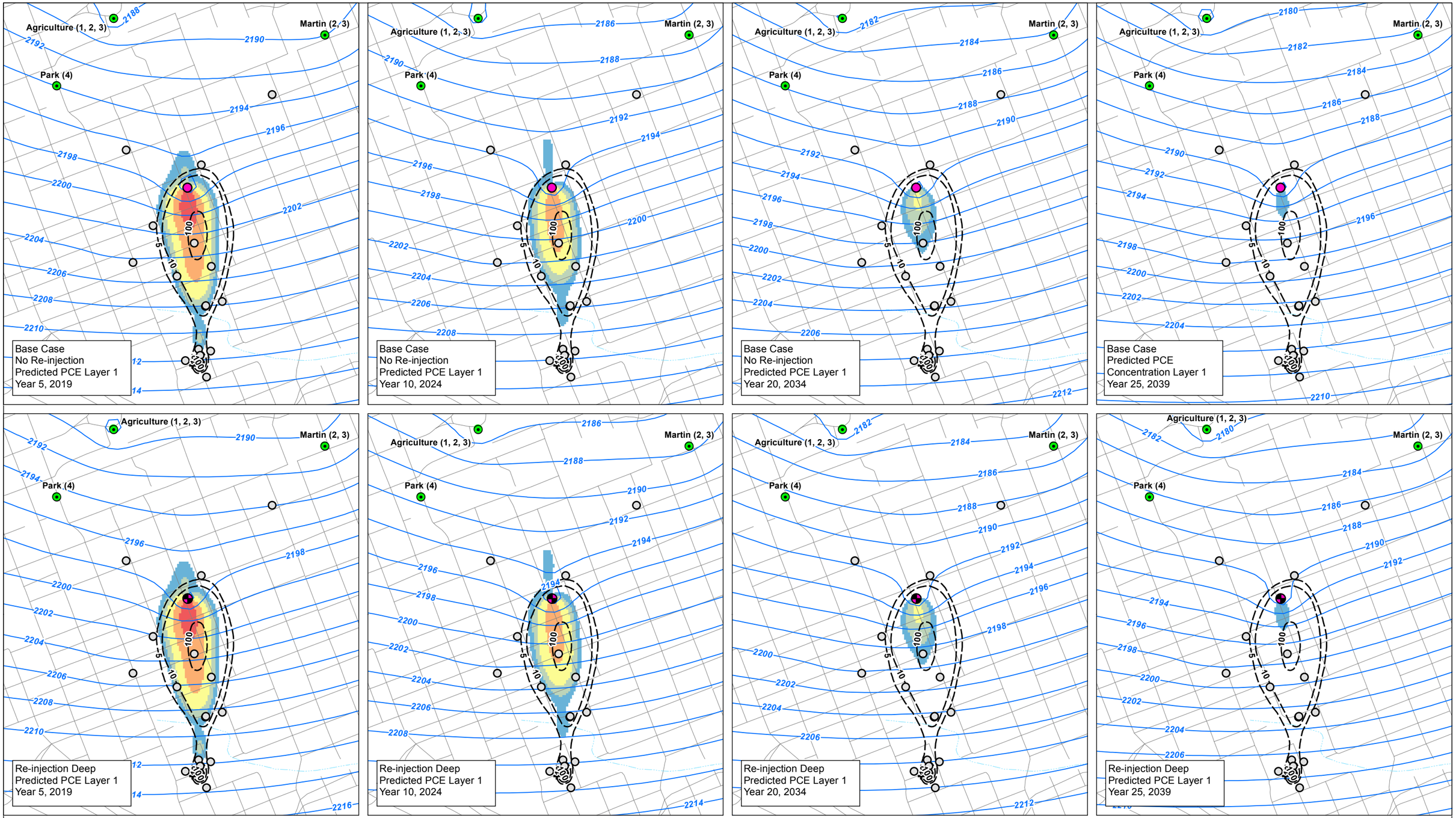
Job No: 22241866 | Date: March 2016

Re-Injection Downgradient from the Plume along 7th Street

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 7-12

M:\DCS\Projects\ENV_Legacy\GIS\Mission_Linen\Park_Euclid_modeling\maps\2016\Modeling Report\Fig7-12 PCE EX Reinj 7th St.mxd



Groundwater Extraction Well

Groundwater Extraction Well and Deep Re-injection Well

Production Well

Martin (2, 3) Production Well Name and Screened Model Layers

Regional Aquifer Monitoring Well

Abandoned Production Well

Simulated Groundwater Potentiometric Surface (feet)

Interpreted PCE Concentration in Regional Aquifer, April 2014 (µg/L)

Simulated PCE Concentration (µg/L)

- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200

0 1,200 Feet

N

URS

Project Name: Park-Euclid WQARF Site

Job No: 22241866

Date: March 2016

Re-Injection in a Deep Layer (Layer 4) at the Extraction Well Location

Regional Aquifer Groundwater Modeling Report
Park-Euclid WQARF Site, Tucson, Arizona

Figure 7-13

M:\DCS\Projects\ENV_Legacy\GIS\Mission_Linen\Park_Euclid_modeling\maps\2016\Modeling Report\Fig7-13 PCE EX Reinj Deep.mxd

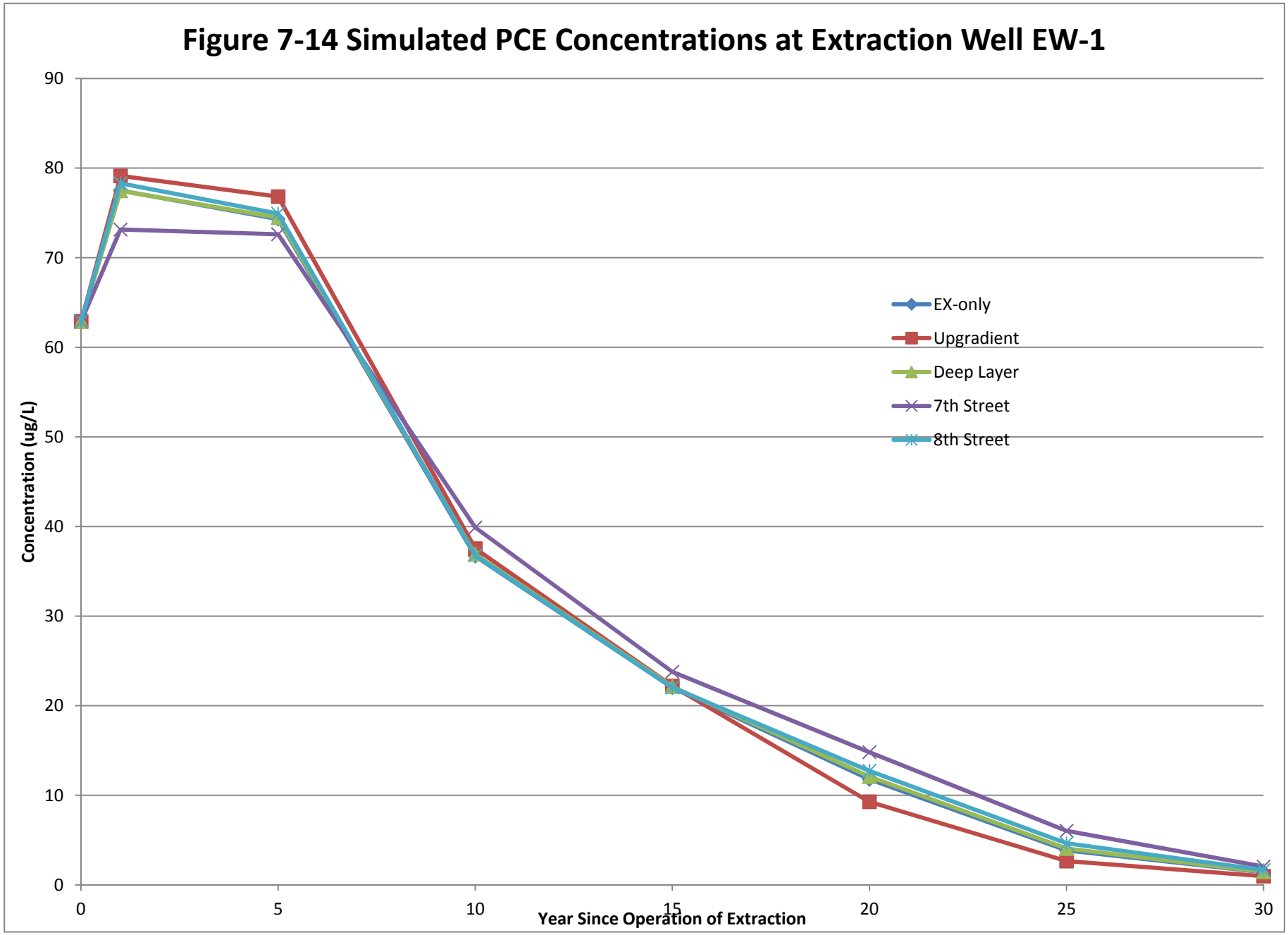


Figure 7-14 Simulated PCE Concentrations at Extraction Well EW-1
Concentration (ug/L)
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
Year Since Operation of Extraction
EX-only
Upgradient
Deep Layer
7th Street
8th Street

Appendix A
University of Arizona Pumping Records

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Tues	09/26/06			661,523		355,200	30,178		46,834
Wed	09/27/06			664,316		356,408	30,277		46,981
Thur	09/28/06			666,921		357,548	30,364		47,127
Fri	09/29/06			669,052		358,383	30,438		47,274
Sat	09/30/06			671,701		359,390	30,526		47,420
Sun	10/01/06			674,350		360,397	30,614		47,567
Monday	10/02/06			676,999		361,404	30,702		47,713
Tues	10/03/06			680,404		362,991	30,818		47,860
Wed	10/04/06			682,435		363,821	30,888		48,006
Thur	10/05/06			684,940		364,881	30,973		48,152
Fri	10/06/06			687,579		366,073	31,063		48,299
Sat	10/07/06			690,244		366,981	31,153		48,445
Sun	10/08/06			692,910		367,890	31,243		48,592
Monday	10/09/06			695,575		368,798	31,334		48,738
Tues	10/10/06			698,132		369,596	31,423		48,885
Wed	10/11/06			700,929		370,801	31,518		49,031
Thur	10/12/06			703,511		371,979	31,612		49,177
Fri	10/13/06			706,290		373,012	31,706		49,324
Sat	10/14/06			708,914		373,889	31,797		49,470
Sun	10/15/06			711,539		374,766	31,888		49,617
Monday	10/16/06			714,163		375,643	31,979		49,763
Tues	10/17/06			717,498		376,900	32,094		49,910
Wed	10/18/06			719,671		377,045	32,170		50,056
Thur	10/19/06			722,216		378,329	32,258		50,203
Fri	10/20/06			724,904		379,069	32,353		50,349
Sat	10/21/06			726,112		379,964	32,443		50,495
Sun	10/22/06			727,320		380,860	32,532		50,642
Monday	10/23/06			728,528		381,755	32,622		50,788
Tues	10/24/06			731,265		382,961	32,716		50,935
Wed	10/25/06			734,162		384,083	32,805		51,081
Thur	10/26/06			736,787		385,120	32,902		51,228
Fri	10/27/06			739,580		385,966	32,994		51,374
Sat	10/28/06			742,256		386,635	33,081		51,520
Sun	10/29/06			744,932		387,304	33,169		51,667
Monday	10/30/06			747,608		387,973	33,256		51,813
Tues	10/31/06			752,258		388,824	33,349		51,960
Wed	11/01/06			753,596		389,707	33,460		52,106
Thur	11/02/06			755,861		390,278	33,537		52,253
Fri	11/03/06			758,496		391,013	33,627		52,399
Sat	11/04/06			761,188		391,646	33,714		52,546
Sun	11/05/06			763,880		392,278	33,800		52,692
Monday	11/06/06			766,572		392,911	33,887		52,838
Tues	11/07/06			769,207		393,733	33,947		52,985
Wed	11/08/06			771,863		394,619	33,997		53,131
Thur	11/09/06			774,544		395,647	34,055		53,278
Fri	11/10/06			777,205		396,671	34,104		53,424
Sat	11/11/06			779,822		397,250	34,148		53,571
Sun	11/12/06			782,439		397,829	34,192		53,717
Monday	11/13/06			785,055		398,407	34,235		53,864
Tues	11/14/06			787,672		398,986	34,236		54,010
Wed	11/15/06			790,990		399,993	34,236		54,156
Thur	11/16/06			793,643		400,652	34,236		54,303
Fri	11/17/06			795,736		401,106	34,239		54,449
Sat	11/18/06			798,353		401,787	34,293		54,596
Sun	11/19/06			800,970		402,468	34,346		54,742
Monday	11/20/06			803,587		403,149	34,400		54,889
Tues	11/21/06			806,666		404,280	34,465		55,035
Wed	11/22/06			808,885		405,009	34,505		55,181

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Thur	11/23/06			811,558		405,956	34,510		55,328
Fri	11/24/06			814,231		406,903	34,515		55,474
Sat	11/25/06			816,750		407,617	34,517		55,621
Sun	11/26/06			819,268		408,332	34,519		55,767
Monday	11/27/06			821,787		409,046	34,520		55,914
Tues	11/28/06			823,345		409,860	34,542		56,060
Wed	11/29/06			824,902		410,616	34,632		56,207
Thur	11/30/06			826,905		411,338	34,651		56,353
Fri	12/01/06			830,051		411,979	34,690		56,499
Sat	12/02/06			832,522		412,621	34,705		56,646
Sun	12/03/06			834,992		413,262	34,719		56,792
Monday	12/04/06			837,463		413,903	34,734		56,939
Tues	12/05/06			840,665		414,811	34,776		57,085
Wed	12/06/06			842,785		415,390	34,807		57,232
Thur	12/07/06			845,223		416,051	34,843		57,378
Fri	12/08/06			847,908		416,921	34,873		57,524
Sat	12/09/06			850,494		417,488	34,887		57,671
Sun	12/10/06			853,079		418,056	34,902		57,817
Monday	12/11/06			855,665		418,623	34,916		57,964
Tues	12/12/06			858,274		419,324	34,947		58,110
Wed	12/13/06			860,761		419,759	34,977		58,257
Thur	12/14/06			863,585		420,310	35,001		58,403
Fri	12/15/06			866,584		420,322	35,037		58,550
Sat	12/16/06			869,067		420,679	35,042		58,696
Sun	12/17/06			871,549		421,037	35,048		58,842
Monday	12/18/06			874,032		421,394	35,053		58,989
Tues	12/19/06			876,763		421,850	35,056		59,135
Wed	12/20/06			878,698		421,996	35,056		59,282
Thur	12/21/06			881,115		422,342	35,058		59,428
Fri	12/22/06			883,826		422,762	35,100		59,575
Sat	12/23/06			886,236		422,890	35,139		59,721
Sun	12/24/06			888,645		423,018	35,179		59,868
Monday	12/25/06			891,055		423,146	35,218		60,014
Tues	12/26/06			893,464		423,274	35,258		60,160
Wed	12/27/06			895,972		423,454	35,301		60,307
Thur	12/28/06			898,479		423,634	35,344		60,453
Fri	12/29/06			900,987		423,814	35,387		60,600
Sat	12/30/06			903,356		423,988	35,423		60,746
Sun	12/31/06			905,725		424,162	35,460		60,893
Monday	01/01/07			908,093		424,336	35,497		61,039
Tues	01/02/07			910,462		424,510	35,534		61,164
Wed	01/03/07			913,571		424,981	35,613		61,289
Thur	01/04/07			915,684		425,399	35,658		61,415
Fri	01/05/07			918,122		425,883	35,712		61,540
Sat	01/06/07			918,698		426,135	35,740		61,665
Sun	01/07/07			919,275		426,388	35,767		61,790
Monday	01/08/07			919,851		426,640	35,794		61,915
Tues	01/09/07			922,444		427,039	35,825		62,041
Wed	01/10/07			925,037		427,438	35,857		62,166
Thur	01/11/07			927,510		428,174	35,880		62,291
Fri	01/12/07			929,760		428,413	35,925		62,416
Sat	01/13/07			932,354		428,549	35,942		62,542
Sun	01/14/07			934,948		428,684	35,960		62,667
Monday	01/15/07			937,542		428,820	35,978		62,792
Tues	01/16/07			940,136		428,955	35,996		62,917
Wed	01/17/07			943,276		429,570	36,044		63,042
Thur	01/18/07			945,388		429,948	36,065		63,168
Fri	01/19/07			948,098		430,386	36,121		63,293

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Sat	01/20/07			950,795		430,562	36,140		63,418
Sun	01/21/07			953,491		430,739	36,160		63,543
Monday	01/22/07			956,188		430,915	36,180		63,668
Tues	01/23/07			958,393		431,159	36,212		63,794
Wed	01/24/07			961,016		431,506	36,248		63,919
Thur	01/25/07			963,519		432,015	36,292		64,044
Fri	01/26/07			966,125		432,408	36,323		64,169
Sat	01/27/07			968,767		432,763	36,347		64,294
Sun	01/28/07			971,408		433,118	36,371		64,420
Monday	01/29/07			974,050		433,473	36,395		64,545
Tues	01/30/07			976,587		433,690	36,426		64,670
Wed	01/31/07			979,217		433,910	36,477		64,795
Thur	02/01/07			981,776		434,128	36,522		64,921
Fri	02/02/07			984,840		434,334	36,579		65,046
Sat	02/03/07			987,247		434,620	36,607		65,171
Sun	02/04/07			989,655		434,905	36,635		65,296
Monday	02/05/07			992,062		435,191	36,663		65,421
Tues	02/06/07			995,358		435,482	36,695		65,547
Wed	02/07/07			997,546		435,698	36,740		65,672
Thur	02/08/07			999,937		436,018	36,773		65,797
Fri	02/09/07			2,664		436,068	36,815		65,922
Sat	02/10/07			5,212		436,118	36,840		66,047
Sun	02/11/07			7,759		436,167	36,866		66,173
Monday	02/12/07			10,307		436,217	36,891		66,298
Tues	02/13/07			12,973		436,961	36,948		66,423
Wed	02/14/07			15,747		438,340	37,025		66,548
Thur	02/15/07			17,809		438,738	37,047		66,674
Fri	02/16/07			20,423		439,206	37,102		66,799
Sat	02/17/07			23,075		439,721	37,133		66,924
Sun	02/18/07			25,727		440,235	37,163		67,049
Monday	02/19/07			28,379		440,750	37,194		67,174
Tues	02/20/07			31,263		441,716	37,231		67,300
Wed	02/21/07			33,578		442,161	37,288		67,425
Thur	02/22/07			37,770		443,458	37,358		67,550
Fri	02/23/07			39,866		444,106	37,393		67,675
Sat	02/24/07			41,961		444,754	37,428		67,800
Sun	02/25/07			44,250		445,483	37,445		67,926
Monday	02/26/07			46,539		446,211	37,470		68,051
Tues	02/27/07			49,076		447,135	37,526		68,176
Wed	02/28/07			51,744		448,039	37,597		68,301
Thur	03/01/07			54,426		448,959	37,647		68,426
Fri	03/02/07			56,956		449,735	37,702		68,552
Sat	03/03/07			59,565		450,477	37,736		68,677
Sun	03/04/07			62,175		451,218	37,771		68,802
Monday	03/05/07			64,784		451,960	37,805		68,927
Tues	03/06/07			67,954		453,170	37,888		69,053
Wed	03/07/07			70,199		453,886	37,938		69,178
Thur	03/08/07			72,748		454,846	38,006		69,303
Fri	03/09/07			75,343		455,754	38,066		69,428
Sat	03/10/07			75,596		456,752	38,132		69,553
Sun	03/11/07			75,849		457,750	38,198		69,679
Monday	03/12/07			76,102		458,748	38,264		69,804
Tues	03/13/07			76,355		459,596	38,311		69,929
Wed	03/14/07			76,608		460,875	38,386		70,054
Thur	03/15/07			78,746		461,631	38,395		70,179
Fri	03/16/07			81,243		462,588	38,409		70,305
Sat	03/17/07			83,842		463,609	38,428		70,430
Sun	03/18/07			86,440		464,630	38,446		70,555

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Monday	03/19/07			89,039		465,651	38,465		70,680
Tues	03/20/07			91,679		466,783	38,513		70,806
Wed	03/21/07			94,356		467,829	38,516		70,931
Thur	03/22/07			97,006		468,711	38,518		71,056
Fri	03/23/07			100,218		469,473	38,559		71,181
Sat	03/24/07			102,768		470,353	38,559		71,306
Sun	03/25/07			105,317		471,233	38,560		71,432
Monday	03/26/07			107,867		472,113	38,560		71,557
Tues	03/27/07			110,499		473,109	38,660		71,682
Wed	03/28/07			113,308		474,050	38,778		71,807
Thur	03/29/07			115,837		474,707	38,890		71,932
Fri	03/30/07			118,518		475,394	38,992		72,055
Sat	03/31/07			121,141		476,172	39,081		72,178
Sun	04/01/07			123,763		476,950	39,169		72,301
Monday	04/02/07			126,386		477,728	39,258		72,424
Tues	04/03/07			129,609		478,917	39,383		72,547
Wed	04/04/07			131,489		479,741	39,468		72,670
Thur	04/05/07			134,210		480,735	39,560		72,793
Fri	04/06/07			137,107		481,747	39,676		72,916
Sat	04/07/07			139,654		482,672	39,749		73,039
Sun	04/08/07			142,202		483,598	39,822		73,162
Monday	04/09/07			144,749		484,523	39,896		73,285
Tues	04/10/07			147,579		485,570	40,006		73,408
Wed	04/11/07			150,201		486,513	40,094		73,531
Thur	04/12/07			152,923		487,419	40,177		73,654
Fri	04/13/07			155,645		488,326	40,260		73,777
Sat	04/14/07			158,245		489,071	40,348		73,900
Sun	04/15/07			160,844		489,815	40,436		74,023
Monday	04/16/07			163,444		490,560	40,525		74,146
Tues	04/17/07			166,729		491,565	40,587		74,269
Wed	04/18/07			168,588		492,329	40,638		74,392
Thur	04/19/07			170,168		493,349	40,677		74,515
Fri	04/20/07			171,748		494,308	40,761		74,638
Sat	04/21/07			173,329		495,099	40,844		74,761
Sun	04/22/07			174,909		495,891	40,928		74,884
Monday	04/23/07			176,489		496,682	41,012		75,007
Tues	04/24/07			179,269		497,483	41,097		75,130
Wed	04/25/07			181,957		498,476	41,171		75,253
Thur	04/26/07			184,642		499,403	41,249		75,376
Fri	04/27/07			187,176		500,333	41,343		75,499
Sat	04/28/07			189,909		501,262	41,405		75,622
Sun	04/29/07			192,643		502,192	41,468		75,745
Monday	04/30/07			195,376		503,121	41,530		75,868
Tues	05/01/07			198,733		504,586	41,549		75,991
Wed	05/02/07			201,226		505,261	41,724		76,114
Thur	05/03/07			203,431		506,171	41,794		76,237
Fri	05/04/07			206,261		507,155	41,909		76,359
Sat	05/05/07			208,421		508,082	42,029		76,482
Sun	05/06/07			210,582		509,009	42,148		76,605
Monday	05/07/07			212,742		509,936	42,268		76,728
Tues	05/08/07			215,557		510,860	42,363		76,851
Wed	05/09/07			218,273		511,925	42,455		76,974
Thur	05/10/07			219,511		512,929	42,566		77,097
Fri	05/11/07			222,550		514,165	42,697		77,220
Sat	05/12/07			225,290		515,211	42,781		77,343
Sun	05/13/07			228,030		516,257	42,866		77,466
Monday	05/14/07			230,769		517,302	42,951		77,589
Tues	05/15/07			233,509		518,348	43,036		77,712

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Wed	05/16/07			236,182		518,388	43,120		77,835
Thur	05/17/07			238,770		520,304	43,205		77,958
Fri	05/18/07			242,171		521,639	43,300		78,081
Sat	05/19/07			244,730		522,556	43,368		78,204
Sun	05/20/07			247,288		523,473	43,436		78,327
Monday	05/21/07			249,847		524,390	43,504		78,450
Tues	05/22/07			252,910		525,637	43,580		78,573
Wed	05/23/07			255,603		526,733	43,668		78,696
Thur	05/24/07			257,982		527,594	43,752		78,819
Fri	05/25/07			260,726		528,644	43,848		78,942
Sat	05/26/07			263,454		529,618	43,929		79,065
Sun	05/27/07			266,181		530,593	44,010		79,188
Monday	05/28/07			268,909		531,567	44,091		79,311
Tues	05/29/07			271,636		532,541	44,172		79,434
Wed	05/30/07			274,387		533,753	44,263		79,557
Thur	05/31/07		98,562	276,603		534,861	44,316		79,680
Fri	06/01/07		98,895	279,134		536,006	44,372		79,803
Sat	06/02/07		99,198	281,674		537,091	44,441		79,926
Sun	06/03/07		99,502	284,213		538,177	44,511		80,049
Monday	06/04/07		99,805	286,753		539,262	44,581		80,172
Tues	06/05/07		99,819	289,555		540,279	44,713		80,295
Wed	06/06/07		99,833	292,313		541,499	44,803		80,418
Thur	06/07/07		100,087	294,683		542,624	44,852		80,541
Fri	06/08/07		100,400	297,375		543,786	44,916		80,664
Sat	06/09/07		100,700	299,871		544,930	44,980		80,787
Sun	06/10/07		101,000	302,366		546,074	45,045		80,910
Monday	06/11/07		101,301	304,862		547,218	45,110		81,032
Tues	06/12/07		70,942	307,397		548,181	45,158		81,401
Wed	06/13/07		71,281	310,366		548,222	45,238		81,572
Thur	06/14/07		71,414	312,828		549,241	45,303		81,706
Fri	06/15/07		71,574	315,289		550,259	45,369		81,839
Sat	06/16/07		71,827	317,851		551,312	45,431		81,988
Sun	06/17/07		72,079	320,414		552,364	45,493		82,138
Monday	06/18/07		72,332	322,976		553,417	45,554		82,287
Tues	06/19/07		72,608	325,544		554,629	45,616		82,435
Wed	06/20/07		72,890	328,116		555,861	45,694		82,584
Thur	06/21/07		73,189	330,932		557,168	45,787		82,744
Fri	06/22/07		73,466	333,502		558,279	45,911		82,888
Sat	06/23/07		73,749	336,093		559,316	46,028		83,033
Sun	06/24/07		74,032	338,684		560,354	46,146		83,178
Monday	06/25/07		74,315	341,275		561,391	46,263		83,323
Tues	06/26/07		74,599	343,960		562,628	46,388		83,476
Wed	06/27/07		74,883	346,612		563,821	46,510		83,625
Thur	06/28/07		75,174	349,161		564,982	46,636		83,787
Fri	06/29/07		75,454	351,944		566,076	46,755		83,928
Sat	06/30/07		75,761	354,611		567,160	46,877		84,072
Sun	07/01/07		76,069	357,277		568,244	46,998		84,215
Monday	07/02/07		76,376	359,944		569,328	47,120		84,359
Tues	07/03/07		76,590	362,452		570,530	47,221		84,502
Wed	07/04/04		76,886	365,161		571,795	47,343		84,657
Thur	07/05/07		77,181	367,870		573,060	47,464		84,812
Fri	07/06/07		77,443	370,430		574,328	47,577		84,950
Sat	07/07/07		77,719	372,973		575,561	47,689		85,102
Sun	07/08/07		77,995	375,517		576,795	47,801		85,253
Monday	07/09/07		78,272	378,060		578,028	47,912		85,405
Tues	07/10/07		78,554	380,658		579,061	48,032		85,552
Wed	07/11/07		78,844	383,385		580,241	48,152		85,698
Thur	07/12/07		79,184	386,548		581,621	48,288		85,878

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Fri	07/13/07		79,408	388,627		582,397	48,390		85,999
Sat	07/14/07		79,689	390,028		582,809	48,508		86,121
Sun	07/15/07		79,970	391,428		583,220	48,626		86,244
Monday	07/16/07		80,251	392,829		583,632	48,744		86,366
Tues	07/17/07		80,609	396,284		585,152	48,893		86,367
Wed	07/18/07		80,818	398,411		586,036	48,986		86,367
Thur	07/19/07		81,112	401,104		587,283	49,109		86,368
Fri	07/20/07		81,415	403,976		588,456	49,239		86,442
Sat	07/21/07		81,672	406,457		589,353	49,345		86,582
Sun	07/22/07		81,929	408,937		590,251	49,452		86,722
Monday	07/23/07		82,186	411,418		591,148	49,559		86,862
Tues	07/24/07		82,469	414,014		592,055	49,681		87,005
Wed	07/25/07		82,758	416,679		593,017	49,797		87,144
Thur	07/26/07		83,044	419,361		593,925	49,913		87,279
Fri	07/27/07		83,312	421,839		594,789	50,025		87,408
Sat	07/28/07		83,540	424,087		595,644	50,039		87,529
Sun	07/29/07		83,767	426,335		596,498	50,053		87,651
Monday	07/30/07		83,994	428,583		597,353	50,066		87,772
Tues	07/31/07		84,179	431,424		598,405	50,153		87,927
Wed	08/01/07		84,490	433,988		599,635	50,185		88,082
Thur	08/02/07		84,597	436,790		600,621	50,282		88,220
Fri	08/03/07		84,713	438,267		601,405	50,359		88,337
Sat	08/04/07		84,947	440,606		602,307	50,411		88,475
Sun	08/05/07		85,181	442,944		603,210	50,464		88,613
Monday	08/06/07		85,415	445,283		604,112	50,516		88,750
Tues	08/07/07		85,599	447,634		604,895	50,605		88,886
Wed	08/08/07		85,815	450,053		605,823	50,639		89,017
Thur	08/09/07		86,027	452,120		606,819	50,728		89,140
Fri	08/10/07		86,251	454,343		607,812	50,823		89,265
Sat	08/11/07		86,381	456,637		608,804	50,920		89,395
Sun	08/12/07		86,511	458,932		609,797	51,017		89,524
Monday	08/13/07		86,641	461,226		610,789	51,114		89,653
Tues	08/14/07		86,911	463,760		611,984	51,226		89,790
Wed	08/15/07		87,233	466,773		613,360	51,363		89,933
Thur	08/16/07		87,453	468,849		614,265	51,448		90,053
Fri	08/17/07		87,721	471,369		615,222	51,563		90,180
Sat	08/18/07		87,989	473,560		616,222	51,677		90,311
Sun	08/19/07		88,258	475,750		617,221	51,792		90,441
Monday	08/20/07		88,526	477,941		618,221	51,907		90,572
Tues	08/21/07		88,789	481,377		619,306	52,018		90,705
Wed	08/22/07		89,111	484,542		620,739	52,154		90,846
Thur	08/23/07		89,325	486,582		621,588	52,247		90,969
Fri	08/24/07		89,440	488,726		622,669	52,336		91,097
Sat	08/25/00		89,685	491,232		623,581	52,365		91,237
Sun	08/26/07		89,929	493,739		624,492	52,393		91,378
Monday	08/27/07		90,174	496,245		625,404	52,422		91,519
Tues	08/28/07		90,454	498,901		626,512	52,544		91,636
Wed	08/29/07		90,715	501,373		627,599	52,659		91,771
Thur	08/30/07		91,044	504,516		629,007	52,796		91,922
Fri	08/31/07		91,260	506,525		629,817	52,888		92,042
Sat	09/01/07		91,507	508,952		630,018	52,977		92,165
Sun	09/02/07		91,755	511,379		630,219	53,067		92,287
Monday	09/03/07		92,002	513,805		630,419	53,157		92,409
Tues	09/04/07		92,250	516,232		630,620	53,247		92,532
Wed	09/05/07		92,567	519,248		634,713	53,337		92,684
Thur	09/06/07		92,805	521,428		635,790	53,439		92,811
Fri	09/07/07		93,060	523,804		636,847	53,547		92,969
Sat	09/08/07		93,097	525,578		637,816	53,615		93,093

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Sun	09/09/07		93,134	527,353		638,786	53,684		93,218
Monday	09/10/07		93,171	529,127		639,755	53,753		93,342
Tues	09/11/07		93,184	531,204		641,121	53,831		93,485
Wed	09/12/07		93,444	533,822		642,148	53,953		93,614
Thur	09/13/07		93,701	536,281		643,349	54,064		93,754
Fri	09/14/07		93,987	538,994		644,328	54,172		93,872
Sat	09/15/07		94,219	541,453		645,331	54,269		94,008
Sun	09/16/07		94,451	543,911		646,334	54,365		94,143
Monday	09/17/07		94,683	546,370		647,337	54,461		94,279
Tues	09/18/07		95,022	549,770		648,173	54,571		94,396
Wed	09/19/07		95,220	551,633		649,102	54,699		94,544
Thur	09/20/07		95,470	554,005		649,940	54,803		94,678
Fri	09/21/07		95,749	556,564		651,169	54,920		94,819
Sat	09/22/07		96,004	558,960		652,480	55,017		94,819
Sun	09/23/07		96,259	561,357		653,791	55,115		94,819
Monday	09/24/07		96,515	563,753		655,102	55,213		94,819
Tues	09/25/07		96,796	566,404		656,441	55,325		94,819
Wed	09/26/07		97,076	568,935		657,824	55,446		94,819
Thur	09/27/07		97,315	571,466		659,062	55,547		94,819
Fri	09/28/07		97,590	574,067		660,426	55,666		94,819
Sat	09/29/07		97,840	576,643		661,697	55,768		94,819
Sun	09/30/07		98,091	579,218		662,967	55,871		94,819
Monday	10/01/07		98,341	581,794		664,238	55,973		94,819
Tues	10/02/07		98,341	584,648		665,806	56,128		94,819
Wed	10/03/07		98,341	586,798		667,000	56,245		94,819
Thur	10/04/07		98,341	589,179		668,092	56,345		94,819
Fri	10/05/07		98,341	591,816		669,401	56,474		94,819
Sat	10/06/07		98,341	594,398		670,670	56,500		94,819
Sun	10/07/07		98,341	596,980		671,939	56,526		94,819
Monday	10/08/07		98,341	599,562		673,208	56,551		94,819
Tues	10/09/07		98,341	602,377		674,656	56,577		94,819
Wed	10/10/07		98,341	604,679		675,804	56,697		94,819
Thur	10/11/07		98,341	607,292		677,057	56,819		94,819
Fri	10/12/07		98,341	610,017		678,325	56,938		94,819
Sat	10/13/07		98,341	612,532		679,564	57,046		94,819
Sun	10/14/07		98,341	615,048		680,803	57,155		94,819
Monday	10/15/07		98,341	617,563		682,042	57,264		94,819
Tues	10/16/07		98,341	620,735		683,569	57,387		94,819
Wed	10/17/07		98,341	621,066		684,643	57,507		94,819
Thur	10/18/07		98,341	621,396		685,786	57,619		94,819
Fri	10/19/07		98,341	621,727		686,950	57,730		94,819
Sat	10/20/07		98,341	621,910		688,146	57,844		94,819
Sun	10/21/07		98,341	622,092		689,343	57,957		94,819
Monday	10/22/07		98,341	622,275		690,539	58,070		94,819
Tues	10/23/07		98,341	622,458		691,775	58,187		94,819
Wed	10/24/07		98,341	622,640		693,039	58,310		94,819
Thur	10/25/07		98,341	622,823		694,228	58,441		94,819
Fri	10/26/07		98,341	623,006		695,495	58,540		94,819
Sat	10/27/07		98,341	623,188		696,772	58,677		94,819
Sun	10/28/07		98,341	623,371		698,050	58,813		94,819
Monday	10/29/07		98,341	623,553		699,327	58,949		94,819
Tues	10/30/07		98,341	623,736		700,597	58,961		94,819
Wed	10/31/07		98,341	623,919		701,879	59,078		94,819
Thur	11/01/07		98,341	624,101		703,136	59,190		94,819
Fri	11/02/07		98,341	624,284		704,393	59,302		94,832
Sat	11/03/07		98,579	626,654		705,598	59,377		94,834
Sun	11/04/07		98,817	629,024		706,803	59,451		94,836
Monday	11/05/07		99,055	631,394		708,008	59,525		94,838

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Tues	11/06/07		99,292	633,718		709,162	59,619		94,840
Wed	11/07/07		99,563	636,226		710,413	59,716		94,842
Thur	11/08/07		99,841	638,816		711,683	59,755		94,844
Fri	11/09/07		100,118	641,342		712,926	59,793		94,846
Sat	11/10/07		100,383	643,612		714,145	59,832		94,849
Sun	11/11/07		100,649	645,882		715,364	59,870		94,851
Monday	11/12/07		100,914	648,152		716,582	59,909		94,853
Tues	11/13/07		101,179	650,422		717,801	59,947		94,855
Wed	11/14/07		101,541	653,837		719,485	60,076		94,857
Thur	11/15/07		101,733	655,296		720,093	60,150		94,969
Fri	11/16/07		101,832	657,606		720,864	60,247		95,094
Sat	11/17/07		101,936	660,193		721,805	60,358		95,217
Sun	11/18/07		102,039	662,779		722,746	60,470		95,339
Monday	11/19/07		102,143	665,366		723,687	60,581		95,462
Tues	11/20/07		102,147	667,450		724,562	60,666		95,591
Wed	11/21/07		102,147	669,793		725,526	60,759		95,729
Thur	11/22/07		102,147	672,067		726,410	60,828		95,847
Fri	11/23/07		102,147	674,340		727,293	60,897		95,965
Sat	11/24/07		102,159	676,535		727,819	60,961		96,083
Sun	11/25/07		102,170	678,731		728,344	61,026		96,201
Monday	11/26/07		102,181	680,926		728,870	61,091		96,319
Tues	11/27/07		102,381	683,439		729,736	61,179		96,470
Wed	11/28/07		102,666	685,951		730,687	61,291		96,629
Thur	11/29/09		102,922	688,340		731,638	61,388		96,786
Fri	11/30/07		102,990	690,688		732,551	61,441		96,931
Sat	12/01/07		103,150	693,101		733,582	61,527		96,986
Sun	12/02/07		103,310	695,514		734,613	61,613		97,040
Monday	12/03/07		103,470	697,927		735,644	61,699		97,095
Tues	12/04/07		103,471	700,758		737,109	61,821		97,119
Wed	12/05/07		103,480	702,552		737,871	61,900		97,143
Thur	12/06/07		103,644	704,876		739,863	61,980		97,158
Fri	12/07/07		103,877	707,373		739,911	62,070		97,254
Sat	12/08/07		104,124	708,933		740,702	62,098		97,367
Sun	12/09/07		104,370	710,492		741,494	62,127		97,479
Monday	12/10/07		104,617	712,052		742,285	62,155		97,591
Tues	12/11/07		104,717	714,491		743,587	62,180		97,611
Wed	12/12/07		104,717	717,746		744,890	62,276		97,630
Thur	12/13/07		104,717	720,013		745,663	62,355		97,678
Fri	12/14/07		104,717	722,217		746,364	62,449		97,732
Sat	12/15/07		104,717	724,694		747,507	62,502		97,756
Sun	12/16/07		104,717	727,171		748,651	62,555		97,780
Monday	12/17/07		104,717	729,648		749,794	62,608		97,804
Tues	12/18/07		104,717	731,839		750,357	62,770		97,928
Wed	12/19/07		104,717	734,387		751,398	62,839		97,983
Thur	12/20/07		104,717	736,717		752,029	62,918		97,984
Fri	12/21/07		104,717	739,165		752,763	63,021		97,986
Sat	12/22/07		104,717	741,649		753,289	63,097		97,990
Sun	12/23/07		104,717	744,134		753,814	63,173		97,994
Monday	12/24/07		104,717	746,618		754,340	63,249		97,998
Tues	12/25/07		104,717	749,092		754,887	63,332		98,002
Wed	12/26/07		104,717	751,565		755,434	63,415		98,005
Thur	12/27/07		104,717	754,105		756,043	63,511		98,010
Fri	12/28/07		104,717	756,644		756,652	63,608		98,015
Sat	12/29/07		104,717	759,079		757,180	63,698		98,017
Sun	12/30/07		104,717	761,513		757,708	63,789		98,020
Monday	12/31/07		104,717	763,948		758,236	63,879		98,022
Tues	01/01/08		104,717	766,287		758,819	63,960		98,026
Wed	01/02/08		104,717	768,626		759,402	64,041		98,027

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Thur	01/03/08		104,717	771,788		760,341	64,169		98,028
Fri	01/04/08		104,717	773,573		760,962	64,234		98,028
Sat	01/05/08		104,717	776,105		761,674	64,333		98,028
Sun	01/06/08		104,717	778,637		762,387	64,431		98,028
Monday	01/07/08		104,717	781,169		763,099	64,530		98,028
Tues	01/08/08		104,717	783,488		763,611	64,629		98,032
Wed	01/09/08		104,717	786,131		764,135	64,742		98,033
Thur	01/10/08		104,717	788,454		764,676	64,839		98,034
Fri	01/11/08		104,717	791,012		765,329	64,950		98,035
Sat	01/12/08		104,717	793,479		765,871	65,047		98,067
Sun	01/13/08		104,717	795,946		766,412	65,143		98,099
Monday	01/14/08		104,717	798,413		766,954	65,240		98,131
Tues	01/15/08		104,717	801,037		767,600	65,357		98,131
Wed	01/16/08		104,717	804,100		768,270	65,492		98,235
Thur	01/17/08		104,717	806,410		768,911	65,594		98,381
Fri	01/18/08		104,717	806,613		769,455	65,694		98,518
Sat	01/19/08		104,717	808,060		770,098	65,804		98,571
Sun	01/20/08		104,717	809,506		770,742	65,914		98,624
Monday	01/21/08		104,717	810,953		771,385	66,023		98,677
Tues	01/21/08		104,717	813,451		771,882	66,126		98,681
Wed	01/23/08		104,717	816,052		772,442	66,253		98,792
Thur	01/24/08		104,717	818,502		773,048	66,348		98,934
Fri	01/25/08		104,717	820,885		773,718	66,440		99,087
Sat	01/26/08		104,717	822,577		774,317	66,544		99,224
Sun	01/27/08		104,717	824,269		774,917	66,649		99,362
Monday	01/28/08		104,717	825,961		775,516	66,754		99,499
Tues	01/29/08		104,717	827,117		776,167	66,889		99,628
Wed	01/30/08		104,717	829,585		776,721	67,001		99,759
Thur	01/31/08		104,717	832,116		777,299	67,095		99,923
Fri	02/01/08		104,717	834,765		777,954	67,209		100,088
Sat	02/02/08		104,717	837,355		778,383	67,318		100,237
Sun	02/03/08		104,717	839,945		778,811	67,426		100,385
Monday	02/04/08		104,717	842,535		779,240	67,535		100,533
Tues	02/05/08		104,717	845,401		780,446	67,621		100,665
Wed	02/06/08		104,717	847,666		780,917	67,706		100,677
Thur	02/07/08		104,717	849,972		781,461	67,878		100,691
Fri	02/08/08		104,717	852,400		782,045	67,978		100,705
Sat	02/09/08		104,717	854,646		782,709	68,061		100,781
Sun	02/10/08		104,717	856,891		783,372	68,144		100,858
Monday	02/11/08		104,717	859,137		784,036	68,227		100,934
Tues	02/12/08		104,717	861,382		784,700	68,311		101,011
Wed	02/13/08		104,717	863,628		785,364	68,394		101,087
Thur	02/14/08		104,717	865,873		786,027	68,477		101,164
Fri	02/15/08		104,717	868,119		786,691	68,560		101,240
Sat	02/16/08		104,717	870,364		787,355	68,644		101,316
Sun	02/17/08		104,717	872,610		788,018	68,727		101,393
Monday	02/18/08		104,717	874,855		788,682	68,810		101,469
Tues	02/19/08		104,717	877,095		789,219	68,838		101,480
Wed	02/20/08		104,717	879,209		789,984	68,858		101,576
Thur	02/21/08		104,717	881,559		790,364	68,966		101,636
Fri	02/22/08		104,717	884,264		791,050	69,079		101,790
Sat	02/23/08		104,717	886,786		791,500	69,189		101,911
Sun	02/23/08		104,717	889,307		791,950	69,299		102,031
Monday	02/25/08		104,717	891,829		792,400	69,410		102,152
Tues	02/26/08		104,750	894,242		792,917	69,511		102,300
Wed	02/27/08		104,944	896,652		793,427	69,611		102,439
Thur	02/28/08		105,248	898,952		793,910	69,719		102,565
Fri	02/29/08		105,583	901,526		794,400	69,821		102,582

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Sat	03/01/08		105,742	903,890		794,850	69,912		102,696
Sun	03/02/08		105,902	906,254		795,299	70,002		102,809
Monday	03/03/08		106,061	908,618		795,749	70,092		102,922
Tues	03/04/08		106,383	911,332		796,395	70,206		103,082
Wed	03/05/08		106,678	913,969		796,890	70,316		103,212
Thur	03/06/08		106,872	915,776		797,365	70,391		103,311
Fri	03/07/08		107,155	918,121		798,051	70,479		103,415
Sat	03/08/08		107,399	920,449		798,556	70,570		103,540
Sun	03/09/08		107,643	922,778		799,062	70,661		103,665
Monday	03/10/08		107,887	925,106		799,567	70,752		103,790
Tues	03/11/08		108,138	927,567		800,137	70,856		103,937
Wed	03/12/08		108,452	930,206		800,629	70,967		104,098
Thur	03/13/08		108,710	932,518		801,126	71,069		104,243
Fri	03/14/08		109,020	934,975		801,621	71,069		104,384
Sat	03/15/08		109,181	937,211		802,079	71,069		104,539
Sun	03/16/08		109,343	939,446		802,538	71,069		104,693
Monday	03/17/08		109,504	941,682		802,996	71,069		104,848
Tues	03/18/08		109,740	944,514		803,686	71,069		105,024
Wed	03/19/08		109,811	945,831		804,213	71,069		105,185
Thur	03/20/08		109,882	947,147		804,678	71,069		105,322
Fri	03/21/08		109,953	949,779		805,142	71,069		105,459
Sat	03/22/08		110,149	952,074		805,565	71,069		105,585
Sun	03/23/08		110,345	954,370		805,989	71,069		105,711
Monday	03/24/08		110,541	956,665		806,412	71,069		105,836
Tues	03/25/08		110,848	959,221		806,859	71,069		105,992
Wed	03/26/08		111,188	961,890		807,347	71,069		106,164
Thur	03/28/08		111,492	964,416		807,823	71,069		106,319
Fri	03/29/08		111,836	966,801		808,188	71,069		106,473
Sat	03/30/08		112,114	969,266		808,553	71,069		106,623
Sun	03/31/08		112,393	971,732		808,918	71,069		106,772
Monday	04/01/08		112,671	974,197		809,283	71,075		106,922
Tues	04/02/08		112,866	976,520		809,648	71,150		107,070
Wed	04/03/08		113,165	979,323		810,013	71,271		107,223
Thur	04/04/08		113,438	981,994		810,378	71,343		107,377
Fri	04/04/08		113,689	984,293		810,743	71,428		107,506
Sat	04/05/08		113,933	986,708		811,108	71,505		107,632
Sun	04/06/08		114,176	989,124		811,473	71,582		107,758
Monday	04/07/08		114,420	991,539		811,838	71,658		107,883
Tues	04/08/08		114,670	993,964		813,431	71,745		108,031
Wed	04/09/08		114,902	996,318		815,050	71,833		108,178
Thur	04/10/08		115,176	998,906		816,496	72,004		108,325
Fri	04/11/08		115,416	1,157		817,979	72,004		108,464
Sat	04/12/08		115,659	3,525		819,703	72,093		108,590
Sun	04/13/08		115,901	5,894		821,426	72,182		108,716
Monday	04/14/08		116,144	8,262		823,150	72,271		108,842
Tues	04/15/08		116,454	11,321		824,260	72,360		109,006
Wed	04/16/08		116,454	13,548		825,575	72,450		109,150
Thur	04/17/08		116,454	16,040		827,115	72,539		109,293
Fri	04/18/08		116,454	18,632		828,655	72,628		109,457
Sat	04/19/08		116,454	21,275		830,275	72,717		109,616
Sun	04/20/08		116,454	23,919		831,895	72,806		109,776
Monday	04/21/08		116,454	26,562		833,515	72,896		109,935
Tues	04/22/08		116,454	29,135		835,134	72,993		110,091
Wed	04/23/08		116,454	31,817		836,775	73,091		110,247
Thur	04/24/08		116,454	34,356		838,364	73,190		110,407
Fri	04/25/08		116,454	36,948		839,899	73,271		110,571
Sat	04/26/08		116,454	39,566		841,504	73,366		110,723
Sun	04/27/08		116,454	42,183		843,110	73,462		110,876

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Monday	04/28/08		116,454	44,801		844,715	73,558		111,029
Tues	04/29/08		116,454	47,472		846,324	73,654		111,198
Wed	04/30/08		116,454	50,082		847,967	73,750		111,358
Thur	05/01/08		116,454	52,706		849,715	73,850		111,498
Fri	05/02/08		116,454	55,398		851,201	73,949		111,673
Sat	05/03/08		116,454	56,722		851,684	74,048		111,831
Sun	05/04/08		116,454	58,045		852,168	74,147		111,988
Monday	05/05/08		116,454	59,369		852,651	74,246		112,146
Tues	05/06/08		116,454	62,455		852,884	74,357		112,297
Wed	05/07/08		116,454	64,713		852,988	74,443		112,469
Thur	05/08/08		116,454	67,166		853,135	74,536		112,613
Fri	05/09/08		116,454	69,938		853,283	74,635		112,765
Sat	05/10/08		116,454	72,538		853,283	74,730		112,918
Sun	05/11/08		116,454	75,138		853,283	74,825		113,070
Monday	05/12/08		116,454	77,738		853,283	74,920		113,223
Tues	05/13/08		116,454	80,243		853,283	75,013		113,378
Wed	05/14/08		116,454	82,921		853,283	75,109		113,554
Thur	05/15/08		116,454	86,164		853,283	75,223		113,756
Fri	05/16/08		116,454	88,152		853,283	75,295		113,884
Sat	05/17/08		116,454	90,496		853,283	75,306		114,019
Sun	05/18/08		116,454	92,839		853,283	75,316		114,155
Monday	05/19/08		116,454	95,183		853,283	75,327		114,290
Tues	05/20/08		116,454	97,608		853,283	75,419		114,413
Wed	05/21/08		116,454	100,283		853,283	75,521		114,576
Thur	05/22/08		116,454	102,807		853,283	75,614		114,739
Fri	05/23/08		116,454	105,439		853,283	75,717		114,921
Sat	05/24/08		116,454	108,028		853,283	75,811		115,086
Sun	05/25/08		116,454	110,616		853,283	75,905		115,252
Monday	05/26/08		116,454	113,205		853,283	75,999		115,418
Tues	05/27/08		116,454	115,793		853,286	76,093		115,584
Wed	05/28/08		116,454	118,418		854,499	76,188		115,744
Thur	05/29/08		116,454	120,999		856,128	76,279		115,900
Fri	05/30/08		116,454	123,714		857,715	76,370		116,057
Sat	05/31/08		116,454	126,255		859,302	76,459		116,216
Sun	06/01/08		116,454	128,795		860,888	76,547		116,376
Monday	06/02/08		116,454	131,336		862,475	76,636		116,535
Tues	06/03/08		116,454	134,036		864,184	76,751		116,698
Wed	06/04/08		116,454	137,084		866,123	76,840		116,885
Thur	06/05/08		116,454	139,720		867,808	76,935		117,060
Fri	06/06/08		116,454	142,158		869,337	77,022		117,222
Sat	06/07/08		116,454	144,595		870,867	77,109		117,384
Sun	06/08/08		116,454	147,033		872,396	77,196		117,545
Monday	06/09/08		116,454	149,470		873,925	77,283		117,707
Tues	06/10/08		116,454	152,004		875,674	77,379		117,901
Wed	06/11/08		116,454	154,785		877,331	77,487		118,052
Thur	06/12/08		116,454	157,127		878,864	77,560		118,210
Fri	06/13/08		116,454	159,689		880,464	77,653		118,375
Sat	06/14/08		116,454	162,244		882,022	77,746		118,501
Sun	06/15/08		116,454	164,799		883,581	77,838		118,628
Monday	06/16/08		116,454	167,354		885,139	77,930		118,754
Tues	06/17/08		116,454	170,620		887,030	78,041		118,881
Wed	06/18/08		116,454	172,587		888,059	78,118		119,092
Thur	06/19/08		116,454	175,027		889,468	78,209		119,219
Fri	06/20/08		116,668	177,651		890,934	78,302		119,554
Sat	06/21/08		116,897	180,363		892,565	78,396		119,736
Sun	06/22/08		117,159	183,074		894,197	78,491		119,918
Monday	06/23/08		117,420	185,786		895,828	78,586		120,101
Tues	06/24/08		117,739	187,813		897,085	78,659		120,240

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Wed	06/25/08		118,034	190,395		898,687	78,752		120,414
Thur	06/26/08		118,318	192,821		900,282	78,839		120,582
Fri	06/27/08		118,602	195,335		901,836	78,927		120,754
Sat	06/28/08		118,892	197,889		903,406	79,017		120,930
Sun	06/29/08		119,182	200,443		904,976	79,108		121,107
Monday	06/30/08		119,472	202,997		906,546	79,198		121,284
Tues	07/01/08		119,761	205,545		908,175	79,298		121,457
Wed	07/02/08		120,032	207,931		909,744	79,381		121,625
Thur	07/03/08		120,303	210,242		911,256	79,469		121,789
Fri	07/04/08		120,534	212,618		912,769	79,556		121,949
Sat	07/05/08		120,765	214,993		914,282	79,643		122,109
Sun	07/06/08		120,996	217,369		915,794	79,731		122,269
Monday	07/07/08		121,227	219,744		917,307	79,818		122,429
Tues	07/08/08		121,502	222,598		918,874	79,908		122,603
Wed	07/09/08		121,774	224,533		920,372	79,995		122,764
Thur	07/10/08		122,010	226,988		921,449	80,066		122,895
Fri	07/11/08		122,246	229,443		922,525	80,136		123,026
Sat	07/12/08		122,293	231,772		924,333	80,216		123,175
Sun	07/13/08		122,340	234,101		926,142	80,296		123,324
Monday	07/14/08		122,387	236,430		927,950	80,375		123,473
Tues	07/15/08		122,580	238,902		929,469	80,462		123,623
Wed	07/16/08		122,773	241,374		930,988	80,550		123,774
Thur	07/17/08		123,040	243,784		932,514	80,586		123,911
Fri	07/18/08		123,320	246,381		934,093	80,680		124,066
Sat	07/19/08		123,600	248,473		935,654	80,722		124,217
Sun	07/20/08		123,879	250,565		937,216	80,764		124,367
Monday	07/21/08		124,159	252,657		938,777	80,806		124,518
Tues	07/22/08		124,442	254,675		940,449	80,892		124,675
Wed	07/23/08		124,725	256,693		942,121	80,978		124,833
Thur	07/24/08		124,998	258,033		943,610	81,069		124,966
Fri	07/25/08		125,271	260,372		944,832	81,153		125,090
Sat	07/26/08		125,546	262,810		946,381	81,238		125,211
Sun	07/27/08		125,821	265,249		947,929	81,323		125,332
Monday	07/28/08		126,096	267,687		949,478	81,408		125,453
Tues	07/29/08		126,369	270,108		951,056	81,491		125,636
Wed	07/30/08		126,645	272,571		952,645	81,589		125,769
Thur	07/31/08		126,917	275,044		954,274	81,666		125,900
Fri	08/01/08		127,176	277,578		955,975	81,763		126,034
Sat	08/02/08		127,463	280,126		958,076	81,832		126,170
Sun	08/03/08		127,751	282,675		960,178	81,901		126,305
Monday	08/04/08		128,038	285,223		962,279	81,970		126,440
Tues	08/05/08		128,315	287,702		963,516	82,080		126,578
Wed	08/06/08		128,567	289,876		964,459	82,154		126,695
Thur	08/07/08		128,819	292,050		965,403	82,228		126,813
Fri	08/08/08		129,097	294,380		966,888	82,301		126,940
Sat	08/09/08		129,338	296,813		968,417	82,380		127,082
Sun	08/10/08		129,580	299,246		969,946	82,459		127,224
Monday	08/11/08		129,821	301,679		971,475	82,538		127,367
Tues	08/12/08		130,064	303,899		972,949	82,627		127,490
Wed	08/13/08		130,330	306,370		974,532	82,718		127,620
Thur	08/14/08		130,584	308,777		976,090	82,793		127,746
Fri	08/15/08		130,866	311,133		977,557	82,880		127,880
Sat	08/16/08		131,065	313,472		979,035	82,955		128,005
Sun	08/17/08		131,264	315,810		980,513	83,030		128,131
Monday	08/18/08		131,463	318,149		981,991	83,106		128,256
Tues	08/19/08		131,805	321,276		984,085	83,209		128,401
Wed	08/20/08		132,002	323,163		985,264	83,295		128,523
Thur	08/21/08		132,254	325,513		986,845	83,365		128,651

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Fri	08/22/08		132,536	328,000		988,444	83,456		128,783
Sat	08/23/08		132,813	330,426		990,034	83,493		128,913
Sun	08/24/08		133,089	332,852		991,625	83,530		129,043
Monday	08/25/08		133,366	335,278		993,215	83,567		129,173
Tues	08/26/08		133,642	337,876		994,887	83,647		129,345
Wed	08/27/08		133,955	340,573		996,600	83,728		129,493
Thur	08/28/08		134,222	342,712		998,068	83,809		129,728
Fri	08/29/08		134,453	344,946		999,540	83,904		129,799
Sat	08/30/08		134,727	347,369		1,474	83,987		129,870
Sun	08/31/08		135,002	349,791		2,947	84,070		129,941
Monday	09/01/08		135,276	352,214		4,421	84,153		130,012
Tues	09/02/08		135,550	354,636		5,894	84,236		130,083
Wed	09/03/08		135,817	357,038		7,449	84,318		130,135
Thur	09/04/08		136,084	359,440		9,004	84,400		130,187
Fri	09/05/08		136,351	361,766		10,496	84,484		130,391
Sat	09/06/08		136,646	364,343		12,185	84,575		130,501
Sun	09/07/08		136,941	366,919		13,875	84,665		130,612
Monday	09/08/08		137,236	369,496		15,564	84,755		130,723
Tues	09/09/08		137,472	371,596		16,912	84,823		130,866
Wed	09/10/08		137,740	373,877		18,424	84,913		130,967
Thur	09/11/08		138,011	376,492		20,112	84,971		131,102
Fri	09/12/08		138,273	378,773		21,539	85,077		131,235
Sat	09/13/08		138,539	381,054		23,014	85,167		131,332
Sun	09/14/08		138,804	383,335		24,488	85,258		131,428
Monday	09/15/08		139,070	385,616		25,963	85,348		131,524
Tues	09/16/08		139,404	388,704		27,695	85,460		131,680
Wed	09/17/08		139,644	390,795		29,280	85,555		131,798
Thur	09/18/08		139,897	393,090		30,764	85,651		131,928
Fri	09/19/08		140,162	395,373		32,252	85,739		132,035
Sat	09/20/08		140,432	397,746		33,771	85,831		132,165
Sun	09/21/08		140,703	400,119		35,289	85,922		132,295
Monday	09/22/08		140,973	402,492		36,808	86,014		132,424
Tues	09/23/08		141,242	404,911		38,330	86,107		132,564
Wed	09/24/08		141,541	407,908		40,148	86,211		132,707
Thur	09/25/08		141,762	409,688		41,449	86,295		132,826
Fri	09/26/08		142,063	412,140		43,088	86,396		132,964
Sat	09/27/08		142,329	414,463		44,644	86,483		133,096
Sun	09/28/08		142,596	416,785		46,201	86,570		133,228
Monday	09/29/08		142,862	419,108		47,757	86,657		133,360
Tues	09/30/08		143,148	421,546		49,133	86,757		133,502
Wed	10/01/08		143,428	424,152		50,847	86,865		133,653
Thur	10/02/08		143,701	426,577		52,369	86,985		133,796
Fri	10/03/08		143,967	428,892		53,862	87,061		133,926
Sat	10/04/08		144,220	431,190		55,305	87,147		134,054
Sun	10/05/08		144,472	433,488		56,747	87,233		134,183
Monday	10/06/08		144,725	435,786		58,190	87,320		134,311
Tues	10/07/08		144,977	438,164		59,747	87,410		134,427
Wed	10/08/08		145,270	440,618		61,339	87,512		134,542
Thur	10/09/08		145,525	442,984		62,834	87,605		134,643
Fri	10/10/08		145,795	445,378		64,319	87,712		134,789
Sat	10/11/08		146,072	447,730		65,842	87,799		134,912
Sun	10/12/08		146,348	450,082		67,366	87,886		135,035
Monday	10/13/08		146,625	452,434		68,889	87,973		135,158
Tues	10/14/08		146,895	454,714		70,408	88,059		135,263
Wed	10/15/08		147,170	457,466		71,944	88,152		135,371
Thur	10/16/08		147,453	459,542		73,530	88,248		135,510
Fri	10/17/08		147,737	461,894		75,084	88,347		135,657
Sat	10/18/08		148,054	464,478		76,770	88,447		135,770

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Sun	10/19/08		148,371	467,061		78,455	88,548		135,882
Monday	10/20/08		148,688	469,645		80,141	88,648		135,994
Tues	10/21/08		148,841	471,460		81,197	88,727		136,120
Wed	10/22/08		149,134	473,960		82,689	88,837		136,231
Thur	10/23/08		149,391	476,223		84,234	88,925		136,316
Fri	10/24/08		149,662	478,588		85,780	89,024		136,457
Sat	10/25/08		149,930	480,929		87,308	89,116		136,580
Sun	10/26/08		150,198	483,271		88,836	89,208		136,704
Monday	10/27/08		150,466	485,612		90,364	89,300		136,827
Tues	10/28/08		150,775	488,347		92,163	89,410		136,998
Wed	10/29/08		151,009	490,332		93,453	89,490		137,136
Thur	10/30/08		151,279	492,684		94,951	89,586		137,296
Fri	10/31/08		151,543	495,050		96,463	89,686		137,427
Sat	11/01/08		151,817	497,471		97,985	89,773		137,533
Sun	11/02/08		152,091	499,892		99,507	89,861		137,639
Monday	11/03/08		152,365	502,313		101,029	89,948		137,745
Tues	11/04/08		152,644	504,676		102,495	90,031		137,907
Wed	11/05/08		152,904	507,038		103,960	90,132		138,069
Thur	11/06/08		153,172	509,250		105,501	90,216		138,202
Fri	11/07/08		153,416	511,644		106,902	90,295		138,298
Sat	11/08/08		153,680	513,868		108,372	90,379		138,409
Sun	11/09/08		153,944	516,093		109,841	90,462		138,520
Monday	11/10/08		154,208	518,317		111,311	90,546		138,632
Tues	11/11/08		154,471	520,770		112,923	90,636		138,767
Wed	11/12/08		154,734	523,222		114,535	90,722		138,901
Thur	11/13/08		154,979	525,298		115,661	90,793		138,978
Fri	11/14/08		155,257	527,866		117,225	90,889		139,129
Sat	11/15/08		155,513	528,394		118,701	90,979		139,266
Sun	11/16/08		155,769	528,923		120,178	91,068		139,404
Monday	11/17/08		156,025	529,451		121,654	91,157		139,542
Tues	11/18/08		156,252	531,862		123,138	91,238		139,699
Wed	11/19/08		156,468	534,214		124,507	91,283		139,818
Thur	11/20/08		156,667	536,880		126,108	91,379		139,857
Fri	11/21/08	12	156,834	538,223		127,135	91,458		139,884
Sat	11/22/08	220	156,881	539,227		127,968	91,549		139,915
Sun	11/23/08	428	156,927	540,230		128,802	91,641		139,945
Monday	11/24/08	637	156,974	541,234		129,635	91,733		139,976
Tues	11/25/08	833	157,004	541,767		130,917	91,821		139,986
wed	11/26/08	1,099	157,034	543,853		132,264	91,891		139,997
Thur	11/27/08	1,300	157,064	545,050		133,225	91,981		140,010
Fri	11/28/08	1,501	157,094	546,246	1,270	134,186	92,071		140,024
Sat	11/29/08	1,705	157,123	547,472	1,443	134,970	92,161		140,037
Sun	11/30/08	1,910	157,153	548,698	1,617	135,753	92,251		140,050
Monday	12/01/08	2,114	157,183	549,924	1,790	136,537	92,341		140,063
Tues	12/02/08	2,394	157,213	552,294	1,991	138,015	92,439		140,068
Wed	12/03/08	2,658	157,243	554,777	2,192	139,525	92,536		140,147
Thur	12/04/08	2,843	157,366	556,478	2,382	140,578	92,634		140,183
Fri	12/05/08	3,036	157,516	558,508	2,556	141,743	92,772		140,231
Sat	12/06/08	3,280	157,563	560,355	2,732	142,410	92,817		140,231
Sun	12/07/08	3,523	157,610	562,201	2,908	143,076	92,863		140,231
Monday	12/08/08	3,767	157,657	564,048	3,084	143,743	92,909		140,231
Tues	12/09/08	4,040	157,839	566,293	3,286	145,743	93,089		140,231
Wed	12/10/08	4,302	157,845	568,564	3,497	147,476	93,183		140,281
Thur	12/11/08	4,568	158,040	569,847	3,653	148,592	93,274		140,294
Fri	12/12/08	4,828	158,268	571,960	3,856	149,842	93,462		140,305
Sat	12/13/08	5,087	158,526	573,877	4,041	150,942	93,522		140,313
Sun	12/14/08	5,347	158,784	575,795	4,225	152,043	93,582		140,321
Monday	12/15/08	5,607	159,042	577,712	4,410	153,143	93,642		140,330

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Tues	12/16/08	5,963	159,304	579,695	4,614	154,471	93,757		140,337
Wed	12/17/08	6,137	159,440	581,139	4,798	155,157	93,847		140,347
Thur	12/18/08	6,373	159,579	582,341	4,949	155,884	93,920		140,354
Fri	12/19/08	6,630	159,764	583,957	5,134	156,778	94,012		140,367
Sat	12/20/08	6,870	159,814	584,900	5,306	157,199	94,098		140,377
Sun	12/21/08	7,110	159,865	585,842	5,478	157,619	94,183		140,386
Monday	12/22/08	7,350	159,915	586,785	5,649	158,040	94,269		140,396
Tues	12/23/08	7,600	159,992	587,856	5,825	158,602	94,358		140,397
Wed	12/24/08	7,833	159,992	588,553	5,972	158,602	94,435		140,397
Thur	12/25/08	8,071	159,992	588,553	6,145	158,602	94,521		140,397
Fri	12/26/08	8,305	159,992	588,553	6,319	158,602	94,607		140,397
Sat	12/27/08	8,528	160,003	589,341	6,479	158,751	94,686		140,397
Sun	12/28/08	8,752	160,013	590,130	6,639	158,900	94,766		140,397
Monday	12/29/08	8,975	160,024	590,918	6,799	159,049	94,846		140,397
Tues	12/30/08	9,207	160,033	591,703	6,970	159,199	94,929		140,397
Wed	12/31/08	9,438	160,042	592,488	7,138	159,349	95,013		140,397
Thur	01/01/09	9,463	160,046	592,877	7,300	159,458	95,090		140,405
Fri	01/02/09	9,888	160,050	593,267	7,462	159,566	95,168		140,412
Sat	01/03/08	10,114	160,054	593,524	7,630	159,648	95,209		140,421
Sun	01/04/08	10,340	160,059	593,782	7,797	159,729	95,250		140,431
Monday	01/05/08	10,566	160,063	594,039	7,965	159,811	95,292		140,440
Tues	01/06/08	10,840	160,067	594,907	8,143	160,085	95,339		140,446
Wed	01/07/09	11,030	160,139	596,211	8,352	160,297	95,394		140,447
Thur	01/08/08	11,340	160,271	597,514	8,542	160,297	95,436		140,451
Fri	01/09/09	11,538	160,357	598,686	8,702	161,027	95,480		140,453
Sat	01/10/09	11,762	160,390	599,627	8,909	161,318	95,522		140,461
Sun	01/11/09	11,986	160,423	600,568	9,115	161,609	95,565		140,469
Monday	01/12/09	12,211	160,456	601,509	9,321	161,900	95,608		140,477
Tues	01/13/09	12,460	160,527	603,249	9,508	162,442	95,654		140,485
wed	01/14/09	12,682	160,654	604,361	9,709	162,856	95,700		140,488
Thur	01/15/09	13,017	160,849	606,468	9,931	163,541	95,750		140,494
Fri	01/16/09	13,163	160,915	607,642	10,093	164,024	95,786		140,497
Sat	01/17/09	13,404	160,932	609,217	10,289	164,521	95,830		140,503
Sun	01/18/09	13,645	160,950	610,791	10,484	165,018	95,874		140,509
Monday	01/19/09	13,886	160,967	612,366	10,679	165,515	95,918		140,515
Tues	01/20/09	14,141	160,972	613,961	10,875	166,070	95,963		140,525
Wed	01/21/09	14,342	161,152	615,552	11,074	166,727	96,009		140,534
Thur	01/22/09	14,370	161,387	617,700	11,295	167,614	96,059		140,535
Fri	01/23/09	14,821	161,453	618,834	11,450	168,018	96,121		140,536
Sat	01/24/09	15,053	161,501	620,124	11,634	168,091	96,150		140,539
Sun	01/25/09	15,285	161,549	621,414	11,818	168,165	96,180		140,542
Monday	01/26/09	15,517	161,597	622,704	12,002	168,238	96,209		140,544
Tues	01/27/09	15,756	161,815	624,545	12,197	169,928	96,255		140,553
Wed	01/28/09	15,996	162,051	626,388	12,400	170,761	96,303		140,564
Thur	01/29/09	16,242	162,251	628,425	12,595	171,544	96,348		140,574
Fri	01/30/09	16,472	162,466	630,682	12,785	172,171	96,392		140,581
Sat	01/31/09	16,705	162,643	632,318	12,976	172,917	96,434		140,583
Sun	02/01/09	16,939	162,821	633,954	13,167	173,664	96,477		140,586
Monday	02/02/09	17,172	162,998	635,590	13,358	174,410	96,520		140,589
Tues	02/03/09	17,486	163,199	637,635	13,577	175,566	96,572		140,605
Wed	02/04/09	17,699	163,400	639,680	13,764	176,512	96,610		140,612
Thur	02/05/09	17,992	163,577	642,627	13,991	177,765	96,665		140,621
Fri	02/06/09	18,144	163,753	644,138	14,052	178,204	96,700		140,629
Sat	02/07/09	18,367	163,826	644,506	14,123	178,587	96,739		140,636
Sun	02/08/09	18,591	163,900	644,874	14,194	178,969	96,778		140,643
Monday	02/09/09	18,815	163,973	645,242	14,265	179,352	96,818		140,651
Tues	02/10/09	19,090	164,202	645,778	14,336	179,483	96,860		140,658
Wed	02/11/09	19,238	164,310	646,280	14,407	179,545	96,901		140,662

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Thur	02/12/09	19,480	164,348	646,954	14,478	179,882	96,946		140,667
Fri	02/13/09	19,727	164,492	647,474	14,662	180,071	97,112		140,670
Sat	02/14/09	19,949	164,500	647,982	14,718	180,108	97,112		140,670
sun	02/15/09	20,172	164,507	648,491	14,773	180,146	97,112		140,670
Monday	02/16/09	20,395	164,515	648,999	14,828	180,183	97,112		140,670
tues	02/17/09	20,623	164,681	650,477	14,884	180,313	97,161		140,670
Wed	02/18/09	20,852	164,837	650,740	14,939	180,760	97,202		140,671
Thur	02/19/09	21,232	164,983	652,514	14,995	181,439	97,278		140,674
Fri	02/20/09	21,311	165,129	654,287	15,050	182,118	97,288		140,677
Sat	02/21/09	21,540	165,196	656,191	15,224	182,790	97,330		140,680
Sun	02/22/09	21,769	165,263	658,094	15,398	183,462	97,373		140,684
Monday	02/23/09	21,998	165,330	659,998	15,571	184,134	97,416		140,688
Tues	02/24/09	22,236	165,453	662,155	15,636	185,049	97,455		140,693
Wed	02/25/09	22,464	165,621	664,113	15,826	185,768	97,498		140,693
Thur	02/27/09	22,700	165,789	666,175	15,948	186,750	97,538		140,695
Fri	02/27/09	22,931	165,980	668,274	16,069	187,549	97,582		140,697
Sat	02/28/09	23,159	166,083	670,096	16,191	188,277	97,624		140,700
Sun	03/01/09	23,387	166,186	671,918	16,312	189,006	97,666		140,703
Monday	03/02/09	23,615	166,289	673,740	16,434	189,734	97,708		140,706
Tues	03/03/09	23,901	166,498	676,357	16,653	190,924	97,796		140,729
wed	03/04/09	24,083	166,638	678,095	16,827	191,519	97,798		140,763
Thur	03/05/09	24,395	166,837	680,700	17,047	192,672	97,848		140,764
Fri	03/06/09	24,547	166,974	682,151	17,200	193,293	97,881		140,764
sat	03/07/09	24,793	167,079	684,112	17,396	194,110	97,925		140,767
sun	03/08/09	25,039	167,183	686,074	17,592	194,926	97,968		140,770
Monday	03/09/09	25,285	167,288	688,035	17,787	195,743	98,012		140,774
tues	03/10/09	25,498	167,376	689,926	17,963	196,281	98,051		140,777
wed	03/11/09	25,710	167,464	691,817	18,138	196,818	98,091		140,780
Thur	03/12/09	25,939	167,620	693,717	18,338	197,597	98,135		140,783
Fri	03/13/09	26,167	167,776	695,616	18,538	198,376	98,180		140,786
sat	03/14/09	26,396	167,780	697,338	18,712	198,809	98,236		140,789
sun	03/15/09	26,625	167,784	699,059	18,887	199,243	98,291		140,793
Monday	03/16/09	26,854	167,788	700,781	19,061	199,676	98,347		140,796
Tues	03/17/09	27,015	167,793	702,844	19,199	200,498	98,404		140,800
Wed	03/18/09	27,273	167,797	705,097	19,338	200,979	98,470		140,803
Thur	03/19/09	27,495	167,801	707,266	19,537	201,924	98,532		140,807
Fri	03/20/09	27,717	167,818	708,732	19,702	202,417	98,578		140,815
Sat	03/21/09	27,942	167,821	710,618	19,826	203,033	98,637		140,823
Sun	03/22/09	28,167	167,825	712,505	19,951	203,648	98,697		140,831
Monday	03/23/09	28,392	167,828	714,391	20,076	204,264	98,756		140,839
Tues	03/24/09	28,618	167,991	716,035	20,201	204,916	98,806		140,849
Wed	03/25/09	28,845	168,015	718,172	20,414	205,762	98,873		140,857
Thur	03/26/09	29,084	168,037	720,496	20,582	206,922	98,927		140,865
Fri	03/27/09	29,309	168,181	722,291	20,766	207,589	98,985		140,875
Sat	03/28/09	29,526	168,188	724,195	20,954	208,265	99,044		140,883
Sun	03/29/09	29,742	168,194	726,098	21,141	208,942	99,102		140,890
Monday	03/30/09	29,959	168,201	728,002	21,329	209,618	99,161		140,898
Tues	03/31/09	30,186	168,437	730,220	21,507	210,618	99,221		140,906
Wed	04/01/09	30,402	168,589	732,302	21,693	211,372	99,278		140,914
Thur	04/02/09	30,623	168,613	734,648	21,887	212,219	99,390		140,922
Fri	04/03/09	30,843	168,859	736,618	21,951	212,918	99,398		140,927
Sat	04/04/09	31,054	168,892	738,654	22,016	213,587	99,459		140,933
sun	04/05/09	31,264	168,925	740,689	22,081	214,256	99,520		140,939
Monday	04/06/09	31,474	168,958	742,725	22,146	214,925	99,581		140,946
tues	04/07/09	31,745	169,056	744,252	22,614	215,604	99,630		140,952
Wed	04/08/09	31,905	169,252	746,450	22,794	216,596	99,687		140,956
Thur	04/09/09	32,121	169,409	748,486	22,892	217,394	99,747		140,964
Fri	04/10/09	32,337	169,456	750,699	23,171	218,324	99,805		140,974

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Sat	04/11/09	32,546	169,457	752,361	129	218,786	99,860		140,984
Sun	04/12/09	32,755	169,459	754,023	257	219,248	99,916		140,994
Monday	04/13/09	32,965	169,460	755,685	386	219,710	99,972		141,004
Tues	04/14/09	33,180	169,463	757,893	391	220,514	100,005		141,050
Wed	04/15/09	33,394	169,470	760,100	395	221,318	100,088		141,095
Thur	04/16/09	33,612	169,473	762,290	582	222,052	100,146		141,102
Fri	04/17/09	34,034	169,480	766,456	778	223,503	100,257		141,116
Sat	04/18/09	34,174	169,482	767,844	975	223,987	100,294		141,120
Sun	04/19/09	34,314	169,485	769,233	1,171	224,470	100,331		141,124
Monday	04/20/09	34,455	169,487	770,621	1,368	224,954	100,368		141,129
Tues	04/21/09	34,729	169,490	772,447	1,540	225,908	100,423		141,223
wed	04/22/09	34,894	169,493	774,875	1,727	226,654	100,476		141,345
Thur	04/23/09	35,189	169,496	777,484	1,963	227,579	100,549		141,491
Fri	04/24/09	35,363	169,499	779,081	2,118	228,441	100,596		141,617
sat	04/25/09	35,585	169,501	781,007	2,317	228,928	100,654		141,749
sun	04/26/09	35,808	169,504	782,934	2,515	229,414	100,713		141,881
Monday	04/27/09	36,030	169,507	784,860	2,714	229,901	100,771		142,012
tues	04/28/09	36,184	169,674	786,741	2,877	230,614	100,828		142,155
wed	04/29/09	36,398	169,853	788,641	3,083	231,305	100,892		142,286
Thur	04/30/09	36,649	170,072	791,086	3,285	231,873	100,995		142,486
Fri	05/01/09	36,838	170,293	792,599	3,480	232,373	101,005		142,551
sat	05/02/09	37,045	170,461	793,104	3,658	232,810	101,062		142,685
sun	05/03/09	37,251	170,628	793,610	3,837	233,248	101,120		142,819
Monday	05/04/09	37,457	170,796	794,115	4,015	233,685	101,177		142,953
Tues	05/05/09	37,685	170,977	795,107	4,206	234,031	101,231		143,098
Wed	05/06/09	37,889	171,224	796,106	4,399	234,352	101,295		143,219
Thur	05/07/09	38,175	171,434	798,067	4,617	234,782	101,356		143,361
Fri	05/08/09	38,313	171,597	799,232	4,778	235,135	101,403		143,483
Sat	05/09/09	38,545	171,710	800,704	4,966	235,463	101,458		143,608
Sun	05/10/09	38,776	171,822	802,175	5,153	235,790	101,512		143,733
Monday	05/11/09	39,008	171,935	803,647	5,340	236,118	101,567		143,859
Tues	05/12/09	39,073	172,189	805,275	15	236,656	101,624		143,985
Wed	05/13/09	39,295	172,389	806,613	215	237,331	101,681		144,108
Thur	05/14/09	39,552	172,626	808,174	360	237,566	101,738		144,240
Fri	05/15/09	39,813	172,764	809,619	552	238,144	101,798		144,365
Sat	05/16/09	40,062	172,846	810,900	737	238,435	101,849		144,497
Sun	05/17/09	40,311	172,928	812,182	922	238,727	101,900		144,629
Monday	05/18/09	40,561	173,010	813,463	1,107	239,018	101,951		144,760
Tues	05/19/09	40,868	173,188	815,335	1,327	239,786	102,008		144,908
Wed	05/20/09	41,063	173,251	816,503	1,490	240,214	102,112		145,046
Thur	05/21/09	41,314	173,253	817,852	1,663	240,487	102,118		145,191
Fri	05/22/09	41,569	173,275	818,616	1,842	240,757	102,171		145,363
Sat	05/23/09	41,822	173,278	820,307	2,020	240,924	102,191		145,496
sun	05/24/09	42,074	173,281	821,997	2,199	241,090	102,210		145,629
Monday	05/25/09	42,326	173,284	823,688	2,378	241,257	102,230		145,763
tues	05/26/09	42,531	173,306	825,342	2,550	241,447	102,381		145,882
Wed	05/27/09	42,776	173,469	827,371	2,754	241,740	102,439		146,008
Thur	05/28/09	43,039	173,521	829,521	2,923	242,068	102,494		146,137
Fri	05/29/09	43,271	173,638	831,558	3,103	242,525	102,547		146,257
Sat	05/30/09	43,502	173,722	833,652	3,283	242,765	102,600		146,383
Sun	05/31/09	43,733	173,806	835,745	3,463	243,005	102,653		146,509
Monday	06/01/09	43,964	173,890	837,839	3,643	243,245	102,706		146,634
Tues	06/02/09	44,233	174,044	840,445	3,852	243,698	102,770		146,771
Wed	06/03/09	44,411	174,106	842,493	4,042	244,151	102,824		146,906
Thur	06/04/09	44,667	174,240	844,540	4,215	244,614	102,875		147,039
Fri	06/05/09	44,859	174,416	846,506	4,400	245,222	102,929		147,161
Sat	06/06/09	45,078	174,496	848,327	4,577	245,447	102,980		147,304
Sun	06/07/09	45,296	174,575	850,147	4,754	245,673	103,032		147,448

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Monday	06/08/09	45,514	174,655	851,968	4,931	245,898	103,083		147,592
Tues	06/09/09	45,780	174,785	854,240	5,135	246,208	103,147		147,726
wed	06/10/09	45,959	174,821	856,397	5,213	246,592	103,199		147,870
Thur	06/11/09	46,255	174,924	858,333	5,474	246,815	103,247		147,999
Fri	06/12/09	46,475	175,017	860,202	5,659	247,144	103,363		148,134
sat	06/13/09	46,731	175,068	861,811	5,851	247,479	103,401		148,265
sun	06/14/09	46,987	175,119	863,419	6,043	247,814	103,440		148,397
Monday	06/15/09	47,243	175,170	865,028	6,234	248,149	103,478	216	148,528
tues	06/16/09	47,504	175,207	867,625	6,296	248,522	103,543	273	148,662
wed	06/17/09	47,762	175,325	869,410	6,580	248,977	103,608	299	148,793
Thur	06/18/09	48,020	175,467	871,225	6,758	249,433	103,677	299	148,933
Fri	06/19/09	48,286	175,686	873,234	6,946	249,878	103,747	310	149,068
sat	06/20/09	48,539	175,713	874,963	7,126	250,077	103,817	409	149,210
sun	06/21/09	48,791	175,739	876,693	7,306	250,277	103,886	507	149,352
Monday	06/22/09	49,043	175,766	878,422	7,486	250,476	103,956	606	149,494
Tues	06/23/09	49,305	175,914	880,401	7,664	250,881	104,025	843	149,623
Wed	06/24/09	49,586	176,129	882,543	7,873	251,376	104,093	1,053	149,758
Thur	06/25/09	49,884	176,299	884,405	8,046	251,787	104,162	1,257	149,915
Fri	06/26/09	50,057	176,368	885,798	8,204	251,958	59	1,283	150,035
Sat	06/27/09	50,308	176,431	887,618	8,377	252,231	129	1,363	150,169
Sun	06/28/09	50,559	176,494	889,438	8,550	252,505	199	1,442	150,303
Mon	06/29/09	50,810	176,557	891,258	8,723	252,778	269	1,522	150,437
Tues	06/30/09	51,063	176,767	893,074	8,916	253,063	343	1,717	150,559
Wed	07/01/09	51,320	177,011	895,492	9,127	253,347	426	1,943	150,755
Thur	07/02/09	51,577	177,080	896,938	9,275	253,756	486	2,177	150,838
Fri	07/03/09	51,827	177,223	897,506	9,435	254,301	553	2,414	150,962
Sat	07/04/09	52,090	177,356	898,500	9,636	254,629	629	2,663	151,090
Sun	07/05/09	52,353	177,489	899,494	9,838	254,958	705	2,912	151,218
Mon	07/06/09	52,615	177,622	900,488	10,039	255,286	781	3,161	151,345
Tues	07/07/09	52,896	177,808	901,444	10,241	255,655	849	3,505	151,465
Wed	07/08/09	53,108	177,946	902,494	10,412	256,299	918	3,697	151,592
Thur	07/09/09	53,363	178,128	903,588	10,609	256,612	998	3,956	151,712
Fri	07/10/09	53,619	178,373	904,519	10,780	257,023	1,067	4,256	151,835
Sat	07/11/09	53,869	178,516	905,597	10,964	257,458	1,141	4,523	151,950
Sun	07/12/09	54,119	178,658	906,674	11,148	257,892	1,216	4,790	152,064
Mon	07/13/09	54,369	178,801	907,752	11,332	258,327	1,291	5,057	152,179
Tues	07/14/09	54,626	178,980	908,843	11,483	258,883	1,356	5,398	152,291
Wed	07/15/09	54,869	179,210	910,336	11,673	259,596	1,436	5,721	152,414
Thur	07/16/09	55,167	179,495	910,436	11,822	260,327	1,509	6,111	152,544
Fri	07/17/09	55,377	179,700	911,572	12,009	261,059	1,577	6,424	152,666
Sat	07/18/09	55,619	179,889	912,170	12,185	261,618	1,649	6,740	152,787
Sun	07/19/09	55,860	180,078	912,769	12,362	262,176	1,722	7,056	152,908
Mon	07/20/09	56,102	180,267	913,367	12,539	262,735	1,794	7,372	153,028
Tues	07/21/09	56,334	180,506	913,748	12,615	263,418	1,871	7,636	153,163
Wed	07/22/09	56,566	180,744	914,129	12,691	264,100	1,948	7,900	153,297
Thur	07/23/09	56,858	180,961	914,219	12,838	264,771	2,020	8,191	153,437
Fri	07/24/09	57,038	181,134	914,258	13,001	265,189	2,085	8,372	153,589
Sat	07/25/09	57,273	181,345	914,283	13,183	265,847	2,157	8,584	153,696
Sun	07/26/09	57,507	181,557	914,309	13,364	266,504	2,230	8,796	153,802
Mon	07/27/09	57,741	181,768	914,334	13,546	267,162	2,302	9,008	153,909
Tues	07/28/09	57,977	182,003	914,334	13,704	267,993	2,373	9,246	154,050
Wed	07/29/09	58,214	182,247	914,334	13,903	268,846	2,454	9,499	154,163
Thur	07/30/09	58,446	182,447	914,334	14,061	269,551	2,519	9,701	154,286
Fri	07/31/09	58,681	182,661	914,334	14,237	270,816	2,591	9,962	154,417
Sat	08/01/09	58,916	182,803	914,334	14,421	272,084	2,663	10,207	154,547
Sun	08/02/09	59,150	182,946	914,334	14,606	273,351	2,736	10,453	154,678
Mon	08/03/09	59,385	183,088	914,334	14,790	274,619	2,809	10,698	154,808
Tuesday	08/04/09	59,622	183,313	914,334	14,984	275,789	2,881	10,997	154,940

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Wednesda	08/05/09	59,859	183,526	914,334	15,132	277,091	2,953	11,295	155,079
Thursday	08/06/09	60,139	183,741	914,334	15,315	278,446	3,028	11,707	155,214
Friday	08/07/09	60,337	183,965	914,334	15,502	279,765	3,105	11,919	155,351
Saturday	08/08/09	60,570	184,028	914,334	15,673	280,967	3,175	12,164	155,486
Sunday	08/09/09	60,803	184,092	914,334	15,843	282,169	3,245	12,408	155,622
Monday	08/10/09	61,036	184,155	914,334	16,013	283,371	3,316	12,653	155,757
Tuesday	08/11/09	61,276	184,351	914,334	16,181	284,725	3,386	12,931	155,886
Wednesda	08/12/09	61,509	184,554	914,334	16,361	286,037	3,461	13,173	156,048
Thursday	08/13/09	61,740	184,716	914,334	16,528	287,230	3,530	13,388	156,177
Friday	08/14/09	61,973	184,903	914,334	16,701	288,502	3,602	13,577	156,344
Saturday	08/15/09	62,205	185,060	914,334	16,885	289,742	3,674	13,797	156,479
Sunday	08/16/09	62,438	185,216	914,334	17,068	290,983	3,747	14,017	156,615
Monday	08/17/09	62,671	185,373	914,334	17,252	292,223	3,819	14,237	156,750
Tuesday	08/18/09	62,976	185,613	914,334	17,416	293,829	3,902	14,587	156,888
Wednesda	08/19/09	63,138	185,759	914,334	17,574	293,953	3,965	14,759	157,021
Thursday	08/20/09	63,374	185,939	914,334	17,745	294,151	4,034	15,008	157,149
Friday	08/21/09	63,606	186,183	914,334	17,910	297,533	4,108	15,340	157,289
Saturday	08/22/09	63,845	186,404	914,334	18,081	298,793	4,181	15,605	157,433
Sunday	08/23/09	64,083	186,626	914,334	18,253	300,053	4,253	15,871	157,578
Monday	08/24/09	64,321	186,847	914,334	18,424	301,313	4,326	16,136	157,722
Tuesday	08/25/09	64,560	187,079	914,334	18,592	302,597	4,399	16,458	157,854
Wednesda	08/26/09	64,799	187,327	914,334	18,765	303,859	4,475	16,826	157,989
Thursday	08/27/09	65,041	187,518	914,334	18,940	305,126	4,547	17,113	158,122
Friday	08/28/09	65,279	187,782	914,334	19,280	306,348	4,621	17,475	158,236
Saturday	08/29/09	65,518	188,005	914,334	19,392	307,659	4,694	17,824	158,374
Sunday	08/30/09	65,758	188,228	914,334	19,504	308,971	4,768	18,173	158,512
Monday	08/31/09	65,998	188,451	914,334	19,617	310,282	4,841	18,522	158,650
Tuesday	09/01/09	66,316	188,699	914,334	19,818	311,504	4,928	19,036	158,795
Wednesda	09/02/09	66,486	188,939	914,334	19,990	312,922	4,991	19,256	158,939
Thursday	09/03/09	66,749	189,178	914,334	20,170	314,262	5,063	19,618	159,097
Friday	09/04/09	66,958	189,387	914,334	20,356	315,453	5,135	19,903	159,232
Saturday	09/05/09	67,196	189,589	914,334	20,544	316,686	5,206	20,144	159,373
Sunday	09/06/09	67,433	189,791	914,334	20,732	317,919	5,277	20,385	159,515
Monday	09/07/09	67,670	189,993	914,334	20,921	319,152	5,348	20,626	159,657
Tuesday	09/08/09	67,810	190,204	914,334	21,090	320,415	5,420	20,916	159,790
Wednesda	09/09/09	68,129	190,414	914,334	21,259	321,678	5,493	21,206	159,923
Thursday	09/10/09	68,367	190,637	914,334	21,283	322,898	5,567	21,518	160,048
Friday	09/11/09	68,599	190,811	914,334	21,306	323,694	5,637	21,802	160,182
Saturday	09/12/09	68,836	191,044	914,334	21,469	324,977	5,712	22,134	160,326
Sunday	09/13/09	69,072	191,277	914,334	21,632	326,261	5,786	22,467	160,469
Monday	09/14/09	69,308	191,510	914,334	21,794	327,544	5,860	22,800	160,613
Tuesday	09/15/09	69,564	191,753	914,334	21,963	328,837	5,926	23,186	160,757
Wednesda	09/16/09	69,778	191,958	914,334	22,118	330,083	6,009	23,502	160,896
Thursday	09/17/09	70,015	192,004	914,334	22,270	331,316	6,082	23,869	161,028
Friday	09/18/09	70,246	192,211	914,334	22,433	332,540	6,159	24,209	161,167
Saturday	09/19/09	70,494	192,305	914,334	22,450	333,892	6,236	24,570	161,310
Sunday	09/20/09	70,741	192,399	914,334	22,468	335,244	6,314	24,930	161,454
Monday	09/21/09	70,989	192,492	914,334	22,486	336,596	6,391	25,290	161,597
Tuesday	09/22/09	71,236	192,586	914,334	22,503	337,948	6,469	25,651	161,741
Wednesda	09/23/09	71,408	192,773	914,334	22,521	338,949	6,533	25,836	161,876
Thursday	09/24/09	71,634	192,914	914,334	22,539	340,114	6,604	26,090	162,027
Friday	09/25/09	71,869	192,948	914,334	22,557	341,425	6,680	26,463	162,175
Saturday	09/26/09	72,092	193,111	914,334	22,574	342,630	6,756	26,715	162,319
Sunday	09/27/09	72,316	193,273	914,334	22,592	343,835	6,832	26,968	162,463
Monday	09/28/09	72,539	193,436	914,334	22,610	345,040	6,907	27,220	162,607
Tuesday	09/29/09	72,762	193,456	914,334	22,627	346,210	6,975	27,574	162,750
Wednesda	09/30/09	72,980	193,456	914,334	22,645	347,567	7,052	27,946	162,912
Thursday	10/01/09	73,189	193,498	914,334	22,791	348,690	7,124	28,253	163,060

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Friday	10/02/09	73,393	193,686	914,334	22,914	349,948	7,197	28,520	163,235
Saturday	10/03/09	73,575	193,704	914,334	23,062	351,170	7,271	28,759	163,399
Sunday	10/04/09	73,757	193,721	914,334	23,211	352,392	7,345	28,997	163,564
Monday	10/05/09	73,940	193,739	914,334	23,359	353,614	7,418	29,236	163,728
Tuesday	10/06/09	74,135	193,884	914,334	23,544	354,842	7,506	29,557	163,963
Wednesda	10/07/09	74,225	194,050	914,334	23,678	356,144	7,566	29,760	164,066
Thursday	10/08/09	74,382	194,215	914,334	23,853	357,483	7,649	30,020	164,250
Friday	10/09/09	74,401	194,440	914,334	24,005	358,745	7,716	30,381	164,420
Saturday	10/10/09	74,412	194,633	914,334	24,162	360,000	7,790	30,680	164,587
Sunday	10/11/09	74,422	194,826	914,334	24,318	361,256	7,864	30,980	164,754
Monday	10/12/09	74,432	195,019	914,334	24,475	362,511	7,938	31,280	164,920
Tuesday	10/13/09	74,447	195,225	914,334	24,628	363,791	8,013	31,559	165,083
Wednesda	10/14/09	74,455	195,430	914,334	24,780	365,070	8,088	31,837	165,246
Thursday	10/15/09	74,462	195,696	914,334	24,946	366,324	8,174	32,192	165,404
Friday	10/16/09	74,462	195,883	914,334	25,056	367,578	8,278	32,364	165,561
Saturday	10/17/09	74,462	196,095	914,334	25,180	368,827	8,340	32,666	165,708
Sunday	10/18/09	74,462	196,307	914,334	25,304	370,076	8,402	32,968	165,854
Monday	10/19/09	74,462	196,520	914,334	25,428	371,325	8,464	33,270	166,000
Tuesday	10/20/09	74,462	196,803	914,334	25,589	372,902	8,553	33,709	166,191
Wednesda	10/21/09	74,463	196,926	914,334	25,715	373,961	8,617	33,915	166,335
Thursday	10/22/09	74,463	197,093	914,334	25,862	375,174	8,691	34,131	166,508
Friday	10/23/09	74,464	197,305	914,334	26,015	376,359	8,765	34,415	166,679
Saturday	10/24/09	74,464	197,405	914,334	26,164	377,590	8,839	34,628	166,848
Sunday	10/25/09	74,465	197,504	914,334	26,313	378,822	8,914	34,841	167,017
Monday	10/26/09	74,466	197,604	914,334	26,462	380,053	8,988	35,054	167,186
Tuesday	10/27/09	74,466	197,783	914,334	26,608	381,224	9,060	35,306	167,357
Wednesda	10/28/09	74,467	198,023	914,334	26,768	382,453	9,129	35,573	167,539
Thursday	10/29/09	74,468	198,194	914,334	26,919	383,722	9,213	35,788	167,713
Friday	10/30/09	74,468	198,380	914,334	27,066	384,973	9,281	36,014	167,882
Saturday	10/31/09	74,468	198,509	914,334	27,211	386,326	9,359	36,212	168,058
Sunday	11/01/09	74,468	198,638	914,334	27,356	387,678	9,437	36,411	168,234
Monday	11/02/09	74,468	198,767	914,334	27,501	389,031	9,516	36,610	168,410
Tuesday	11/03/09	74,468	198,950	914,334	27,649	390,154	9,590	36,885	168,569
Wednesda	11/04/09	74,468	199,132	914,334	27,796	391,276	9,664	37,160	168,727
Thursday	11/05/09	74,468	199,336	914,334	27,937	392,511	9,735	37,417	168,880
Friday	11/06/09	74,468	199,539	914,334	28,078	393,746	9,805	37,674	169,052
Saturday	11/07/09	74,468	199,692	914,334	28,220	395,022	9,880	37,845	169,222
Sunday	11/08/09	74,469	199,846	914,334	28,362	396,298	9,955	38,015	169,392
Monday	11/09/09	74,469	200,000	914,334	28,505	397,574	10,030	38,185	169,562
Tuesday	11/10/09	74,469	200,191	914,334	28,656	398,706	10,112	38,548	169,724
Wednesda	11/11/09	74,469	200,376	914,334	28,762	399,878	10,167	38,670	169,890
Thursday	11/12/09	74,469	200,503	914,334	28,909	401,015	10,244	38,946	170,065
Friday	11/13/09	74,469	200,727	914,334	29,044	402,307	10,314	39,173	170,300
Saturday	11/14/09	74,469	200,807	914,334	29,202	403,509	10,387	39,349	170,449
Sunday	11/15/09	74,469	200,888	914,334	29,360	404,710	10,461	39,526	170,599
Monday	11/16/09	74,469	200,968	914,334	29,519	405,912	10,535	39,703	170,749
Tuesday	11/17/09	74,469	201,121	914,334	29,675	407,131	10,605	39,951	170,920
Wednesda	11/18/09	74,469	201,368	914,334	29,855	408,744	10,693	40,336	171,135
Thursday	11/19/09	74,469	201,500	914,334	29,997	409,652	10,757	40,476	171,264
Friday	11/20/09	74,469	201,725	914,334	30,161	410,970	10,837	40,713	171,438
Saturday	11/21/09	74,469	201,828	914,334	30,303	412,224	10,907	40,931	171,611
Sunday	11/22/09	74,469	201,930	914,334	30,445	413,478	10,977	41,148	171,784
Monday	11/23/09	74,469	202,033	914,334	30,587	414,732	11,047	41,365	171,957
Tuesday	11/24/09	74,469	202,189	914,334	30,728	415,995	11,120	41,584	172,132
Wednesda	11/25/09	74,469	202,340	914,334	30,865	417,217	11,192	41,795	172,301
Thursday	11/26/09	74,469	202,397	914,334	30,999	418,548	11,267	41,920	172,480
Friday	11/27/09	74,469	202,454	914,334	31,133	419,879	11,343	42,045	172,659
Saturday	11/28/09	74,469	202,463	914,334	31,256	421,004	11,414	42,141	172,824

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Sunday	11/29/09	74,469	202,472	914,334	31,379	422,128	11,486	42,237	172,990
Monday	11/30/09	74,469	202,480	914,334	31,502	423,253	11,557	42,334	173,156
Tuesday	12/01/09	74,469	202,633	914,334	31,665	424,625	11,639	42,670	173,321
Wednesda	12/02/09	74,469	202,782	914,334	31,779	426,089	11,705	42,770	173,517
Thursday	12/03/09	74,469	202,929	914,334	31,898	427,253	11,772	43,063	173,671
Friday	12/04/09	74,480	203,077	914,334	32,020	428,417	11,849	43,214	173,824
Saturday	12/05/09	74,480	203,130	914,334	32,143	429,698	11,922	43,367	173,993
Sunday	12/06/09	74,481	203,183	914,334	32,265	430,979	11,994	43,520	174,162
Monday	12/07/09	74,481	203,237	914,334	32,388	432,260	12,066	43,672	174,330
Tuesday	12/08/09	74,482	203,374	914,334	32,530	433,621	12,140	43,920	174,515
Wednesda	12/09/09	74,483	203,488	914,334	32,664	434,805	12,218	44,139	174,652
Thursday	12/10/09	74,484	203,622	914,334	32,817	435,920	12,289	44,393	174,821
Friday	12/11/09	74,484	203,642	914,334	32,990	437,180	12,369	44,684	175,007
Saturday	12/12/09	74,484	203,733	914,334	33,161	437,180	12,441	44,966	175,185
Sunday	12/13/09	74,484	203,824	914,334	33,332	437,180	12,514	45,248	175,364
Monday	12/14/09	74,484	203,915	914,334	33,503	437,180	12,587	45,530	175,542
Tuesday	12/15/09	74,488	204,022	914,334	33,628	437,180	12,653	45,836	175,676
Wednesda	12/16/09	74,488	204,232	914,334	33,802	437,180	12,731	46,106	175,878
Thursday	12/17/09	74,490	204,441	914,334	33,964	437,228	12,803	46,333	176,025
Friday	12/18/09	74,491	204,545	914,334	34,113	438,385	12,869	46,435	176,182
Saturday	12/19/09	74,493	204,573	914,334	34,271	439,661	12,939	46,575	176,227
Sunday	12/20/09	74,494	204,602	914,334	34,429	440,937	13,010	46,715	176,272
Monday	12/21/09	74,496	204,630	914,334	34,588	442,213	13,081	46,854	176,318
Tuesday	12/22/09	74,497	204,758	914,334	34,771	443,710	13,163	47,023	176,327
Wednesda	12/23/09	74,498	204,782	914,334	34,900	444,756	13,230	47,111	176,332
Thursday	12/24/09	74,499	204,784	914,334	35,100	446,738	13,336	47,143	176,332
Friday	12/25/09	74,499	204,785	914,334	35,350	448,720	13,442	47,176	176,333
Saturday	12/26/09	74,499	204,804	914,334	35,454	449,637	13,492	47,338	176,333
Sunday	12/27/09	74,499	204,824	914,334	35,558	450,554	13,541	47,499	176,333
Monday	12/28/09	74,499	204,844	914,334	35,662	451,471	13,591	47,661	176,333
Tuesday	12/29/09	74,499	204,846	914,334	35,813	451,471	13,663	47,795	176,333
Wednesda	12/30/09	74,499	204,848	914,334	35,963	451,471	13,736	47,929	176,333
Thursday	12/31/09	74,499	204,850	914,334	36,019	451,471	13,924	48,278	176,333
Friday	01/01/10	74,499	204,852	914,334	36,047	451,471	14,018	48,454	176,333
Saturday	01/02/10	74,502	204,854	914,334	36,056	451,471	14,049	48,513	176,333
Sunday	01/03/10	74,505	204,855	914,334	36,066	451,471	14,081	48,571	176,333
Monday	01/04/10	74,508	204,857	914,334	36,075	451,471	14,112	48,630	176,389
Tuesday	01/05/10	74,508	204,857	914,334	36,075	451,497	14,189	48,782	176,397
Wednesda	01/06/10	74,508	204,967	914,334	36,091	452,062	14,266	48,935	176,469
Thursday	01/07/10	74,508	205,115	914,334	36,092	453,583	14,329	49,101	176,540
Friday	01/08/10	74,512	205,213	914,334	36,092	454,773	14,402	49,224	176,696
Saturday	01/09/10	74,513	205,231	914,334	36,094	456,075	14,477	49,364	176,869
Sunday	01/10/10	74,514	205,248	914,334	36,095	457,378	14,551	49,504	177,042
Monday	01/11/10	74,515	205,266	914,334	36,097	458,680	14,626	49,644	177,215
Tuesday	01/12/10	74,517	205,276	914,334	36,300	459,720	14,691	49,799	177,345
Wednesda	01/13/10	74,518	205,373	914,334	36,509	460,757	14,755	49,979	177,501
Thursday	01/14/10	74,519	205,484	914,334	36,714	461,923	14,818	50,164	177,670
Friday	01/15/10	74,521	205,550	914,334	36,925	463,167	14,883	50,381	177,841
Saturday	01/16/10	74,522	205,639	914,334	37,136	464,435	14,926	50,638	178,014
Sunday	01/17/10	74,523	205,729	914,334	37,347	465,703	14,970	50,895	178,186
Monday	01/18/10	74,524	205,818	914,334	37,558	466,971	15,013	51,153	178,359
Tuesday	01/19/10	74,526	205,907	914,334	37,769	468,239	15,144	51,331	178,532
Wednesda	01/20/10	74,527	206,004	914,334	37,961	469,296	15,202	51,509	178,682
Thursday	01/21/10	74,528	206,100	914,334	38,152	470,353	15,260	51,685	178,831
Friday	01/22/10	74,530	206,238	914,334	38,344	471,491	15,320	51,845	178,986
Saturday	01/23/10	74,531	206,276	914,334	38,544	472,546	15,380	52,005	179,138
Sunday	01/24/10	74,532	206,314	914,334	38,744	473,601	15,440	52,164	179,290
Monday	01/25/10	74,533	206,352	914,334	38,945	474,656	15,500	52,324	179,443

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Tuesday	01/26/10	74,534	206,526	914,334	39,173	475,950	15,570	52,482	179,611
Wednesda	01/27/10	74,535	206,635	914,334	39,344	476,975	15,622	52,658	179,747
Thursday	01/28/10	74,536	206,732	914,334	39,563	478,100	15,690	52,811	179,899
Friday	01/29/10	74,536	206,832	914,334	39,752	479,245	15,748	52,989	180,061
Saturday	01/30/10	74,537	206,900	914,334	39,947	480,320	15,808	53,167	180,188
Sunday	01/31/10	74,538	206,967	914,334	40,141	481,396	15,869	53,346	180,315
Monday	02/01/10	74,539	207,035	914,334	40,336	482,471	15,929	53,524	180,443
Tuesday	02/02/10	74,540	207,138	914,334	40,583	483,653	16,010	53,666	180,562
Wednesda	02/03/10	74,540	207,256	914,334	40,741	484,786	16,059	53,788	180,673
Thursday	02/04/10	74,541	207,443	914,334	40,933	486,099	16,119	53,985	180,816
Friday	02/05/10	74,541	207,536	914,334	41,133	487,082	16,184	54,099	180,928
Saturday	02/06/10	74,542	207,590	914,334	41,329	488,239	16,247	54,214	181,053
Sunday	02/07/10	74,542	207,643	914,334	41,524	489,397	16,310	54,328	181,178
Monday	02/08/10	74,542	207,697	914,334	41,720	490,554	16,373	54,443	181,303
Tuesday	02/09/10	74,542	207,858	914,334	41,913	491,724	16,437	54,615	181,429
Wednesda	02/10/10	74,542	207,965	914,334	42,106	492,893	16,501	54,786	181,555
Thursday	02/11/10	74,542	208,123	914,334	42,302	494,063	16,567	54,949	181,705
Friday	02/12/10	74,542	208,238	914,334	42,493	495,312	16,631	55,146	181,840
Saturday	02/13/10	74,542	208,288	914,334	42,681	496,365	16,631	55,285	181,948
Sunday	02/14/10	74,542	208,337	914,334	42,869	497,417	16,631	55,425	182,055
Monday	02/15/10	74,542	208,386	914,334	43,057	498,470	16,631	55,565	182,162
Tuesday	02/16/10	74,543	208,530	914,334	43,280	499,688	16,631	55,768	182,269
Wednesda	02/17/10	74,543	208,674	914,334	43,461	500,881	16,631	55,971	182,376
Thursday	02/18/10	74,543	208,857	914,334	43,665	502,091	16,631	56,207	182,487
Friday	02/19/10	74,543	209,018	914,334	43,853	503,293	16,631	56,413	182,599
Saturday	02/20/10	74,544	209,064	914,334	44,050	504,449	16,631	56,575	182,719
Sunday	02/21/10	74,544	209,111	914,334	44,248	505,604	16,631	56,737	182,839
Monday	02/22/10	74,544	209,157	914,334	44,446	506,760	16,631	56,900	182,959
Tuesday	02/23/10	74,545	209,292	914,334	44,655	508,114	16,631	57,150	183,088
Wednesda	02/24/10	74,545	209,428	914,334	44,864	509,468	16,631	57,401	183,217
Thursday	02/25/10	74,545	209,568	914,334	45,035	510,637	16,631	57,620	183,313
Friday	02/26/10	74,545	209,711	914,334	45,229	511,738	16,631	57,780	183,425
Saturday	02/27/10	74,546	209,751	914,334	45,406	513,118	16,631	57,926	183,538
Sunday	02/28/10	74,546	209,792	914,334	45,582	514,497	16,631	58,072	183,651
Monday	03/01/10	74,547	209,832	914,334	45,759	515,877	16,631	58,218	183,764
Tuesday	03/02/10	74,548	209,991	914,334	45,964	517,256	16,631	58,407	183,853
Wednesda	03/03/10	74,548	210,150	914,334	46,169	517,495	16,631	58,596	183,941
Thursday	03/04/10	74,548	210,305	914,334	46,314	518,872	16,631	58,804	184,026
Friday	03/05/10	74,549	210,484	914,334	46,520	519,930	16,631	59,056	184,137
Saturday	03/06/10	74,549	210,586	914,334	46,698	521,131	16,631	59,209	184,237
Sunday	03/07/10	74,550	210,689	914,334	46,876	522,331	16,631	59,363	184,336
Monday	03/08/10	74,550	210,791	914,334	47,054	523,532	16,631	59,516	184,436
Tuesday	03/09/10	74,550	210,791	914,334	47,232	524,572	16,631	59,643	184,532
Wednesda	03/10/10	74,551	210,791	914,334	47,409	526,008	16,631	59,815	184,635
Thursday	03/11/10	74,551	210,825	914,334	47,619	527,108	16,631	59,984	184,737
Friday	03/12/10	74,551	210,859	914,334	47,829	528,208	16,631	60,152	184,838
Saturday	03/13/10	74,552	210,861	914,334	48,036	529,233	16,631	60,235	184,928
Sunday	03/14/10	74,552	210,863	914,334	48,244	530,258	16,631	60,317	185,017
Monday	03/15/10	74,553	210,865	914,334	48,452	531,283	16,631	60,400	185,106
Tuesday	03/16/10	74,554	210,868	914,334	48,690	532,314	16,631	60,548	185,189
Wednesda	03/17/10	74,554	210,871	914,334	48,873	533,522	16,631	60,636	185,268
Thursday	03/18/10	74,555	210,877	914,334	49,086	534,671	16,631	60,755	185,345
Friday	03/19/10	74,556	210,881	914,334	49,299	535,807	16,631	60,879	185,426
Saturday	03/20/10	74,557	210,901	914,334	49,512	536,998	16,631	61,007	185,513
Sunday	03/21/10	74,558	210,920	914,334	49,725	538,189	16,631	61,134	185,600
Monday	03/22/10	74,559	210,940	914,334	49,938	539,380	16,631	61,261	185,687
Tuesday	03/23/10	74,560	210,988	914,334	50,157	540,597	16,631	61,482	185,791
Wednesda	03/24/10	74,560	211,036	914,334	50,375	541,814	16,631	61,702	185,894

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Thursday	03/25/10	74,561	211,038	914,334	50,584	542,996	16,631	61,930	185,976
Friday	03/26/10	74,562	211,069	914,334	50,793	544,178	16,631	62,195	186,049
Saturday	03/27/10	74,563	211,096	914,334	50,935	545,383	16,631	62,406	186,135
Sunday	03/28/10	74,563	211,123	914,334	51,077	546,587	16,631	62,618	186,221
Monday	03/29/10	74,564	211,149	914,334	51,220	547,792	16,631	62,829	186,307
Tuesday	03/30/10	74,565	211,248	914,334	51,646	549,067	16,631	63,101	186,393
Wednesda	03/31/10	74,566	211,382	914,334	51,856	550,274	16,631	63,419	186,459
Thursday	04/01/10	74,567	211,484	914,334	52,073	551,512	16,631	63,706	186,545
Friday	04/02/10	74,567	211,620	914,334	52,295	552,714	16,631	63,989	186,677
Saturday	04/03/10	74,568	211,696	914,334	52,506	553,948	16,631	64,231	186,768
Sunday	04/04/10	74,569	211,771	914,334	52,717	555,182	16,631	64,473	186,860
Monday	04/05/10	74,570	211,846	914,334	52,928	556,416	16,631	64,715	186,952
Tuesday	04/06/10	74,572	212,004	914,334	53,197	557,634	16,631	65,181	187,041
Wednesda	04/07/10	74,573	212,158	914,334	53,382	558,961	16,631	65,390	187,148
Thursday	04/08/10	74,574	212,314	914,334	53,619	560,427	16,631	65,844	187,249
Friday	04/09/10	74,575	212,394	914,334	53,807	561,358	16,631	66,099	187,328
Saturday	04/10/10	74,576	212,414	914,334	54,025	562,577	16,631	66,398	187,408
Sunday	04/11/10	74,577	212,433	914,334	54,242	563,795	16,631	66,697	187,488
Monday	04/12/10	74,578	212,453	914,334	54,460	565,014	16,631	66,996	187,568
Tuesday	04/13/10	74,579	212,589	914,334	54,669	566,270	16,631	67,337	187,656
Wednesda	04/14/10	74,581	212,888	914,334	54,884	567,546	16,631	67,685	187,770
Thursday	04/15/10	74,582	213,052	914,334	55,100	568,898	16,631	68,025	187,872
Friday	04/16/10	74,583	213,246	914,334	55,232	570,021	16,631	68,412	187,945
Saturday	04/17/10	74,584	213,344	914,334	55,467	571,282	16,631	68,765	188,033
Sunday	04/18/10	74,585	213,442	914,334	55,703	572,544	16,631	69,118	188,120
Monday	04/19/10	74,586	213,540	914,334	55,939	573,805	16,631	69,471	188,208
Tuesday	04/20/10	74,587	213,753	914,334	56,178	575,193	16,631	69,916	188,306
Wednesda	04/21/10	74,588	213,892	914,334	56,345	576,233	16,631	70,178	188,387
Thursday	04/22/10	74,589	214,058	914,334	56,546	577,510	16,631	70,549	188,500
Friday	04/23/10	74,591	214,213	914,334	56,748	578,755	16,631	70,808	188,651
Saturday	04/24/10	74,592	214,339	914,334	56,961	580,075	16,631	71,112	188,762
Sunday	04/25/10	74,593	214,465	914,334	57,173	581,396	16,631	71,416	188,872
Monday	04/26/10	74,595	214,591	914,334	57,385	582,716	16,631	71,720	188,983
Tuesday	04/27/10	74,595	214,739	914,334	57,555	583,811	16,631	72,109	189,059
Wednesda	04/28/10	74,596	214,922	914,334	57,748	585,230	16,631	72,371	189,144
Thursday	04/29/10	74,597	215,083	914,334	57,930	586,226	16,631	72,748	189,220
Friday	04/30/10	74,598	215,212	914,334	58,120	587,500	16,631	73,078	189,336
Saturday	05/01/10	74,599	215,341	914,334	58,304	588,709	16,631	73,366	189,447
Sunday	05/02/10	74,601	215,470	914,334	58,489	589,919	16,631	73,654	189,558
Monday	05/03/10	74,602	215,600	914,334	58,673	591,128	16,631	73,943	189,668
Tuesday	05/04/10	74,604	215,754	914,334	58,773	592,340	16,631	74,410	189,762
Wednesda	05/05/10	74,605	215,923	914,334	58,822	593,602	16,631	74,634	189,843
Thursday	05/06/10	74,606	216,137	914,334	59,176	594,884	16,631	75,121	189,916
Friday	05/07/10	74,608	216,311	914,334	59,336	596,030	16,631	75,608	189,988
Saturday	05/08/10	74,609	216,443	914,334	59,512	597,387	16,631	75,921	190,063
Sunday	05/09/10	74,611	216,575	914,334	59,688	598,743	16,631	76,234	190,139
Monday	05/10/10	74,613	216,708	914,334	59,864	600,100	16,631	76,547	190,214
Tuesday	05/11/10	74,614	216,776	914,334	60,019	601,127	16,631	76,777	190,303
Wednesda	05/12/10	74,616	216,829	914,334	60,188	602,491	16,787	77,001	190,410
Thursday	05/13/10	74,618	216,849	914,334	60,328	603,121	16,848	77,183	190,511
Friday	05/14/10	74,620	216,917	914,334	60,492	604,211	16,848	77,362	190,601
Saturday	05/15/10	74,622	216,945	914,334	60,713	605,544	16,848	77,467	190,684
Sunday	05/16/10	74,624	216,973	914,334	60,934	606,878	16,848	77,572	190,767
Monday	05/17/10	74,626	217,002	914,334	61,154	608,211	16,848	77,677	190,851
Tuesday	05/18/10	74,627	217,065	914,334	61,154	609,042	16,848	77,922	190,934
Wednesda	05/19/10	74,627	217,090	914,334	61,279	609,042	16,848	78,004	191,016
Thursday	05/20/10	74,627	217,119	914,334	61,440	610,193	16,848	78,157	191,096
Friday	05/21/10	74,627	217,138	914,334	61,513	611,258	16,848	78,256	191,173

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Saturday	05/22/10	74,627	217,154	914,334	61,713	612,060	16,848	78,305	191,265
Sunday	05/23/10	74,627	217,170	914,334	61,913	612,863	16,848	78,353	191,357
Monday	05/24/10	74,627	217,185	914,334	62,114	613,665	16,848	78,402	191,449
Tuesday	05/25/10	74,627	217,188	914,334	62,304	614,444	16,851	78,449	191,558
Wednesda	05/26/10	74,627	217,191	914,334	62,507	615,304	16,884	78,506	191,649
Thursday	05/27/10	74,627	217,204	914,334	62,697	616,365	16,937	78,551	191,732
Friday	05/28/10	74,644	217,224	914,334	62,861	617,332	16,985	78,612	191,809
Saturday	05/29/10	74,644	217,247	914,334	63,026	618,124	17,034	78,663	191,889
Sunday	05/30/10	74,644	217,271	914,334	63,190	618,917	17,083	78,715	191,969
Monday	05/31/10	74,644	217,295	914,334	63,354	619,709	17,132	78,766	192,050
Tuesday	06/01/10	74,644	217,319	914,334	63,518	620,501	17,181	78,817	192,130
Wednesda	06/02/10	74,644	217,345	914,334	63,676	621,542	17,229	78,863	192,213
Thursday	06/03/10	74,644	217,369	914,334	63,852	622,464	17,291	78,918	192,292
Friday	06/04/10	74,644	217,398	914,334	64,060	623,582	17,365	79,005	192,376
Saturday	06/05/10	74,644	217,434	914,334	64,260	624,502	17,429	79,078	192,452
Sunday	06/06/10	74,644	217,471	914,334	64,460	625,421	17,494	79,152	192,528
Monday	06/07/10	74,644	217,507	914,334	64,659	626,341	17,559	79,225	192,604
Tuesday	06/08/10	74,644	217,560	914,334	64,868	627,668	17,649	79,372	192,675
Wednesda	06/09/10	74,644	217,695	914,334	65,087	628,991	17,743	79,553	192,751
Thursday	06/10/10	74,644	217,829	914,334	65,305	630,313	17,836	79,733	192,826
Friday	06/11/10	74,644	217,888	914,334	65,493	631,189	17,918	79,851	192,912
Saturday	06/12/10	74,644	218,001	914,334	65,688	632,295	17,998	79,969	193,014
Sunday	06/13/10	74,644	218,114	914,334	65,884	633,400	18,079	80,087	193,115
Monday	06/14/10	74,644	218,226	914,334	66,080	634,506	18,159	80,205	193,217
Tuesday	06/15/10	74,644	218,351	914,334	66,308	635,855	18,262	80,354	193,299
Wednesda	06/16/10	74,644	218,433	914,334	66,476	636,664	18,327	80,418	193,372
Thursday	06/17/10	74,644	218,495	914,334	66,679	637,601	18,413	80,510	193,450
Friday	06/18/10	74,644	218,557	914,334	66,872	638,711	18,488	80,602	193,523
Saturday	06/19/10	74,644	218,630	914,334	67,069	639,714	18,561	80,693	193,761
Sunday	06/20/10	74,644	218,703	914,334	67,266	640,717	18,634	80,783	193,998
Monday	06/21/10	74,644	218,777	914,334	67,463	641,720	18,707	80,874	194,235
Tuesday	06/22/10	74,644	218,845	914,334	67,664	642,654	18,787	80,991	194,306
Wednesda	06/23/10	74,644	218,913	914,334	67,865	643,587	18,867	81,107	194,367
Thursday	06/24/10	74,644	219,000	914,334	68,065	644,749	18,867	81,227	194,439
Friday	06/25/10	74,644	219,087	914,334	68,265	645,911	18,867	81,346	194,517
Saturday	06/26/10	74,644	219,177	914,334	68,453	645,920	18,871	81,439	194,569
Sunday	06/27/10	74,644	219,268	914,334	68,642	645,928	18,876	81,532	194,620
Monday	06/28/10	74,644	219,359	914,334	68,831	645,937	18,880	81,626	194,671
Tuesday	06/29/10	74,644	219,422	914,334	69,002	646,818	18,967	81,707	194,825
Wednesda	06/30/10	74,644	219,534	914,334	69,227	648,045	19,076	81,823	194,900
Thursday	07/01/10	74,644	219,650	914,334	69,388	649,039	19,154	81,832	194,958
Friday	07/02/10	74,644	219,970	914,334	69,579	650,179	19,246	81,842	195,029
Saturday	07/03/10	74,644	219,990	914,334	69,674	650,835	19,306	81,852	195,105
Sunday	07/04/10	74,644	220,009	914,334	69,768	651,490	19,365	81,862	195,182
Monday	07/05/10	74,644	220,029	914,334	69,863	652,146	19,424	81,871	195,259
Tuesday	07/06/10	74,644	220,087	914,334	70,005	654,113	19,602	81,881	195,333
Wednesda	07/07/10	74,644	220,262	914,334	70,076	655,527	19,713	81,891	195,417
Thursday	07/08/10	74,644	220,377	914,334	70,111	656,383	19,801	81,968	195,515
Friday	07/09/10	74,644	220,437	914,334	70,146	657,582	19,877	82,013	195,591
Saturday	07/10/10	74,644	220,498	914,334	70,305	658,254	19,965	82,067	195,691
Sunday	07/11/10	74,644	220,558	914,334	70,464	658,925	20,054	82,121	195,791
Monday	07/12/10	74,644	220,618	914,334	70,624	659,597	20,142	82,175	195,890
Tuesday	07/13/10	74,644	220,706	914,334	70,778	661,611	20,229	82,233	195,936
Wednesda	07/14/10	74,644	220,816	914,334	70,941	662,753	20,320	82,312	196,018
Thursday	07/15/10	74,644	221,034	914,334	71,096	663,826	20,408	82,380	196,111
Friday	07/16/10	74,644	221,102	914,334	71,253	664,993	20,498	82,468	196,220
Saturday	07/17/10	74,644	221,171	914,334	71,332	666,059	20,587	82,530	196,320
Sunday	07/18/10	74,644	221,239	914,334	71,412	667,124	20,677	82,592	196,420

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Monday	07/19/10	74,644	221,308	914,334	71,491	668,190	20,767	82,654	196,520
Tuesday	07/20/10	74,644	221,446	914,334	71,653	669,614	20,873	82,756	196,609
Wednesda	07/21/10	74,644	221,605	914,334	71,815	670,592	20,946	82,809	196,714
Thursday	07/22/10	74,644	221,605	914,334	72,139	671,475	21,032	82,872	196,819
Friday	07/23/10	74,644	221,690	914,334	72,393	672,526	21,118	82,936	196,920
Saturday	07/24/10	74,644	221,756	914,334	72,473	673,459	21,205	83,015	197,025
Sunday	07/25/10	74,644	221,822	914,334	72,552	674,391	21,293	83,094	197,129
Monday	07/26/10	74,644	221,888	914,334	72,632	675,324	21,380	83,173	197,233
Tuesday	07/27/10	74,644	222,014	914,334	72,867	676,640	21,482	83,252	197,313
Wednesda	07/28/10	74,644	222,059	914,334	73,036	677,323	21,552	83,290	197,371
Thursday	07/29/10	74,644	222,132	914,334	73,227	678,296	21,635	83,340	197,439
Friday	07/30/10	74,644	222,204	914,334	73,443	679,236	21,730	83,399	197,510
Saturday	07/31/10	74,644	222,251	914,334	73,622	679,938	21,809	83,433	197,588
Sunday	08/01/10	74,644	222,297	914,334	73,800	680,639	21,889	83,467	197,665
Monday	08/02/10	74,644	222,344	914,334	73,979	681,341	21,969	83,500	197,742
Tuesday	08/03/10	74,644	222,411	914,334	74,207	682,223	22,073	83,590	197,812
Wednesda	08/04/10	74,644	222,478	914,334	74,367	683,524	22,143	83,658	197,877
Thursday	08/05/10	74,644	222,630	914,334	74,562	684,395	22,229	83,727	197,932
Friday	08/06/10	74,644	222,670	914,334	74,768	685,426	22,314	83,794	197,988
Saturday	08/07/10	74,644	222,710	914,334	74,963	686,336	22,397	83,852	197,906
Sunday	08/08/10	74,644	222,749	914,334	75,158	687,246	22,480	83,910	197,824
Monday	08/09/10	74,644	222,789	914,334	75,353	688,156	22,564	83,967	197,742
Tuesday	08/10/10	74,644	222,855	914,334	75,515	688,909	22,653	84,044	197,812
Wednesda	08/11/10	74,644	222,980	914,334	75,714	690,075	22,743	84,142	197,877
Thursday	08/12/10	74,644	223,036	914,334	75,913	691,153	22,829	84,241	197,932
Friday	08/13/10	74,644	223,114	914,334	76,111	692,210	22,910	84,324	197,988
Saturday	08/14/10	74,644	223,206	914,334	76,150	693,335	23,001	84,415	198,051
Sunday	08/15/10	74,644	223,299	914,334	76,188	694,461	23,092	84,506	198,114
Monday	08/16/10	74,644	223,392	914,334	76,227	695,586	23,183	84,598	198,177
Tuesday	08/17/10	74,644	223,477	914,334	76,442	696,662	23,278	84,741	198,283
Wednesda	08/18/10	74,644	223,591	914,334	76,663	698,059	23,378	84,847	198,308
Thursday	08/19/10	74,644	223,649	914,334	76,836	698,953	23,447	84,972	198,371
Friday	08/20/10	74,644	223,760	914,334	77,029	699,932	23,540	85,163	198,425
Saturday	08/21/10	74,644	223,861	914,334	77,220	701,048	23,625	85,301	198,473
Sunday	08/22/10	74,644	223,962	914,334	77,411	702,164	23,709	85,440	198,521
Monday	08/23/10	74,644	224,062	914,334	77,602	703,280	23,793	85,579	198,570
Tuesday	08/24/10	74,644	224,223	914,334	77,768	704,388	23,890	85,821	198,645
Wednesda	08/25/10	74,644	224,293	914,334	77,959	705,292	23,968	85,948	198,733
Thursday	08/26/10	74,644	224,338	914,334	78,146	706,326	24,054	86,105	198,787
Friday	08/27/10	74,644	224,478	914,334	78,340	707,243	24,143	86,240	198,819
Saturday	08/28/10	74,644	224,521	914,334	78,460	708,054	24,230	86,335	198,850
Sunday	08/29/10	74,644	224,564	914,334	78,581	708,865	24,317	86,429	198,881
Monday	08/30/10	74,644	224,606	914,334	78,702	709,676	24,404	86,524	198,912
Tuesday	08/31/10	74,644	224,671	914,334	79,063	710,720	24,467	86,667	198,913
Wednesda	09/01/10	74,644	224,766	914,334	79,270	711,806	24,556	86,832	198,934
Thursday	09/02/10	74,645	224,895	914,334	79,501	713,091	24,657	87,064	198,977
Friday	09/03/10	74,760	224,951	914,334	87,181	713,921	24,731	87,181	199,004
Saturday	09/04/10	74,760	225,041	914,334	87,318	714,951	24,816	87,318	199,029
Sunday	09/05/10	74,760	225,131	914,334	87,455	715,981	24,900	87,455	199,055
Monday	09/06/10	74,760	225,221	914,334	87,591	717,011	24,984	87,591	199,080
Tuesday	09/07/10	74,760	225,311	914,334	87,728	718,041	25,068	87,728	199,105
Wednesda	09/08/10	74,760	225,412	914,334	87,911	719,134	25,154	87,911	199,165
Thursday	09/09/10	74,760	225,513	914,334	88,093	720,230	25,241	88,093	199,225
Friday	09/10/10	74,760	225,623	914,334	88,348	721,365	25,334	88,348	199,290
Saturday	09/11/10	74,760	225,681	914,334	88,471	722,298	25,419	88,471	199,341
Sunday	09/12/10	74,760	225,740	914,334	88,594	723,230	25,504	88,594	199,392
Monday	09/13/10	74,760	225,798	914,334	88,717	724,163	25,589	88,717	199,443
Tuesday	09/14/10	74,760	225,972	914,334	88,885	725,960	25,684	88,885	199,475

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Wednesda	09/15/10	74,784	226,195	914,334	89,110	727,732	25,784	89,110	199,519
Thursday	09/16/10	75,060	226,256	914,334	89,206	728,215	25,854	89,206	199,564
Friday	09/17/10	75,373	226,484	914,334	89,352	729,227	25,947	89,352	199,609
Saturday	09/18/10	75,652	226,484	914,334	89,466	730,310	26,039	89,466	199,628
Sunday	09/19/10	75,930	226,484	914,334	89,580	731,394	26,131	89,580	199,648
Monday	09/20/10	76,209	226,484	914,334	89,694	732,477	26,223	89,694	199,667
Tuesday	09/21/10	76,550	226,586	914,334	89,913	733,701	26,297	89,913	199,800
Wednesda	09/22/10	76,735	226,659	914,334	90,005	734,924	26,372	90,005	199,841
Thursday	09/23/10	76,987	226,709	914,334	90,105	736,074	26,480	90,105	199,882
Friday	09/24/10	77,250	226,762	914,334	90,246	736,829	26,550	90,246	199,940
Saturday	09/25/10	77,523	226,812	914,334	90,317	737,718	26,630	90,317	199,963
Sunday	09/26/10	77,797	226,863	914,334	90,388	738,607	26,711	90,388	199,986
Monday	09/27/10	78,071	226,913	914,334	90,460	739,496	26,792	90,460	200,008
Tuesday	09/28/10	78,345	226,981	914,334	90,569	740,547	26,885	90,569	200,048
Wednesda	09/29/10	78,620	227,057	914,334	90,712	741,755	26,963	90,712	200,088
Thursday	09/30/10	78,690	227,168	914,334	90,902	743,177	27,054	90,902	200,207
Friday	10/01/10	78,797	227,278	914,334	91,091	744,599	27,146	91,091	200,326
Saturday	10/02/10	78,861	227,357	914,334	91,195	745,895	27,231	91,195	200,458
Sunday	10/03/10	78,925	227,436	914,334	91,300	747,192	27,317	91,300	200,589
Monday	10/04/10	78,989	227,515	914,334	91,404	748,488	27,402	91,404	200,721
Tuesday	10/05/10	79,065	227,567	914,334	91,526	749,748	27,490	91,526	200,846
Wednesda	10/06/10	79,140	227,619	914,334	91,647	751,007	27,578	91,647	200,971
Thursday	10/07/10	79,252	227,687	914,334	91,764	752,026	27,653	91,764	201,092
Friday	10/08/10	79,389	227,727	914,334	91,887	753,009	27,738	91,887	201,228
Saturday	10/09/10	79,493	227,767	914,334	91,967	753,884	27,819	91,967	201,360
Sunday	10/10/10	79,596	227,808	914,334	92,047	754,760	27,901	92,047	201,492
Monday	10/11/10	79,700	227,848	914,334	92,128	755,635	27,982	92,128	201,624
Tuesday	10/12/10	79,889	227,962	914,334	92,304	756,901	28,073	92,304	201,760
Wednesda	10/13/10	80,077	227,980	914,334	92,479	758,167	28,163	92,479	201,894
Thursday	10/14/10	80,300	228,115	914,334	92,625	759,543	28,235	92,625	202,022
Friday	10/15/10	80,507	228,155	914,334	92,796	760,708	28,329	92,796	202,139
Saturday	10/16/10	80,628	228,184	914,334	92,986	761,761	28,376	92,986	202,266
Sunday	10/17/10	80,750	228,214	914,334	93,177	762,815	28,423	93,177	202,393
Monday	10/18/10	80,871	228,243	914,334	93,367	763,868	28,470	93,367	202,520
Tuesday	10/19/10	81,071	228,301	914,334	93,668	765,339	28,577	93,668	202,677
Wednesda	10/20/10	81,192	228,557	914,334	93,668	766,265	28,642	93,668	202,772
Thursday	10/21/10	81,359	228,569	914,334	93,668	767,221	28,730	93,668	202,888
Friday	10/22/10	81,680	228,581	914,334	93,760	768,650	28,825	93,760	203,021
Saturday	10/23/10	81,723	228,593	914,334	94,140	769,216	28,903	94,140	203,143
Sunday	10/24/10	81,765	228,605	914,334	94,519	769,781	28,982	94,519	203,264
Monday	10/25/10	81,808	228,617	914,334	94,899	770,347	29,060	94,899	203,385
Tuesday	10/26/10	81,895	228,644	914,334	95,284	771,292	29,146	95,284	203,506
Wednesda	10/27/10	81,982	228,670	914,334	95,669	772,236	29,232	95,669	203,627
Thursday	10/28/10	82,063	228,709	914,334	96,032	773,149	29,313	96,032	203,748
Friday	10/29/10	82,144	228,749	914,334	96,395	774,062	29,393	96,395	203,869
Saturday	10/30/10	82,178	228,766	914,334	96,751	774,684	29,475	96,751	203,991
Sunday	10/31/10	82,213	228,783	914,334	97,106	775,307	29,557	97,106	204,112
Monday	11/01/10	82,248	228,800	914,334	97,462	775,929	29,639	97,462	204,233
Tuesday	11/02/10	82,352	228,824	914,334	97,919	776,807	29,707	97,919	204,362
Wednesda	11/03/10	82,404	228,865	914,334	2,376	776,981	29,773	98,249	204,485
Thursday	11/04/10	82,462	228,886	914,334	2,558	778,133	29,839	98,579	204,608
Friday	11/05/10	82,537	228,914	914,334	2,750	779,585	29,929	98,969	204,745
Saturday	11/06/10	82,581	228,925	914,334	2,926	780,414	30,007	99,069	204,859
Sunday	11/07/10	82,626	228,936	914,334	3,101	781,244	30,085	99,169	204,973
Monday	11/08/10	82,670	228,947	914,334	3,276	782,073	30,162	99,268	205,087
Tuesday	11/09/10	82,752	228,969	914,334	3,465	783,171	30,249	99,415	205,209
Wednesda	11/10/10	82,798	228,988	914,334	3,643	784,295	30,326	99,546	205,330
Thursday	11/11/10	82,827	228,992	914,334	3,817	785,609	30,407	99,627	205,456

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Friday	11/12/10	82,856	228,995	914,334	3,990	785,921	30,488	99,708	205,582
Saturday	11/13/10	82,877	228,998	914,334	4,138	786,620	30,568	99,775	205,705
Sunday	11/14/10	82,898	229,001	914,334	4,286	787,319	30,648	99,842	205,827
Monday	11/15/10	82,919	229,004	914,334	4,433	788,018	30,728	99,909	205,949
Tuesday	11/16/10	83,044	229,025	914,334	4,595	789,455	30,828	100,143	206,105
Wednesda	11/17/10	83,061	229,030	914,334	4,723	790,324	30,909	100,186	206,208
Thursday	11/18/10	83,115	229,042	914,334	4,825	791,087	30,980	100,285	206,309
Friday	11/19/10	83,187	229,053	914,334	4,963	792,022	31,067	100,418	206,432
Saturday	11/20/10	83,240	229,072	914,334	5,079	792,854	31,149	100,503	206,548
Sunday	11/21/10	83,293	229,090	914,334	5,196	793,686	31,230	100,589	206,665
Monday	11/22/10	83,346	229,108	914,334	5,312	794,518	31,311	100,674	206,782
Tuesday	11/23/10	83,409	229,126	914,334	5,427	795,921	31,395	100,789	206,898
Wednesda	11/24/10	83,424	229,130	914,334	5,527	796,387	31,482	100,885	207,015
Thursday	11/25/10	83,447	229,134	914,334	5,585	796,690	31,558	100,920	207,134
Friday	11/26/10	83,490	229,137	914,334	5,643	796,992	31,634	100,955	207,252
Saturday	11/27/10	83,494	229,139	914,334	5,702	797,072	31,708	100,973	207,365
Sunday	11/28/10	83,497	229,141	914,334	5,760	797,152	31,782	100,990	207,478
Monday	11/29/10	83,501	229,143	914,334	5,819	797,232	31,857	101,007	207,592
Tuesday	11/30/10	83,549	229,147	914,334	6,008	797,915	31,940	101,094	207,718
Wednesda	12/01/10	83,575	229,150	914,334	6,216	798,462	32,032	101,231	207,829
Thursday	12/02/10	83,601	229,153	914,334	6,380	799,008	32,103	101,249	207,940
Friday	12/03/10	83,632	229,162	914,334	6,544	799,859	32,175	101,344	208,061
Saturday	12/04/10	83,646	229,167	914,334	6,706	800,262	32,251	101,391	208,175
Sunday	12/05/10	83,660	229,171	914,334	6,869	800,666	32,328	101,438	208,289
Monday	12/06/10	83,674	229,176	914,334	7,032	801,069	32,405	101,485	208,403
Tuesday	12/07/10	83,713	229,190	914,334	7,185	801,972	32,487	101,580	208,516
Wednesda	12/08/10	83,739	229,201	914,334	7,319	802,757	32,569	101,666	208,630
Thursday	12/09/10	83,782	229,211	914,334	7,386	803,538	32,648	101,769	208,742
Friday	12/10/10	83,840	229,224	914,334	7,679	804,426	32,719	101,817	208,857
Saturday	12/11/10	83,876	229,232	914,334	7,863	805,020	32,800	101,817	208,973
Sunday	12/12/10	83,913	229,241	914,334	8,047	805,615	32,881	101,817	209,088
Monday	12/13/10	83,949	229,249	914,334	8,231	806,209	32,963	101,817	209,204
Tuesday	12/14/10	84,023	229,263	914,334	8,437	807,160	33,058	101,817	209,322
Wednesda	12/15/10	84,041	229,266	914,334	8,590	807,420	33,124	101,817	209,425
Thursday	12/16/10	84,079	229,272	914,334	8,761	808,006	33,201	101,817	209,534
Friday	12/17/10	84,125	229,278	914,334	8,955	808,745	33,288	101,817	209,648
Saturday	12/18/10	84,139	229,281	914,334	9,114	808,988	33,362	101,817	209,762
Sunday	12/19/10	84,153	229,284	914,334	9,274	809,230	33,436	101,817	209,877
Monday	12/20/10	84,167	229,288	914,334	9,433	809,473	33,510	101,817	209,991
Tuesday	12/21/10	84,174	229,289	914,334	9,592	809,765	33,585	101,817	210,106
Wednesda	12/22/10	84,190	229,294	914,334	9,746	810,074	33,660	101,817	210,216
Thursday	12/23/10	84,194	229,296	914,334	9,892	810,236	33,734	101,817	210,324
Friday	12/24/10	84,200	229,296	914,334	10,038	810,360	33,811	101,817	210,438
Saturday	12/25/10	84,202	229,296	914,334	10,157	810,417	33,887	101,817	210,549
Sunday	12/26/10	84,205	229,297	914,334	10,277	810,473	33,963	101,817	210,660
Monday	12/27/10	84,207	229,297	914,334	10,396	810,530	34,040	101,817	210,771
Tuesday	12/28/10	84,209	229,299	914,334	10,501	810,741	34,116	101,817	210,826
Wednesda	12/29/10	84,210	229,300	914,334	10,605	810,952	34,192	101,817	210,881
Thursday	12/30/10	84,213	229,300	914,334	10,700	811,045	34,270	101,817	211,047
Friday	12/31/10	84,215	229,301	914,334	10,794	811,137	34,348	101,817	211,213
Saturday	01/01/11	84,216	229,303	914,334	10,875	811,239	34,423	101,817	211,324
Sunday	01/02/11	84,217	229,305	914,334	10,957	811,341	34,499	101,817	211,435
Monday	01/03/11	84,218	229,306	914,334	11,038	811,443	34,575	101,817	211,546
Tuesday	01/04/11	84,220	229,308	914,334	11,138	811,937	34,672	101,817	211,665
Wednesda	01/05/11	84,225	229,309	914,334	11,196	812,057	34,733	101,817	211,784
Thursday	01/06/11	84,234	229,309	914,334	11,254	812,341	34,811	101,817	211,900
Friday	01/07/11	84,234	229,309	914,334	11,308	812,407	34,890	101,817	212,016
Saturday	01/08/11	84,236	229,310	914,334	11,362	812,502	34,967	101,817	212,133

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Sunday	01/09/11	84,238	229,311	914,334	11,416	812,597	35,044	101,817	212,251
Monday	01/10/11	84,240	229,312	914,334	11,469	812,692	35,120	101,817	212,368
Tuesday	01/11/11	84,241	229,312	914,334	11,521	812,885	35,198	101,817	212,480
Wednesda	01/12/11	84,244	229,315	914,334	11,570	813,148	35,274	101,817	212,588
Thursday	01/13/11	84,251	229,316	914,334	11,605	813,445	35,352	101,817	212,690
Friday	01/14/11	84,266	229,316	914,334	11,652	814,002	35,430	101,817	212,792
Saturday	01/15/11	84,268	229,317	914,334	11,676	814,245	35,482	101,817	212,859
Sunday	01/16/11	84,271	229,317	914,334	11,699	814,489	35,535	101,817	212,927
Monday	01/17/11	84,273	229,318	914,334	11,723	814,732	35,587	101,817	212,995
Tuesday	01/18/11	84,280	229,319	914,334	11,794	815,461	35,743	101,817	213,198
Wednesda	01/19/11	84,304	229,323	914,334	11,881	816,486	35,844	101,817	213,329
Thursday	01/20/11	84,316	229,325	914,334	11,930	816,980	35,915	101,817	213,411
Friday	01/21/11	84,346	229,330	914,334	11,973	817,689	36,002	101,817	213,504
Saturday	01/22/11	84,358	229,334	914,334	11,973	818,428	36,093	101,817	213,615
Sunday	01/23/11	84,369	229,338	914,334	11,973	819,168	36,184	101,817	213,725
Monday	01/24/11	84,381	229,341	914,334	11,973	819,907	36,276	101,817	213,836
Tuesday	01/25/11	84,468	229,377	914,334	11,973	820,609	36,373	101,817	213,945
Wednesda	01/26/11	84,528	229,412	914,334	11,973	821,311	36,442	101,817	214,030
Thursday	01/27/11	84,564	229,413	914,334	11,973	821,970	36,531	101,817	214,127
Friday	01/28/11	84,600	229,426	914,334	11,973	822,572	36,618	102,015	214,234
Saturday	01/29/11	84,616	229,427	914,334	11,973	823,119	36,700	102,045	214,340
Sunday	01/30/11	84,632	229,429	914,334	11,973	823,666	36,782	102,074	214,446
Monday	01/31/11	84,648	229,430	914,334	11,973	824,213	36,865	102,104	214,552
Tuesday	02/01/11	84,688	229,442	914,334	11,973	825,053	36,959	102,104	214,667
Wednesda	02/02/11	84,776	229,452	914,334	11,973	826,359	37,069	102,104	214,797
Thursday	02/03/11	84,788	229,461	914,334	11,973	827,180	37,139	102,104	214,874
Friday	02/04/11	84,903	229,519	914,334	11,973	829,178	37,237	102,104	214,989
Saturday	02/05/11	84,969	229,525	914,334	11,973	829,844	37,327	102,104	215,085
Sunday	02/06/11	85,035	229,530	914,334	11,973	830,510	37,417	102,104	215,181
Monday	02/07/11	85,100	229,536	914,334	11,973	831,176	37,508	102,104	215,278
Tuesday	02/08/11	85,188	229,572	914,334	11,973	832,157	37,598	102,104	215,368
Wednesda	02/09/11	85,265	229,592	914,334	11,973	833,339	37,692	102,104	215,466
Thursday	02/10/11	85,357	229,620	914,334	11,973	834,298	37,780	102,104	215,560
Friday	02/11/11	85,432	229,634	914,334	11,973	835,257	37,868	102,104	215,659
Saturday	02/12/11	85,495	229,648	914,334	11,973	835,441	37,958	102,104	215,760
Sunday	02/13/11	85,557	229,661	914,334	11,973	835,625	38,049	102,104	215,860
Monday	02/14/11	85,619	229,675	914,334	11,973	835,809	38,140	102,104	215,961
Tuesday	02/15/11	85,727	229,713	914,334	11,973	839,192	38,232	102,104	216,061
Wednesda	02/16/11	85,897	229,816	914,334	11,973	841,083	38,331	102,104	216,173
Thursday	02/17/11	86,067	229,846	914,334	11,973	842,059	38,430	102,104	216,285
Friday	02/18/11	86,195	229,956	914,334	11,973	843,415	38,506	102,104	216,375
Saturday	02/19/11	86,334	230,023	914,334	11,973	844,842	38,606	102,104	216,469
Sunday	02/20/11	86,474	230,089	914,334	11,973	846,269	38,706	102,104	216,563
Monday	02/21/11	86,613	230,156	914,334	11,973	847,696	38,806	102,104	216,656
Tuesday	02/22/11	86,792	230,267	914,334	11,973	849,179	38,887	102,096	216,754
Wednesda	02/23/11	86,988	230,395	914,334	11,973	850,666	38,995	102,096	216,858
Thursday	02/24/11	87,249	230,549	914,334	11,973	852,397	39,074	102,096	216,984
Friday	02/25/11	87,335	230,630	914,334	11,973	853,577	39,195	102,096	217,068
Saturday	02/26/11	87,519	230,720	914,334	11,973	855,012	39,288	102,096	217,174
Sunday	02/27/11	87,704	230,810	914,334	11,973	856,448	39,380	102,096	217,280
Monday	02/28/11	87,889	230,900	914,334	11,973	857,883	39,473	102,096	217,386
Tuesday	03/01/11	88,113	231,038	914,334	11,990	859,359	39,575	102,096	217,493
Wednesda	03/02/11	88,354	231,184	914,334	11,990	860,845	39,678	102,096	217,602
Thursday	03/03/11	88,512	231,309	914,334	11,990	862,184	39,777	102,096	217,702
Friday	03/04/11	88,714	231,446	914,334	11,990	863,430	39,874	102,096	217,803
Saturday	03/05/11	88,917	231,530	914,334	11,992	864,627	39,988	102,096	217,906
Sunday	03/06/11	89,120	231,613	914,334	11,993	865,825	40,103	102,096	218,009
Monday	03/07/11	89,323	231,697	914,334	11,995	867,022	40,217	102,096	218,112

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Tuesday	03/08/11	89,521	231,793	914,334	12,194	868,376	40,262	102,096	218,214
Wednesda	03/09/11	89,718	231,889	914,334	12,443	869,730	40,352	102,096	218,316
Thursday	03/10/11	89,983	232,031	914,334	12,750	871,272	40,467	102,096	218,438
Friday	03/11/11	90,099	232,089	914,334	12,936	872,196	40,533	102,096	218,516
Saturday	03/12/11	90,239	232,150	914,334	13,182	873,526	40,621	102,096	218,613
Sunday	03/13/11	90,379	232,211	914,334	13,428	874,855	40,709	102,096	218,711
Monday	03/14/11	90,520	232,272	914,334	13,673	876,185	40,797	102,096	218,808
Tuesday	03/15/11	90,675	232,333	914,334	13,918	877,704	40,886	102,096	218,914
Wednesda	03/16/11	90,779	232,379	914,334	14,193	879,165	40,985	102,096	219,023
Thursday	03/17/11	90,878	232,438	6	14,377	880,738	41,077	102,096	219,146
Friday	03/18/11	90,996	232,510	9	14,620	882,175	41,140	102,096	219,252
Saturday	03/19/11	91,137	232,578	12	14,867	883,517	41,228	102,096	219,346
Sunday	03/20/11	91,279	232,646	16	15,114	884,860	41,317	102,096	219,439
Monday	03/21/11	91,420	232,714	19	15,361	886,202	41,405	102,096	219,533
Tuesday	03/22/11	91,602	232,815	180	15,649	888,105	41,511	102,096	219,628
Wednesda	03/23/11	91,750	232,862	189	15,855	889,012	41,581	102,096	219,689
Thursday	03/24/11	91,878	232,927	189	16,067	890,480	41,657	102,096	219,788
Friday	03/25/11	92,060	233,013	189	16,314	891,834	41,746	102,096	219,878
Saturday	03/26/11	92,246	233,100	189	16,314	892,695	41,843	102,096	219,968
Sunday	03/27/11	92,431	233,186	189	16,314	893,557	41,941	102,096	220,058
Monday	03/28/11	92,616	233,273	189	16,314	894,418	42,039	102,096	220,148
Tuesday	03/29/11	92,858	233,395	189	16,314	897,002	42,141	102,096	220,236
Wednesda	03/30/11	93,100	233,515	189	16,314	898,273	42,236	102,096	220,320
Thursday	03/31/11	93,287	233,605	189	16,314	899,609	42,333	102,096	220,409
Friday	04/01/11	93,547	233,746	189	16,314	900,976	42,431	102,096	220,510
Saturday	04/02/11	93,765	233,851	189	16,314	902,320	42,528	102,096	220,619
Sunday	04/03/11	93,983	233,956	189	16,314	903,665	42,625	102,096	220,727
Monday	04/04/11	94,200	234,061	189	16,314	905,009	42,723	102,096	220,835
Tuesday	04/05/11	94,413	234,175	189	16,321	906,279	42,821	102,096	220,918
Wednesda	04/06/11	94,660	234,298	189	16,586	907,656	42,909	102,096	221,006
Thursday	04/07/11	94,899	234,415	189	16,865	909,284	43,010	102,096	221,113
Friday	04/08/11	95,031	234,471	189	17,075	910,345	43,081	102,096	221,177
Saturday	04/09/11	95,164	234,526	189	17,320	911,592	43,165	102,096	221,265
Sunday	04/10/11	95,298	234,582	189	17,564	912,838	43,250	102,096	221,352
Monday	04/11/11	95,432	234,637	189	17,809	914,085	43,334	102,096	221,439
Tuesday	04/12/11	95,659	234,764	189	18,051	915,320	43,424	102,096	221,520
Wednesda	04/13/11	95,905	234,896	189	18,286	916,618	43,510	102,096	221,606
Thursday	04/14/11	96,114	234,988	189	18,531	917,294	43,597	102,096	221,689
Friday	04/15/11	96,313	235,066	189	18,779	918,120	43,684	102,096	221,780
Saturday	04/16/11	96,510	235,143	189	19,020	919,228	43,770	102,096	221,873
Sunday	04/17/11	96,708	235,221	189	19,261	920,337	43,856	102,096	221,966
Monday	04/18/11	96,905	235,298	189	19,502	921,445	43,941	102,096	222,058
Tuesday	04/19/11	97,124	235,387	198	19,737	922,636	44,026	102,096	222,152
Wednesda	04/20/11	97,342	235,475	207	19,971	923,826	44,111	102,096	222,245
Thursday	04/21/11	97,542	235,547	225	20,227	925,107	44,203	102,096	222,345
Friday	04/22/11	97,773	235,643	227	20,465	926,338	44,289	102,096	222,439
Saturday	04/23/11	97,925	235,705	229	20,700	927,528	44,371	102,096	222,531
Sunday	04/24/11	98,077	235,767	230	20,934	928,719	44,454	102,096	222,623
Monday	04/25/11	98,228	235,828	232	21,168	929,909	44,536	102,096	222,715
Tuesday	04/26/11	98,439	235,916	235	21,417	931,158	44,625	102,096	222,809
Wednesda	04/27/11	98,641	235,916	240	21,649	932,385	44,712	102,096	222,903
Thursday	04/28/11	98,838	235,916	241	21,892	933,634	44,799	102,096	222,996
Friday	04/29/11	99,041	236,173	241	22,127	934,873	44,881	102,096	223,092
Saturday	04/30/11	99,199	236,224	241	22,368	936,093	44,967	102,096	223,188
Sunday	05/01/11	99,356	236,274	241	22,609	937,313	45,052	102,096	223,285
Monday	05/02/11	99,514	236,325	241	22,850	938,533	45,138	102,096	223,381
Tuesday	05/03/11	99,734	236,433	241	23,107	939,841	45,229	102,096	223,482
Wednesda	05/04/11	99,954	236,541	241	23,364	941,148	45,321	102,096	223,582

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Thursday	05/05/11	100,238	236,666	241	23,580	942,302	45,397	102,096	223,680
Friday	05/06/11	100,385	236,738	241	23,829	943,464	45,486	102,096	223,767
Saturday	05/07/11	100,598	236,815	241	24,067	944,545	45,571	102,096	223,858
Sunday	05/08/11	100,812	236,892	241	24,305	945,626	45,656	102,096	223,949
Monday	05/09/11	101,025	236,970	241	24,544	946,707	45,741	102,096	224,041
Tuesday	05/10/11	101,230	237,061	241	24,799	947,757	45,831	102,096	224,145
Wednesda	05/11/11	101,435	237,152	241	25,054	948,807	45,921	102,096	224,249
Thursday	05/12/11	101,584	237,217	241	25,268	949,829	45,996	102,096	224,318
Friday	05/13/11	101,793	237,306	241	25,518	950,610	46,087	102,096	224,420
Saturday	05/14/11	101,939	237,362	241	25,757	951,478	46,170	102,096	224,507
Sunday	05/15/11	102,085	237,418	241	25,995	952,345	46,253	102,096	224,594
Monday	05/16/11	102,231	237,474	241	26,234	953,213	46,336	102,096	224,681
Tuesday	05/17/11	102,231	237,547	241	26,473	954,084	46,421	102,096	224,773
Wednesda	05/18/11	102,231	237,615	241	26,758	955,174	46,521	102,096	224,892
Thursday	05/19/11	102,231	237,647	241	26,940	955,945	46,583	102,096	224,978
Friday	05/20/11	102,231	237,673	241	27,199	956,541	46,671	102,096	225,047
Saturday	05/21/11	102,485	237,730	241	27,447	957,505	46,757	102,096	225,059
Sunday	05/22/11	102,740	237,788	241	27,696	958,469	46,843	102,096	225,071
Monday	05/23/11	102,994	237,845	241	27,944	959,434	46,929	102,096	225,083
Tuesday	05/24/11	103,249	237,903	241	28,193	960,398	47,015	102,096	225,095
Wednesda	05/25/11	103,503	237,960	241	28,441	961,362	47,101	102,096	225,107
Thursday	05/26/11	103,758	238,043	241	28,658	961,363	47,178	102,096	225,167
Friday	05/27/11	103,872	238,126	241	28,874	961,363	47,255	102,096	225,286
Saturday	05/28/11	104,044	238,192	241	29,123	961,363	47,340	102,096	225,465
Sunday	05/29/11	104,216	238,259	241	29,371	961,363	47,425	102,096	225,644
Monday	05/30/11	104,388	238,325	241	29,619	961,363	47,510	102,096	225,823
Tuesday	05/31/11	104,560	238,391	241	29,868	961,363	47,595	102,096	226,002
Wednesda	06/01/11	104,796	238,454	241	30,103	962,654	47,675	102,096	226,090
Thursday	06/02/11	104,939	238,527	241	30,333	963,898	47,755	102,096	226,146
Friday	06/03/11	105,082	238,600	241	30,563	965,142	47,835	102,096	226,203
Saturday	06/04/11	105,245	238,660	241	30,741	966,358	47,921	102,168	226,301
Sunday	06/05/11	105,409	238,720	241	30,920	967,574	48,007	102,240	226,400
Monday	06/06/11	105,572	238,780	241	31,099	968,790	48,093	102,312	226,498
Tuesday	06/07/11	105,784	238,886	241	31,338	970,018	48,179	102,312	226,580
Wednesda	06/08/11	105,976	238,899	241	31,888	971,182	48,266	102,312	226,665
Thursday	06/09/11	106,162	239,045	241	31,958	972,300	48,348	102,312	226,742
Friday	06/10/11	106,390	239,124	241	32,073	973,545	48,451	102,312	226,828
Saturday	06/11/11	106,573	239,202	241	32,312	974,513	48,546	102,312	226,910
Sunday	06/12/11	106,756	239,280	241	32,552	975,482	48,641	102,312	226,992
Monday	06/13/11	106,938	239,359	241	32,791	976,450	48,736	102,312	227,074
Tuesday	06/14/11	107,228	239,502	241	33,069	977,790	48,851	102,312	227,177
Wednesda	06/15/11	107,359	239,569	241	33,275	978,562	48,928	102,312	227,240
Thursday	06/16/11	107,613	239,685	241	33,528	979,595	49,029	102,312	227,324
Friday	06/17/11	107,822	239,790	241	33,789	980,791	49,134	102,312	227,421
Saturday	06/18/11	108,028	239,885	241	34,022	981,413	49,226	102,312	227,499
Sunday	06/19/11	108,234	239,979	241	34,256	982,035	49,318	102,312	227,577
Monday	06/20/11	108,440	240,074	241	34,489	982,657	49,410	102,312	227,656
Tuesday	06/21/11	108,654	240,169	241	34,738	984,522	49,508	102,312	227,736
Wednesda	06/22/11	108,928	240,295	241	34,991	985,668	49,616	102,361	227,831
Thursday	06/23/11	109,131	240,404	241	35,185	986,494	49,700	102,368	227,903
Friday	06/24/11	109,392	240,535	241	35,412	987,536	49,798	102,377	227,988
Saturday	06/25/11	109,632	240,684	241	35,449	988,502	49,894	102,386	228,072
Sunday	06/26/11	109,872	240,832	241	35,485	989,469	49,989	102,395	228,156
Monday	06/27/11	110,112	240,981	241	35,521	990,435	50,085	102,405	228,239
Tuesday	06/28/11	110,371	240,981	241	35,752	991,352	50,184	102,413	228,321
Wednesda	06/29/11	110,626	241,138	241	35,999	992,270	50,286	102,422	228,407
Thursday	06/30/11	110,874	241,309	241	36,236	993,216	50,382	102,430	228,488
Friday	07/01/11	111,121	241,476	241	36,489	993,310	50,484	102,440	228,573

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Saturday	07/02/11	111,360	241,647	241	36,714	993,404	50,582	102,451	228,659
Sunday	07/03/11	111,600	241,818	241	36,939	993,499	50,681	102,462	228,745
Monday	07/04/11	111,840	241,989	241	37,164	993,593	50,780	102,473	228,832
Tuesday	07/05/11	112,080	242,160	241	37,389	993,687	50,878	102,484	228,918
Wednesda	07/06/11	112,329	242,357	241	37,521	993,844	50,973	102,496	229,013
Thursday	07/07/11	112,560	242,516	241	37,709	993,844	51,169	102,507	229,097
Friday	07/08/11	112,790	242,674	241	37,896	993,844	51,243	102,518	229,180
Saturday	07/09/11	113,032	242,852	241	38,145	994,778	51,317	102,529	229,264
Sunday	07/10/11	113,273	243,030	241	38,395	995,713	51,391	102,540	229,349
Monday	07/11/11	113,515	243,207	241	38,644	996,647	51,466	102,551	229,434
Tuesday	07/12/11	113,761	243,395	241	38,672	997,648	51,576	102,552	229,521
Wednesda	07/13/11	113,991	243,568	241	38,749	998,615	51,667	102,554	229,604
Thursday	07/14/11	114,220	243,741	241	38,826	999,582	51,766	102,554	229,686
Friday	07/15/11	114,451	243,919	241	38,853	592	51,853	102,593	229,770
Saturday	07/16/11	114,686	244,016	241	39,331	1,648	51,958	102,603	229,854
Sunday	07/17/11	114,921	244,114	241	39,809	2,705	52,054	102,612	229,939
Monday	07/18/11	115,156	244,212	241	40,287	3,761	52,150	102,622	230,023
Tuesday	07/19/11	115,412	244,518	241	40,539	4,829	52,250	102,631	230,112
Wednesda	07/20/11	115,684	244,732	241	40,806	5,822	52,357	102,641	230,200
Thursday	07/21/11	115,859	244,857	241	41,016	6,815	52,429	102,651	230,287
Friday	07/22/11	116,092	245,031	241	41,413	7,654	52,528	102,656	230,361
Saturday	07/23/11	116,330	245,200	241	41,609	8,605	52,603	102,665	230,446
Sunday	07/24/11	116,567	245,369	241	41,805	9,555	52,690	102,675	230,531
Monday	07/25/11	116,805	245,537	241	42,001	10,506	52,776	102,684	230,616
Tuesday	07/26/11	117,090	245,671	241	42,240	11,319	52,858	102,695	230,693
Wednesda	07/27/11	117,277	245,817	241	42,484	12,261	52,941	102,703	230,780
Thursday	07/28/11	117,511	245,975	241	42,728	13,125	53,026	102,713	230,862
Friday	07/29/11	117,753	246,149	241	42,968	14,059	53,111	102,723	230,945
Saturday	07/30/11	117,994	246,322	241	43,221	14,910	53,197	102,734	231,028
Sunday	07/31/11	118,235	246,495	241	43,473	15,761	53,282	102,744	231,112
Monday	08/01/11	118,476	246,667	241	43,726	16,612	53,368	102,754	231,196
Tuesday	08/02/11	118,691	246,806	241	43,987	17,735	53,451	102,767	231,268
Wednesda	08/03/11	118,922	246,971	241	44,227	19,048	53,533	102,779	231,349
Thursday	08/04/11	119,163	247,135	241	44,475	20,386	53,619	102,791	231,430
Friday	08/05/11	119,403	247,299	241	44,722	21,724	53,705	102,802	231,511
Saturday	08/06/11	119,644	247,462	241	44,727	23,663	53,790	102,814	231,593
Sunday	08/07/11	119,886	247,624	241	44,732	25,602	53,875	102,825	231,676
Monday	08/08/11	120,127	247,786	241	44,737	27,541	53,960	102,837	231,759
Tuesday	08/09/11	120,372	247,952	241	44,981	27,991	54,044	102,848	231,837
Wednesda	08/10/11	120,616	248,117	241	45,225	28,441	54,128	102,859	231,914
Thursday	08/11/11	120,860	248,288	241	45,446	29,818	54,210	102,872	232,007
Friday	08/12/11	121,104	248,459	241	45,666	31,194	54,291	102,885	232,099
Saturday	08/13/11	121,352	248,619	241	45,724	32,519	54,384	102,899	232,182
Sunday	08/14/11	121,600	248,779	241	45,781	33,843	54,471	102,912	232,265
Monday	08/15/11	121,848	248,939	241	45,838	35,168	54,559	102,925	232,348
Tuesday	08/16/11	122,145	249,109	241	46,010	36,697	54,651	102,940	232,443
Wednesda	08/17/11	122,314	249,279	241	46,354	37,501	54,713	102,961	232,514
Thursday	08/18/11	122,588	249,404	241	47,042	37,501	54,802	102,967	232,576
Friday	08/19/11	122,814	249,569	241	47,117	37,501	54,890	102,972	232,654
Saturday	08/20/11	123,059	249,724	241	47,139	37,967	54,978	102,984	232,730
Sunday	08/21/11	123,303	249,879	241	47,161	38,432	55,065	102,996	232,805
Monday	08/22/11	123,547	250,034	241	47,184	38,898	55,153	103,008	232,880
Tuesday	08/23/11	123,782	250,171	241	47,250	38,898	55,222	103,017	232,940
Wednesda	08/24/11	124,031	250,336	241	47,382	39,553	55,308	103,031	233,015
Thursday	08/25/11	124,274	250,487	241	47,616	39,553	55,389	103,042	233,090
Friday	08/26/11	124,536	250,664	241	47,839	39,553	55,466	103,055	233,172
Saturday	08/27/11	124,779	250,814	241	48,089	39,553	55,558	103,067	233,242
Sunday	08/28/11	125,023	250,965	241	48,339	39,553	55,643	103,078	233,313

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Monday	08/29/11	125,266	251,116	241	48,589	39,553	55,728	103,089	233,384
Tuesday	08/30/11	125,519	251,282	241	48,851	40,967	55,820	103,099	233,459
Wednesda	08/31/11	125,767	251,448	241	49,067	42,082	55,897	103,109	233,522
Thursday	09/01/11	126,058	251,625	241	49,316	42,546	55,986	103,120	233,590
Friday	09/02/11	126,264	251,773	241	49,547	43,560	56,068	103,127	233,652
Saturday	09/03/11	126,509	251,932	241	49,785	44,578	56,151	103,135	233,717
Sunday	09/04/11	126,753	252,091	241	50,023	45,595	56,233	103,144	233,783
Monday	09/05/11	126,998	252,250	241	50,261	46,613	56,315	103,152	233,848
Tuesday	09/06/11	127,243	252,409	241	50,500	47,630	56,397	103,160	233,913
Wednesda	09/07/11	127,498	252,588	241	50,737	47,693	56,480	103,168	233,980
Thursday	09/08/11	127,752	252,767	241	50,973	47,756	56,563	103,176	234,047
Friday	09/09/11	128,047	252,899	241	51,074	47,756	56,647	103,185	234,100
Saturday	09/10/11	128,271	253,037	241	51,123	48,496	56,719	103,185	234,182
Sunday	09/11/11	128,494	253,174	241	51,173	49,237	56,797	103,185	234,263
Monday	09/12/11	128,718	253,312	241	51,222	49,977	56,874	103,185	234,344
Tuesday	09/13/11	128,946	253,412	241	51,272	50,043	56,962	103,213	234,418
Wednesda	09/14/11	129,191	253,555	241	51,518	50,043	57,045	103,222	234,506
Thursday	09/15/11	129,444	253,707	241	51,732	50,044	57,118	103,229	234,596
Friday	09/16/11	129,665	253,815	241	51,995	50,044	57,206	103,238	234,684
Saturday	09/17/11	129,907	253,943	241	52,234	51,002	57,280	103,247	234,780
Sunday	09/18/11	130,150	254,071	241	52,473	51,959	57,361	103,256	234,875
Monday	09/19/11	130,392	254,198	241	52,713	52,917	57,442	103,265	234,971
Tuesday	09/20/11	130,726	254,385	241	53,005	54,588	57,544	103,276	235,093
Wednesda	09/21/11	130,920	254,506	241	53,195	55,575	57,610	103,283	235,165
Thursday	09/22/11	131,184	254,662	241	53,437	56,888	57,693	103,293	235,263
Friday	09/23/11	131,446	254,820	241	53,677	58,210	57,779	103,303	235,360
Saturday	09/24/11	131,696	254,971	241	53,916	59,490	57,855	103,317	235,454
Sunday	09/25/11	131,947	255,122	241	54,155	60,771	57,936	103,331	235,548
Monday	09/26/11	132,197	255,273	241	54,394	62,051	58,017	103,345	235,642
Tuesday	09/27/11	132,453	255,431	241	54,632	63,268	58,094	103,345	235,732
Wednesda	09/28/11	132,718	255,592	241	54,915	64,566	58,169	103,355	235,826
Thursday	09/29/11	132,957	255,733	241	55,109	65,625	58,247	103,373	235,898
Friday	09/30/11	133,215	255,892	241	55,362	66,839	58,326	103,384	235,983
Saturday	10/01/11	133,469	256,046	241	55,599	67,966	58,403	103,391	236,065
Sunday	10/02/11	133,722	256,201	241	55,835	69,093	58,480	103,398	236,147
Monday	10/03/11	133,975	256,355	241	56,072	70,219	58,557	103,405	236,229
Tuesday	10/04/11	134,229	256,509	241	56,308	71,346	58,633	103,412	236,311
Wednesda	10/05/11	134,535	256,667	241	56,546	72,426	58,709	103,424	236,390
Thursday	10/06/11	134,748	256,825	241	56,783	73,506	58,785	103,424	236,468
Friday	10/07/11	134,962	257,006	241	57,030	74,643	58,863	103,441	236,554
Saturday	10/08/11	135,163	257,148	241	57,276	75,744	58,943	103,451	236,639
Sunday	10/09/11	135,363	257,290	241	57,523	76,845	59,022	103,462	236,723
Monday	10/10/11	135,564	257,432	241	57,769	77,946	59,101	103,472	236,808
Tuesday	10/11/11	135,925	257,581	241	57,988	78,953	59,169	103,483	236,889
Wednesda	10/12/11	136,164	257,723	241	58,221	79,917	59,212	103,489	236,968
Thursday	10/13/11	136,413	257,898	241	58,453	80,975	59,278	103,497	237,051
Friday	10/14/11	136,668	258,102	241	58,696	81,697	59,356	103,507	237,128
Saturday	10/15/11	136,923	258,260	241	58,942	83,105	59,424	103,515	237,208
Sunday	10/16/11	137,178	258,418	241	59,189	84,514	59,497	103,522	237,289
Monday	10/17/11	137,433	258,576	241	59,435	85,922	59,570	103,530	237,370
Tuesday	10/18/11	137,697	258,700	241	59,654	87,320	59,646	103,538	237,456
Wednesda	10/19/11	138,017	258,892	241	59,910	88,578	59,732	103,547	237,533
Thursday	10/20/11	138,208	259,005	241	60,114	89,836	59,795	103,555	237,609
Friday	10/21/11	138,461	259,157	241	60,354	91,182	59,873	103,566	237,693
Saturday	10/22/11	138,717	259,250	241	60,592	92,518	59,952	103,577	237,775
Sunday	10/23/11	138,973	259,344	241	60,830	93,854	60,031	103,588	237,857
Monday	10/24/11	139,228	259,437	241	61,069	95,190	60,109	103,599	237,939
Tuesday	10/25/11	139,503	259,717	241	61,309	95,640	60,196	103,607	238,022

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Wednesda	10/26/11	139,768	259,881	241	61,548	97,866	60,279	103,616	238,106
Thursday	10/27/11	140,033	260,023	241	61,786	99,192	60,361	103,625	238,187
Friday	10/28/11	140,292	260,177	241	62,035	100,561	60,447	103,634	238,274
Saturday	10/29/11	140,528	260,326	241	62,270	101,776	60,525	103,643	238,354
Sunday	10/30/11	140,763	260,475	241	62,505	102,990	60,603	103,652	238,433
Monday	10/31/11	140,999	260,623	241	62,740	104,205	60,682	103,661	238,513
Tuesday	11/01/11	141,261	260,759	241	62,968	105,590	60,762	103,667	238,605
Wednesda	11/02/11	141,553	260,913	241	63,225	106,739	60,845	103,669	238,685
Thursday	11/03/11	141,782	261,047	241	63,463	108,254	60,925	103,672	238,767
Friday	11/04/11	142,010	261,180	241	63,700	109,768	61,005	103,676	238,848
Saturday	11/05/11	142,205	261,312	241	63,943	110,778	61,085	103,679	238,932
Sunday	11/06/11	142,399	261,444	241	64,186	111,787	61,165	103,682	239,016
Monday	11/07/11	142,594	261,576	241	64,429	112,797	61,245	103,685	239,100
Tuesday	11/08/11	142,812	261,705	241	64,650	113,975	61,317	103,701	239,173
Wednesda	11/09/11	143,008	261,845	241	64,894	115,281	61,396	103,710	239,206
Thursday	11/10/11	143,194	261,998	241	65,129	116,557	61,472	103,718	239,336
Friday	11/11/11	143,461	262,150	241	65,368	117,900	61,547	103,724	239,410
Saturday	11/12/11	143,708	262,150	241	65,462	119,074	61,578	103,731	239,476
Sunday	11/13/11	143,954	262,150	241	65,556	120,248	61,609	103,737	239,542
Monday	11/14/11	144,201	262,150	241	65,650	121,422	61,639	103,744	239,608
Tuesday	11/15/11	144,423	262,150	241	65,902	122,518	61,717	103,751	239,672
Wednesda	11/16/11	144,656	262,150	241	66,194	123,954	61,811	103,751	239,756
Thursday	11/17/11	144,841	262,150	241	66,416	124,943	61,878	103,751	239,806
Friday	11/18/11	145,049	262,150	241	66,664	126,129	61,955	103,751	239,870
Saturday	11/19/11	145,264	262,150	241	66,917	127,361	62,033	103,751	239,934
Sunday	11/20/11	145,480	262,150	241	67,170	128,594	62,111	103,751	239,998
Monday	11/21/11	145,695	262,150	241	67,424	129,826	62,190	103,751	240,062
Tuesday	11/22/11	145,930	262,150	241	67,672	131,145	62,268	103,751	240,126
Wednesda	11/23/11	146,139	262,150	241	67,929	132,388	62,350	103,751	240,188
Thursday	11/24/11	146,306	262,150	241	68,153	133,552	62,410	103,751	240,253
Friday	11/25/11	146,473	262,150	241	68,377	134,712	62,471	103,751	240,317
Saturday	11/26/11	146,626	262,150	241	68,616	135,742	62,540	103,751	240,379
Sunday	11/27/11	146,779	262,150	241	68,854	136,771	62,610	103,751	240,441
Monday	11/28/11	146,932	262,150	241	69,093	137,801	62,679	103,751	240,502
Tuesday	11/29/11	147,119	262,150	241	69,353	139,070	62,759	103,751	240,566
Wednesda	11/30/11	147,322	262,150	241	69,601	140,329	62,837	103,751	240,628
Thursday	12/01/11	147,575	262,150	241	69,849	141,618	62,917	103,751	240,691
Friday	12/02/11	147,814	262,150	241	70,143	142,835	62,991	103,751	240,755
Saturday	12/03/11	148,026	262,150	241	70,376	144,108	63,067	103,751	240,820
Sunday	12/04/11	148,239	262,150	241	70,609	145,382	63,143	103,751	240,884
Monday	12/05/11	148,451	262,150	241	70,842	146,655	63,220	103,751	240,949
Tuesday	12/06/11	148,684	262,150	241	71,120	148,049	63,306	103,751	241,016
Wednesda	12/07/11	148,916	262,150	241	71,397	149,442	63,393	103,751	241,083
Thursday	12/08/11	149,135	262,150	241	71,616	150,455	63,459	103,751	241,130
Friday	12/09/11	149,223	262,150	241	71,830	151,148	63,519	103,751	241,183
Saturday	12/10/11	149,231	262,150	241	72,074	151,920	63,587	103,751	241,241
Sunday	12/11/11	149,239	262,150	241	72,317	152,691	63,656	103,751	241,299
Monday	12/12/11	149,247	262,150	241	72,561	153,463	63,724	103,751	241,358
Tuesday	12/13/11	149,257	262,150	241	72,771	154,330	63,783	103,751	241,418
Wednesda	12/14/11	149,287	262,150	241	73,025	155,065	63,855	103,751	241,475
Thursday	12/15/11	149,291	262,150	241	73,274	156,016	63,926	103,751	241,548
Friday	12/16/11	149,291	262,150	241	73,490	156,199	63,983	103,751	241,590
Saturday	12/17/11	149,293	262,150	241	73,706	156,199	64,036	103,751	241,645
Sunday	12/18/11	149,294	262,150	241	73,921	156,199	64,088	103,751	241,701
Monday	12/19/11	149,295	262,150	241	74,137	156,199	64,141	103,751	241,757
Tuesday	12/20/11	149,296	262,150	241	74,391	156,199	64,208	103,751	241,813
Wednesda	12/21/11	149,301	262,150	241	74,584	156,199	64,257	103,751	241,874
Thursday	12/22/11	149,304	262,150	241	74,817	156,199	64,257	103,751	241,919

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Friday	12/23/11	149,308	262,150	241	75,050	156,199	64,257	103,751	241,978
Saturday	12/24/11	149,310	262,150	241	75,272	156,199	64,257	103,751	242,033
Sunday	12/25/11	149,311	262,150	241	75,494	156,199	64,257	103,751	242,089
Monday	12/26/11	149,313	262,150	241	75,717	156,199	64,257	103,751	242,145
Tuesday	12/27/11	149,316	262,150	241	75,942	156,199	64,257	103,751	242,201
Wednesda	12/28/11	149,318	262,150	241	76,166	156,199	64,257	103,751	242,256
Thursday	12/29/11	149,320	262,150	241	76,394	156,199	64,257	103,751	242,313
Friday	12/30/11	149,321	262,150	241	76,621	156,199	64,257	103,751	242,370
Saturday	12/31/11	149,321	262,150	241	76,848	156,199	64,257	103,751	242,430
Sunday	01/01/12	149,322	262,150	241	77,075	156,199	64,257	103,751	242,489
Monday	01/02/12	149,322	262,150	241	77,302	156,199	64,257	103,751	242,549
Tuesday	01/03/12	149,322	262,150	241	77,547	156,199	64,262	103,751	242,600
Wednesda	01/04/12	149,329	262,150	241	77,730	156,199	64,321	103,751	242,669
Thursday	01/05/12	149,336	262,150	241	77,913	156,199	64,321	103,751	242,732
Friday	01/06/12	149,349	262,150	241	78,196	156,199	64,321	103,751	242,794
Saturday	01/07/12	149,352	262,150	241	78,429	156,199	64,321	103,751	242,839
Sunday	01/08/12	149,355	262,150	241	78,662	156,199	64,321	103,751	242,885
Monday	01/09/12	149,357	262,150	241	78,894	156,199	64,321	103,751	242,930
Tuesday	01/10/12	149,367	262,150	241	79,139	156,199	64,321	103,751	242,966
Wednesda	01/11/12	149,384	262,150	241	79,372	156,199	64,321	103,751	243,001
Thursday	01/12/12	149,418	262,150	241	79,607	156,199	64,321	103,751	243,034
Friday	01/13/12	149,534	262,150	241	79,877	156,199	64,321	103,751	243,064
Saturday	01/14/12	149,549	262,150	241	80,032	156,199	64,321	103,751	243,083
Sunday	01/15/12	149,564	262,150	241	80,186	156,199	64,321	103,751	243,102
Monday	01/16/12	149,579	262,150	241	80,341	156,199	64,321	103,751	243,121
Tuesday	01/17/12	149,623	262,150	241	80,804	156,199	64,321	103,751	243,178
Wednesda	01/18/12	149,691	262,150	241	81,035	156,199	64,321	103,751	243,206
Thursday	01/19/12	149,745	262,150	241	81,265	156,199	64,321	103,751	243,232
Friday	01/20/12	149,838	262,150	241	81,523	156,199	64,321	103,751	243,264
Saturday	01/21/12	149,849	262,150	241	81,775	156,199	64,321	103,751	243,297
Sunday	01/22/12	149,859	262,150	241	82,027	156,199	64,321	103,751	243,330
Monday	01/23/12	149,870	262,150	241	82,279	156,199	64,321	103,751	243,363
Tuesday	01/24/12	149,994	262,150	241	82,291	156,199	64,321	103,751	243,392
Wednesda	01/25/12	150,132	262,150	241	82,540	156,199	64,321	103,751	243,437
Thursday	01/26/12	150,197	262,150	241	82,736	156,199	64,321	103,751	243,463
Friday	01/27/12	150,265	262,150	241	82,954	156,199	64,321	103,751	243,503
Saturday	01/28/12	150,288	262,150	241	83,179	156,199	64,321	103,751	243,543
Sunday	01/29/12	150,311	262,150	241	83,403	156,199	64,321	103,751	243,584
Monday	01/30/12	150,334	262,150	241	83,628	156,199	64,321	103,751	243,624
Tuesday	01/31/12	150,393	262,150	241	83,875	156,199	64,321	103,751	243,665
Wednesda	02/01/12	150,471	262,150	241	84,115	156,199	64,321	103,751	243,728
Thursday	02/02/12	150,623	262,150	241	84,345	156,199	64,321	103,751	243,758
Friday	02/03/12	150,774	262,150	241	84,574	156,199	64,321	103,751	243,788
Saturday	02/04/12	151,130	262,150	241	84,793	156,199	64,321	103,751	243,828
Sunday	02/05/12	151,486	262,150	241	85,011	156,199	64,321	103,751	243,868
Monday	02/06/12	151,841	262,150	241	85,230	156,199	64,321	103,751	243,908
Tuesday	02/07/12	151,843	262,150	241	85,489	156,199	64,321	103,751	243,951
Wednesda	02/08/12	152,067	262,150	241	85,687	156,199	64,321	103,751	243,987
Thursday	02/09/12	152,335	262,150	241	85,727	156,199	64,321	103,751	244,032
Friday	02/10/12	152,591	262,150	241	85,975	156,199	64,321	103,751	244,078
Saturday	02/11/12	152,847	262,150	241	86,197	156,199	64,321	103,751	244,111
Sunday	02/12/12	153,103	262,150	241	86,420	156,199	64,321	103,751	244,144
Monday	02/13/12	153,359	262,150	241	86,642	156,199	64,321	103,751	244,177
Tuesday	02/14/12	153,685	262,150	241	86,906	156,199	64,321	103,751	244,225
Wednesda	02/15/12	153,870	262,150	241	87,094	156,199	64,321	103,751	244,253
Thursday	02/16/12	154,126	262,150	241	87,319	156,199	64,321	103,751	244,288
Friday	02/17/12	154,391	262,150	241	87,555	156,199	64,321	103,751	244,325
Saturday	02/18/12	154,639	262,150	241	87,769	156,199	64,321	103,751	244,358

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Sunday	02/19/12	154,887	262,150	241	87,984	156,199	64,321	103,751	244,390
Monday	02/20/12	155,135	262,150	241	88,199	156,199	64,321	103,751	244,423
Tuesday	02/21/12	155,416	262,150	241	88,426	156,199	64,321	103,751	244,467
Wednesda	02/22/12	155,622	262,150	241	88,651	156,199	64,321	103,751	244,496
Thursday	02/23/12	155,664	262,150	241	88,886	156,199	64,321	103,751	244,523
Friday	02/24/12	155,706	262,150	241	89,108	156,199	64,321	103,751	244,553
Saturday	02/25/12	155,801	262,150	241	89,332	156,199	64,321	103,751	244,592
Sunday	02/26/12	155,897	262,150	241	89,557	156,199	64,321	103,751	244,631
Monday	02/27/12	155,992	262,150	241	89,782	156,199	64,321	103,751	244,670
Tuesday	02/28/12	156,096	262,150	241	90,024	156,199	64,321	103,751	244,710
Wednesda	02/29/12	156,219	262,150	241	90,290	156,199	64,321	103,751	244,753
Thursday	03/01/12	156,306	262,150	241	90,487	156,199	64,321	103,751	244,785
Friday	03/02/12	156,400	262,150	241	90,716	156,199	64,321	103,751	244,815
Saturday	03/03/12	156,494	262,150	241	90,942	156,199	64,321	103,751	244,846
Sunday	03/04/12	156,587	262,150	241	91,167	156,199	64,321	103,751	244,878
Monday	03/05/12	156,680	262,150	241	91,393	156,199	64,321	103,751	244,909
Tuesday	03/06/12	156,794	262,150	241	91,620	156,199	64,321	103,751	244,939
Wednesda	03/07/12	156,908	262,150	241	91,847	156,199	64,321	103,751	244,968
Thursday	03/08/12	156,999	262,150	241	92,128	156,199	64,321	103,751	245,009
Friday	03/09/12	157,089	262,150	241	92,409	156,199	64,321	103,751	245,049
Saturday	03/10/12	157,150	262,150	241	92,596	156,199	64,322	103,751	245,076
Sunday	03/11/12	157,210	262,150	241	92,783	156,199	64,324	103,751	245,103
Monday	03/12/12	157,271	262,150	241	92,970	156,199	64,326	103,751	245,130
Tuesday	03/13/12	157,332	262,150	241	93,206	156,199	64,326	103,751	245,160
Wednesda	03/14/12	157,364	262,150	241	93,402	156,199	64,326	103,761	245,183
Thursday	03/15/12	157,419	262,150	241	93,637	156,199	64,326	103,761	245,212
Friday	03/16/12	157,493	262,150	241	93,894	156,199	64,326	103,761	245,244
Saturday	03/17/12	157,549	262,150	241	94,110	156,199	64,326	103,761	245,273
Sunday	03/18/12	157,606	262,150	241	94,326	156,199	64,326	103,761	245,302
Monday	03/19/12	157,662	262,150	241	94,543	156,199	64,326	103,761	245,331
Tuesday	03/20/12	157,759	262,455	241	94,815	156,199	64,326	103,761	245,372
Wednesda	03/21/12	157,872	262,472	241	94,998	156,199	64,326	103,761	245,400
Thursday	03/22/12	157,986	262,520	241	95,223	156,199	64,326	103,761	245,430
Friday	03/23/12	158,112	262,612	241	95,442	156,749	64,326	103,761	245,453
Saturday	03/24/12	158,208	262,662	241	95,664	157,300	64,326	103,761	245,482
Sunday	03/25/12	158,305	262,713	241	95,886	157,850	64,326	103,761	245,512
Monday	03/26/12	158,401	262,764	241	96,108	158,401	64,326	103,761	245,541
Tuesday	03/27/12	158,536	262,919	241	96,342	158,401	64,326	103,761	245,571
Wednesda	03/28/12	158,674	263,114	241	96,575	158,401	64,326	103,761	245,602
Thursday	03/29/12	158,832	263,114	241	96,826	158,401	64,326	103,761	245,632
Friday	03/30/12	158,912	263,475	241	97,016	158,401	64,326	103,913	245,662
Saturday	03/31/12	159,015	263,563	241	97,251	158,401	64,326	104,066	245,690
Sunday	04/01/12	159,119	263,652	241	97,486	158,401	64,326	104,218	245,718
Monday	04/02/12	159,222	263,740	241	97,721	158,401	64,326	104,370	245,746
Tuesday	04/03/12	159,469	264,044	241	97,963	158,401	64,326	104,534	245,777
Wednesda	4/4/2012	159,607	264,347	241	98,184	158,401	64,327	104,727	245,801
Thursday	4/5/2012	159,774	264,650	241	98,376	158,401	64,327	104,986	245,820
Friday	4/6/2012	160,002	264,954	241	98,648	158,401	64,327	105,363	245,850
Saturday	4/7/2012	160,152	265,109	241	98,856	158,401	64,327	105,584	245,874
Sunday	4/8/2012	160,301	265,264	241	99,065	158,401	64,327	105,805	245,898
Monday	4/9/2012	160,451	265,419	241	99,274	158,401	64,327	106,026	245,923
Tuesday	4/10/2012	160,648	265,574	241	99,504	158,401	64,327	106,383	245,983
Wednesda	4/11/2012	160,841	265,861	241	99,744	158,401	64,327	106,724	245,994
Thursday	4/12/2012	161,034	266,559	241	99,984	158,401	64,327	107,064	246,005
Friday	4/13/2012	161,263	266,823	241	100,227	158,401	64,327	107,444	246,027
Saturday	4/14/2012	161,415	267,099	241	100,447	158,401	64,327	107,648	246,054
Sunday	4/15/2012	161,566	267,375	241	100,668	158,401	64,327	107,853	246,082
Monday	4/16/2012	161,718	267,651	241	100,888	158,401	64,327	108,057	246,109

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Tuesday	4/17/2012	161,908	267,933	241	101,095	158,401	64,327	108,367	246,134
Wednesda	4/18/2012	162,088	268,260	241	101,319	158,401	64,327	108,660	246,159
Thursday	4/19/2012	162,322	268,570	241	101,567	158,401	64,327	109,064	246,173
Friday	4/20/2012	162,492	268,936	241	101,757	158,401	64,327	109,403	246,192
Saturday	4/21/2012	162,672	269,241	241	102,003	158,401	64,327	109,718	246,212
Sunday	4/22/2012	162,852	269,545	241	102,248	158,401	64,327	110,034	246,232
Monday	4/23/2012	163,032	269,850	241	102,493	158,401	64,327	110,349	246,251
Tuesday	4/24/2012	163,172	270,154	241	102,654	158,401	64,327	110,588	246,266
Wednesda	4/25/2012	163,312	270,459	241	102,815	158,401	64,327	110,826	246,281
Thursday	4/26/2012	163,591	270,764	241	103,136	158,401	64,327	111,302	246,311
Friday	4/27/2012	163,809	271,088	241	103,355	158,401	64,327	111,752	246,334
Saturday	4/28/2012	163,961	271,337	241	103,514	160,016	64,327	112,004	246,355
Sunday	4/29/2012	164,113	271,585	241	103,674	161,630	64,327	112,256	246,375
Monday	4/30/2012	164,264	271,834	241	103,833	163,245	64,327	112,508	246,395
Tuesday	5/1/2012	164,398	272,050	241	104,311	164,501	64,327	112,750	246,416
Wednesda	5/2/2012	164,548	272,292	241	104,540	166,423	64,327	112,988	246,436
Thursday	5/3/2012	164,722	272,583	241	104,723	168,344	64,327	113,289	246,458
Friday	5/4/2012	164,941	272,885	241	104,956	169,790	64,327	113,691	246,476
Saturday	5/5/2012	165,123	273,198	241	105,191	171,562	64,327	114,018	246,498
Sunday	5/6/2012	165,305	273,512	241	105,426	173,334	64,327	114,345	246,520
Monday	5/7/2012	165,488	273,825	241	105,661	175,106	64,327	114,672	246,541
Tuesday	5/8/2012	165,679	274,105	241	105,882	177,063	64,327	115,009	246,575
Wednesda	5/9/2012	165,869	274,384	241	106,103	179,020	64,327	115,346	246,609
Thursday	5/10/2012	166,051	274,687	241	106,329	179,052	64,327	115,619	246,626
Friday	5/11/2012	166,200	274,933	241	106,543	180,793	64,327	115,865	246,649
Saturday	5/12/2012	166,371	275,169	241	106,786	182,554	64,327	116,153	246,670
Sunday	5/13/2012	166,543	275,406	241	107,028	184,315	64,327	116,442	246,691
Monday	5/14/2012	166,714	275,643	241	107,271	186,076	64,327	116,730	246,712
Tuesday	5/15/2012	166,893	275,939	241	107,306	188,040	64,327	117,057	246,734
Wednesda	5/16/2012	167,115	276,255	241	107,472	189,241	64,327	117,451	246,757
Thursday	5/17/2012	167,279	276,538	241	107,759	190,620	64,327	117,760	246,774
Friday	5/18/2012	167,464	276,840	241	107,945	192,473	64,327	118,108	246,792
Saturday	5/19/2012	167,639	277,123	241	108,157	194,377	64,327	118,420	246,825
Sunday	5/20/2012	167,813	277,405	241	108,369	196,280	64,327	118,733	246,858
Monday	5/21/2012	167,988	277,688	241	108,581	198,184	64,327	119,045	246,890
Tuesday	5/22/2012	168,193	277,974	241	108,824	199,667	64,327	119,411	246,907
Wednesda	5/23/2012	168,486	278,388	241	109,084	201,568	64,327	119,959	246,907
Thursday	5/24/2012	168,648	278,664	241	109,260	203,468	64,327	120,255	246,907
Friday	5/25/2012	168,781	278,906	241	109,476	205,110	64,327	120,504	246,907
Saturday	5/26/2012	168,948	279,118	241	109,692	206,843	64,327	120,772	246,907
Sunday	5/27/2012	169,116	279,330	241	109,909	208,575	64,327	121,040	246,907
Monday	5/28/2012	169,283	279,542	241	110,125	210,308	64,327	121,307	246,907
Tuesday	5/29/2012	169,451	279,754	241	110,342	212,040	64,327	121,575	246,907
Wednesda	5/30/2012	169,695	280,116	241	110,342	213,897	64,327	122,017	246,907
Thursday	5/31/2012	169,914	280,466	241	110,342	215,933	64,327	122,403	246,907
Friday	6/1/2012	170,127	280,797	241	110,342	217,793	64,327	122,808	246,907
Saturday	6/2/2012	170,354	281,109	241	110,342	217,797	64,327	123,236	246,907
Sunday	6/3/2012	170,581	281,422	241	110,342	217,801	64,327	123,664	246,907
Monday	6/4/2012	170,808	281,734	241	110,342	217,805	64,327	124,092	246,907
Tuesday	6/5/2012	170,970	282,069	241	110,342	219,068	64,327	124,550	246,907
Wednesda	6/6/2012	171,131	282,404	241	110,342	220,331	64,327	125,007	246,907
Thursday	6/7/2012	171,481	282,688	241	110,342	222,857	64,327	125,342	246,907
Friday	6/8/2012	171,678	282,988	241	110,342	224,610	64,327	125,723	246,907
Saturday	6/9/2012	171,896	283,312	241	110,342	226,354	64,327	126,133	246,907
Sunday	6/10/2012	172,113	283,637	241	110,342	228,099	64,327	126,544	246,907
Monday	6/11/2012	172,331	283,961	241	110,342	229,843	64,327	126,954	246,907
Tuesday	6/12/2012	172,331	284,301	241	110,342	232,053	64,327	127,421	246,907
Wednesda	6/13/2012	172,331	284,601	241	110,342	233,425	64,327	127,888	246,907

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Thursday	6/14/2012	172,331	284,940	241	110,342	235,575	64,327	128,342	246,907
Friday	6/15/2012	172,331	285,268	241	110,342	237,140	64,327	128,830	246,907
Saturday	6/16/2012	172,331	285,581	241	110,342	238,825	64,327	129,265	246,907
Sunday	6/17/2012	172,331	285,894	241	110,342	240,510	64,327	129,699	246,907
Monday	6/18/2012	172,331	286,207	241	110,342	242,195	64,327	130,134	246,907
Tuesday	6/19/2012	172,331	286,582	241	110,342	244,107	64,327	130,592	246,907
Wednesda	6/20/2012	172,331	286,957	241	110,368	245,947	64,327	131,050	246,907
Thursday	6/21/2012	172,331	287,184	241	110,569	247,385	64,327	131,505	246,907
Friday	6/22/2012	172,331	287,527	241	110,812	249,282	64,327	131,946	246,907
Saturday	6/23/2012	172,338	287,835	241	111,026	250,979	64,327	132,365	246,907
Sunday	6/24/2012	172,344	288,143	241	111,239	252,675	64,327	132,785	246,907
Monday	6/25/2012	172,351	288,451	241	111,452	254,372	64,327	133,204	246,907
Tuesday	6/26/2012	172,351	288,847	241	111,659	256,538	64,327	133,598	246,907
Wednesda	6/27/2012	172,351	289,124	241	111,901	258,012	64,327	134,091	246,907
Thursday	6/28/2012	172,351	289,439	241	112,107	259,623	64,327	134,518	246,907
Friday	6/29/2012	172,351	289,754	241	112,313	261,234	64,327	134,944	246,907
Saturday	6/30/2012	172,356	290,090	241	112,526	262,979	64,327	135,385	246,907
Sunday	7/1/2012	172,361	290,427	241	112,738	264,725	64,327	135,825	246,907
Monday	7/2/2012	172,365	290,764	241	112,951	266,470	64,327	136,266	246,907
Tuesday	7/3/2012	172,577	291,082	241	113,153	268,234	64,327	136,721	246,907
Wednesda	7/4/2012	172,771	291,265	241	113,316	269,434	64,327	136,929	246,907
Thursday	7/5/2012	172,964	291,448	241	113,479	270,634	64,327	137,137	246,907
Friday	7/6/2012	173,350	291,814	241	113,805	273,033	64,327	137,553	246,907
Saturday	7/7/2012	173,608	292,058	241	114,022	274,633	64,327	137,830	246,907
Sunday	7/8/2012	173,865	292,302	241	114,239	276,232	64,327	138,107	246,907
Monday	7/9/2012	174,123	292,545	241	114,456	277,832	64,327	138,384	246,907
Tuesday	7/10/2012	174,396	292,841	241	114,675	279,590	64,327	138,799	246,907
Wednesda	7/11/2012	174,659	293,130	241	114,879	283,014	64,327	139,159	246,907
Thursday	7/12/2012	174,921	293,419	241	115,083	283,821	64,327	139,519	246,907
Friday	7/13/2012	175,233	293,678	241	115,371	284,627	64,326	139,886	246,907
Saturday	7/14/2012	175,488	293,927	241	115,589	286,478	64,326	140,177	246,907
Sunday	7/15/2012	175,743	294,177	241	115,807	288,328	64,326	140,469	246,907
Monday	7/16/2012	175,998	294,426	241	116,025	290,179	64,326	140,760	246,907
Tuesday	7/17/2012	176,183	294,610	241	116,199	291,461	64,326	141,060	246,907
Wednesda	7/18/2012	176,408	294,941	241	116,418	293,534	64,326	141,454	246,907
Thursday	7/19/2012	176,589	295,254	241	116,635	295,365	64,326	141,810	246,907
Friday	7/20/2012	176,814	295,548	241	116,858	296,620	64,326	142,129	246,907
Saturday	7/21/2012	177,003	295,830	241	117,082	297,757	64,326	142,470	246,907
Sunday	7/22/2012	177,192	296,113	241	117,305	298,894	64,326	142,811	246,907
Monday	7/23/2012	177,380	296,395	241	117,528	300,031	64,326	143,152	246,907
Tuesday	7/24/2012	177,581	296,709	241	117,751	303,441	64,326	143,495	246,907
Wednesda	7/25/2012	177,855	297,030	241	117,974	305,572	64,326	143,981	246,907
Thursday	7/26/2012	178,062	297,337	241	118,197	306,842	64,326	144,246	246,907
Friday	7/27/2012	178,211	297,582	241	118,384	308,622	64,326	144,609	246,907
Saturday	7/28/2012	178,421	297,870	241	118,613	310,282	64,326	144,939	246,907
Sunday	7/29/2012	178,631	298,158	241	118,841	311,941	64,326	145,270	246,907
Monday	7/30/2012	178,841	298,446	241	119,070	313,601	64,326	145,600	246,907
Tuesday	7/31/2012	179,027	298,726	241	119,190	314,859	64,326	145,958	246,907
Wednesda	8/1/2012	179,212	299,006	241	119,310	316,117	64,326	146,315	246,907
Thursday	8/2/2012	179,443	299,286	241	119,431	317,374	64,326	146,673	246,907
Friday	8/3/2012	179,673	299,567	241	119,551	318,632	64,326	147,030	246,907
Saturday	8/4/2012	179,876	299,893	241	119,671	319,890	64,326	147,326	246,907
Sunday	8/5/2012	180,079	300,218	241	119,791	321,148	64,326	147,622	246,907
Monday	8/6/2012	180,281	300,544	241	119,912	322,405	64,326	147,918	246,907
Tuesday	8/7/2012	180,468	300,842	241	120,130	323,663	64,326	148,206	246,907
Wednesda	8/8/2012	180,723	301,157	241	120,284	325,514	64,326	148,610	246,907
Thursday	8/9/2012	180,977	301,471	241	120,438	327,364	64,326	149,014	246,907
Friday	8/10/2012	181,196	301,736	241	120,438	328,679	64,326	149,444	246,907

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Saturday	8/11/2012	181,375	302,034	241	120,438	328,923	64,326	149,854	246,907
Sunday	8/12/2012	181,553	302,333	241	120,438	329,166	64,326	150,263	246,907
Monday	8/13/2012	181,732	302,631	241	120,438	329,410	64,326	150,673	246,907
Tuesday	8/14/2012	181,990	303,141	241	120,438	330,141	64,326	151,304	246,907
Wednesda	8/15/2012	182,288	303,650	241	120,438	331,602	64,326	151,935	246,907
Thursday	8/16/2012	182,515	303,776	241	120,438	334,525	64,326	152,148	246,907
Friday	8/17/2012	182,742	303,902	241	120,438	340,372	64,326	152,361	246,907
Saturday	8/18/2012	182,970	304,215	241	120,438	340,755	64,326	152,581	246,907
Sunday	8/19/2012	183,199	304,528	241	120,438	343,024	64,326	152,801	246,907
Monday	8/20/2012	183,427	304,840	241	120,438	345,293	64,326	153,021	246,907
Tuesday	8/21/2012	183,678	305,163	241	120,438	347,083	64,326	153,681	246,907
Wednesda	8/22/2012	183,929	305,486	241	120,438	348,873	64,326	154,502	246,907
Thursday	8/23/2012	184,148	305,771	241	120,438	350,313	64,326	154,925	246,907
Friday	8/24/2012	184,367	306,056	241	120,438	351,753	64,326	155,348	246,907
Saturday	8/25/2012	184,575	306,363	241	120,438	353,547	64,326	155,705	246,907
Sunday	8/26/2012	184,783	306,669	241	120,438	355,197	64,326	156,062	246,907
Monday	8/27/2012	184,991	306,976	241	120,438	356,848	64,326	156,419	246,907
Tuesday	8/28/2012	185,239	307,289	241	120,438	358,608	64,326	156,861	246,907
Wednesda	8/29/2012	185,487	307,601	241	120,438	360,368	64,326	157,303	246,907
Thursday	8/30/2012	185,773	307,901	241	120,438	361,284	64,326	157,777	246,907
Friday	8/31/2012	186,059	308,200	241	120,438	362,199	64,366	158,251	246,907
Saturday	9/1/2012	186,199	308,500	241	120,438	363,742	64,373	158,648	246,907
Sunday	9/2/2012	186,339	308,799	241	120,438	365,284	64,380	159,046	246,907
Monday	9/3/2012	186,479	309,099	241	120,438	366,827	64,387	159,443	246,907
Tuesday	9/4/2012	186,898	309,397	241	120,438	368,369	64,409	159,840	246,907
Wednesda	9/5/2012	187,137	309,693	241	120,438	369,502	64,453	160,266	246,907
Thursday	9/6/2012	187,376	309,988	241	120,438	370,634	64,540	160,692	246,907
Friday	9/7/2012	187,648	310,253	241	120,438	372,898	64,713	161,169	246,907
Saturday	9/8/2012	187,856	310,537	241	120,438	374,867	64,849	161,545	246,907
Sunday	9/9/2012	188,064	310,821	241	120,438	376,475	64,984	161,922	246,907
Monday	9/10/2012	188,272	311,106	241	120,438	378,083	65,120	162,298	246,907
Tuesday	9/11/2012	188,498	311,406	-	120,442	379,665	65,257	162,701	246,907
Wednesda	9/12/2012	188,736	311,553	-	120,447	381,609	65,360	162,995	246,907
Thursday	9/13/2012	188,974	311,908	-	120,457	381,864	65,464	163,453	246,907
Friday	9/14/2012	189,213	312,263	478	120,497	381,879	65,670	163,911	246,907
Saturday	9/15/2012	189,389	312,500	955	120,537	381,902	65,808	164,216	246,907
Sunday	9/16/2012	189,565	312,736	1,433	120,577	381,925	65,945	164,521	246,907
Monday	9/17/2012	189,742	312,973	1,911	120,616	381,948	66,083	164,826	246,907
Tuesday	9/18/2012	189,971	313,284	1,914	120,656	382,286	66,188	165,228	246,907
Wednesda	9/19/2012	190,220	313,625	1,932	120,893	382,962	66,319	165,650	246,907
Thursday	9/20/2012	190,440	313,922	2,088	121,122	384,314	66,424	166,043	246,907
Friday	9/21/2012	190,660	314,218	2,244	121,351	387,019	66,528	166,436	246,907
Saturday	9/22/2012	190,870	314,482	2,372	121,579	391,077	66,638	166,790	246,907
Sunday	9/23/2012	191,080	314,745	2,521	121,806	395,134	66,748	167,145	246,907
Monday	9/24/2012	191,289	315,008	2,670	122,033	399,192	66,858	167,499	246,907
Tuesday	9/25/2012	191,570	315,322	2,807	122,259	403,249	66,968	167,980	246,907
Wednesda	9/26/2012	191,732	315,615	2,972	122,485	405,372	67,105	168,216	246,907
Thursday	9/27/2012	191,937	315,809	3,129	122,767	407,495	67,257	168,539	246,907
Friday	9/28/2012	192,072	315,958	3,263	122,938	409,865	67,356	168,734	246,907
Saturday	9/29/2012	192,247	316,207	3,327	122,938	410,655	67,493	169,005	246,907
Sunday	9/30/2012	192,421	316,456	3,392	122,938	411,445	67,629	169,275	246,907
Monday	10/1/2012	192,595	316,705	3,456	122,938	412,235	67,766	169,546	246,907
Tuesday	10/2/2012	192,796	316,932	3,586	123,001	413,520	67,916	169,833	246,907
Wednesda	10/3/2012	193,012	317,216	3,750	123,172	415,385	68,065	170,155	246,907
Thursday	10/4/2012	193,122	317,396	3,863	123,393	416,760	68,171	170,432	246,907
Friday	10/5/2012	193,122	317,610	4,021	123,613	419,387	68,319	170,709	246,907
Saturday	10/6/2012	193,122	317,660	4,130	124,022	422,013	68,457	170,913	246,907
Sunday	10/7/2012	193,122	317,710	4,239	124,431	424,640	68,595	171,118	246,907

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Monday	10/8/2012	193,122	317,760	4,349	124,840	424,941	68,733	171,322	246,907
Tuesday	10/9/2012	193,122	317,909	4,436	124,851	425,242	68,829	171,540	246,907
Wednesda	10/10/2012	193,122	318,207	4,523	124,861	425,844	68,926	171,758	246,907
Thursday	10/11/2012	193,122	318,804	4,696	124,978	427,048	69,119	172,193	246,907
Friday	10/12/2012	193,122	319,028	4,840	125,094	428,584	69,232	172,500	246,907
Saturday	10/13/2012	193,122	319,201	4,950	125,304	430,353	69,362	172,717	246,907
Sunday	10/14/2012	193,122	319,374	5,060	125,514	432,122	69,492	172,934	246,907
Monday	10/15/2012	193,122	319,546	5,170	125,724	433,891	69,622	173,151	246,907
Tuesday	10/16/2012	193,122	319,755	5,298	125,939	434,386	69,757	173,395	246,907
Wednesda	10/17/2012	193,122	319,954	5,418	126,166	435,748	69,862	173,715	246,907
Thursday	10/18/2012	193,256	320,208	5,428	126,385	437,505	69,966	174,050	246,907
Friday	10/19/2012	193,390	320,461	5,438	126,603	439,362	70,175	174,384	246,907
Saturday	10/20/2012	193,526	320,610	5,442	126,640	440,687	70,183	174,559	246,907
Sunday	10/21/2012	193,662	320,759	5,446	126,677	442,011	70,191	174,733	246,907
Monday	10/22/2012	193,798	320,907	5,451	126,714	443,336	70,200	174,908	246,907
Tuesday	10/23/2012	193,942	321,118	5,463	126,824	444,586	70,224	175,125	246,907
Wednesda	10/24/2012	194,086	321,328	5,488	127,045	445,835	70,272	175,342	246,907
Thursday	10/25/2012	194,245	321,527	5,499	127,252	447,378	70,369	175,586	246,907
Friday	10/26/2012	194,416	321,747	5,499	127,448	448,569	70,562	175,865	246,907
Saturday	10/27/2012	194,550	321,893	5,506	127,657	449,445	70,678	176,040	246,907
Sunday	10/28/2012	194,683	322,040	5,514	127,867	450,321	70,795	176,216	246,907
Monday	10/29/2012	194,817	322,187	5,521	128,076	451,197	70,911	176,391	246,907
Tuesday	10/30/2012	194,973	322,449	5,530	128,305	452,273	71,105	176,606	246,907
Wednesda	10/31/2012	195,166	322,710	5,530	128,519	453,790	71,181	176,905	246,907
Thursday	11/1/2012	195,330	322,905	5,540	128,743	455,425	71,291	177,151	246,907
Friday	11/2/2012	195,493	323,100	5,550	128,967	457,060	71,400	177,398	246,907
Saturday	11/3/2012	195,609	323,202	5,550	129,167	458,332	71,518	177,556	246,907
Sunday	11/4/2012	195,726	323,304	5,550	129,368	459,605	71,635	177,713	246,907
Monday	11/5/2012	195,843	323,407	5,550	129,568	460,877	71,753	177,871	246,907
Tuesday	11/6/2012	196,026	323,713	5,572	129,786	462,650	71,877	178,154	246,907
Wednesda	11/7/2012	196,173	323,914	5,585	129,993	464,034	72,006	178,392	246,907
Thursday	11/8/2012	196,327	324,112	5,588	130,190	465,476	72,130	178,654	246,907
Friday	11/9/2012	196,481	324,310	5,590	130,386	466,918	72,254	178,915	246,907
Saturday	11/10/2012	196,569	324,310	5,594	130,529	467,814	72,318	179,017	246,907
Sunday	11/11/2012	196,658	324,310	5,598	130,671	468,710	72,382	179,120	246,907
Monday	11/12/2012	196,746	324,310	5,603	130,814	469,606	72,447	179,222	246,907
Tuesday	11/13/2012	197,011	324,310	5,615	131,242	472,293	72,639	179,572	246,907
Wednesda	11/14/2012	197,254	324,310	5,615	131,473	474,166	72,639	179,946	246,907
Thursday	11/15/2012	197,374	324,474	5,632	131,667	475,054	72,639	180,374	246,907
Friday	11/16/2012	197,671	324,639	5,635	132,079	477,995	72,639	180,525	246,907
Saturday	11/17/2012	197,770	324,749	5,637	132,216	478,975	72,639	180,676	246,907
Sunday	11/18/2012	197,869	324,858	5,640	132,353	479,956	72,639	180,826	246,907
Monday	11/19/2012	197,968	324,968	5,642	132,490	480,936	72,639	180,977	246,907
Tuesday	11/20/2012	198,144	325,184	5,647	132,695	482,548	72,639	181,263	246,907
Wednesda	11/21/2012	198,312	325,398	5,650	132,910	484,086	72,639	181,512	246,907
Thursday	11/22/2012	198,452	325,502	5,654	133,133	485,402	72,639	181,709	246,907
Friday	11/23/2012	198,592	325,605	5,658	133,355	486,718	72,639	181,906	246,907
Saturday	11/24/2012	198,705	325,641	5,660	133,564	487,988	72,639	182,040	246,907
Sunday	11/25/2012	198,817	325,678	5,663	133,773	489,257	72,639	182,173	246,907
Monday	11/26/2012	198,930	325,715	5,665	133,982	490,527	72,639	182,307	246,907
Tuesday	11/27/2012	199,062	325,824	5,667	134,217	492,178	72,639	182,427	246,907
Wednesda	11/28/2012	199,193	326,042	5,669	134,451	493,828	72,639	182,546	246,907
Thursday	11/29/2012	199,455	326,478	5,672	134,538	494,816	72,639	182,785	246,907
Friday	11/30/2012	199,472	326,725	5,679	134,870	496,501	72,639	182,845	246,907
Saturday	12/1/2012	199,489	326,745	5,679	134,988	496,692	72,639	182,865	246,907
Sunday	12/2/2012	199,506	326,765	5,679	135,107	496,884	72,639	182,884	246,907
Monday	12/3/2012	199,524	326,785	5,679	135,225	497,075	72,639	182,904	246,907
Tuesday	12/4/2012	199,592	326,844	5,679	135,344	497,649	72,639	183,023	246,907

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Wednesda	12/5/2012	199,729	326,962	5,679	135,462	498,797	72,639	183,260	246,907
Thursday	12/6/2012	200,003	327,199	5,679	135,581	501,093	0	183,734	246,907
Friday	12/7/2012	200,550	327,673	5,679	136,296	505,685	376	184,683	246,907
Saturday	12/8/2012	200,665	327,776	5,679	136,512	506,975	512	184,829	246,907
Sunday	12/9/2012	200,781	327,880	5,679	136,727	508,264	648	184,974	246,907
Monday	12/10/2012	200,897	327,983	5,679	136,943	509,554	784	185,120	246,907
Tuesday	12/11/2012	201,077	328,159	5,679	137,166	510,583	925	185,261	246,907
Wednesda	12/12/2012	201,257	328,334	5,679	137,389	511,612	1,066	185,401	246,907
Thursday	12/13/2012	201,390	328,421	5,675	137,592	513,670	1,184	185,570	246,907
Friday	12/14/2012	201,503	328,476	5,688	137,760	515,035	1,302	185,663	246,907
Saturday	12/15/2012	201,591	328,527	5,689	137,974	516,209	1,433	185,663	246,907
Sunday	12/16/2012	201,679	328,578	5,689	138,187	517,383	1,565	185,663	246,907
Monday	12/17/2012	201,767	328,629	5,690	138,401	518,557	1,696	185,663	246,907
Tuesday	12/18/2012	201,919	328,766	5,709	138,611	519,980	1,828	185,663	246,907
Wednesda	12/19/2012	202,070	328,903	5,729	138,821	521,402	1,960	185,663	246,907
Thursday	12/20/2012	202,180	329,021	5,735	139,043	522,931	2,088	185,813	246,907
Friday	12/21/2012	202,258	329,060	5,738	139,222	524,271	2,215	185,889	246,907
Saturday	12/22/2012	202,362	329,089	5,740	139,441	525,341	2,352	185,948	246,907
Sunday	12/23/2012	202,466	329,117	5,742	139,660	526,410	2,488	186,006	246,907
Monday	12/24/2012	202,570	329,146	5,745	139,879	527,480	2,625	186,065	246,907
Tuesday	12/25/2012	202,642	329,175	5,750	140,092	529,084	2,757	186,101	246,907
Wednesda	12/26/2012	202,714	329,203	5,754	140,305	530,688	2,888	186,137	246,907
Thursday	12/27/2012	202,792	329,231	5,759	140,491	531,741	3,002	186,176	246,907
Friday	12/28/2012	202,869	329,258	5,764	140,677	532,794	3,116	186,215	246,907
Saturday	12/29/2012	202,939	329,285	5,771	140,899	533,917	3,255	186,235	246,907
Sunday	12/30/2012	203,009	329,311	5,778	141,122	535,041	3,393	186,254	246,907
Monday	12/31/2012	203,079	329,338	5,785	141,345	536,164	3,532	186,274	246,907
Tuesday	1/1/2013	203,152	329,348	5,791	141,537	537,157	3,652	186,289	246,907
Wednesda	1/2/2013	203,224	329,358	5,797	141,729	538,150	3,771	186,304	246,907
Thursday	1/3/2013	203,224	329,491	5,801	141,944	539,018	3,902	186,406	246,907
Friday	1/4/2013	203,224	329,606	5,807	142,127	540,120	4,014	186,522	246,907
Saturday	1/5/2013	203,224	329,679	5,812	142,255	541,190	4,150	186,612	246,907
Sunday	1/6/2013	203,224	329,752	5,817	142,382	542,260	4,285	186,703	246,907
Monday	1/7/2013	203,224	329,825	5,822	142,510	543,330	4,421	186,793	246,907
Tuesday	1/8/2013	203,224	329,934	5,828	142,976	544,652	4,543	187,005	246,907
Wednesda	1/9/2013	203,224	330,109	5,830	143,354	546,081	4,667	187,232	246,907
Thursday	1/10/2013	203,224	330,283	5,832	143,502	547,510	4,790	187,459	246,907
Friday	1/11/2013	203,525	330,501	5,837	143,650	548,999	4,962	187,744	246,907
Saturday	1/12/2013	203,625	330,574	5,841	143,841	550,488	5,080	187,884	246,907
Sunday	1/13/2013	203,726	330,646	5,846	144,032	551,977	5,198	188,023	246,907
Monday	1/14/2013	203,826	330,719	5,851	144,223	553,466	5,316	188,163	246,907
Tuesday	1/15/2013	203,976	330,794	5,857	144,424	554,992	5,440	188,328	246,907
Wednesda	1/16/2013	204,134	330,997	5,860	144,640	556,210	5,566	188,538	246,907
Thursday	1/17/2013	204,278	331,072	5,864	144,876	558,093	5,717	188,538	246,907
Friday	1/18/2013	204,447	331,231	5,868	145,033	559,527	5,829	188,975	246,907
Saturday	1/19/2013	204,526	331,270	5,869	145,172	560,395	5,913	189,065	246,907
Sunday	1/20/2013	204,606	331,309	5,871	145,311	561,262	5,997	189,154	246,907
Monday	1/21/2013	204,686	331,348	5,872	145,450	562,130	6,082	189,244	246,907
Tuesday	1/22/2013	204,925	331,464	5,876	145,627	564,734	6,334	189,512	246,907
Wednesda	1/23/2013	205,083	331,652	5,877	145,803	566,328	6,466	189,746	246,907
Thursday	1/24/2013	205,240	331,840	5,878	146,156	567,921	6,597	189,979	246,907
Friday	1/25/2013	205,415	331,984	5,880	146,509	569,056	6,756	190,244	246,907
Saturday	1/26/2013	205,419	332,259	5,882	146,509	570,723	6,889	190,549	246,907
Sunday	1/27/2013	205,423	332,534	5,884	146,509	572,389	7,022	190,855	246,907
Monday	1/28/2013	205,428	332,810	5,886	146,509	574,056	7,155	191,160	246,907
Tuesday	1/29/2013	205,587	333,012	5,891	146,518	575,482	7,297	191,333	246,907
Wednesda	1/30/2013	205,726	333,124	5,893	146,718	576,820	7,396	191,498	246,907
Thursday	1/31/2013	205,883	333,235	5,898	146,957	578,278	7,480	191,691	246,907

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Friday	2/1/2013	206,040	333,346	5,902	147,196	579,735	7,563	191,885	246,907
Saturday	2/2/2013	206,141	333,400	5,902	147,196	580,957	7,684	192,000	246,907
Sunday	2/3/2013	206,243	333,454	5,902	147,196	582,180	7,806	192,114	246,907
Monday	2/4/2013	206,345	333,508	5,902	147,196	583,402	7,927	192,229	0
Tuesday	2/5/2013	206,496	333,655	5,903	147,723	584,888	8,067	192,443	0
Wednesda	2/6/2013	206,646	333,801	5,904	148,250	586,373	8,206	192,656	0
Thursday	2/7/2013	206,826	333,873	5,904	148,487	587,970	8,312	192,929	0
Friday	2/8/2013	207,086	333,945	5,905	148,724	589,757	8,312	192,937	0
Saturday	2/9/2013	207,207	334,123	5,907	148,937	591,064	8,336	193,098	0
Sunday	2/10/2013	207,327	334,300	5,909	149,151	592,372	8,360	193,259	0
Monday	2/11/2013	207,447	334,478	5,912	149,364	593,679	8,384	193,420	0
Tuesday	2/12/2013	207,580	334,654	5,914	149,558	595,240	8,456	193,567	0
Wednesda	2/13/2013	207,712	334,713	5,916	149,778	596,206	8,509	193,713	0
Thursday	2/14/2013	207,864	334,772	5,918	150,018	597,172	8,619	193,917	0
Friday	2/15/2013	208,016	334,890	5,923	150,258	599,104	8,728	194,120	0
Saturday	2/16/2013	208,136	334,959	5,925	150,462	600,371	8,845	194,268	-
Sunday	2/17/2013	208,255	335,028	5,928	150,667	601,637	8,962	194,417	-
Monday	2/18/2013	208,375	335,097	5,930	150,871	602,904	9,080	194,565	0
Tuesday	2/19/2013	208,375	335,313	5,932	151,104	603,978	9,141	194,850	0
Wednesda	2/20/2013	208,375	335,529	5,934	151,336	605,053	9,202	195,135	0
Thursday	2/21/2013	208,375	335,687	5,938	151,511	607,202	9,282	195,310	0
Friday	2/22/2013	208,375	335,910	5,940	151,773	608,698	9,440	195,639	70
Saturday	2/23/2013	208,375	335,987	5,943	151,978	609,908	9,557	195,781	243
Sunday	2/24/2013	208,375	336,065	5,946	152,182	611,118	9,674	195,923	415
Monday	2/25/2013	208,375	336,143	5,949	152,387	612,328	9,790	196,065	588
Tuesday	2/26/2013	208,377	336,325	5,951	152,611	614,161	9,925	196,341	770
Wednesda	2/27/2013	208,513	336,444	5,953	152,798	615,369	10,019	196,476	957
Thursday	2/28/2013	208,662	336,511	5,955	153,011	616,849	16	196,691	1143
Friday	3/1/2013	208,831	336,625	5,959	153,253	618,089	137	196,940	1294
Saturday	3/2/2013	208,981	336,723	5,961	153,458	619,632	170	197,151	1,462
Sunday	3/3/2013	209,131	336,821	5,963	153,663	621,175	202	197,361	1,630
Monday	3/4/2013	209,281	336,919	5,965	153,869	622,718	234	197,572	1797
Tuesday	3/5/2013	209,402	336,966	5,966	154,034	623,766	331	197,748	1,820
Wednesda	3/6/2013	209,523	337,059	5,967	154,198	624,814	525	197,923	2,042
Thursday	3/7/2013	209,764	337,246	5,969	154,526	626,909	912	198,273	2,287
Friday	3/8/2013	209,992	337,375	5,969	154,770	628,555	1065	198,641	2,475
Saturday	3/9/2013	210,071	337,392	5,970	154,984	629,646	1,192	198,679	2,652
Sunday	3/10/2013	210,151	337,410	5,970	155,198	630,737	1,320	198,717	2,829
Monday	3/11/2013	210,231	337,428	5,970	155,412	631,828	1447	198,755	3,007
Tuesday	3/12/2013	210,389	337,429	5,971	155,412	633,558	1569	198,844	3,172
Wednesda	3/13/2013	210,531	337,471	5,972	155,412	635,288	1715	198,981	3,322
Thursday	3/14/2013	210,700	337,484	5,971	155,412	635,760	1838	199,155	3,448
Friday	3/15/2013	211,011	337,630	5,972	155,412	638,690	2110	199,582	3,857
Saturday	3/16/2013	211,115	337,679	5,972	155,412	639,667	2,200	199,724	3,993
Sunday	3/17/2013	211,218	337,727	5,972	155,412	640,643	2,290	199,867	4,130
Monday	3/18/2013	211,322	337,776	5,972	155,412	641,620	2381	200,009	4,266
Tuesday	3/19/2013	211,483	337,927	5,972	155,412	643,037	2512	200,270	4,453
Wednesda	3/20/2013	211,643	338,078	5,972	155,412	644,453	2642	200,530	4,640
Thursday	3/21/2013	211,826	338,150	5,972	155,574	645,597	2793	200,841	4,861
Friday	3/22/2013	211,952	338,218	5,972	155,784	647,353	2892	201,015	5,027
Saturday	3/23/2013	212,087	338,246	5,972	156,007	648,854	3,023	201,207	5,232
Sunday	3/24/2013	212,221	338,274	5,972	156,231	650,356	3,155	201,398	5,437
Monday	3/25/2013	212,356	338,302	5,972	156,455	651,857	3286	201,590	5,642
Tuesday	3/26/2013	212,509	338,396	5,973	156,678	653,338	3421	201,848	5,864
Wednesda	3/27/2013	212,672	338,453	5,944	156,898	654,552	3552	202,126	6,038
Thursday	3/28/2013	212,817	338,542	5,973	157,128	656,096	3672	202,305	6,244
Friday	3/29/2013	212,962	338,630	5,973	157,316	657,393	3809	202,594	6,422
Saturday	3/30/2013	213,103	338,646	5,973	157,544	658,951	3,943	202,804	6,628

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Sunday	3/31/2013	213,244	338,661	5,974	157,772	660,508	4,078	203,014	6,835
Monday	4/1/2013	213,384	338,677	5,974	158,001	662,066	4212	203,224	7,041
Tuesday	4/2/2013	213,515	338,878	5,974	158,196	663,507	4326	203,342	7,235
Wednesda	4/3/2013	213,661	338,933	5,974	158,412	664,727	4423	203,461	7,394
Thursday	4/4/2013	213,806	338,987	5,974	158,627	665,946	4519	203,698	7,553
Friday	4/5/2013	213,953	339,096	5,974	158,848	668,384	4712	204,172	7,871
Saturday	4/6/2013	214,092	339,130	5,974	159,056	669,789	4,839	204,420	8,057
Sunday	4/7/2013	214,230	339,163	5,974	159,265	671,193	4,967	204,668	8,244
Monday	4/8/2013	214,369	339,196	5,974	159,473	672,598	5,094	204,916	8,430
Tuesday	4/9/2013	214,513	339,352	5,974	159,535	674,215	5,219	205,119	8,634
Wednesda	4/10/2013	214,679	339,429	5,976	159,772	675,902	5,364	205,397	8,646
Thursday	4/11/2013	214,794	339,452	5,978	159,972	677,295	5,479	205,557	9,058
Friday	4/12/2013	214,954	339,492	5,978	160,186	678,484	5,616	205,807	9,212
Saturday	4/13/2013	215,095	339,518	5,978	160,386	679,981	5,747	206,045	9,418
Sunday	4/14/2013	215,235	339,545	5,978	160,587	681,477	5,877	206,282	9,623
Monday	4/15/2013	215,376	339,571	5,977	160,787	682,974	6,008	206,520	9,829
Tuesday	4/16/2013	215,533	339,719	5,977	161,068	684,473	6,141	206,809	10,033
Wednesda	4/17/2013	215,634	339,814	5,977	161,234	685,890	6,236	206,950	10,230
Thursday	4/18/2013	215,775	339,925	5,985	161,234	687,335	6,372	207,162	10,427
Friday	4/19/2013	215,989	340,036	5,991	161,234	688,802	6,495	207,468	10,623
Saturday	4/20/2013	216,132	340,125	5,992	161,234	690,240	6,626	207,712	10,824
Sunday	4/21/2013	216,276	340,214	5,992	161,234	691,678	6,757	207,957	11,024
Monday	4/22/2013	216,420	340,303	5,993	161,234	693,116	6,888	208,201	11,225
Tuesday	4/23/2013	216,586	340,420	5,995	161,442	694,707	7,024	208,501	11,437
Wednesda	4/24/2013	216,751	340,536	5,996	161,649	696,298	7,159	208,802	11,649
Thursday	4/25/2013	216,904	340,633	5,996	161,875	697,579	7,775	209,088	11,818
Friday	4/26/2013	217,099	340,713	5,996	162,146	699,095	7,781	209,406	12,019
Saturday	4/27/2013	217,218	340,762	5,996	162,356	700,554	7,783	209,628	12,218
Sunday	4/28/2013	217,338	340,811	5,996	162,566	702,012	7,785	209,849	12,416
Monday	4/29/2013	217,457	340,860	5,996	162,775	703,471	7,787	210,071	12,615
Tuesday	4/30/2013	217,640	341,055	5,997	163,010	705,174	7,923	210,413	12,835
Wednesday	5/1/2013	217,799	341,135	5,997	163,228	706,347	8,049	210,710	13,021
Thursday	5/2/2013	217,958	341,213	5,997	163,445	707,521	8,174	211,006	13,207
Friday	5/3/2013	218,133	341,320	5,997	163,660	709,868	8,301	211,361	13,430
Saturday	5/4/2013	218,237	341,400	5,997	163,807	710,860	8,301	211,514	13,556
Sunday	5/5/2013	218,341	341,479	5,997	163,953	711,852	8,301	211,668	13,681
Monday	5/6/2013	218,445	341,559	5,997	164,100	712,845	8,301	211,821	13,807
Tuesday	5/7/2013	218,756	341,797	5,997	164,540	715,821	8,301	212,481	14,183
Wednesday	5/8/2013	218,909	341,875	5,997	164,779	717,455	8,344	212,753	14,407
Thursday	5/9/2013	219,065	341,928	5,997	164,999	719,094	8,442	213,018	14,601
Friday	5/10/2013	219,196	341,961	5,997	165,227	720,214	8,584	213,253	14,758
Saturday	5/11/2013	219,303	342,025	5,997	165,455	721,757	8,709	213,394	14,972
Sunday	5/12/2013	219,410	342,088	5,997	165,683	723,301	8,834	213,534	15,185
Monday	5/13/2013	219,518	342,152	5,997	165,912	724,844	8,959	213,675	15,399
Tuesday	5/14/2013	219,607	342,155	5,997	166,102	726,372	9,089	213,859	15,597
Wednesday	5/15/2013	219,722	342,159	5,997	166,306	727,526	9,200	214,077	15,745
Thursday	5/16/2013	219,836	342,212	5,997	166,578	729,258	9,306	214,279	15,974
Friday	5/17/2013	219,979	342,251	5,997	166,762	730,373	9,420	214,540	16,122
Saturday	5/18/2013	220,046	342,260	5,997	166,906	731,311	9,490	214,747	16,254
Sunday	5/19/2013	220,112	342,268	5,997	167,051	732,249	9,560	214,953	16,385
Monday	5/20/2013	220,179	342,277	5,997	167,195	733,187	9,630	215,160	16,516
Tuesday	5/21/2013	220,379	342,303	5,997	167,628	736,000	9,840	215,221	16,910
Wednesday	5/22/2013	220,491	342,360	5,997	167,863	737,436	9,954	215,430	17,131
Thursday	5/23/2013	220,615	342,360	5,997	167,959	738,542	10,038	215,659	17,285
Friday	5/24/2013	220,728	342,361	5,997	168,054	740,117	10,502	215,869	17,502
Saturday	5/25/2013	220,797	342,362	5,997	168,201	741,059	10,520	216,000	17,635
Sunday	5/26/2013	220,866	342,362	5,997	168,349	742,002	10,537	216,131	17,768
Monday	5/27/2013	220,935	342,363	5,997	168,496	742,944	10,555	216,262	17,901

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Tuesday	5/28/2013	221,142	342,366	5,997	168,939	745,771	10,608	216,654	18,299
Wednesday	5/29/2013	221,252	342,392	5,997	169,143	746,967	10,722	216,869	18,480
Thursday	5/30/2013	221,375	342,410	5,997	169,368	748,274	10,843	217,114	18,666
Friday	5/31/2013	221,478	342,450	5,997	169,586	749,915	10,930	217,330	18,885
Saturday	6/1/2013	221,598	342,554	5,997	169,816	751,445	11,014	217,607	19,091
Sunday	6/2/2013	221,717	342,659	5,997	170,045	752,975	11,098	217,884	19,297
Monday	6/3/2013	221,836	342,763	5,997	170,275	754,505	11,181	218,161	19,504
Tuesday	6/4/2013	221,934	342,800	5,997	170,443	755,672	11,235	218,369	19,663
Wednesday	6/5/2013	222,064	342,915	5,997	170,648	757,104	11,309	218,657	19,858
Thursday	6/6/2013	222,226	343,029	5,997	170,929	758,536	11,405	219,027	20,053
Friday	6/7/2013	222,326	343,102	5,997	171,290	759,903	11,491	219,242	20,240
Saturday	6/8/2013	222,463	343,226	5,997	171,448	761,430	11,555	219,540	20,443
Sunday	6/9/2013	222,601	343,349	5,997	171,606	762,956	11,619	219,837	20,647
Monday	6/10/2013	222,738	343,473	5,997	171,763	764,483	11,682	220,135	20,850
Tuesday	6/11/2013	222,912	343,543	5,997	171,962	765,858	11,743	220,431	21,038
Wednesday	6/12/2013	223,029	343,665	5,997	172,194	767,238	11,811	220,790	21,212
Thursday	6/13/2013	223,174	343,751	5,997	172,418	768,794	11,876	221,128	21,428
Friday	6/14/2013	223,276	343,863	5,997	172,620	770,480	11,928	221,387	21,632
Saturday	6/15/2013	223,406	343,953	5,997	172,849	771,874	11,987	221,649	21,780
Sunday	6/16/2013	223,535	344,043	5,997	173,078	773,267	12,045	221,912	21,929
Monday	6/17/2013	223,665	344,133	5,997	173,307	774,661	12,104	222,174	22,077
Tuesday	6/18/2013	223,744	344,258	5,997	173,479	776,192	12,168	222,422	22,432
Wednesday	6/19/2013	223,888	344,413	5,997	173,737	779,331	12,277	222,729	22,694
Thursday	6/20/2013	224,017	344,486	5,997	173,935	779,958	12,339	223,293	22,849
Friday	6/21/2013	224,145	344,558	5,997	174,133	780,584	12,401	223,346	23,004
Saturday	6/22/2013	224,179	344,608	5,997	174,180	780,584	12,421	223,398	23,055
Sunday	6/23/2013	224,213	344,659	5,997	174,227	780,584	12,441	223,451	23,106
Monday	6/24/2013	224,247	344,709	5,997	174,275	780,584	12,462	223,503	23,157
Tuesday	6/25/2013	224,349	344,860	5,997	174,416	780,584	12,522	223,713	23,310
Wednesday	6/26/2013	224,553	345,162	5,997	174,698	785,085	12,703	224,133	23,616
Thursday	6/27/2013	224,961	345,246	5,997	175,262	789,586	12,884	224,973	24,228
Friday	6/28/2013	225,096	345,401	5,997	175,659	790,950	12,931	225,163	24,410
Saturday	6/29/2013	225,211	345,499	5,997	175,806	792,414	12,977	225,461	24,607
Sunday	6/30/2013	225,325	345,597	5,997	175,953	793,877	13,023	225,760	24,803
Monday	7/1/2013	225,440	345,695	5,997	176,100	795,341	13,069	226,058	25,000
Tuesday	7/2/2013	225,550	345,695	5,997	176,204	796,815	13,117	226,058	25,180
Wednesday	7/3/2013	225,688	345,892	5,997	176,308	798,289	13,165	226,599	25,359
Thursday	7/4/2013	225,813	345,972	5,997	176,533	799,705	13,209	226,928	25,561
Friday	7/5/2013	225,937	346,052	5,997	176,758	801,120	13,253	227,257	25,763
Saturday	7/6/2013	226,058	346,169	5,997	176,976	802,595	13,287	227,533	25,960
Sunday	7/7/2013	226,179	346,286	5,997	177,194	804,071	13,320	227,810	26,157
Monday	7/8/2013	226,300	346,403	5,997	177,412	805,546	13,354	228,086	26,354
Tuesday	7/9/2013	226,427	346,515	5,997	177,623	806,647	13,401	228,358	26,537
Wednesday	07/10/13	226,544	346,717	5,997	177,832	808,459	13,434	228,623	26,777
Thursday	07/11/13	226,656	346,788	5,997	178,028	809,709	13,464	228,859	26,949
Friday	07/12/13	226,815	346,899	5,997	178,258	811,043	13,537	229,194	27,335
Saturday	07/13/13	226,952	346,986	5,997	178,467	812,498	13,561	229,542	27,463
Sunday	07/14/13	227,090	347,074	5,997	178,675	813,952	13,586	229,891	27,592
Monday	07/15/13	227,227	347,162	5,997	178,884	815,407	13,610	230,239	27,720
Tuesday	07/16/13	227,355	347,256	5,997	179,087	816,854	13,655	230,476	27,911
Wednesday	07/17/13	227,482	347,349	5,997	179,290	818,300	13,700	230,743	28,102
Thursday	07/18/13	227,627	347,421	5,997	179,505	819,741	13,744	231,060	28,305
Friday	07/19/13	227,772	347,494	5,997	179,719	821,181	13,788	231,377	28,507
Saturday	07/20/13	227,897	347,566	5,997	179,932	822,656	13,832	231,592	28,705
Sunday	07/21/13	228,021	347,639	5,997	180,144	824,132	13,875	231,808	28,903
Monday	07/22/13	228,146	347,712	5,997	180,357	825,607	13,919	232,023	29,101
Tuesday	07/23/13	228,270	347,757	5,997	180,571	826,899	13,971	232,286	29,304
Wednesday	07/24/13	228,393	347,802	5,997	180,785	828,190	14,022	232,548	29,506

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Thursday	07/25/13	228,533	347,915	5,997	181,005	829,691	14,060	232,815	29,719
Friday	07/26/13	228,672	348,027	5,997	181,225	831,192	14,097	233,082	29,931
Saturday	07/27/13	228,781	348,093	5,997	181,434	832,544	14,132	233,291	30,139
Sunday	07/28/13	228,891	348,158	5,997	181,643	833,896	14,167	233,501	30,347
Monday	07/29/13	229,001	348,224	5,997	181,852	835,248	14,202	233,710	30,555
Tuesday	07/30/13	229,137	348,252	5,997	182,092	836,603	14,257	233,919	30,747
Wednesday	07/31/13	229,277	348,361	5,997	182,273	838,038	14,306	234,266	30,969
Thursday	08/01/13	229,425	348,416	5,997	3	839,584	14,345	234,517	31,185
Friday	08/02/13	229,510	348,441	5,997	192	841,028	14,376	234,758	31,389
Saturday	08/03/13	229,629	348,466	5,997	401	842,431	14,414	234,985	31,603
Sunday	08/04/13	229,747	348,490	5,997	611	843,833	14,452	235,212	31,816
Monday	08/05/13	229,866	348,515	5,997	820	845,236	14,489	235,439	32,030
Tuesday	08/06/13	229,996	348,589	5,997	1,034	846,632	14,510	235,655	32,237
Wednesday	08/07/13	230,126	348,737	5,997	1,248	848,028	14,530	235,871	32,444
Thursday	08/08/13	230,297	348,788	5,997	1,514	849,409	14,604	236,216	32,664
Friday	08/09/13	230,408	348,808	5,997	1,692	850,790	14,630	236,428	32,832
Saturday	08/10/13	230,517	348,840	5,997	1,912	852,167	14,679	236,664	33,023
Sunday	08/11/13	230,625	348,871	5,997	2,131	853,544	14,728	236,900	33,213
Monday	08/12/13	230,733	348,902	5,997	2,350	854,921	14,777	237,136	33,403
Tuesday	08/13/13	230,878	348,955	5,997	2,529	856,351	14,799	237,332	33,583
Wednesday	08/14/13	231,062	349,004	5,997	2,783	858,151	14,862	237,603	33,762
Thursday	08/15/13	231,177	349,119	5,997	2,953	859,326	14,882	237,922	33,960
Friday	08/16/13	231,488	349,349	5,997	3,374	860,748	14,940	238,250	34,297
Saturday	08/17/13	231,592	349,426	5,997	3,514	862,161	14,999	238,567	34,409
Sunday	08/18/13	231,695	349,502	5,997	3,655	863,574	15,057	238,883	34,521
Monday	08/19/13	231,799	349,579	5,997	3,795	864,987	15,116	239,200	34,633
Tuesday	08/20/13	231,953	349,711	5,997	4,004	865,864	15,167	239,500	34,851
Wednesday	08/21/13	232,106	349,842	5,997	4,213	866,741	15,217	239,745	35,069
Thursday	08/22/13	232,302	349,978	5,997	4,418	869,231	15,267	240,095	35,274
Friday	08/23/13	232,436	350,057	5,997	4,627	870,683	15,339	240,403	35,491
Saturday	08/24/13	232,596	350,147	5,997	4,819	872,176	15,391	240,693	35,710
Sunday	08/25/13	232,756	350,238	5,997	5,011	873,669	15,444	240,982	35,929
Monday	08/26/13	232,916	350,329	5,997	5,204	875,162	15,497	241,272	36,148
Tuesday	08/27/13	233,050	350,462	5,997	5,377	876,655	15,513	241,516	36,369
Wednesday	08/28/13	233,257	350,647	5,997	5,593	878,005	15,558	241,831	36,621
Thursday	08/29/13	233,430	350,828	5,997	5,773	879,450	15,601	242,240	36,801
Friday	08/30/13	233,576	350,991	5,997	5,866	881,005	15,616	242,506	37,027
Saturday	08/31/13	233,682	351,120	5,997	5,926	881,891	15,648	242,715	37,172
Sunday	09/01/13	233,789	351,249	5,997	5,986	882,776	15,681	242,924	37,317
Monday	09/02/13	233,896	351,378	5,997	6,046	883,662	15,713	243,134	37,463
Tuesday	09/03/13	234,215	351,466	5,997	6,225	886,318	15,810	243,761	37,898
Wednesday	09/04/13	234,399	351,652	5,997	6,500	887,721	15,872	244,094	38,128
Thursday	09/05/13	234,583	351,838	5,997	6,775	889,124	15,934	244,426	38,358
Friday	09/06/13	234,747	351,990	5,997	6,985	890,521	15,973	244,840	38,583
Saturday	09/07/13	234,747	351,997	5,997	7,168	891,848	16,015	245,162	38,796
Sunday	09/08/13	234,747	352,003	5,997	7,351	893,174	16,057	245,483	39,010
Monday	09/09/13	234,747	352,009	5,997	7,534	894,501	16,100	245,805	39,223
Tuesday	09/10/13	234,747	352,709	5,997	7,726	895,987	16,200	246,167	39,455
Wednesday	09/11/13	234,747	352,885	5,997	7,939	897,472	16,262	246,453	39,685
Thursday	09/12/13	234,747	353,089	5,997	8,039	898,698	16,317	246,716	39,855
Friday	09/13/13	234,747	353,270	5,997	8,319	900,254	16,428	247,055	40,095
Saturday	09/14/13	234,760	353,436	5,997	8,543	901,754	16,489	247,411	40,323
Sunday	09/15/13	234,772	353,602	5,997	8,767	903,253	16,549	247,767	40,552
Monday	09/16/13	234,785	353,768	5,997	8,991	904,753	16,610	248,123	40,780
Tuesday	09/17/13	234,917	353,892	5,997	9,185	905,843	16,646	248,398	40,948
Wednesday	09/18/13	235,099	354,096	5,997	9,426	907,310	16,713	248,718	41,225
Thursday	09/19/13	235,326	354,297	5,997	9,642	908,777	16,786	249,112	41,391
Friday	09/20/13	235,426	354,297	5,997	9,843	910,296	16,828	249,388	41,613

Appendix A
University of Arizona Daily Production Records, 2006 through 2013

Day	Date	Aggie	Architecture	CRB	Martin St.	North	Op Sci	Park	South
Saturday	09/21/13	235,600	354,297	5,997	10,045	911,276	16,886	249,700	41,830
Sunday	09/22/13	235,774	354,297	5,997	10,246	912,255	16,945	250,013	42,047
Monday	09/23/13	235,948	354,297	5,997	10,447	913,235	17,003	250,325	42,263
Tuesday	09/24/13	236,122	354,297	5,997	10,656	916,173	17,111	250,583	42,500
Wednesday	09/25/13	236,288	354,297	5,997	10,864	917,518	17,213	250,876	42,693
Thursday	09/26/13	236,483	354,297	5,997	11,081	918,930	17,326	251,206	42,906
Friday	09/27/13	236,693	354,297	5,997	11,296	920,393	17,432	251,461	43,139
Saturday	09/28/13	236,812	354,297	5,997	11,512	921,747	17,555	251,705	43,362
Sunday	09/29/13	236,931	354,297	5,997	11,728	923,102	17,679	251,950	43,585
Monday	09/30/13	237,050	354,297	5,997	11,944	924,456	17,803	252,194	43,807
Tuesday	10/01/13	237,193	354,297	5,997	12,167	926,061	17,924	252,439	44,046
Wednesday	10/02/13	237,335	354,297	5,997	12,389	927,666	18,045	252,683	44,285
Thursday	10/03/13	237,496	354,297	5,997	12,587	928,948	18,154	252,957	44,493
Friday	10/04/13	237,656	354,297	5,997	12,784	930,230	18,263	253,230	44,701
Saturday	10/05/13	237,816	354,297	5,997	12,996	931,639	18,387	253,463	44,917
Sunday	10/06/13	237,976	354,297	5,997	13,209	933,049	18,510	253,697	45,132
Monday	10/07/13	238,136	354,297	5,997	13,421	934,458	18,633	253,930	45,347
Tuesday	10/08/13	238,302	354,297	5,997	13,638	935,856	18,759	254,229	45,558
Wednesday	10/09/13	238,461	354,297	5,997	13,854	937,374	18,877	254,460	45,793
Thursday	10/10/13	238,612	354,297	5,997	14,064	938,762	18,989	254,747	46,028
Friday	10/11/13	238,760	354,297	5,997	14,277	940,143	19,116	254,947	46,241
Saturday	10/12/13	238,904	354,297	5,997	14,490	941,475	19,234	255,150	46,452
Sunday	10/13/13	239,048	354,297	5,997	14,702	942,806	19,352	255,352	46,663
Monday	10/14/13	239,191	354,297	5,997	14,914	944,138	19,470	255,555	46,874
Tuesday	10/15/13	239,347	354,297	5,997	15,139	945,506	19,722	255,796	47,097
Wednesday	10/16/13	239,503	354,297	5,997	15,364	946,873	19,782	256,036	47,319
Thursday	10/17/13	239,705	354,297	5,997	15,576	948,176	19,842	256,363	47,548
Friday	10/18/13	239,826	354,297	5,997	15,768	949,740	19,949	256,514	47,777
Saturday	10/19/13	239,969	354,297	5,997	15,981	950,913	20,071	256,717	47,989
Sunday	10/20/13	240,112	354,297	5,997	16,195	952,085	20,193	256,920	48,202
Monday	10/21/13	240,256	354,297	5,997	16,408	953,258	20,315	257,123	48,414
Tuesday	10/22/13	240,436	354,297	5,997	16,641	954,974	20,449	257,402	48,656
Wednesday	10/23/13	240,603	354,297	5,997	16,859	956,452	20,577	257,614	48,898
Thursday	10/24/13	240,735	354,297	5,997	17,036	957,783	20,681	257,878	49,097
Friday	10/25/13	240,887	354,297	5,997	17,244	959,060	20,801	258,111	49,301
Saturday	10/26/13	241,035	354,419	5,997	17,457	960,273	20,927	258,341	49,515
Sunday	10/27/13	241,184	354,541	5,997	17,669	961,487	21,053	258,572	49,729
Monday	10/28/13	241,332	354,664	5,997	17,882	962,700	21,179	258,802	49,943
Tuesday	10/29/13	241,451	354,908	5,997	17,913	964,350	21,304	259,037	50,161
Wednesday	10/30/13	241,610	355,222	5,997	17,913	965,247	21,438	259,298	50,430
Thursday	10/31/13	241,788	355,425	5,997	17,917	966,144	21,578	259,481	50,619
Friday	11/01/13	241,912	355,658	5,997	17,921	968,729	21,693	259,669	50,829
Saturday	11/02/13	242,071	355,910	5,997	17,923	970,339	21,829	259,905	51,069
Sunday	11/03/13	242,230	356,162	5,997	17,926	971,948	21,965	260,142	51,308
Monday	11/04/13	242,390	356,414	5,997	17,929	973,558	22,101	260,378	51,547
Tuesday	11/05/13	242,508	356,644	5,997	18,017	974,946	22,219	260,544	51,756
Wednesday	11/06/13	242,625	356,874	5,997	18,104	976,333	22,336	260,709	51,965
Thursday	11/07/13	242,792	357,087	5,997	18,335	979,034	22,476	260,938	52,156
Friday	11/08/13	242,902	357,333	5,997	18,512		22,579	261,101	52,392

Appendix H

University of Arizona Water Supply Information

H-1 UA Response to Water Provider Questionnaire

H-2 Select Photographs of UA Water Supply Wells

H-3 UA Memorandum for Groundwater Pumping Rates

1. PLANNING DOCUMENTS

a. *Please provide copies of any available documents useful in planning for water needs within your service area, including any water resources plans, land use plans, population projections, and capital improvement plans.*

The University of Arizona's water system is a Public Water system (PWSID 20-423) regulated by the Arizona Department of Environmental Quality (ADEQ). The system supplies potable water and reclaimed water to University facilities on the main campus and the Arizona Health Sciences Center (AHSC) campuses.

The source of water for the system includes eight groundwater wells, eleven principal metered connections to the Tucson Water potable water system, and one reclaimed water metered connection to the Tucson Water system; refer to Figures 2 and 3. The distribution system consists of piping within tunnels and direct buried distribution mains. The system provides potable water to the University facilities, however fire protection water on the campus is provided by the Tucson Water system.

Figure 1 indicates the existing Campus Planning Area Boundary and the area currently serviced the water system. The Comprehensive Campus Plan can be downloaded at http://www.pdc.arizona.edu/resources/documents/UACCP-2009Update_Final_web.pdf and the University's Capital Improvement Plan can be downloaded at http://www.pdc.arizona.edu/resources/documents/Current_CIP.pdf. The Comprehensive Campus Plan indicates that the campus facilities will expand from the current 10.7 gross square feet to approximately 20.6M square feet in the next 20 years.

To meet the planned growth on the campus, near term capital improvements plans for the water system include:

- Replacement of the North Well
- Replacement of the CRB well.
- Construct water storage facilities in the system.
- Construct main line extensions.

2. CURRENT WATER USES

a. In acre feet per year, how much water do you currently provide to customers within your service area? Please provide a map of your service area.

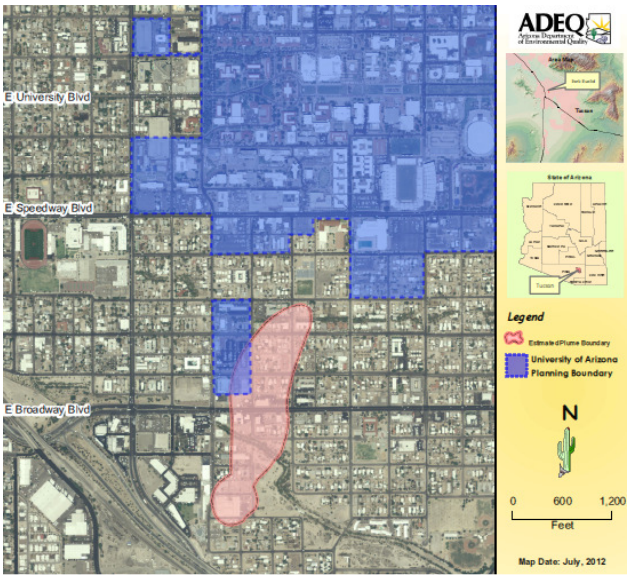
The attached Figure 1 indicates the service area for the University's water system.

Based on records for the period between January 2014 and December 2014, the University supplied the following to their customers:

- Groundwater well production 1,055.58 AF
- Potable water purchased 407.05 AF
- Reclaimed water purchased 201.78 AF
- Total 1,664.41 AF

b. In acre feet per year, how much water do you serve within the Park – Euclid WQARF Site?

Currently the University does not supply water to any customers within the Park – Euclid WQARF site. For clarity, there is a portion of the Campus Planning area within the WQARF site as indicated below. However the University's water system currently does not extend to this area and the all University customers in this area are served by Tucson Water.



c. In either percentage or volume, estimate the amount of water currently put to the following end uses:

• Municipal	1.445 AF
• Industrial (Non-municipal)	0 AF
• Agricultural	0 AF
• Turf Irrigation/Landscaping	222 AF
• Recreational	0 AF

d. Do you currently deliver water for potable use? If so, please provide information regarding the quantity delivered and the number of customers and service connections.

Results for analytical testing of the groundwater and the distribution system did not indicate any parameters exceeding the MCL's. Analytical results are on file with ADEQ.

3. CURRENT WATER SOURCES

a. How much of the water you provide within your service area is groundwater?

Groundwater well production by University wells in 2014 was 1,055.58 AF. Additionally a portion of the potable water purchased from Tucson Water could be groundwater.

b. How much of the water you provide within your service area is surface water?

Surface water – 0 AF. The campus utilizes water harvesting for irrigation, however this water is not metered.

c. How much of the water you provide within your service area is reclaimed water?

Reclaimed water purchased from Tucson Water in 2014 was 201.78 AF

d. Do you serve water from any other sources?

No.

e. *What are other sources of water available to you?*

Currently the University receives potable water and reclaimed water through metered connections to the Tucson Water Public Water system. No other water source is available.

f. *Do you have a contract for Central Arizona Project water?*

Currently the University does not have a contract for Central Arizona Project water.

g. *How much of the water you provide in your service area is from wells within the Park – Euclid WQARF Site boundary? Please provide well location coordinates and well construction information for these wells.*

There are no University wells within the Park- Euclid WQARF site as defined by the plume indicated on the map provided with the Questionnaire. A map of the University's groundwater wells are indicated on the attached Figure 2. Coordinates are provided on Sheet 2 of Figure 2.

h. *How much of the water you provide in your service area is from wells within five miles outside of the Park - Euclid plume boundary? Please provide well location coordinates and well construction information for these wells.*

All groundwater production within the University's water system is within 5 miles of the Park- Euclid WQARF plume boundary as define on the map provided with the Questionnaire.

i. *In acre feet per year, please provide the groundwater production for each well identified in 3g and 3h above.*

Well Name	ADWR No.	2014 Production (AF)
Agriculture (Aggie)	55-618687	126.29
Architectural	55-618691	178.93
CRB	55-528535	0.00
Martin Street	55-618690	218.99
North	55-618688	53.89
Optical Sciences	55-201737	139.62
Park	55-217003	193.94
South	55-618689	143.93

4. IMPAIRED WELLS

a. *Please provide a list of any production wells within your service area that currently produce water that contains contaminants, regardless of the suspected source, and identify the contaminant names and most recent concentrations.*

None

b. *Using the provided plume map as a guide, please identify and provide a location for any of your production wells that are downgradient of the Park - Euclid plume boundary.*

Potentially all 8 wells.

c. *Using the provided plume map as a guide, please identify and provide a location for any of your production wells that are within one mile outside the Park – Euclid plume boundary.*

Well Name	ADWR No.	Approximate Distance from Plume (FT)
Agriculture (Aggie)	55-618687	2,350
Architectural	55-618691	3,850
CRB	55-528535	4,650
Martin Street	55-618690	2,250
Optical Sciences	55-201737	2,850
Park	55-217003	2,175

d. *Please identify any wells that have been shut down due to contamination. For each well, please provide any available information regarding dates and levels of contamination.*

None

5. TREATMENT AND DELIVERY SYSTEM

a. *Please describe or provide documents describing any current treatment of the water provided within your service area.*

Groundwater is disinfected at the well heads.

b. *Please provide a map of your current system.*

Please refer to the attached Figures 1 and 2.

c. ***Are there physical constraints in your system in terms of limited*** *space at well sites or system bottlenecks that would be relevant to well modification, replacement, or treatment?*

Yes, land use limitations at the campus well site are very constrained. The existing and planned development within the campus planning area poses a number of issues in regards to expansion of the well sites and for the development of new well site or treatment facilities.

6. FUTURE WATER USES

a. *Please describe current land uses in your service area, and any changing land uses that might impact future water needs within your service area.*

As indicated above, the Comprehensive Campus projects significant growth within the Campus Planning area.

b. *Please describe any past or current changes in your service area that might be predictive of future changes.*

As growth on the campus occurs, the active service area for the University's water system will expand to the campus Planning Boundary.

c. *Please provide any information about customer growth over time.*

The demands for water are directly proportional to the planned growth on the campus.

d. *Please describe any current plans for modification or additions to your treatment or delivery systems.*

Currently there are no plans to modify or add additional water treatment facilities.

e. *Do you currently have plans to drill new wells or replace existing wells? Please provide any available information about the planned locations and details of well completion.*

Plans to develop a replacement well for the existing CRB and North wells are being developed. Both wells will be at the same approximately location (within 660' of the existing well).

7. WATER PROVIDER SYSTEM REQUIREMENTS

a. *Is your delivery system a transportation or distribution system? Please describe.*

The University's potable and reclaimed water systems are distribution systems, conveying water from the sources indicated above to University facilities.

b. *Are there portions of your service area that are unavailable for location of future wells? Please describe.*

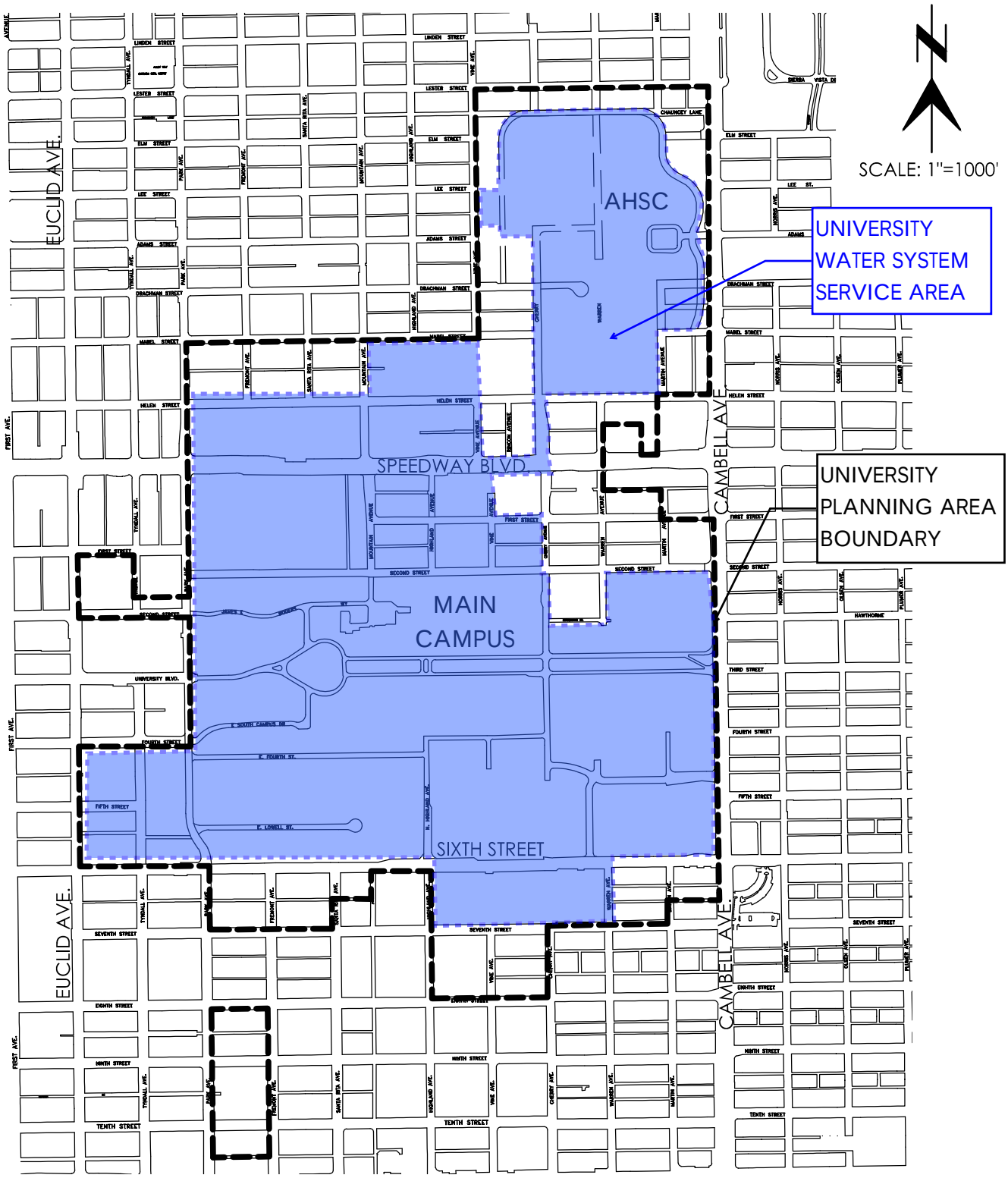
Based on the Comprehensive Campus Plan, locations for new wells that provide adequate maintenance access are very limited.

c. *Please provide any additional information about unique system requirements that might constrain use of alternative water supplies or water treatment systems.*

Cost of water and the interconnection with the existing water distribution system.

d. *Are you currently regulated as a Public Water System under the Safe Drinking Water Act?*

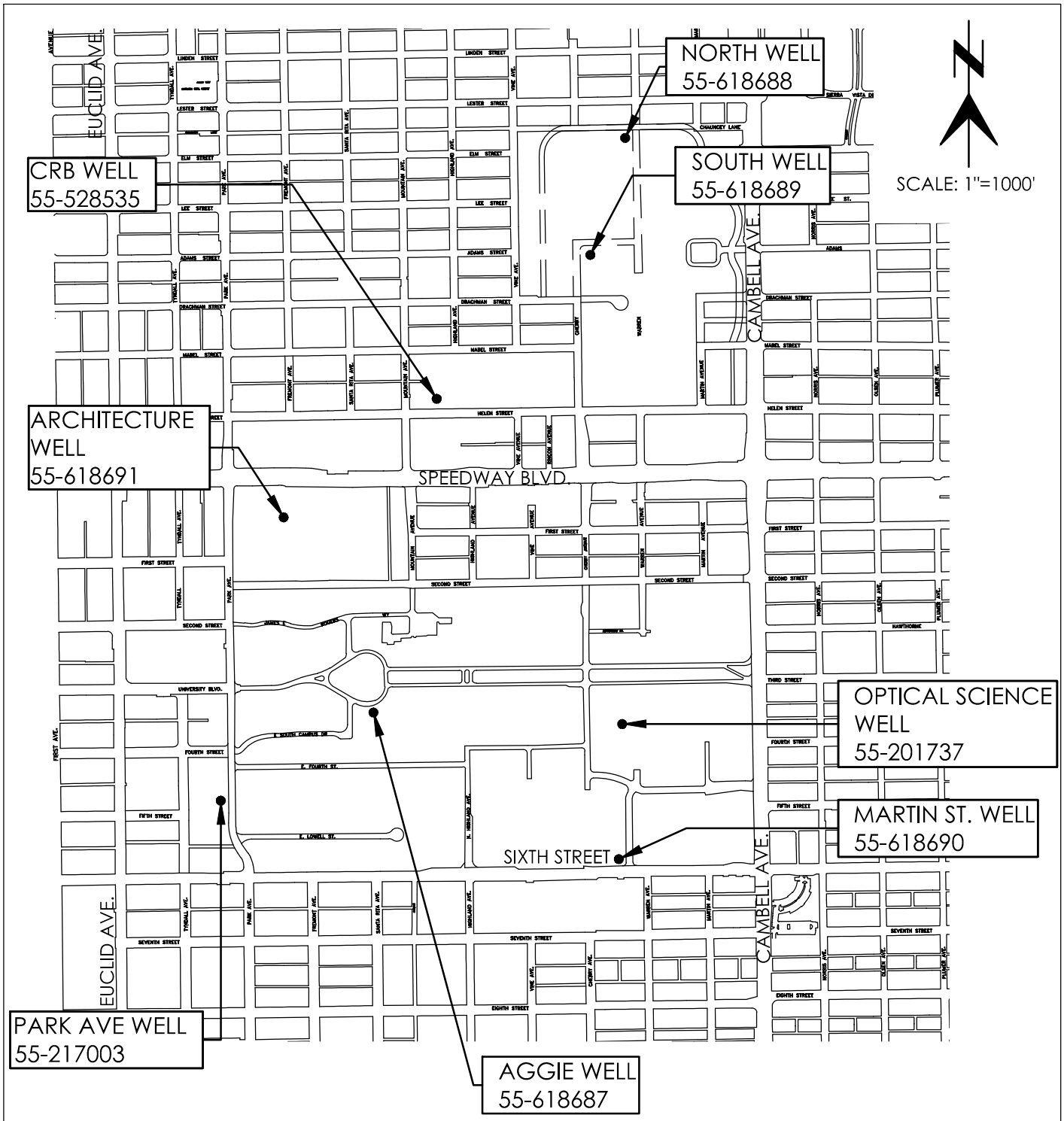
The University's water system is regulated as a Public Water System.



THE UNIVERSITY OF ARIZONA
FACILITY MANAGEMENT

FIGURE 1
WATER SYSTEM
SYSTEM MAP

SHEET 1 OF 1



THE UNIVERSITY OF ARIZONA
FACILITY MANAGEMENT

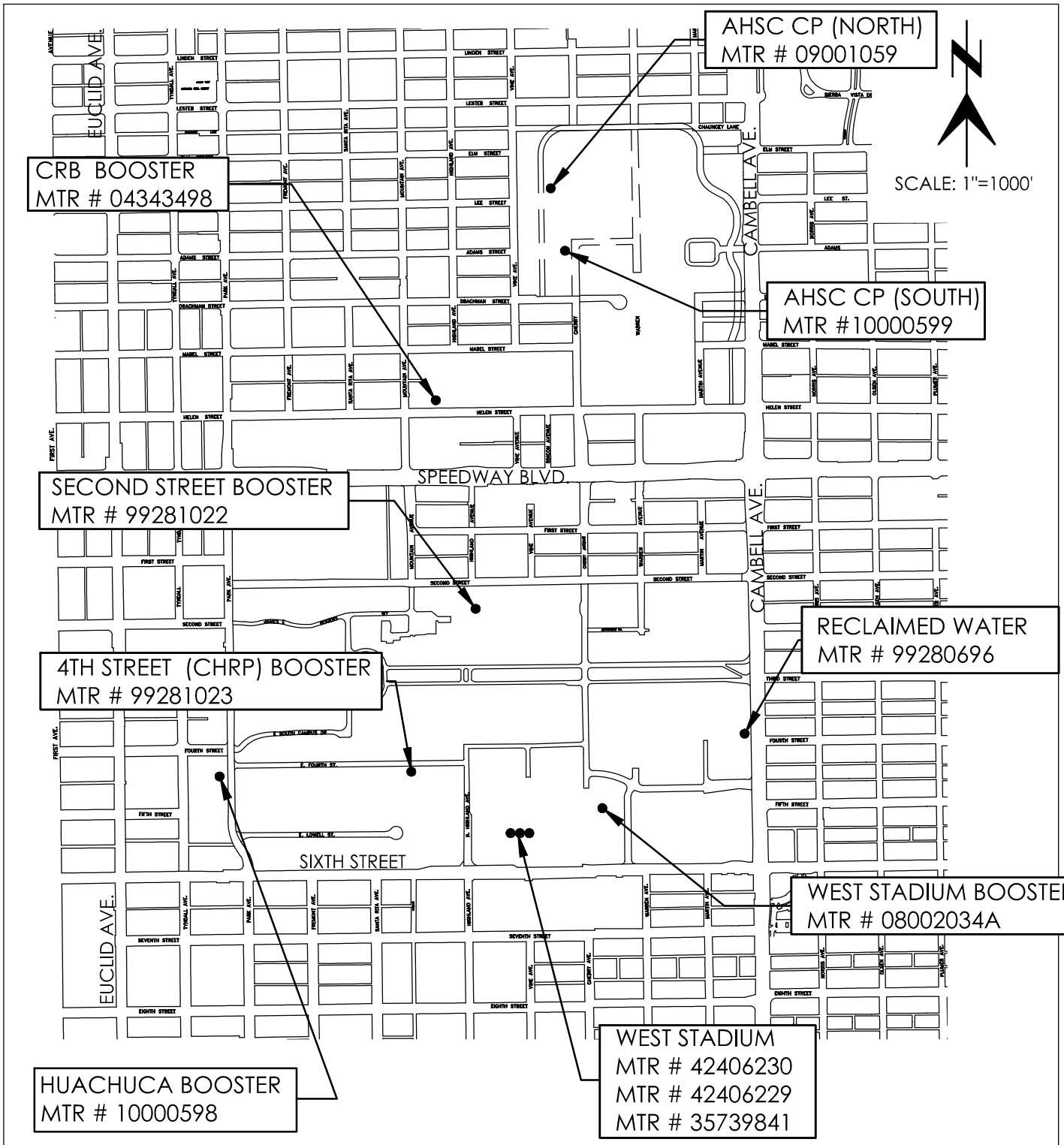
FIGURE 2
WATER SYSTEM
WELL MAP

SHEET 1 OF 2

WELL INFORMATION			
WELL NAME	NO.	LAT	LONG
NORTH	55-618688	32.2431	-110.9471
SOUTH	55-618689	32.2407	-110.9477
OPTICAL SCIENCE	55-201737	32.2308	-110.9469
MARTIN ST.	55-618690	32.2280	-110.9454
AGGIE	55-618687	32.2312	-110.9534
PARK AVE.	55-217003	32.2297	-110.9569
ARCHITECTURE	55-618691	32.2353	-110.9544
CRB	55-5285.35	32.2375	-110.9520

THE UNIVERSITY OF ARIZONA
FACILITY MANAGEMENT

FIGURE 2
WATER SYSTEM
WELL MAP
TABLE
SHEET 2 OF 2



THE UNIVERSITY OF ARIZONA
FACILITY MANAGEMENT

FIGURE 3
WATER SYSTEM
TUCSON WATER
INTERCONNECTION
SHEET 1 OF 2

TUCSON WATER METER INFORMATION		
NAME	ADDRESS	METER
AHSC CP (NORTH)	1652 N. RING RD	9001059
AHSC CP (SOUTH)	1501 N. CHEERY AVE	10000599
CRB BOOSTER	1331 E. HELEN ST.	4343498
SECOND STREET BOOSTER	1400 E. SECOND ST.	99281022
4TH STREET BOOSTER (CHRP)	1300 4TH ST.	99281023
HUACHUCA BOOSTER	621 N. PARK	10000598
WEST STADIUM	1435 E. 5TH ST. #1	42406230
WEST STADIUM	1435 E. 5TH ST. #2	42406229
WEST STADIUM	1435 E. 5TH ST #3	35739841
WETS STADIUM BOOSTER	525 N. CHERRY AVE.	08002034A
RECLAIMED WATER	601 N. CAMBELL AVE.	99280696

THE UNIVERSITY OF ARIZONA
FACILITY MANAGEMENT

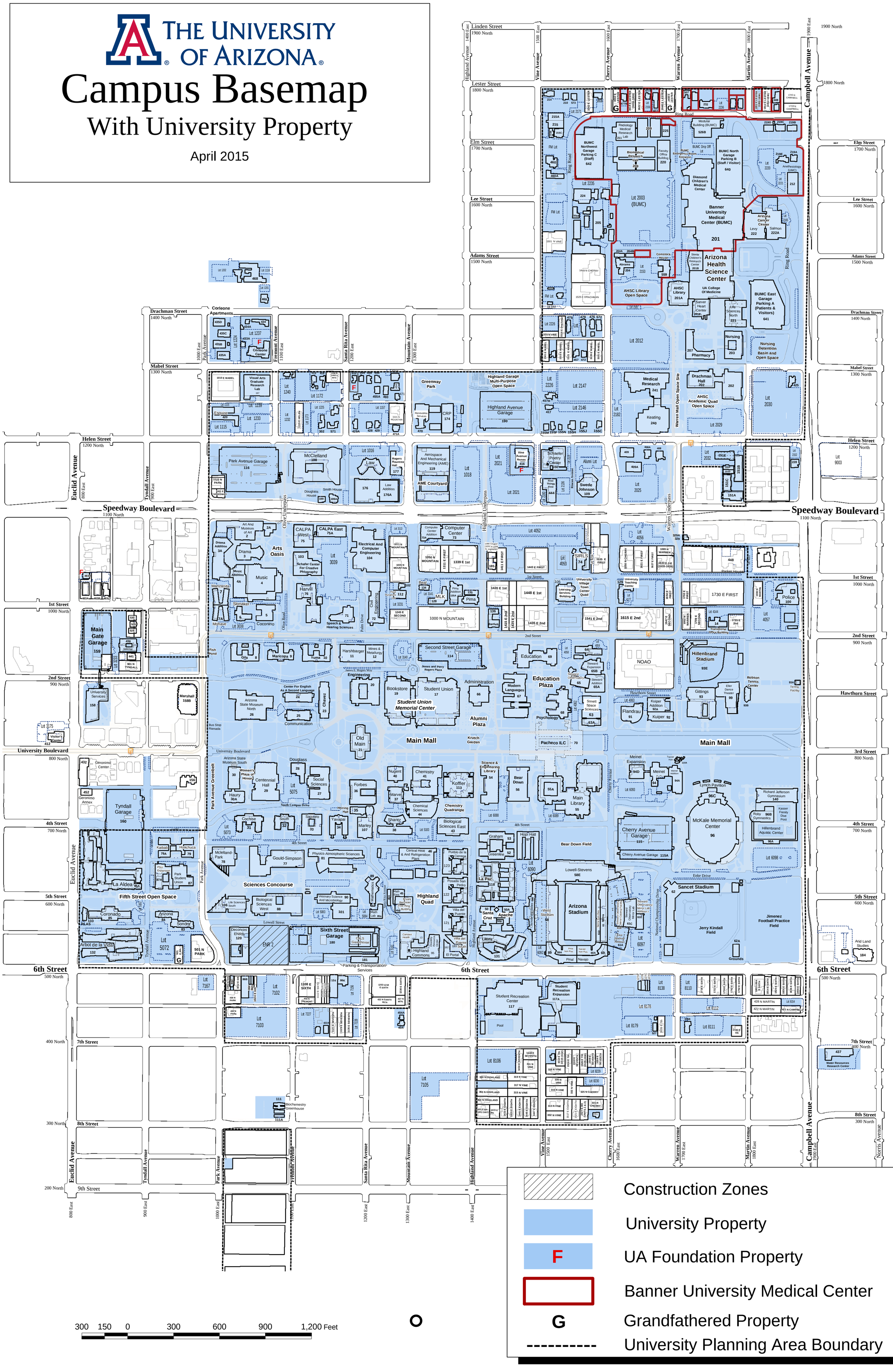
FIGURE 3
WATER SYSTEM
TUCSON WATER
INTERCONNECTION TABLE
SHEET 2 OF 2

THE UNIVERSITY OF ARIZONA

Campus Basemap

With University Property

April 2015



The University of Arizona - Planning, Design, and Construction

Photo	Well:
1	Martin

Direction Taken:
West-Northwest

Description:

Fenced area around Martin.

Photo	Well:
2	Park

Direction Taken:
North

Description:

Fenced area outside of Park.

Photo	Well:
3	Park

Direction Taken:
North

Description:

Staging/access area and storage tank for Park

Photo	Well:
4	Park

Direction Taken:
North

Description:

Piping/dosing for Park

Photo 5	Well: Aggie
Direction Taken: North	
Description: Wellhead in basement of building below vault.	

Photo 6	Well: Aggie
Direction Taken: Northeast	
Description: Dosing and conveyance for Aggie in basement.	

Photo 7	Well: Aggie
Direction Taken: West/Upward	
Description: Access vault to wellhead.	

Photo 8	Well: Aggie
Direction Taken: West	
Description: Access vault to wellhead	

GLHN ARCHITECTS & ENGINEERS, INC
2939 E Broadway Blvd | Tucson, AZ 85716
T520.881.4546 | F520.795.1822 | GLHN.com

MEMORANDUM

TO: **Robert Boudra, R.G.**
AECOM
Denver, CO

FROM: John C. McGann
GLHN Architects & Engineers, Inc.
2939 E Broadway Blvd.
Tucson, AZ 85716

REFERENCE: Project Name: Park – Euclid WQARF
University of Arizona
Water System

GLHN Job No.: 1435.07

SUBJECT: Projected Groundwater Withdrawals

DATE: June 22, 2015

Based on discussions during our phone conversation of June 16, 2015, we reviewed our responses to Water Provider Questionaire and the projection of future groundwater withdrawals on the campus:

As indicated in the response to Question 1a, the source of water for the University's water system includes eight groundwater wells, eleven principal metered connections to the Tucson Water potable water system and one reclaimed water metered connection to the Tucson Water system. The basic system functions with the wells being based loaded and the various connections to the Tucson Water system supplying the campus demand which exceeds the well capacity. From a potable water standpoint, approximately

The responses to the Questionaire also noted that the 2009 Update to the Comprehensive Campus Plan indicated that the campus facilities will expand from the current 10.7 gross square feet to approximately 20.6M square feet in the next 20 years. As Christopher Kopach, noted in our conversation, due to the current economic climate, the growth rate of the campus may be less than what is indicated in the Comprehensive Plan.

In review of existing data, we made the following assumption in projecting the future groundwater withdrawals from the University's groundwater wells:

1. Based on current trends, the annual growth rate for campus facilities was estimated to be 2.5%.

2. The configuration of the water system will remain with the University groundwater wells and future storage tanks being based loaded and demands in excess of the capacity of the University's water system will be augmented by metered services from the Tucson Water public water system.

3. Agriculture Well (55-618687) – Base on the location of the well in the water system and the areas of planned growth on the campus, the increase in the annual production for this well was assumed to be 0.50% per year.

4. Architectural Well (55-618691) – This well is fairly responsive to the campus demands, and is within the zone of influence of the development occurring north of Speedway

Boulevard. However this increase will be mitigated by the redevelopment of the CRB well. It is assume that the production of this well will increase 1.00% per year.

5. CRB Well (55-528535) – The CRB well has been taken out of service due to failures in the gravel pack and screens. The replacement of the well was scheduled to be part of a current project, however funding for the well portion of the project has been delayed. It is assumed that the replacement well will be completed in 2018, refer to Figure 1

   The proposed improvements include a replacement well, storage tank and booster pumps. The location of this well is near the centroid of the demands on the the northern half of the campus. It is anticipated that the production for this well will increase approximately 2% initially, and after additional growth occurs on the north campus the annual increase in production will increase to 5% in the later years due to the proximity of the central plant.

6. Martin Street Well (55-618690) – This well is based loaded on the system and we anticipate minor increases in production.

7. North Well (55-618688) – To accommodate the expansion of the hospital, this well is scheduled to be replaced in 2016 as indicated on Figure 2. It is proposed that in association with the replacement well storage be added to the site. While the principle supply to the hospital will remain a connection to Tucson Water, the associated demands for the central plant will remain connected to the University's water system.

8. Optical Sciences Well (55-201737) – Due to the nature of the well we are assuming a minor increase (+/- 0.5% / year) in the future withdrawal for this well.

9. Park Ave Well (55-217003) – The Park Ave Well is fairly responsible to demand on the system. It is anticipated that the majority of the additional production will occur in the later years when the area south of Sixth Street is developed.

10. South Well (55-618689) – There are several structural issues with the well and may need to be replaced in the next several years.

Utilizing the above assumptions, Table A, indicates the anticipated groundwater production from the University wells. If you have questions regarding this information, please contact us.

INITIALS:
JCM

Figure 1 - CRB Well

Scale: 1:1,200

Figure 2 - North Well

Scale: 1:1,200

University of Arizona
Groundwater Production

	Well No.	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Base Total Potable Water Demand (AF)		1,480																									
Annual Demand Growth Factor		2.50%																									
Projected Potable Water Demand		1,480	1,517	1,555	1,594	1,634	1,674	1,716	1,759	1,803	1,848	1,895	1,942	1,990	2,040	2,091	2,143	2,197	2,252	2,308	2,366	2,425	2,486	2,548	2,612	2,677	2,744
Agriculture (Aggie)	55-618687																										
Annual Production Rate Factor		0.50%																									
Projected Withdrawal (AF)		126	127	128	128	129	129	130	131	131	132	133	133	134	135	135	136	137	137	138	139	140	140	141	142	142	143
Architectural	55-618691																										
Annual Production Rate Factor		2.00%																									
Projected Withdrawal (AF)		179	183	186	190	194	198	202	206	210	214	218	222	227	231	236	241	246	251	256	261	266	271	277	282	288	294
CRB Well	55-528535																										
Annual Production Rate Factor					2.00%			2.50%					3.00%					3.50%					4.00%				
Projected Withdrawal (AF)		-	-	-	300	306	312	320	328	336	345	353	364	375	386	397	409	424	439	454	470	486	506	526	547	569	592
Martin Street	55-618690																										
Annual Production Rate Factor		0.05%																									
Projected Withdrawal (AF)		219	219	219	219	219	220	220	220	220	220	220	220	220	220	221	221	221	221	221	221	221	221	221	222	222	222
North Well	55-618688																										
Annual Production Rate Factor		2.00%																									
Projected Withdrawal (AF)		54	200	204	208	212	216	221	225	230	234	239	244	249	254	259	264	269	275	280	286	291	297	303	309	315	322
Optical Sciences	55-201737																										
Annual Production Rate Factor		0.50%																									
Projected Withdrawal (AF)		140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
Park Ave	55-217003																										
Annual Production Rate Factor		2.00%						2.50%					3.00%					3.50%					4.00%				
Projected Withdrawal (AF)		194	195	196	197	198	199	204	209	214	220	225	232	239	246	253	261	270	280	289	299	310	322	335	349	363	377
South Well	55-618689																										
Annual Production Rate Factor		1.00%				2%																					
Projected Withdrawal (AF)		144	145	146	147	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
Total Well production (AF)		1,056	1,209	1,220	1,532	1,602	1,620	1,644	1,668	1,693	1,718	1,744	1,773	1,803	1,834	1,865	1,897	1,934	1,971	2,010	2,049	2,090	2,136	2,183	2,232	2282.19	2334.3315
Water Supplied by Tucson Water (AF)		424	308	334	62	32	55	73	91	111	130	151	169	187	206	226	246	263	281	299	317	335	350	365	380	395	410
	Replacement Well complete																										

Appendix I

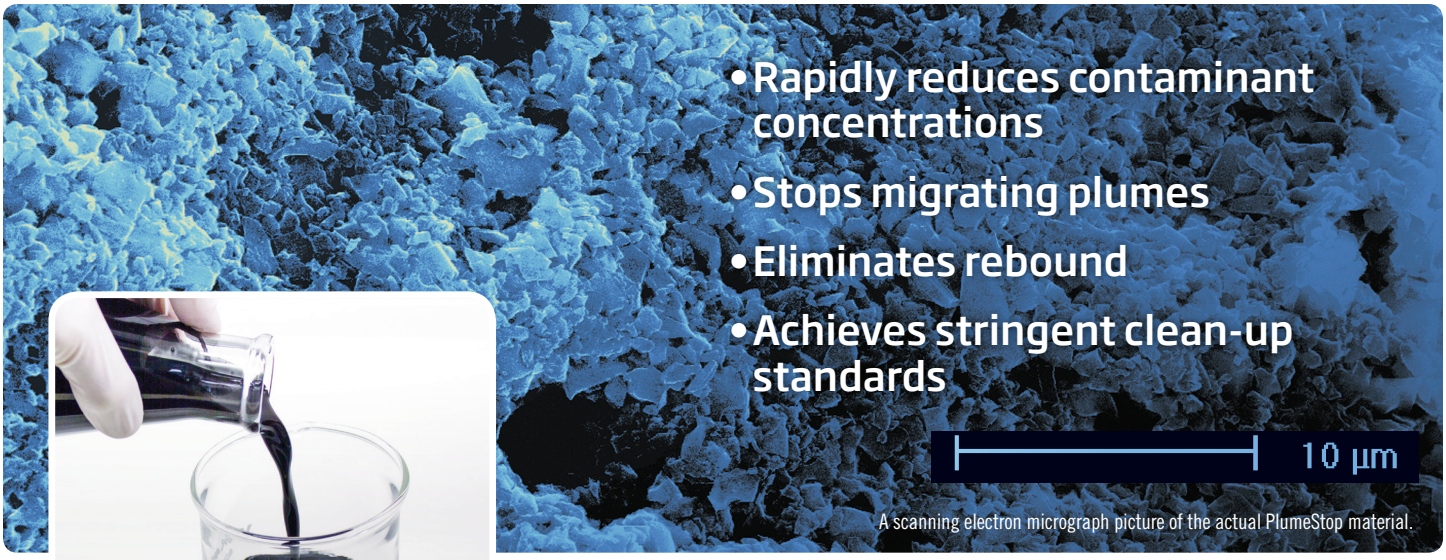
PlumeStop™ Information

I-1 PlumeStop™ Product Information

I-2 PlumeStop™ Site Applicability Tech Memo

PlumeStop™
COLLOIDAL BIOMATRIX

plumestop.com



A scanning electron micrograph picture of the actual PlumeStop material.

PlumeStop liquid-based remediation substrate

PlumeStop provides remediation professionals with these additional benefits:

- Eliminates problematic back-diffusing contaminants and associated rebound
- Distributes widely into contaminated zones under low injection pressures (a clear advantage over hard to distribute, powdered activated carbon products)
- Effectively treats a range of petroleum and chlorinated hydrocarbons
- Packaged in liquid form for clean and simple subsurface injection

PlumeStop™ is an innovative, in situ remediation substrate which quickly and effectively treats contaminated groundwater. It does this through the use of highly dispersible, fast-acting, sorption-based technology which captures and concentrates dissolved-phase contaminants within its structure. Once contaminants are sorbed, biodegradation processes proceed at an accelerated rate.

PlumeStop is an environmentally friendly, patent-pending product based on the use of unique, biologically enriching polymers to suspend a colloidal-scale solid sorbent material. This highly dispersible sorbent pulls contaminants directly from groundwater and stimulates their biodegradation in situ.

Once in place PlumeStop is expected to last for decades with minimal impact on aquifer oxidation-reduction potential or geochemistry.

To learn more about PlumeStop visit plumestop.com or contact your local REGENESIS Remediation Technologies representative.

REGENESIS

regenesis.com

PlumeStop™
LIQUID ACTIVATED CARBON™

PlumeStop Technical Bulletin 3.1

Post-Sorption Contaminant Biodegradation

Quick Reference:

- Post-sorption contaminant biodegradation
- Net acceleration of contaminant biodegradation rate

Background

PlumeStop™ Liquid Activated Carbon™ is composed of very fine particles of activated carbon (1-2 µm) suspended in water through the use of unique organic polymer dispersion chemistry. Once in the subsurface the material behaves as a colloidal biomatrix, sorbing to the aquifer matrix, rapidly removing contaminants from groundwater and expediting permanent contaminant biodegradation.

Wide-Area Dispersive Distribution

Unlike any other sorbent technology, PlumeStop can be emplaced in the subsurface through dispersive flow from low-pressure injection (without fracturing the formation), providing a wide-area thin-film coating of the aquifer matrix through which it passes. It does not create preferential flow pathways, plug the formation, or compromise monitoring-wells through extreme carbon loading in contrasting respect to the majority of the surrounding porosity (i.e. the porosity external to the fractures or 'soil partings' themselves) as may be the case with pressure-emplaced powdered activated carbon products. More information on low-pressure ease of distribution and dispersive emplacement of PlumeStop can be found in PlumeStop Technical Bulletin 1.1: Distribution through a Permeable Medium.

Rapid Removal of Contaminants from Groundwater

PlumeStop rapidly sorbs organic contaminants from aqueous solution (hours). Pollutants partition directly into the PlumeStop particles sorbed to the soil formation, removing the pollutants from groundwater. Contaminant advection in the aqueous phase is therefore eliminated (i.e. the *plume* is *stopped*) and partitioning into the vapor-phase is also reduced (Henry's Law). Results can be dramatic, with groundwater cleanup objectives often met within

© Regenesis 2015

days of PlumeStop application. Information on the sorption of contaminants by PlumeStop can be found in PlumeStop Technical Bulletin 2.1: Sorption of Contaminants from Solution.

Acceleration of Contaminant Biodegradation

Once in place and with contaminants partitioned onto its surface, PlumeStop is colonized by contaminant-degrading bacteria. These may be naturally present or applied as an inoculum. The combination of a degradative microflora and the target contaminant in local abundance (i.e. concentrated on the PlumeStop rather than dispersed in the groundwater and formation) reduces mass-transfer kinetic constraints and supports greater speed and efficiency of degradation. The net result is a substantial increase in the instantaneous rate and extent of contaminant destruction.

Biodegradation Study

Study Objective

The present study provides an illustration of the synergy of sorption and degradation of PlumeStop. Both post-sorption degradation and the net effect on degradation rate are evaluated.

Test Procedure

Batch-equilibrium samples were prepared in 227 ml (8 oz.) amber serum bottles sealed with Mininert™ valves (Figure 1). All bottles contained 10 g of site soil and 70 mL of water spiked with 3 mg of benzene, thereby filling approximately one third of the container volume. The resulting headspace in the bottles provided adequate oxygen to maintain aerobic status throughout the study. The four conditions tested are summarized in Table 1.

Table 1. Batch-Equilibrium Study – Conditions tested.

Condition	Description
Sterile control	Autoclaved soil and sodium azide (abiotic control)
Live control	Natural soil (biotic control)
PlumeStop Treated	Soil and PlumeStop (biotic test)
Sterile PlumeStop Treated	Autoclaved soil, PlumeStop and sodium azide (abiotic test)

© Regenesis 2015

The conditions were tested in parallel, and run over a period of 28 days. Microcosms were sampled destructively in triplicate on days 1, 7, 14, 21 and 28. Benzene was quantified in the aqueous phase, and also as a mass-balance extract of the total soil-water system (i.e. the aqueous and solid-phase microcosm contents together).

Figure 1. Batch-Equilibrium Study – Experimental Set-up

Test Results

Aqueous-phase concentrations of benzene are presented graphically in Figure 2. Data from the total system extractions are presented in Figure 3.

Figure 2 illustrates a rapid and significant reduction in aqueous-phase benzene concentration in both the biotic and abiotic PlumeStop systems within the first sampling period. Thereafter, the aqueous benzene concentration in the biotic PlumeStop system continued to decrease to non-detect levels, whereas that in the abiotic PlumeStop control remained broadly static. Benzene concentrations in the soil-only control (biotic, no PlumeStop) changed little in the first week suggestive of an acclimation period, and thereafter declined steadily. Benzene concentrations in the soil-only sterile control did not change significantly for the first 21 days but showed a minor decrease thereafter.

© Regenesis 2015

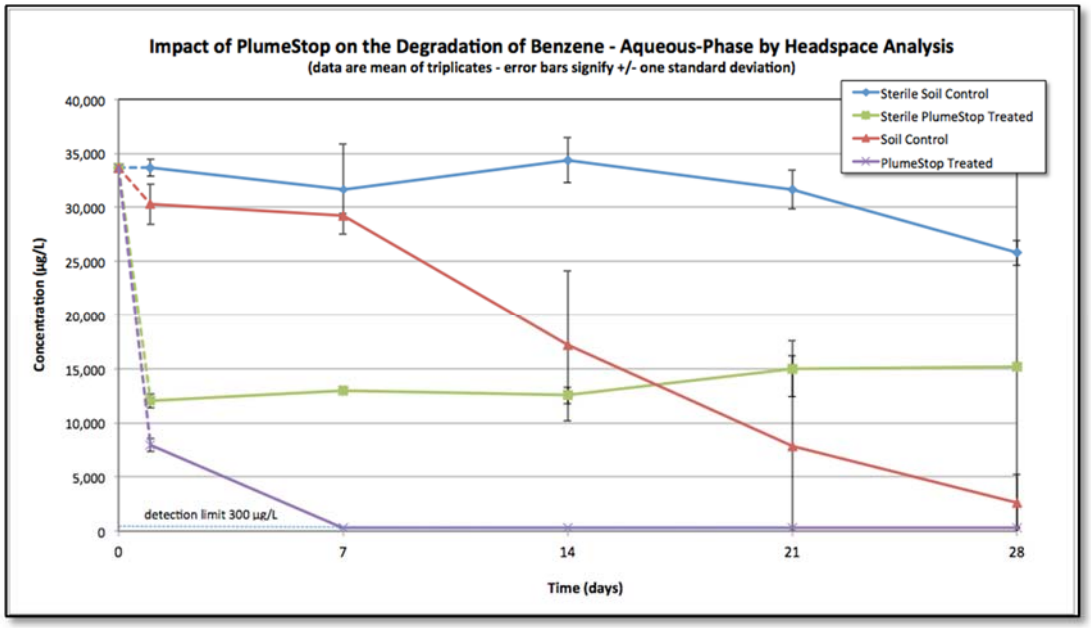


Figure 2. Batch-Equilibrium Study – Aqueous-Phase Results

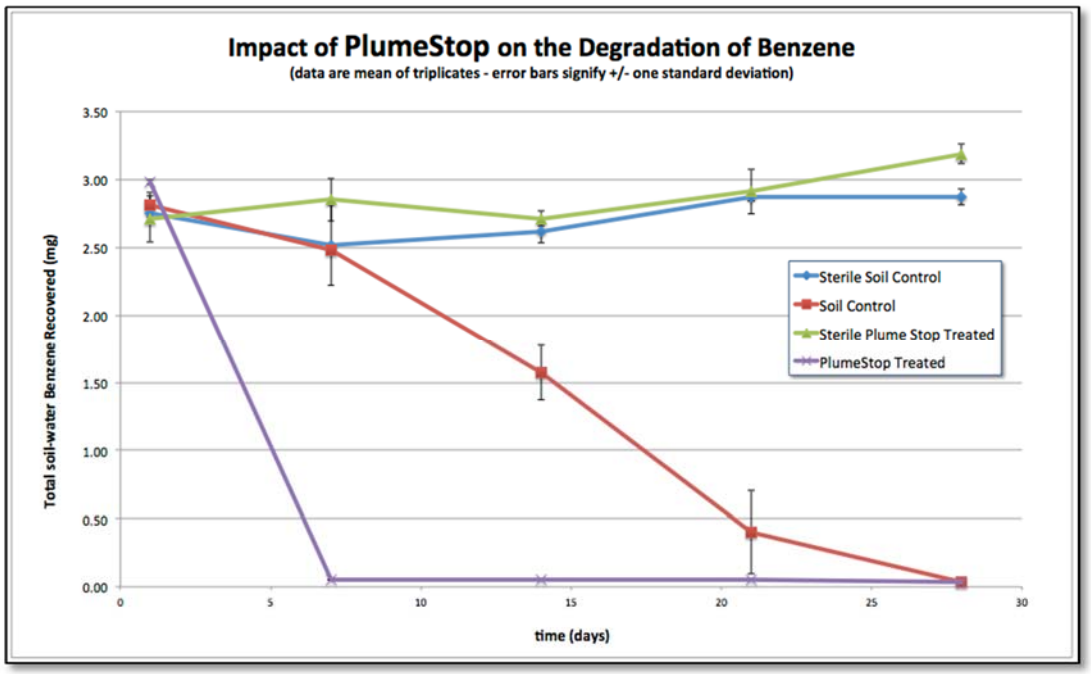


Figure 3. Batch-Equilibrium Study – Total System Extraction

© Regenesis 2015

Total system extract data (both soil and water combined) are presented in Figure 3. In both the sterile control and the sterile PlumeStop treated samples, the total benzene mass remained constant at approximately 3 mg throughout the entire experiment. In contrast, the benzene concentrations in both biotic systems declined through the course of the experiment, however the decline was markedly sharper in the PlumeStop-treated system, reaching the detection limit by the seven-day time point compared to a 90% reduction at 28 days for the soil-only system.

Test Conclusion

The rapid and significant reductions in the aqueous-phase benzene concentration over the first sampling period in both the biotic and abiotic PlumeStop systems, in contrast with the soil-only controls, may reasonably be attributed to abiotic sorption processes (Figure 2). The continued concentration reduction in the biotic PlumeStop system is consistent with a destructive process as opposed to further sorption, since the aqueous benzene concentration in the abiotic PlumeStop control remained constant. Biodegradation would clearly be the most logical mechanism given that the system was biotic, differing only from the abiotic PlumeStop control in that it was not poisoned.

The destruction is further confirmed in the total system extractions (Figure 3), in which the full initial mass of benzene was recovered from the abiotic PlumeStop control, confirming non-destructive abiotic sorption (and also extraction-method validation). In contrast, the mass-balance of benzene in the biotic systems with and without PlumeStop describes a destructive reduction, consistent with biodegradation. Benzene was fully degraded in the biotic PlumeStop system within the first seven days of the test, in contrast with 12.5% degraded over the same period in the biotic control. This approximates to a half-life of less than one day in the biotic PlumeStop system as compared to ten days in the biotic control. This would represent a >10x rate increase (based on the first-order approximation) over biotic aqueous rates, which are themselves consistent with published literature[i].

Summary

Together the above study shows clearly that sorption of contaminants onto PlumeStop does not inhibit their subsequent biodegradation, but rather, the rate of degradation is significantly stimulated by amendment with PlumeStop.

© Regenesis 2015

PlumeStop™
LIQUID ACTIVATED CARBON™

[i] P. H. Howard, R. S. Boethling, W. F. Jarvis, W. M. Meylan, E. M. Michalenko, Handbook of Environmental Degradation Rates,*Lewis Publishers, Inc.* ISBN 0 87371, 3 (1991).

PlumeStop is manufactured and distributed for sale by REGENESIS, San Clemente, CA, USA.
For more information or to contact a technical representative visit www.regenesis.com.

REGENESIS
Technology-Based Solutions for the Environment

1011 Calle Sombra
San Clemente, CA 92673
949-366-8000
www.regenesis.com

© Regenesis 2015

PlumeStop™
LIQUID ACTIVATED CARBON™

Technical Bulletin 4.1

Regeneration of Sorptive Capacity

Quick Reference:

- PlumeStop binding site bio-regeneration
- Extended functional longevity

Background

PlumeStop™ Liquid Activated Carbon™ is composed of very fine particles of activated carbon (1-2µm) suspended in water through the use of unique organic polymer dispersion chemistry. Once in the subsurface, the material behaves as a colloidal biomatrix binding to the aquifer matrix, rapidly removing contaminants from groundwater, and expediting permanent contaminant biodegradation.

Wide-Area Dispersive Distribution

Unlike any other sorbent technology, PlumeStop can be emplaced in the subsurface through dispersive flow from low-pressure injection (without fracturing the formation), providing a wide-area thin-film coating of the aquifer matrix through which it passes. It does not create preferential flow pathways, plug the formation, or compromise monitoring-wells through extreme carbon loading in contrasting respect to the majority of the surrounding porosity (i.e. the porosity external to the fractures or 'soil partings' themselves) as may be the case with pressure-emplaced powdered activated carbon products. More information on low-pressure ease of distribution and dispersive emplacement of PlumeStop can be found in PlumeStop Technical Bulletin 1.1: Distribution through a Permeable Medium.

Rapid Removal of Contaminants from Groundwater

PlumeStop rapidly sorbs organic contaminants from aqueous solution (hours). Pollutants partition directly into the PlumeStop particles sorbed to the soil formation, removing the pollutants from groundwater. Contaminant advection in the aqueous phase is therefore eliminated (i.e. the *plume* is *stopped*) and partitioning into the vapor-phase is also reduced (Henry's Law). Results can be dramatic, with groundwater cleanup objectives often met within days of PlumeStop application. Information on the sorption of contaminants by PlumeStop can be found in PlumeStop Technical Bulletin 2.1: Sorption of Contaminants from Solution.

© Regenesis 2015

Acceleration of Contaminant Biodegradation

Once in place and with contaminants partitioned onto its surface, PlumeStop is colonized by contaminant-degrading bacteria. These may be naturally present or applied as an inoculum. The bringing together of a degradative microflora and the target contaminant in local abundance (i.e. concentrated on the PlumeStop rather than dispersed in the groundwater and formation) reduces mass-transfer kinetic constraints and supports greater speed and efficiency of degradation. The net result is a substantial increase in the instantaneous rate and extent of contaminant destruction.

Further information on the stimulation of contaminant biodegradation by PlumeStop can be found in PlumeStop Technical Bulletin 3.1: Stimulation of Biodegradation Rates.

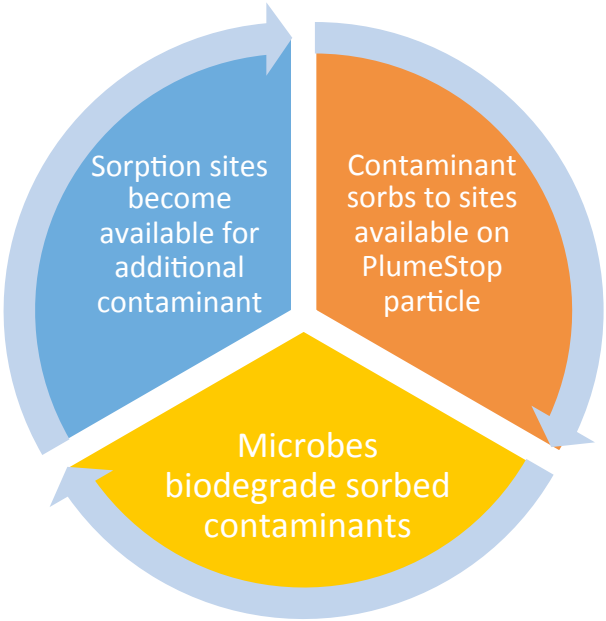
Regeneration In-Place

Once in place with particles coating aquifer pore surfaces, PlumeStop continues to regenerate in-place by the continual cycle of contaminant sorption and biodegradation:

1) Dissolved-phase contaminants partition out of the groundwater and are concentrated on sorption sites of the PlumeStop particles.

2) Opportunistic contaminant-degrading microbes colonize the PlumeStop. These together form the bio-matrix.

3) Biodegradation of contaminants within the bio-matrix frees up sorption sites allowing further contaminant to partition out of the groundwater.



This cyclical pattern results in on-going contaminant capture and destruction and regeneration of the PlumeStop bio-matrix. This allows a one-time application of PlumeStop to remain functional for an extended / indefinite period of time.

© Regenesis 2015

Data Supporting the In-Place Regeneration

To demonstrate the in-place regeneration of PlumeStop, a laboratory study was undertaken comparing the removal of perchloroethene (PCE) from soil/water slurries treated with PlumeStop versus a sterile control.

Test Procedure

Twenty-seven microcosm samples were prepared in 8 oz amber serum bottles sealed with Mininert™ valves (Figure 1). Each bottle contained site soil (20 g), PlumeStop (50 mg/L), microbial consortia (1 x 10^6 cells/mL *Dehalococcoides ethenogenes*), and sodium lactate as an electron donor to promote biological reductive dechlorination (1,000 mg/L). The experiment was initiated with the addition of 2.3 mg of PCE to each bottle, bringing the total mass of each sample mixture to 250 g.

Figure 1. Experimental set-up - test microcosms

Similarly, twenty-seven sterile control samples were prepared with autoclaved site soil (20 g), sodium lactate (1,000 mg/L), and sodium azide (200 mg/L), a biocide added to inhibit biological activity. PCE (2.3 mg) was then added to each control bottle to give a total sample mass of 250 g.

All bottles were placed on an orbital shaker at room temperature throughout the entire experiment.

After 24 hours, three PlumeStop treated samples and three control samples were chilled prior to removing a 1 mL aliquot for headspace analysis by GC-ECD in order to determine the PCE concentration in water. The same sample bottles were then sacrificed and subjected to a 48-hour hexane extraction (total system extraction – both soil and water phases). The hexane extract was analyzed by GC-ECD to give the total mass of PCE within each bottle.

After two weeks, the same sampling procedure described above was repeated on six more sample bottles, three from each condition. At the same time, all remaining sample bottles were spiked with an additional 2.3 mg of PCE and 25 mg of sodium lactate. The freshly spiked bottles were allowed to equilibrate for six hours before an additional six sacrificial bottles were sampled and analyzed in the manner described in order to establish a new post-spike baseline.

© Regenesis 2015

The identical procedure described above of analyzing–spiking–analyzing was repeated at the four week and six week time points of the experiment, such that PCE was spiked and analyzed through four complete cycles. Two additional PCE analysis only cycles (no spikes) were also conducted at the eight- and ten-week time points.

Results

PCE concentrations present in the aqueous phase, as measured by headspace analysis, indicated that in the test vials with PlumeStop, the majority of the PCE was almost immediately sorbed by the PlumeStop (same day) and thus removed from aqueous solution (Figure 2). Within the control vials (no PlumeStop or biological activity), the data show a PCE build-up in the aqueous phase over time with the addition of each successive PCE spike.

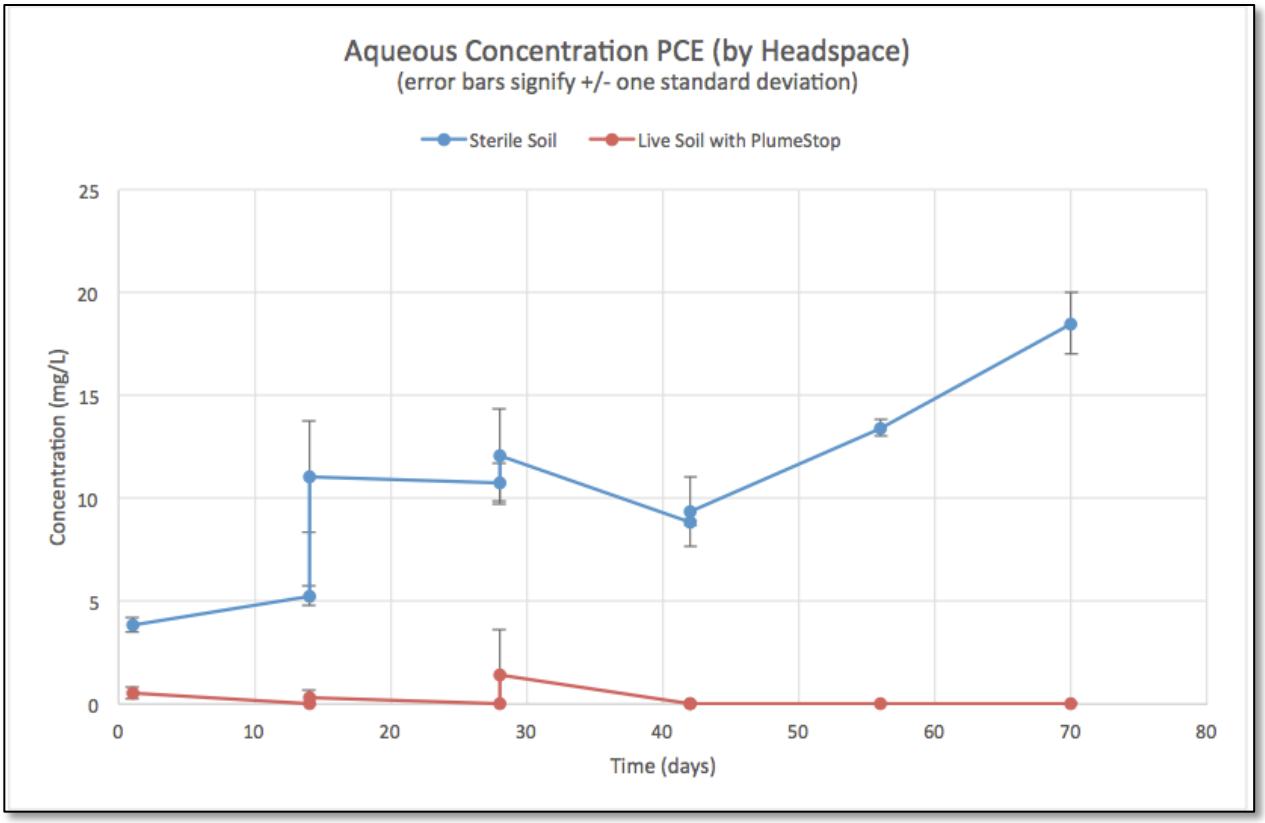


Figure 2. Comparison of dissolved-phase PCE concentration on cumulative loading with and without PlumeStop.

Data from the total system extraction (Figure 3) clearly indicates the rapid degradation of PCE within the PlumeStop amended vials. At the time of each sampling, less than 10% of the added PCE remained in the PlumeStop amended vials prior to re-spiking with additional PCE. Conversely, in the control vials absent PlumeStop and biological activity, PCE concentration increased with each additional PCE spike.

© Regenesis 2015

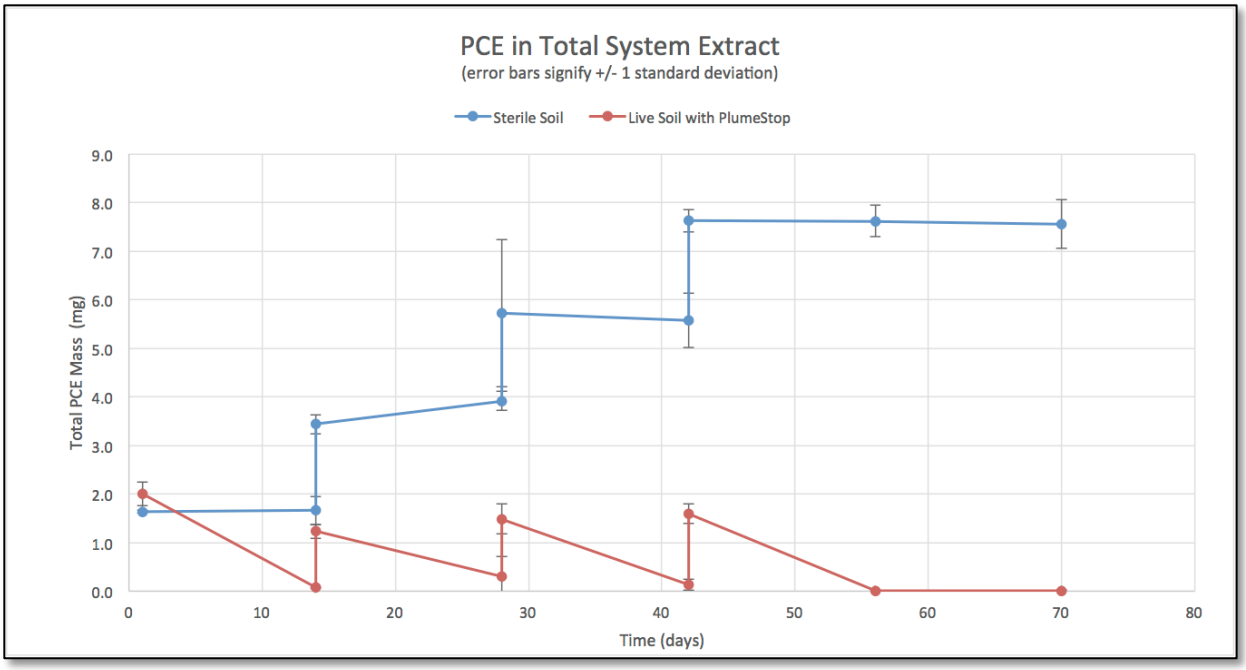


Figure 3. Comparison of PCE mass on cumulative loading with and without PlumeStop – total system extracts.

Summary and Conclusion

The laboratory test conducted clearly demonstrated the ability of PlumeStop to re-generate in place:

1) PCE rapidly partitioned onto the PlumeStop particles removing PCE from the aqueous-phase.
2) Once partitioned onto the PlumeStop particles the PCE was degraded, leaving negligible PCE in the system (sorbed-phase or aqueous-phase).
3) After sorbed PCE was degraded, the regenerated PlumeStop particles were again able to sorb additional PCE from solution, thereby providing capacity for continued contaminant sorption and degradation.

The manner in which the sorptive capacity of PlumeStop regenerates during contaminant bio-destruction suggests extended if not indefinite treatment longevity.

REGENESIS

© Regenesis 2015

PlumeStop™ Technical Bulletin 1.1

Distribution through a Permeable Medium

Quick Reference:

- PlumeStop distribution through > 16' (5 m) packed medium readily achieved
- Even coating of sand matrix with PlumeStop secured
- Retained coating not subject to wash-out
- No detectable impact on permeability

Background

PlumeStop™ Liquid Activated Carbon™ is composed of very fine particles of activated carbon (1-2µm) suspended in water through the use of unique organic polymer dispersion chemistry. Once in the subsurface, the material behaves as a colloidal biomatrix, sorbing to the aquifer matrix, rapidly removing contaminants from groundwater and expediting permanent contaminant biodegradation.

PlumeStop Flows through Permeable Media

PlumeStop is a very fine suspension of charged particles that resists clumping and has a very low viscosity (similar to water). As a result, PlumeStop is easily applied to subsurface through gravity-feed or low-pressure injection. Once applied, the material moves as a colloidal suspension through the permeable aquifer zones coating the pore structures with a thin (*ca*. 1 µm) layer of PlumeStop particles.

Long Column Study - 16 Foot (5 meter)

Study Objective

In order to evaluate in detail the movement of PlumeStop through a simple permeable soil medium over field-relevant distances, an extended column study was undertaken in the laboratory.

Experimental Setup

A 16 foot (4.9 m) long by 2 inch (5 cm) diameter transparent PVC column was erected (Figure 1). The column was place in a vertical position supported by a standing rack system. End-caps were affixed along with Viton® tubing (size 16; 0.12" / 3.1 mm ID). A white background was affixed with calibration marks every four feet (1.22 m).

© Regenesis 2015

The column was then packed with 35.4 lbs. (16.1 kg) of Lapis Lustre #60 silica sand with particle size ranging from 210 µm to 420 µm (fine to medium sand). Packing was accomplished with sand in slurry form with periodic tapping and draining of the column to eliminate voids and increase evenness of compaction.

Based upon the volume and characteristics of the material packed within the column, the open pore volume (matrix total porosity) was calculated to be approximately 0.11 cubic feet (3.0 L) (30%).

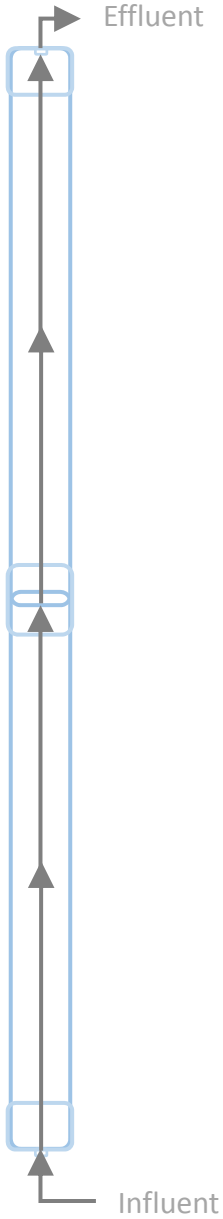


Figure 1. 16' Experimental Column.

Operation

A peristaltic pump was used to flow water and PlumeStop from a reservoir at the bottom of the column upward. Effluent leaving the top of the column was captured in a separate reservoir. Flow rates and pressures were measured at both the influent and effluent ports. Initially, water alone was pumped into the column at a target rate of 60 ml/minute (column seepage velocity 3.2 minutes per foot / 10.3 minutes per meter; = 0.16 cm/sec assuming ideal flow (unity of mobile and total porosity)). Once the desired flow-rate was secured and the system tested for leaks, the influent reservoir was switched to PlumeStop.

The system was operated until breakthrough of PlumeStop from the column was observed, and then continued at steady-state conditions for approximately 3.5 pore volumes before returning the influent to water-only for approximately 9 pore volumes. Monitoring of influent/effluent PlumeStop concentrations proceeded until effluent concentrations declined to zero.

© Regenesis 2015

Quantitative analysis was by UV-visible spectrometry (565 nm) enabling total mass of carbon retained within the column to be determined.

Results

The movement of the PlumeStop through the column was readily apparent visually, as the black color could be easily seen through the transparent PVC column casing (Figure 2). After 69 minutes / 1.4 pore volumes, PlumeStop had moved completely through the column at even flow without fracture or visible fingering, and was detected in the effluent. The effluent PlumeStop concentration increased for another 25 minutes post initial break-through (*ca*. 0.34 pore volumes), thereafter reaching a steady state at approximately 98% of influent concentration (difference not significant at $p > 0.05$).

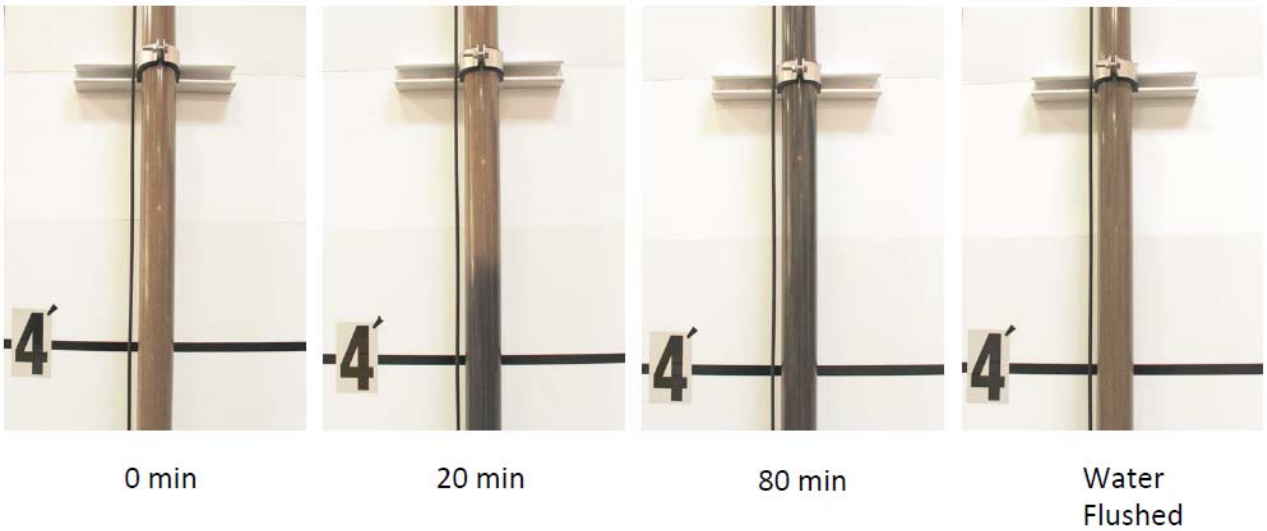


Figure 2. Visible PlumeStop migration front and coating residue following water-flush.

After approximately 3.5 pore volumes at steady state, the influent material was switched back to water only. PlumeStop concentrations in the effluent declined sharply after one pore volume, reaching detection limits (0.1% of applied concentration) within 2.0 pore volumes. Data are presented graphically in Figure 3.

Carbon Retention Mass Balance

Mass-balance calculations from influent and effluent PlumeStop concentrations and flow rate determined 5.7% of the applied PlumeStop carbon to have been retained within the column. This was further supported by elemental analysis of the column sand (analyzed destructively following the study), revealing a consistent loading of 20 – 45 mg/kg elemental carbon (corrected against test sand-only blanks) throughout the column following extensive flushing (a total of 9 pore volumes of water post-PlumeStop application) (Figure 4).

© Regenesis 2015

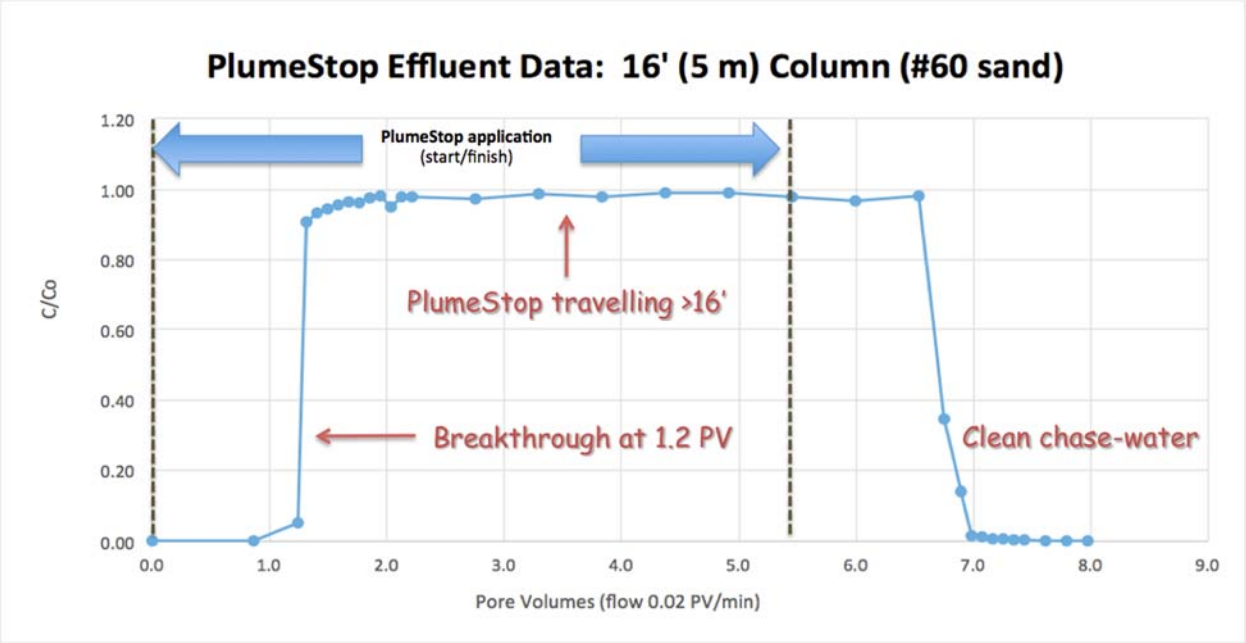


Figure 3. PlumeStop breakthrough dynamic – 16' (5m) column study.

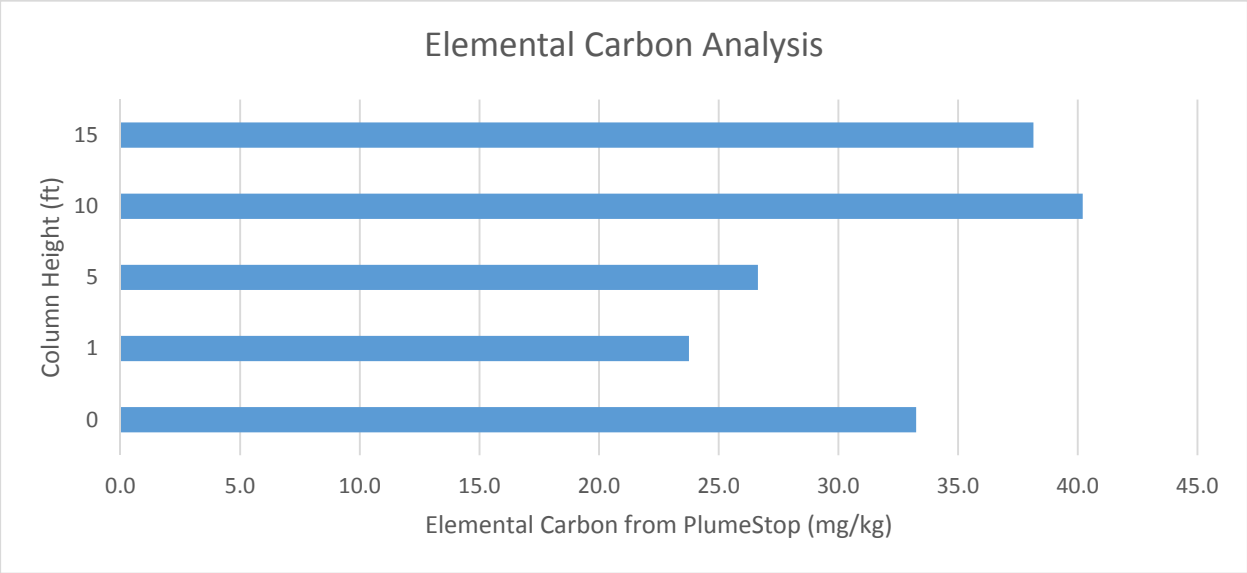


Figure 4. Elemental carbon (corrected against clean packing sand) at discrete depths.

Discussion

The ability to transport activated carbon as a liquid material through a permeable soil formation leaving a dispersed bound residue resistant to washout is clearly demonstrated by

© Regenesis 2015

this study. Breakthrough from the column following application of 1.3 pore volumes without visible soil parting (fracturing) or fingering illustrates ease of distribution through (low-pressure) dispersive flow.

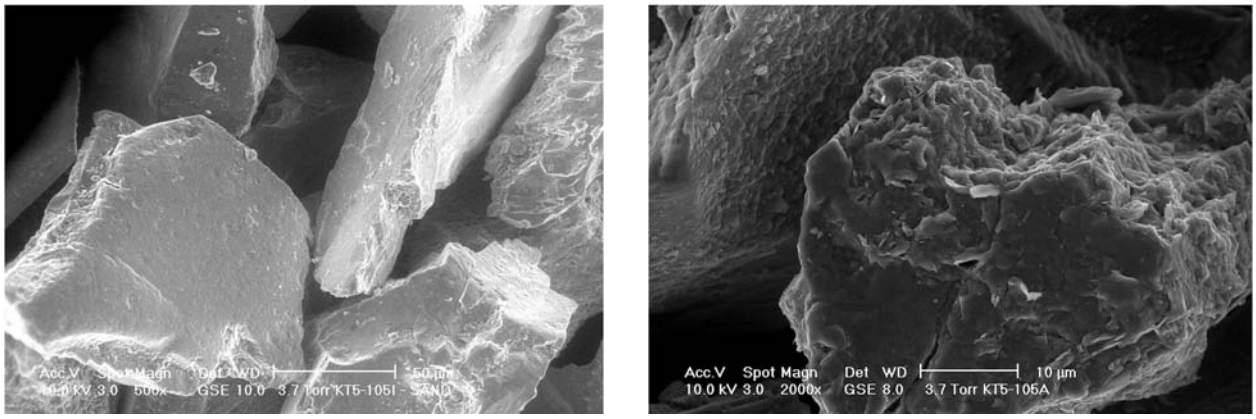


Figure 5. Scanning electron micrograph (SEM) of sand particles without PlumeStop (left) and coated with PlumeStop colloid (right) (Birnstingl et al., 2014).

Retention of activated carbon on the soil matrix is consistent with both theory and scanning electron micrograph data (Figure 5) (Birnstingl et al., 2014). The total mass of carbon retained on the column serves to increase the partitioning of organic contaminants out from the aqueous phase, thereby affording engineering benefits applicable to both risk modeling and remediation.

It should be noted that theoretical retention by other soil types will be different from that noted above – the present study is primarily intended to illustrate the principle of long-distance dispersive distribution and matrix-coating. In field applications, the fraction of activated carbon retained per unit volume will be influenced both by soil-type and volume and manner of application. PlumeStop transport and retention through other soil types will be the subject of subsequent Technical Bulletins.

Conclusions

1. PlumeStop can be freely dispersed through at least 16’ (5m) of fine to medium sand (similar to water).
2. 5.7% of the PlumeStop carbon (dry weight) was retained on the column of the present study, suggesting that when injecting through a well into an aquifer environment, significantly greater radial transport distances would be possible.

© Regenesis 2015

3. The retained activated carbon coating of the matrix was evenly dispersed throughout the column body and length (20 – 45 mg/kg range throughout column) – plugging, clumping, fracturing or fingering were not observed.
4. The retained coating was not subject to wash-out, even under vigorous flushing of nine pore volumes within 24 hours.
5. Total volume occupied by retained solids was approximately 0.1% of the soil pore volume and presented no measurable impact on permeability.

Literature Cited

Birnstingl, J., Sandefur, C., Thoreson, K., Rittenhouse, S., and Mork, B. (2014). PlumeStop™ Colloidal Biomatrix – securing rapid contaminant reduction and accelerated biodegradation using a dispersive injectable reagent. San Clemente, CA: REGENESIS Bioremediation Products.

-oO0Oo-

PlumeStop is manufactured and distributed for sale by REGENESIS, San Clemente, CA, USA.
For more information or to contact a technical representative visit www.regenesis.com.

REGENESIS
Technology-Based Solutions for the Environment

1011 Calle Sombra
San Clemente, CA 92673
949-366-8000
www.regenesis.com

© Regenesis 2015

February 20th, 2015

TECHNICAL MEMORANDUM

TO: Geoffrey Uhlemann, AECOM, Denver, CO (303-694-2770)

CC: Todd Herrington, West Region Manager, Regenesis, Denver, CO (303-399-1622)
Scott Wilson, President & CEO, Regenesis, San Clemente, CA (949-366-8000)
Ben Mork, VP of Research & Development, Regenesis, Sam Clemente, CA (949-366-8000)

FROM: Dr. Jeremy Birnstingl, VP of Environmental Technology, Regenesis Ltd, Bath, United Kingdom (+44 (0)1225 731 446)

SUBJECT: PlumeStop applicability for the Park-Euclid WQARF Site and response to questions related to the PlumeStop option in the AECOM Park-Euclid WQARF Feasibility Study (FS).

We appreciate the opportunity to provide PlumeStop as a barrier option to prevent further migration of solvent contamination at the Park-Euclid WQARF site. PlumeStop is a new fluidized, colloidal carbon technology designed to allow remediation practitioners to effectively create plume barriers and other remedial configurations to immobilize and biodegrade solvent contamination. Because PlumeStop is a colloidal material that injects easily into well networks, the Park-Euclid WQARF Project appears to be an excellent candidate for this remedial technology especially when coupled with the inject-and-extract strategy proposed by AECOM. Such a system will allow for rapid emplacement of a carbon-based barrier system that will provide extremely long-term operational value.

Since this technology is relatively new we are providing this technical memorandum to address three potential areas of concern. These areas are:

1. Performance data to show that PlumeStop is capable of rapid and sustained solvent reductions;
2. Support that there are no toxic chemicals present in the proprietary PlumeStop carrier material that would cause further degradation of groundwater quality; and
3. Support and commitment that PlumeStop can be transported long distances (+60 feet) through injection and extraction wells designed to pull the material into a desired barrier configuration.

Summary of PlumeStop and Applicability to WQARF site

PlumeStop™ Colloidal Biomatrix is an innovative technology (patented) designed to address the challenges of excessive time and end-point uncertainty in groundwater bioremediation. This paradigm-shifting technology secures rapid groundwater contaminant concentration reductions (in days) with the use of highly dispersible, fast-acting, sorption-based technology which captures and concentrates dissolved-phase contaminants within its structure. Once contaminants are sorbed onto the regenerative

matrix, contamination remains partitioned out of the groundwater phase while remaining susceptible to natural biodegradation processes active in the aquifer. These processes are further enhanced by the locally increased bioavailability of the contaminants to the bacteria that naturally colonize the PlumeStop post-application, forming a synergistic, self-regenerating bio-matrix.

For this reason we believe that PlumeStop offers a unique treatment strategy that will allow for complete removal of migrating solvent contamination at the Park-Euclid site for a performance period greatly exceeding that of pump-and-treat (P&T) system without the capital and O&M costs associated with ongoing P&T.

A link to additional PlumeStop information can be found here.

Recent Performance Data for Solvent Plumes

PlumeStop has shown consistently good performance on all solvent sites on which it has been applied to date (CA, WA, IN, SC, OH, IL). Although the duration of available data are limited owing to the technology being relatively new, the four primary performance features of the technology are confirmed by field performance, namely:

- Dispersive distribution from low-pressure injection (no fracturing);
- Rapid orders of magnitude dissolved-phase concentration reductions (contaminant sorption);
- Post-sorption biodegradation (proliferation of an active degradative microflora);
- Bioregeneration of sorptive capacity (contaminant flux capture in excess of sorptive capacity).

An example of performance is provided in Figure 1. VOC concentrations dropped by an order of magnitude on each of the first three sampling events, with a corresponding proliferation of solvent-degrading bacteria and their functional genes (e.g. >800% increase in *Dehalococcoides spp*. counts without inoculation) with corresponding dissolved-phase concentrations at or close to detection limits (5µgL, 2µg/L VC), which were secured for all compounds within six months, where they have remained to date (15 months). Significantly, the dissolved-phase solvent flux through the treatment area would be sufficient to saturate the sorption capacity of the added PlumeStop within approximately 250 days. Concentrations within the treatment area remain below detection at 459 days (and counting), which together with the observed microbial proliferation, contributes lines of evidence in support of the bio-regeneration of sorptive capacity (to date approaching 200%).

Worth noting is that the budgetary FS design provided to AECOM recommends enough PlumeStop to allow for a theoretical operational barrier life-span of several centuries without additional biostimulation. While this must clearly remain conjecture – no existing product is centuries old – an operational capacity of decades would be a reasonable expectation, with the sorptive duration further extended through bio-regeneration by natural attenuation processes, whether slow or otherwise. By way of perspective, complete contaminant capture at the present flux for 100 years would challenge less than 5% of the material's sorptive capacity, even without recourse to bio-regeneration. We anticipate that once emplaced the PlumeStop barrier would result in multiple order-of-magnitude reductions of solvent concentrations within days to weeks as the solvent plume intersects the barrier.

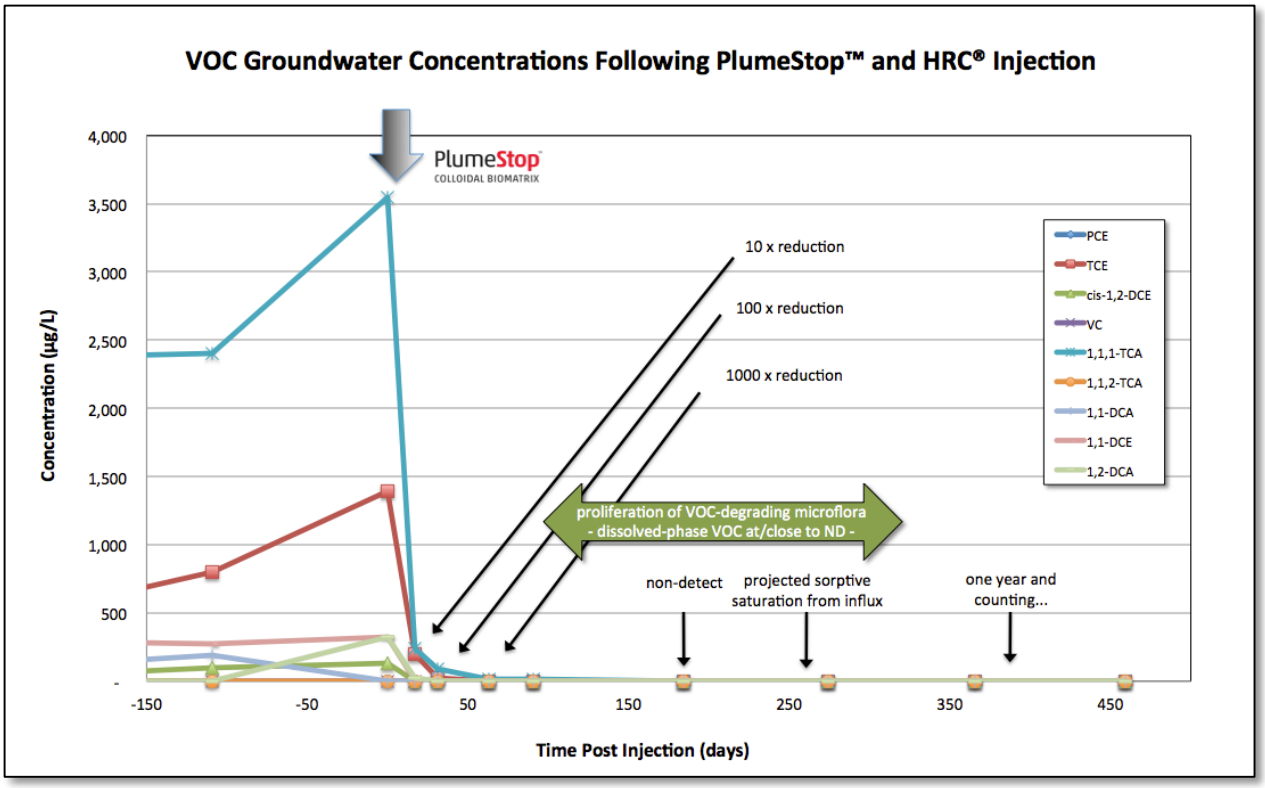


Figure 1. Field Performance Example – Indiana Site

Composition of PlumeStop – no toxic chemical injected

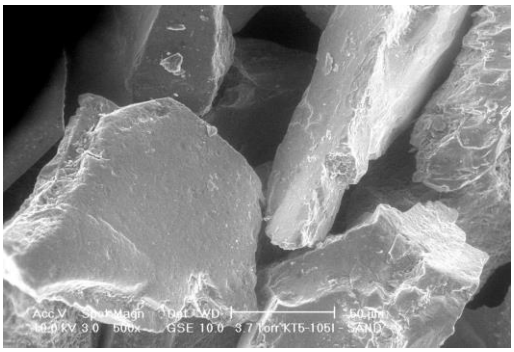
PlumeStop is shipped as a suspension of colloidal (≦2.5 µm) activated carbon particles in water, and comprises up to 2% by mass of a proprietary anti-clumping / distribution supporting surface treatment. Optional bioremediation nutrients may also be added, and the material may be applied in conjunction with compatible electron donors/acceptors and microbial inocula as dictated by the requirements of the site.

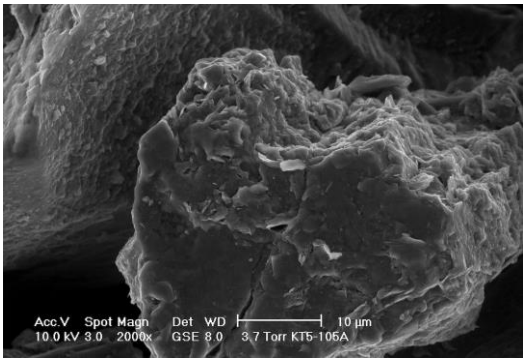
The specific chemistry of the proprietary PlumeStop material may be shared as necessary under formal non-disclosure agreement (NDA). It may nevertheless be noted that its components are approved for use in foods, and that the product has met with no regulatory obstacles for use in any of the states in which it has been applied (CA, WA, IN, SC, OH, IL, MI) or proposed to date. There should be no concerns for the application of PlumeStop in potable water aquifers.

PlumeStop Transport via Injection and Extraction Wells

PlumeStop is applied to the subsurface as a low-pressure liquid injection. It transports through the formation via pore-flow rather than fracture emplacement (sometimes termed 'soil parting'), and indeed care should be taken to avoid the latter to prevent patchy or incomplete treatment and monitoring well data corruption. The injected PlumeStop transports through the mobile porosity as a colloidal suspension leaving a coating on the formation as it passes. In this way it can be envisioned much the same as an ink.

The formation coating is micron-scale, and comprises a dispersed thin film rather than clumps or plugs (Figures 2a-b).





Figures 2a-b. Electron micrographs of sand prior to PlumeStop addition (left) and post-PlumeStop addition (right) illustrating micron-scale particulate coating with PlumeStop.

This affords a broad and even treatment of the primary aquifer porosity surfaces through which it passes, with minimal disruption to groundwater flow and hydraulic conductivity.

The surface treatment to secure dispersive distribution of the PlumeStop is based on surface-charge modification of the colloidal carbon particles. Through this, the charge interaction with the formation is reduced but not entirely eliminated – there are still interactions between the PlumeStop particles themselves and between the particles and formation, although these are weaker such that they are more easily overcome by the shear forces of the flowing liquid. This therefore eliminates particle clumping and propensity to clog, while still enabling a coating to be left on the formation. The thickness of this will be a function of surface charge of the aquifer solids, the flow rate, and dilution of the PlumeStop.

The nature of PlumeStop distribution through an aquifer will be strongly influenced by the local hydrology. As with any injected fluid, the flow paths will be dictated by local hydraulic conductivity. Naturally, distribution will principally be secured through the primary rather than secondary porosity. With appropriate application, this is nevertheless sufficient to address secondary porosity contamination through capturing back-diffusing mass – a key feature of the PlumeStop technology.

However, as distance increases from the point of application, distribution will become increasingly dominated by preferential flow-paths. This can reduce the proportion of the primary porosity through which the PlumeStop is dispersed. The significance of this to a given application will be variable, and will relate to the relative dominance of the principal flow paths and to the application point spacing employed during injection. The engineering control and application flexibility that would be made possible through the groundwater recirculation/PlumeStop application technique proposed for the Park-Euclid project appears to provide an excellent mechanism for gaining the required PlumeStop distribution in a transect across the plume.

Experience to date has not identified a maximum limit to the potential PlumeStop radius of distribution in a given formation. Rather, the dispersive distribution secured has principally been a function of the volume injected. This itself is dictated by dose requirements and the balance of injection spacing, injection

time, and formation permeability/complexity for the site in question. This is typically determined through a succinct program of pump tests to confirm design assumptions ahead of formal reagent application.

For the Park-Euclid site, a similar program of distribution testing and application optimization would be recommended. Given the important site requirements and the nature of PlumeStop as an emerging technology, Regenesis would be willing to contribute resource without charge in partial support of this.

Appendix J
Feasibility Study Cost Estimates

Summary of Estimated Costs

APPENDIX J

Comparison of Remedies

J-1.0

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Remedy 1: Reference
Phase:	Draft FS Costing	-Remedy 2: Less Aggressive
Year 0:	2016	-Remedy 3: More Aggressive
For:	200 Years	-Remedy 4: Proposed
Date:	April 2016	-Inflation of 1.5% & Rate of Return of 3.5%

PROJECT COST SCHEDULE (200 Year Period of Analysis):

YEAR	CUMULATIVE CURRENT COST				DISCOUNT FACTOR	CUMULATIVE NPV COST			
	1	2	3	4		1	2	3	4
0	$8,107,679	$839,839	$3,688,954	$3,282,659	1.000	$8,107,679	$839,839	$3,688,954	$3,282,659
5	$9,698,199	$1,725,139	$7,076,319	$5,323,819	0.907	$9,616,664	$1,675,353	$6,900,481	$5,209,180
10	$10,807,125	$2,369,525	$9,124,589	$7,125,585	0.823	$10,570,156	$2,230,646	$8,653,748	$6,755,786
20	$11,099,265	$2,617,835	$10,822,719	$8,742,775	0.677	$10,788,901	$2,416,341	$9,914,247	$7,954,372
30	$11,347,615	$4,858,955	$12,182,639	$11,149,745	0.557	$10,933,541	$3,720,249	$10,747,654	$9,420,944
50	$11,528,765	$6,136,525	$12,315,579	$11,130,975	0.377	$11,018,349	$4,268,669	$10,821,706	$9,417,039
100	$11,704,365	$10,095,585	$12,315,579	$11,130,975	0.142	$11,058,913	$5,222,452	$10,821,706	$9,417,039
150	$11,879,965	$15,107,525	$12,315,579	$11,130,975	0.054	$11,074,204	$5,627,657	$10,821,706	$9,417,039
200	$12,086,525	$18,048,915	$12,315,579	$11,130,975	0.020	$11,080,593	$5,726,515	$10,821,706	$9,417,039

Remedy 1 - Summary of Estimated Costs

APPENDIX J

J-2.1

Reference Remedy

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Pulsed SVE for 10 years, then MNA in the UVZ until Year 30
Phase:	Draft FS Costing	-MNA in the PA for 200 years
Year 0:	2016	-Pulsed SVE for 10 years in the LVZ with an expanded LTM network until Year 30
For:	200 Years	-PlumeStop with MNA in the RA for 30 years
Date:	April 2016	-Inflation of 1.5% & Rate of Return of 3.5%

PROJECT COST SCHEDULE (200 Year Period of Analysis):

YEAR	DISCOUNT FACTOR	PERIODIC O&M COST					CUMULATIVE COST	
		UVZ	PA	LVZ	RA	TOTAL	CURRENT	NPV
0	1.000	$138,670	$242,155	$550,834	$7,176,020	$8,107,679	$8,107,679	$8,107,679
1	0.981	$89,000	$20,405	$141,694	$245,830	$496,929	$8,604,608	$8,595,006
2	0.962	$89,000	$20,405	$141,694	$22,460	$273,559	$8,878,167	$8,858,094
3	0.943	$89,000	$20,405	$141,694	$22,460	$273,559	$9,151,726	$9,116,099
4	0.925	$89,000	$20,405	$141,694	$22,460	$273,559	$9,425,285	$9,369,119
5	0.907	$89,000	$14,760	$146,694	$22,460	$272,914	$9,698,199	$9,616,664
6	0.890	$89,000	$700	$141,694	$4,870	$236,264	$9,934,463	$9,826,825
7	0.872	$89,000	$14,760	$141,694	$22,460	$267,914	$10,202,377	$10,060,533
8	0.855	$89,000	$700	$141,694	$4,870	$236,264	$10,438,641	$10,262,651
9	0.839	$89,000	$14,760	$141,694	$22,460	$267,914	$10,706,555	$10,487,415
10	0.823	$89,000	$700	$6,000	$4,870	$100,570	$10,807,125	$10,570,156
11	0.807	$16,060	$14,760	$6,000	$22,460	$59,280	$10,866,405	$10,617,985
12	0.791	$400	$700	$6,000	$4,870	$11,970	$10,878,375	$10,627,456
13	0.776	$16,060	$14,760	$6,000	$22,460	$59,280	$10,937,655	$10,673,455
14	0.761	$400	$700	$6,000	$4,870	$11,970	$10,949,625	$10,682,563
15	0.746	$16,060	$14,760	$400	$22,460	$53,680	$11,003,305	$10,722,622
16	0.732	$400	$700	$6,000	$4,870	$11,970	$11,015,275	$10,731,382
17	0.718	$400	$700	$400	$4,870	$6,370	$11,021,645	$10,735,954
18	0.704	$400	$700	$6,000	$4,870	$11,970	$11,033,615	$10,744,379
19	0.690	$400	$700	$400	$4,870	$6,370	$11,039,985	$10,748,775
20	0.677	$16,060	$14,760	$6,000	$22,460	$59,280	$11,099,265	$10,788,901
21	0.664	$400	$700	$400	$4,870	$6,370	$11,105,635	$10,793,129
22	0.651	$400	$700	$400	$4,870	$6,370	$11,112,005	$10,797,276
23	0.638	$400	$700	$400	$4,870	$6,370	$11,118,375	$10,801,343
24	0.626	$400	$700	$400	$4,870	$6,370	$11,124,745	$10,805,331
25	0.614	$16,060	$14,760	$6,000	$22,460	$59,280	$11,184,025	$10,841,727
26	0.602	$400	$700	$400	$4,870	$6,370	$11,190,395	$10,845,562
27	0.590	$400	$700	$400	$4,870	$6,370	$11,196,765	$10,849,323
28	0.579	$400	$700	$400	$4,870	$6,370	$11,203,135	$10,853,012
29	0.568	$400	$700	$400	$4,870	$6,370	$11,209,505	$10,856,629
30	0.557	$71,320	$14,760	$29,570	$22,460	$138,110	$11,347,615	$10,933,541
31	0.546	$0	$700	$0	$4,870	$5,570	$11,353,185	$10,936,583
32	0.536	$0	$700	$0	$4,870	$5,570	$11,358,755	$10,939,566
33	0.525	$0	$700	$0	$4,870	$5,570	$11,364,325	$10,942,492
34	0.515	$0	$700	$0	$4,870	$5,570	$11,369,895	$10,945,361
35	0.505	$0	$14,760	$0	$22,460	$37,220	$11,407,115	$10,964,162
36	0.495	$0	$700	$0	$4,870	$5,570	$11,412,685	$10,966,921
37	0.486	$0	$700	$0	$4,870	$5,570	$11,418,255	$10,969,627
38	0.476	$0	$700	$0	$4,870	$5,570	$11,423,825	$10,972,280
39	0.467	$0	$700	$0	$4,870	$5,570	$11,429,395	$10,974,883
40	0.458	$0	$14,760	$0	$49,490	$64,250	$11,493,645	$11,004,320
41	0.449	$0	$700	$0	$0	$700	$11,494,345	$11,004,635
42	0.441	$0	$700	$0	$0	$700	$11,495,045	$11,004,943
43	0.432	$0	$700	$0	$0	$700	$11,495,745	$11,005,246
44	0.424	$0	$700	$0	$0	$700	$11,496,445	$11,005,542
45	0.416	$0	$14,760	$0	$0	$14,760	$11,511,205	$11,011,676
46	0.408	$0	$700	$0	$0	$700	$11,511,905	$11,011,962
47	0.400	$0	$700	$0	$0	$700	$11,512,605	$11,012,241
48	0.392	$0	$700	$0	$0	$700	$11,513,305	$11,012,516
49	0.384	$0	$700	$0	$0	$700	$11,514,005	$11,012,785
50	0.377	$0	$14,760	$0	$0	$14,760	$11,528,765	$11,018,349
51	0.370	$0	$700	$0	$0	$700	$11,529,465	$11,018,607
52	0.363	$0	$700	$0	$0	$700	$11,530,165	$11,018,861
53	0.356	$0	$700	$0	$0	$700	$11,530,865	$11,019,110

Remedy 1 - Summary of Estimated Costs

Reference Remedy

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Pulsed SVE for 10 years, then MNA in the UVZ until Year 30
Phase:	Draft FS Costing	-MNA in the PA for 200 years
Year 0:	2016	-Pulsed SVE for 10 years in the LVZ with an expanded LTM network until Year 30
For:	200 Years	-PlumeStop with MNA in the RA for 30 years
Date:	April 2016	-Inflation of 1.5% & Rate of Return of 3.5%

54	0.349	$0	$700	$0	$0	$700	$11,531,565	$11,019,354
55	0.342	$0	$14,760	$0	$0	$14,760	$11,546,325	$11,024,401
56	0.335	$0	$700	$0	$0	$700	$11,547,025	$11,024,635
57	0.329	$0	$700	$0	$0	$700	$11,547,725	$11,024,865
58	0.322	$0	$700	$0	$0	$700	$11,548,425	$11,025,091
59	0.316	$0	$700	$0	$0	$700	$11,549,125	$11,025,313
60	0.310	$0	$14,760	$0	$0	$14,760	$11,563,885	$11,029,890
61	0.304	$0	$700	$0	$0	$700	$11,564,585	$11,030,103
62	0.298	$0	$700	$0	$0	$700	$11,565,285	$11,030,312
63	0.292	$0	$700	$0	$0	$700	$11,565,985	$11,030,516
64	0.287	$0	$700	$0	$0	$700	$11,566,685	$11,030,717
65	0.281	$0	$14,760	$0	$0	$14,760	$11,581,445	$11,034,869
66	0.276	$0	$700	$0	$0	$700	$11,582,145	$11,035,062
67	0.271	$0	$700	$0	$0	$700	$11,582,845	$11,035,252
68	0.265	$0	$700	$0	$0	$700	$11,583,545	$11,035,437
69	0.260	$0	$700	$0	$0	$700	$11,584,245	$11,035,620
70	0.255	$0	$14,760	$0	$0	$14,760	$11,599,005	$11,039,386
71	0.250	$0	$700	$0	$0	$700	$11,599,705	$11,039,561
72	0.245	$0	$700	$0	$0	$700	$11,600,405	$11,039,733
73	0.241	$0	$700	$0	$0	$700	$11,601,105	$11,039,901
74	0.236	$0	$700	$0	$0	$700	$11,601,805	$11,040,066
75	0.231	$0	$14,760	$0	$0	$14,760	$11,616,565	$11,043,482
76	0.227	$0	$700	$0	$0	$700	$11,617,265	$11,043,641
77	0.223	$0	$700	$0	$0	$700	$11,617,965	$11,043,797
78	0.218	$0	$700	$0	$0	$700	$11,618,665	$11,043,950
79	0.214	$0	$700	$0	$0	$700	$11,619,365	$11,044,099
80	0.210	$0	$14,760	$0	$0	$14,760	$11,634,125	$11,047,198
81	0.206	$0	$700	$0	$0	$700	$11,634,825	$11,047,342
82	0.202	$0	$700	$0	$0	$700	$11,635,525	$11,047,483
83	0.198	$0	$700	$0	$0	$700	$11,636,225	$11,047,622
84	0.194	$0	$700	$0	$0	$700	$11,636,925	$11,047,758
85	0.190	$0	$14,760	$0	$0	$14,760	$11,651,685	$11,050,568
86	0.187	$0	$700	$0	$0	$700	$11,652,385	$11,050,699
87	0.183	$0	$700	$0	$0	$700	$11,653,085	$11,050,827
88	0.180	$0	$700	$0	$0	$700	$11,653,785	$11,050,953
89	0.176	$0	$700	$0	$0	$700	$11,654,485	$11,051,076
90	0.173	$0	$14,760	$0	$0	$14,760	$11,669,245	$11,053,625
91	0.169	$0	$700	$0	$0	$700	$11,669,945	$11,053,744
92	0.166	$0	$700	$0	$0	$700	$11,670,645	$11,053,860
93	0.163	$0	$700	$0	$0	$700	$11,671,345	$11,053,974
94	0.160	$0	$700	$0	$0	$700	$11,672,045	$11,054,086
95	0.157	$0	$14,760	$0	$0	$14,760	$11,686,805	$11,056,398
96	0.154	$0	$700	$0	$0	$700	$11,687,505	$11,056,506
97	0.151	$0	$700	$0	$0	$700	$11,688,205	$11,056,611
98	0.148	$0	$700	$0	$0	$700	$11,688,905	$11,056,715
99	0.145	$0	$700	$0	$0	$700	$11,689,605	$11,056,816
100	0.142	$0	$14,760	$0	$0	$14,760	$11,704,365	$11,058,913
101	0.139	$0	$700	$0	$0	$700	$11,705,065	$11,059,011
102	0.137	$0	$700	$0	$0	$700	$11,705,765	$11,059,106
103	0.134	$0	$700	$0	$0	$700	$11,706,465	$11,059,200
104	0.131	$0	$700	$0	$0	$700	$11,707,165	$11,059,292
105	0.129	$0	$14,760	$0	$0	$14,760	$11,721,925	$11,061,195
106	0.126	$0	$700	$0	$0	$700	$11,722,625	$11,061,283
107	0.124	$0	$700	$0	$0	$700	$11,723,325	$11,061,370
108	0.122	$0	$700	$0	$0	$700	$11,724,025	$11,061,455
109	0.119	$0	$700	$0	$0	$700	$11,724,725	$11,061,538
110	0.117	$0	$14,760	$0	$0	$14,760	$11,739,485	$11,063,264
111	0.115	$0	$700	$0	$0	$700	$11,740,185	$11,063,344

Remedy 1 - Summary of Estimated Costs

Reference Remedy

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Pulsed SVE for 10 years, then MNA in the UVZ until Year 30
Phase:	Draft FS Costing	-MNA in the PA for 200 years
Year 0:	2016	-Pulsed SVE for 10 years in the LVZ with an expanded LTM network until Year 30
For:	200 Years	-PlumeStop with MNA in the RA for 30 years
Date:	April 2016	-Inflation of 1.5% & Rate of Return of 3.5%

112	0.112	$0	$700	$0	$0	$700	$11,740,885	$11,063,423
113	0.110	$0	$700	$0	$0	$700	$11,741,585	$11,063,500
114	0.108	$0	$700	$0	$0	$700	$11,742,285	$11,063,576
115	0.106	$0	$14,760	$0	$0	$14,760	$11,757,045	$11,065,141
116	0.104	$0	$700	$0	$0	$700	$11,757,745	$11,065,214
117	0.102	$0	$700	$0	$0	$700	$11,758,445	$11,065,285
118	0.100	$0	$700	$0	$0	$700	$11,759,145	$11,065,355
119	0.098	$0	$700	$0	$0	$700	$11,759,845	$11,065,424
120	0.096	$0	$14,760	$0	$0	$14,760	$11,774,605	$11,066,843
121	0.094	$0	$700	$0	$0	$700	$11,775,305	$11,066,909
122	0.092	$0	$700	$0	$0	$700	$11,776,005	$11,066,974
123	0.091	$0	$700	$0	$0	$700	$11,776,705	$11,067,038
124	0.089	$0	$700	$0	$0	$700	$11,777,405	$11,067,100
125	0.087	$0	$14,760	$0	$0	$14,760	$11,792,165	$11,068,387
126	0.086	$0	$700	$0	$0	$700	$11,792,865	$11,068,447
127	0.084	$0	$700	$0	$0	$700	$11,793,565	$11,068,506
128	0.082	$0	$700	$0	$0	$700	$11,794,265	$11,068,564
129	0.081	$0	$700	$0	$0	$700	$11,794,965	$11,068,620
130	0.079	$0	$14,760	$0	$0	$14,760	$11,809,725	$11,069,788
131	0.078	$0	$700	$0	$0	$700	$11,810,425	$11,069,842
132	0.076	$0	$700	$0	$0	$700	$11,811,125	$11,069,896
133	0.075	$0	$700	$0	$0	$700	$11,811,825	$11,069,948
134	0.073	$0	$700	$0	$0	$700	$11,812,525	$11,069,999
135	0.072	$0	$14,760	$0	$0	$14,760	$11,827,285	$11,071,059
136	0.070	$0	$700	$0	$0	$700	$11,827,985	$11,071,108
137	0.069	$0	$700	$0	$0	$700	$11,828,685	$11,071,156
138	0.068	$0	$700	$0	$0	$700	$11,829,385	$11,071,204
139	0.066	$0	$700	$0	$0	$700	$11,830,085	$11,071,250
140	0.065	$0	$14,760	$0	$0	$14,760	$11,844,845	$11,072,211
141	0.064	$0	$700	$0	$0	$700	$11,845,545	$11,072,256
142	0.063	$0	$700	$0	$0	$700	$11,846,245	$11,072,299
143	0.061	$0	$700	$0	$0	$700	$11,846,945	$11,072,342
144	0.060	$0	$700	$0	$0	$700	$11,847,645	$11,072,385
145	0.059	$0	$14,760	$0	$0	$14,760	$11,862,405	$11,073,256
146	0.058	$0	$700	$0	$0	$700	$11,863,105	$11,073,297
147	0.057	$0	$700	$0	$0	$700	$11,863,805	$11,073,336
148	0.056	$0	$700	$0	$0	$700	$11,864,505	$11,073,375
149	0.055	$0	$700	$0	$0	$700	$11,865,205	$11,073,414
150	0.054	$0	$14,760	$0	$0	$14,760	$11,879,965	$11,074,204
151	0.053	$0	$700	$0	$0	$700	$11,880,665	$11,074,241
152	0.052	$0	$700	$0	$0	$700	$11,881,365	$11,074,277
153	0.051	$0	$700	$0	$0	$700	$11,882,065	$11,074,312
154	0.050	$0	$700	$0	$0	$700	$11,882,765	$11,074,347
155	0.049	$0	$14,760	$0	$0	$14,760	$11,897,525	$11,075,064
156	0.048	$0	$700	$0	$0	$700	$11,898,225	$11,075,098
157	0.047	$0	$700	$0	$0	$700	$11,898,925	$11,075,130
158	0.046	$0	$700	$0	$0	$700	$11,899,625	$11,075,162
159	0.045	$0	$700	$0	$0	$700	$11,900,325	$11,075,194
160	0.044	$0	$14,760	$0	$0	$14,760	$11,915,085	$11,075,844
161	0.043	$0	$700	$0	$0	$700	$11,915,785	$11,075,874
162	0.042	$0	$700	$0	$0	$700	$11,916,485	$11,075,904
163	0.042	$0	$700	$0	$0	$700	$11,917,185	$11,075,933
164	0.041	$0	$700	$0	$0	$700	$11,917,885	$11,075,962
165	0.040	$0	$14,760	$0	$0	$14,760	$11,932,645	$11,076,552
166	0.039	$0	$700	$0	$0	$700	$11,933,345	$11,076,579
167	0.038	$0	$700	$0	$0	$700	$11,934,045	$11,076,606
168	0.038	$0	$700	$0	$0	$700	$11,934,745	$11,076,632
169	0.037	$0	$700	$0	$0	$700	$11,935,445	$11,076,658

Remedy 1 - Summary of Estimated Costs

Reference Remedy

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Pulsed SVE for 10 years, then MNA in the UVZ until Year 30
Phase:	Draft FS Costing	-MNA in the PA for 200 years
Year 0:	2016	-Pulsed SVE for 10 years in the LVZ with an expanded LTM network until Year 30
For:	200 Years	-PlumeStop with MNA in the RA for 30 years
Date:	April 2016	-Inflation of 1.5% & Rate of Return of 3.5%

170	0.036	$0	$14,760	$0	$0	$14,760	$11,950,205	$11,077,193
171	0.036	$0	$700	$0	$0	$700	$11,950,905	$11,077,218
172	0.035	$0	$700	$0	$0	$700	$11,951,605	$11,077,243
173	0.034	$0	$700	$0	$0	$700	$11,952,305	$11,077,267
174	0.034	$0	$700	$0	$0	$700	$11,953,005	$11,077,290
175	0.033	$0	$14,760	$0	$0	$14,760	$11,967,765	$11,077,775
176	0.032	$0	$700	$0	$0	$700	$11,968,465	$11,077,798
177	0.032	$0	$700	$0	$0	$700	$11,969,165	$11,077,820
178	0.031	$0	$700	$0	$0	$700	$11,969,865	$11,077,842
179	0.030	$0	$700	$0	$0	$700	$11,970,565	$11,077,863
180	0.030	$0	$14,760	$0	$0	$14,760	$11,985,325	$11,078,303
181	0.029	$0	$700	$0	$0	$700	$11,986,025	$11,078,324
182	0.029	$0	$700	$0	$0	$700	$11,986,725	$11,078,344
183	0.028	$0	$700	$0	$0	$700	$11,987,425	$11,078,364
184	0.028	$0	$700	$0	$0	$700	$11,988,125	$11,078,383
185	0.027	$0	$14,760	$0	$0	$14,760	$12,002,885	$11,078,782
186	0.027	$0	$700	$0	$0	$700	$12,003,585	$11,078,801
187	0.026	$0	$700	$0	$0	$700	$12,004,285	$11,078,819
188	0.026	$0	$700	$0	$0	$700	$12,004,985	$11,078,837
189	0.025	$0	$700	$0	$0	$700	$12,005,685	$11,078,855
190	0.025	$0	$14,760	$0	$0	$14,760	$12,020,445	$11,079,217
191	0.024	$0	$700	$0	$0	$700	$12,021,145	$11,079,234
192	0.024	$0	$700	$0	$0	$700	$12,021,845	$11,079,250
193	0.023	$0	$700	$0	$0	$700	$12,022,545	$11,079,266
194	0.023	$0	$700	$0	$0	$700	$12,023,245	$11,079,282
195	0.022	$0	$14,760	$0	$0	$14,760	$12,038,005	$11,079,611
196	0.022	$0	$700	$0	$0	$700	$12,038,705	$11,079,626
197	0.021	$0	$700	$0	$0	$700	$12,039,405	$11,079,641
198	0.021	$0	$700	$0	$0	$700	$12,040,105	$11,079,656
199	0.021	$0	$700	$0	$0	$700	$12,040,805	$11,079,670
200	0.020	$0	$45,720	$0	$0	$45,720	$12,086,525	$11,080,593
Total	-	$1,185,890	$1,096,515	$1,919,050	$7,885,070	$12,086,525	$12,086,525	$11,080,593

Remedy 2 - Summary of Estimated Costs

Less Aggressive Remedy

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-MNA in the UVZ for 30 years
Phase:	Draft FS Costing	-MNA in the PA for 30 years, with PlumeStop barrier contingency
Year 0:	2016	-Pulsed SVE for 10 years in the LVZ with existing LTM network until Year 30
For:	200 Years	-MNA with UAWellhead Treatment in the RA for 200 years
Date:	April 2016	-Inflation of 1.5% & Rate of Return of 3.5%

PROJECT COST SCHEDULE (200 Year Period of Analysis):

YEAR	DISCOUNT FACTOR	PERIODIC O&M COST					CUMULATIVE COST	
		UVZ	PA	LVZ	RA	TOTAL	CURRENT	NPV
0	1.000	$32,790	$242,155	$131,234	$433,660	$839,839	$839,839	$839,839
1	0.981	$21,940	$20,405	$126,234	$3,670	$172,249	$1,012,088	$1,008,760
2	0.962	$21,940	$20,405	$126,234	$18,960	$187,539	$1,199,627	$1,189,121
3	0.943	$21,940	$20,405	$126,234	$3,670	$172,249	$1,371,876	$1,351,576
4	0.925	$21,940	$20,405	$126,234	$18,960	$187,539	$1,559,415	$1,525,034
5	0.907	$16,060	$14,760	$131,234	$3,670	$165,724	$1,725,139	$1,675,353
6	0.890	$400	$700	$126,234	$18,960	$146,294	$1,871,433	$1,805,484
7	0.872	$16,060	$14,760	$126,234	$3,670	$160,724	$2,032,157	$1,945,688
8	0.855	$400	$700	$126,234	$18,960	$146,294	$2,178,451	$2,070,838
9	0.839	$16,060	$14,760	$126,234	$3,670	$160,724	$2,339,175	$2,205,676
10	0.823	$400	$700	$10,290	$18,960	$30,350	$2,369,525	$2,230,646
11	0.807	$16,060	$14,760	$10,290	$3,670	$44,780	$2,414,305	$2,266,776
12	0.791	$400	$700	$10,290	$3,670	$15,060	$2,429,365	$2,278,692
13	0.776	$16,060	$14,760	$10,290	$3,670	$44,780	$2,474,145	$2,313,439
14	0.761	$400	$700	$10,290	$3,670	$15,060	$2,489,205	$2,324,899
15	0.746	$16,060	$14,760	$0	$18,960	$49,780	$2,538,985	$2,362,047
16	0.732	$400	$700	$3,330	$3,670	$8,100	$2,547,085	$2,367,975
17	0.718	$400	$700	$0	$3,670	$4,770	$2,551,855	$2,371,399
18	0.704	$400	$700	$3,330	$3,670	$8,100	$2,559,955	$2,377,100
19	0.690	$400	$700	$0	$3,670	$4,770	$2,564,725	$2,380,392
20	0.677	$16,060	$14,760	$3,330	$18,960	$53,110	$2,617,835	$2,416,341
21	0.664	$400	$700	$0	$3,670	$4,770	$2,622,605	$2,419,508
22	0.651	$400	$700	$0	$3,670	$4,770	$2,627,375	$2,422,613
23	0.638	$400	$700	$0	$3,670	$4,770	$2,632,145	$2,425,658
24	0.626	$400	$700	$0	$3,670	$4,770	$2,636,915	$2,428,644
25	0.614	$16,060	$896,140	$3,330	$18,960	$934,490	$3,571,405	$3,002,387
26	0.602	$400	$3,400	$0	$3,670	$7,470	$3,578,875	$3,006,884
27	0.590	$400	$3,400	$0	$3,670	$7,470	$3,586,345	$3,011,295
28	0.579	$400	$3,400	$0	$3,670	$7,470	$3,593,815	$3,015,621
29	0.568	$400	$3,400	$0	$3,670	$7,470	$3,601,285	$3,019,863
30	0.557	$71,320	$90,800	$57,180	$1,038,370	$1,257,670	$4,858,955	$3,720,249
31	0.546	$0	$0	$0	$26,840	$26,840	$4,885,795	$3,734,907
32	0.536	$0	$0	$0	$42,130	$42,130	$4,927,925	$3,757,471
33	0.525	$0	$0	$0	$26,840	$26,840	$4,954,765	$3,771,568
34	0.515	$0	$0	$0	$42,130	$42,130	$4,996,895	$3,793,268
35	0.505	$0	$0	$0	$26,840	$26,840	$5,023,735	$3,806,826
36	0.495	$0	$0	$0	$42,130	$42,130	$5,065,865	$3,827,695
37	0.486	$0	$0	$0	$26,840	$26,840	$5,092,705	$3,840,734
38	0.476	$0	$0	$0	$42,130	$42,130	$5,134,835	$3,860,805
39	0.467	$0	$0	$0	$26,840	$26,840	$5,161,675	$3,873,345
40	0.458	$0	$0	$0	$42,130	$42,130	$5,203,805	$3,892,647
41	0.449	$0	$0	$0	$26,840	$26,840	$5,230,645	$3,904,707
42	0.441	$0	$0	$0	$42,130	$42,130	$5,272,775	$3,923,271
43	0.432	$0	$0	$0	$26,840	$26,840	$5,299,615	$3,934,869
44	0.424	$0	$0	$0	$42,130	$42,130	$5,341,745	$3,952,722
45	0.416	$0	$0	$0	$26,840	$26,840	$5,368,585	$3,963,877
46	0.408	$0	$0	$0	$42,130	$42,130	$5,410,715	$3,981,047
47	0.400	$0	$0	$0	$564,010	$564,010	$5,974,725	$4,206,468
48	0.392	$0	$0	$0	$59,030	$59,030	$6,033,755	$4,229,605
49	0.384	$0	$0	$0	$43,740	$43,740	$6,077,495	$4,246,417
50	0.377	$0	$0	$0	$59,030	$59,030	$6,136,525	$4,268,669
51	0.370	$0	$0	$0	$43,740	$43,740	$6,180,265	$4,284,838
52	0.363	$0	$0	$0	$59,030	$59,030	$6,239,295	$4,306,238
53	0.356	$0	$0	$0	$26,840	$26,840	$6,266,135	$4,315,780

Remedy 2 - Summary of Estimated Costs

Less Aggressive Remedy

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-MNA in the UVZ for 30 years
Phase:	Draft FS Costing	-MNA in the PA for 30 years, with PlumeStop barrier contingency
Year 0:	2016	-Pulsed SVE for 10 years in the LVZ with existing LTM network until Year 3(
For:	200 Years	-MNA with UAWellhead Treatment in the RA for 200 years
Date:	April 2016	-Inflation of 1.5% & Rate of Return of 3.5%

54	0.349	$0	$0	$0	$42,130	$42,130	$6,308,265	$4,330,468
55	0.342	$0	$0	$0	$26,840	$26,840	$6,335,105	$4,339,645
56	0.335	$0	$0	$0	$42,130	$42,130	$6,377,235	$4,353,772
57	0.329	$0	$0	$0	$26,840	$26,840	$6,404,075	$4,362,597
58	0.322	$0	$0	$0	$42,130	$42,130	$6,446,205	$4,376,183
59	0.316	$0	$0	$0	$26,840	$26,840	$6,473,045	$4,384,671
60	0.310	$0	$0	$0	$1,061,540	$1,061,540	$7,534,585	$4,713,885
61	0.304	$0	$0	$0	$26,840	$26,840	$7,561,425	$4,722,048
62	0.298	$0	$0	$0	$42,130	$42,130	$7,603,555	$4,734,613
63	0.292	$0	$0	$0	$26,840	$26,840	$7,630,395	$4,742,464
64	0.287	$0	$0	$0	$42,130	$42,130	$7,672,525	$4,754,549
65	0.281	$0	$0	$0	$26,840	$26,840	$7,699,365	$4,762,099
66	0.276	$0	$0	$0	$42,130	$42,130	$7,741,495	$4,773,721
67	0.271	$0	$0	$0	$26,840	$26,840	$7,768,335	$4,780,982
68	0.265	$0	$0	$0	$42,130	$42,130	$7,810,465	$4,792,159
69	0.260	$0	$0	$0	$26,840	$26,840	$7,837,305	$4,799,143
70	0.255	$0	$0	$0	$65,300	$65,300	$7,902,605	$4,815,804
71	0.250	$0	$0	$0	$50,010	$50,010	$7,952,615	$4,828,317
72	0.245	$0	$0	$0	$65,300	$65,300	$8,017,915	$4,844,341
73	0.241	$0	$0	$0	$50,010	$50,010	$8,067,925	$4,856,376
74	0.236	$0	$0	$0	$65,300	$65,300	$8,133,225	$4,871,786
75	0.231	$0	$0	$0	$50,010	$50,010	$8,183,235	$4,883,360
76	0.227	$0	$0	$0	$65,300	$65,300	$8,248,535	$4,898,181
77	0.223	$0	$0	$0	$26,840	$26,840	$8,275,375	$4,904,155
78	0.218	$0	$0	$0	$42,130	$42,130	$8,317,505	$4,913,351
79	0.214	$0	$0	$0	$26,840	$26,840	$8,344,345	$4,919,096
80	0.210	$0	$0	$0	$42,130	$42,130	$8,386,475	$4,927,940
81	0.206	$0	$0	$0	$26,840	$26,840	$8,413,315	$4,933,465
82	0.202	$0	$0	$0	$42,130	$42,130	$8,455,445	$4,941,971
83	0.198	$0	$0	$0	$26,840	$26,840	$8,482,285	$4,947,285
84	0.194	$0	$0	$0	$42,130	$42,130	$8,524,415	$4,955,465
85	0.190	$0	$0	$0	$26,840	$26,840	$8,551,255	$4,960,575
86	0.187	$0	$0	$0	$42,130	$42,130	$8,593,385	$4,968,442
87	0.183	$0	$0	$0	$26,840	$26,840	$8,620,225	$4,973,357
88	0.180	$0	$0	$0	$42,130	$42,130	$8,662,355	$4,980,923
89	0.176	$0	$0	$0	$26,840	$26,840	$8,689,195	$4,985,650
90	0.173	$0	$0	$0	$1,061,540	$1,061,540	$9,750,735	$5,168,986
91	0.169	$0	$0	$0	$26,840	$26,840	$9,777,575	$5,173,532
92	0.166	$0	$0	$0	$42,130	$42,130	$9,819,705	$5,180,530
93	0.163	$0	$0	$0	$26,840	$26,840	$9,846,545	$5,184,901
94	0.160	$0	$0	$0	$42,130	$42,130	$9,888,675	$5,191,631
95	0.157	$0	$0	$0	$26,840	$26,840	$9,915,515	$5,195,836
96	0.154	$0	$0	$0	$42,130	$42,130	$9,957,645	$5,202,308
97	0.151	$0	$0	$0	$26,840	$26,840	$9,984,485	$5,206,352
98	0.148	$0	$0	$0	$42,130	$42,130	$10,026,615	$5,212,576
99	0.145	$0	$0	$0	$26,840	$26,840	$10,053,455	$5,216,465
100	0.142	$0	$0	$0	$42,130	$42,130	$10,095,585	$5,222,452
101	0.139	$0	$0	$0	$26,840	$26,840	$10,122,425	$5,226,192
102	0.137	$0	$0	$0	$42,130	$42,130	$10,164,555	$5,231,949
103	0.134	$0	$0	$0	$26,840	$26,840	$10,191,395	$5,235,546
104	0.131	$0	$0	$0	$42,130	$42,130	$10,233,525	$5,241,083
105	0.129	$0	$0	$0	$26,840	$26,840	$10,260,365	$5,244,542
106	0.126	$0	$0	$0	$42,130	$42,130	$10,302,495	$5,249,867
107	0.124	$0	$0	$0	$26,840	$26,840	$10,329,335	$5,253,194
108	0.122	$0	$0	$0	$42,130	$42,130	$10,371,465	$5,258,315
109	0.119	$0	$0	$0	$26,840	$26,840	$10,398,305	$5,261,514
110	0.117	$0	$0	$0	$42,130	$42,130	$10,440,435	$5,266,439
111	0.115	$0	$0	$0	$50,010	$50,010	$10,490,445	$5,272,173

Remedy 2 - Summary of Estimated Costs

Less Aggressive Remedy

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-MNA in the UVZ for 30 years
Phase:	Draft FS Costing	-MNA in the PA for 30 years, with PlumeStop barrier contingency
Year 0:	2016	-Pulsed SVE for 10 years in the LVZ with existing LTM network until Year 3(
For:	200 Years	-MNA with UAWellhead Treatment in the RA for 200 years
Date:	April 2016	-Inflation of 1.5% & Rate of Return of 3.5%

112	0.112	$0	$0	$0	$65,300	$65,300	$10,555,745	$5,279,514
113	0.110	$0	$0	$0	$50,010	$50,010	$10,605,755	$5,285,028
114	0.108	$0	$0	$0	$65,300	$65,300	$10,671,055	$5,292,089
115	0.106	$0	$0	$0	$50,010	$50,010	$10,721,065	$5,297,392
116	0.104	$0	$0	$0	$65,300	$65,300	$10,786,365	$5,304,182
117	0.102	$0	$0	$0	$50,010	$50,010	$10,836,375	$5,309,282
118	0.100	$0	$0	$0	$65,300	$65,300	$10,901,675	$5,315,813
119	0.098	$0	$0	$0	$50,010	$50,010	$10,951,685	$5,320,717
120	0.096	$0	$0	$0	$1,084,710	$1,084,710	$12,036,395	$5,425,044
121	0.094	$0	$0	$0	$26,840	$26,840	$12,063,235	$5,427,576
122	0.092	$0	$0	$0	$42,130	$42,130	$12,105,365	$5,431,473
123	0.091	$0	$0	$0	$26,840	$26,840	$12,132,205	$5,433,908
124	0.089	$0	$0	$0	$42,130	$42,130	$12,174,335	$5,437,655
125	0.087	$0	$0	$0	$26,840	$26,840	$12,201,175	$5,439,997
126	0.086	$0	$0	$0	$42,130	$42,130	$12,243,305	$5,443,601
127	0.084	$0	$0	$0	$26,840	$26,840	$12,270,145	$5,445,853
128	0.082	$0	$0	$0	$42,130	$42,130	$12,312,275	$5,449,320
129	0.081	$0	$0	$0	$26,840	$26,840	$12,339,115	$5,451,485
130	0.079	$0	$0	$0	$579,300	$579,300	$12,918,415	$5,497,325
131	0.078	$0	$0	$0	$43,740	$43,740	$12,962,155	$5,500,719
132	0.076	$0	$0	$0	$59,030	$59,030	$13,021,185	$5,505,212
133	0.075	$0	$0	$0	$43,740	$43,740	$13,064,925	$5,508,476
134	0.073	$0	$0	$0	$94,530	$94,530	$13,159,455	$5,515,394
135	0.072	$0	$0	$0	$43,740	$43,740	$13,203,195	$5,518,534
136	0.070	$0	$0	$0	$59,030	$59,030	$13,262,225	$5,522,689
137	0.069	$0	$0	$0	$43,740	$43,740	$13,305,965	$5,525,708
138	0.068	$0	$0	$0	$59,030	$59,030	$13,364,995	$5,529,704
139	0.066	$0	$0	$0	$79,240	$79,240	$13,444,235	$5,534,964
140	0.065	$0	$0	$0	$59,030	$59,030	$13,503,265	$5,538,807
141	0.064	$0	$0	$0	$43,740	$43,740	$13,547,005	$5,541,600
142	0.063	$0	$0	$0	$59,030	$59,030	$13,606,035	$5,545,296
143	0.061	$0	$0	$0	$79,240	$79,240	$13,685,275	$5,550,161
144	0.060	$0	$0	$0	$59,030	$59,030	$13,744,305	$5,553,716
145	0.059	$0	$0	$0	$43,740	$43,740	$13,788,045	$5,556,299
146	0.058	$0	$0	$0	$59,030	$59,030	$13,847,075	$5,559,717
147	0.057	$0	$0	$0	$79,240	$79,240	$13,926,315	$5,564,217
148	0.056	$0	$0	$0	$59,030	$59,030	$13,985,345	$5,567,505
149	0.055	$0	$0	$0	$43,740	$43,740	$14,029,085	$5,569,894
150	0.054	$0	$0	$0	$1,078,440	$1,078,440	$15,107,525	$5,627,657
151	0.053	$0	$0	$0	$43,740	$43,740	$15,151,265	$5,629,954
152	0.052	$0	$0	$0	$94,530	$94,530	$15,245,795	$5,634,823
153	0.051	$0	$0	$0	$43,740	$43,740	$15,289,535	$5,637,033
154	0.050	$0	$0	$0	$59,030	$59,030	$15,348,565	$5,639,957
155	0.049	$0	$0	$0	$43,740	$43,740	$15,392,305	$5,642,082
156	0.048	$0	$0	$0	$59,030	$59,030	$15,451,335	$5,644,895
157	0.047	$0	$0	$0	$79,240	$79,240	$15,530,575	$5,648,597
158	0.046	$0	$0	$0	$59,030	$59,030	$15,589,605	$5,651,302
159	0.045	$0	$0	$0	$43,740	$43,740	$15,633,345	$5,653,267
160	0.044	$0	$0	$0	$42,130	$42,130	$15,675,475	$5,655,124
161	0.043	$0	$0	$0	$26,840	$26,840	$15,702,315	$5,656,284
162	0.042	$0	$0	$0	$42,130	$42,130	$15,744,445	$5,658,069
163	0.042	$0	$0	$0	$26,840	$26,840	$15,771,285	$5,659,185
164	0.041	$0	$0	$0	$42,130	$42,130	$15,813,415	$5,660,902
165	0.040	$0	$0	$0	$26,840	$26,840	$15,840,255	$5,661,975
166	0.039	$0	$0	$0	$42,130	$42,130	$15,882,385	$5,663,626
167	0.038	$0	$0	$0	$26,840	$26,840	$15,909,225	$5,664,658
168	0.038	$0	$0	$0	$42,130	$42,130	$15,951,355	$5,666,246
169	0.037	$0	$0	$0	$26,840	$26,840	$15,978,195	$5,667,238

Remedy 2 - Summary of Estimated Costs

Less Aggressive Remedy

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-MNA in the UVZ for 30 years
Phase:	Draft FS Costing	-MNA in the PA for 30 years, with PlumeStop barrier contingency
Year 0:	2016	-Pulsed SVE for 10 years in the LVZ with existing LTM network until Year 3(
For:	200 Years	-MNA with UAWellhead Treatment in the RA for 200 years
Date:	April 2016	-Inflation of 1.5% & Rate of Return of 3.5%

170	0.036	$0	$0	$0	$42,130	$42,130	$16,020,325	$5,668,766
171	0.036	$0	$0	$0	$26,840	$26,840	$16,047,165	$5,669,720
172	0.035	$0	$0	$0	$42,130	$42,130	$16,089,295	$5,671,189
173	0.034	$0	$0	$0	$26,840	$26,840	$16,116,135	$5,672,107
174	0.034	$0	$0	$0	$42,130	$42,130	$16,158,265	$5,673,520
175	0.033	$0	$0	$0	$26,840	$26,840	$16,185,105	$5,674,402
176	0.032	$0	$0	$0	$42,130	$42,130	$16,227,235	$5,675,761
177	0.032	$0	$0	$0	$26,840	$26,840	$16,254,075	$5,676,610
178	0.031	$0	$0	$0	$42,130	$42,130	$16,296,205	$5,677,916
179	0.030	$0	$0	$0	$26,840	$26,840	$16,323,045	$5,678,733
180	0.030	$0	$0	$0	$1,061,540	$1,061,540	$17,384,585	$5,710,396
181	0.029	$0	$0	$0	$26,840	$26,840	$17,411,425	$5,711,182
182	0.029	$0	$0	$0	$42,130	$42,130	$17,453,555	$5,712,390
183	0.028	$0	$0	$0	$26,840	$26,840	$17,480,395	$5,713,145
184	0.028	$0	$0	$0	$42,130	$42,130	$17,522,525	$5,714,307
185	0.027	$0	$0	$0	$26,840	$26,840	$17,549,365	$5,715,034
186	0.027	$0	$0	$0	$42,130	$42,130	$17,591,495	$5,716,151
187	0.026	$0	$0	$0	$26,840	$26,840	$17,618,335	$5,716,850
188	0.026	$0	$0	$0	$42,130	$42,130	$17,660,465	$5,717,925
189	0.025	$0	$0	$0	$26,840	$26,840	$17,687,305	$5,718,596
190	0.025	$0	$0	$0	$42,130	$42,130	$17,729,435	$5,719,630
191	0.024	$0	$0	$0	$26,840	$26,840	$17,756,275	$5,720,276
192	0.024	$0	$0	$0	$42,130	$42,130	$17,798,405	$5,721,271
193	0.023	$0	$0	$0	$26,840	$26,840	$17,825,245	$5,721,892
194	0.023	$0	$0	$0	$18,960	$18,960	$17,844,205	$5,722,322
195	0.022	$0	$0	$0	$3,670	$3,670	$17,847,875	$5,722,404
196	0.022	$0	$0	$0	$18,960	$18,960	$17,866,835	$5,722,818
197	0.021	$0	$0	$0	$3,670	$3,670	$17,870,505	$5,722,896
198	0.021	$0	$0	$0	$18,960	$18,960	$17,889,465	$5,723,294
199	0.021	$0	$0	$0	$3,670	$3,670	$17,893,135	$5,723,370
200	0.020	$0	$0	$0	$155,780	$155,780	$18,048,915	$5,726,515
Total	-	$327,150	$1,436,735	$1,394,290	$14,890,740	$18,048,915	$18,048,915	$5,726,515

Remedy 3 - Summary of Estimated Costs

APPENDIX J

J-2.3

More Aggressive Remedy

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Continous SVE to Year 5 then pulsed to Year 10 in UVZ, MNA until Year 35
Phase:	Draft FS Costing	-Sparging in the PA for 5 years, then MNA until Year 35
Year 0:	2016	-Pulsed SVE and additional location for 11 years in the LVZ with expanded LTM
For:	40 Years	-Groundwater Extraction in the RA (3B) for 30 years, then MNA until Year 50
Date:	April 2016	-Inflation of 1.5% & Rate of Return of 3.5%

PROJECT COST SCHEDULE (200 Year Period of Analysis):

YEAR	DISCOUNT FACTOR	PERIODIC O&M COST					CUMULATIVE COST	
		UVZ	PA	LVZ	RA (3B)	TOTAL	CURRENT	NPV
0	1.000	$366,980	$410,930	$560,044	$2,351,000	$3,688,954	$3,688,954	$3,688,954
1	0.981	$327,660	$76,265	$267,334	$160,940	$832,199	$4,521,153	$4,505,072
2	0.962	$327,660	$76,265	$150,904	$160,940	$715,769	$5,236,922	$5,193,446
3	0.943	$327,660	$76,265	$150,904	$160,810	$715,639	$5,952,561	$5,868,395
4	0.925	$327,660	$76,265	$150,904	$160,670	$715,499	$6,668,060	$6,530,172
5	0.907	$89,000	$20,405	$155,904	$142,950	$408,259	$7,076,319	$6,900,481
6	0.890	$89,000	$20,405	$150,904	$159,580	$419,889	$7,496,208	$7,273,979
7	0.872	$89,000	$20,405	$150,904	$140,900	$401,209	$7,897,417	$7,623,965
8	0.855	$89,000	$20,405	$150,904	$157,540	$417,849	$8,315,266	$7,981,423
9	0.839	$89,000	$20,405	$150,904	$138,860	$399,169	$8,714,435	$8,316,302
10	0.823	$89,000	$14,760	$150,904	$155,490	$410,154	$9,124,589	$8,653,748
11	0.807	$16,060	$700	$22,720	$137,490	$176,970	$9,301,559	$8,796,533
12	0.791	$400	$14,760	$22,720	$154,670	$192,550	$9,494,109	$8,948,886
13	0.776	$16,060	$700	$22,720	$136,670	$176,150	$9,670,259	$9,085,570
14	0.761	$400	$14,760	$22,720	$153,860	$191,740	$9,861,999	$9,231,475
15	0.746	$16,060	$700	$6,000	$135,860	$158,620	$10,020,619	$9,349,846
16	0.732	$400	$14,760	$400	$153,170	$168,730	$10,189,349	$9,473,328
17	0.718	$400	$700	$6,000	$135,070	$142,170	$10,331,519	$9,575,362
18	0.704	$400	$14,760	$400	$152,150	$167,710	$10,499,229	$9,693,400
19	0.690	$400	$700	$6,000	$134,050	$141,150	$10,640,379	$9,790,824
20	0.677	$16,060	$14,760	$400	$151,120	$182,340	$10,822,719	$9,914,247
21	0.664	$400	$700	$6,000	$133,020	$140,120	$10,962,839	$10,007,259
22	0.651	$400	$700	$400	$150,320	$151,820	$11,114,659	$10,106,091
23	0.638	$400	$700	$400	$132,130	$133,630	$11,248,289	$10,191,400
24	0.626	$400	$700	$400	$149,130	$150,630	$11,398,919	$10,285,703
25	0.614	$16,060	$14,760	$400	$131,180	$162,400	$11,561,319	$10,385,411
26	0.602	$400	$700	$6,000	$148,410	$155,510	$11,716,829	$10,479,043
27	0.590	$400	$700	$400	$130,820	$132,320	$11,849,149	$10,557,173
28	0.579	$400	$700	$400	$148,050	$149,550	$11,998,699	$10,643,771
29	0.568	$400	$700	$400	$130,460	$131,960	$12,130,659	$10,718,707
30	0.557	$16,060	$14,760	$400	$20,760	$51,980	$12,182,639	$10,747,654
31	0.546	$400	$700	$29,570	$3,170	$33,840	$12,216,479	$10,766,135
32	0.536	$400	$700	$0	$20,760	$21,860	$12,238,339	$10,777,843
33	0.525	$400	$700	$0	$3,170	$4,270	$12,242,609	$10,780,085
34	0.515	$400	$700	$0	$20,760	$21,860	$12,264,469	$10,791,345
35	0.505	$71,320	$46,420	$0	$3,170	$120,910	$12,385,379	$10,852,420
36	0.495	$0	$0	$0	$20,760	$20,760	$12,406,139	$10,862,703
37	0.486	$0	$0	$0	$3,170	$3,170	$12,409,309	$10,864,243
38	0.476	$0	$0	$0	$20,760	$20,760	$12,430,069	$10,874,134
39	0.467	$0	$0	$0	$3,170	$3,170	$12,433,239	$10,875,615
40	0.458	$0	$0	$0	-$117,660	-$117,660	$12,315,579	$10,821,706
Total	-	$2,386,500	$994,415	$2,345,364	$6,589,300	$12,315,579	$12,315,579	$10,821,706

Remedy 4 - Summary of Estimated Costs

APPENDIX J

J-2.4

Proposed Remedy

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Pulsed SVE for 10 years, then MNA in the UVZ until Year 30 (Alt 1)
Phase:	Draft FS Costing	-MNA in the PA for 30 years, with PlumeStop barrier contingency (Alt 2)
Year 0:	2016	-Pulsed SVE in LVZ for 10 years with expanded LTM network for 30 years (Alt 1)
For:	40 Years	-Groundwater Extraction in the RA for 30 years, then MNA until Year 50 (Alt 3B)
Date:	April 2016	-Inflation of 1.5% & Rate of Return of 3.5%

PROJECT COST SCHEDULE (200 Year Period of Analysis):

YEAR	DISCOUNT FACTOR	PERIODIC O&M COST					CUMULATIVE COST	
		UVZ	PA	LVZ	RA (3B)	TOTAL	CURRENT	NPV
0	1.000	$138,670	$242,155	$550,834	$2,351,000	$3,282,659	$3,282,659	$3,282,659
1	0.981	$89,000	$20,405	$141,694	$160,940	$412,039	$3,694,698	$3,686,736
2	0.962	$89,000	$20,405	$141,694	$160,940	$412,039	$4,106,737	$4,083,005
3	0.943	$89,000	$20,405	$141,694	$160,810	$411,909	$4,518,646	$4,471,493
4	0.925	$89,000	$20,405	$141,694	$160,670	$411,769	$4,930,415	$4,852,345
5	0.907	$89,000	$14,760	$146,694	$142,950	$393,404	$5,323,819	$5,209,180
6	0.890	$89,000	$700	$141,694	$159,580	$390,974	$5,714,793	$5,556,958
7	0.872	$89,000	$14,760	$141,694	$140,900	$386,354	$6,101,147	$5,893,986
8	0.855	$89,000	$700	$141,694	$157,540	$388,934	$6,490,081	$6,226,708
9	0.839	$89,000	$14,760	$141,694	$138,860	$384,314	$6,874,395	$6,549,124
10	0.823	$89,000	$700	$6,000	$155,490	$251,190	$7,125,585	$6,755,786
11	0.807	$16,060	$14,760	$6,000	$137,490	$174,310	$7,299,895	$6,896,424
12	0.791	$400	$700	$6,000	$154,670	$161,770	$7,461,665	$7,024,423
13	0.776	$16,060	$14,760	$6,000	$136,670	$173,490	$7,635,155	$7,159,043
14	0.761	$400	$700	$6,000	$153,860	$160,960	$7,796,115	$7,281,526
15	0.746	$16,060	$14,760	$400	$135,860	$167,080	$7,963,195	$7,406,210
16	0.732	$400	$700	$6,000	$153,170	$160,270	$8,123,465	$7,523,501
17	0.718	$400	$700	$400	$135,070	$136,570	$8,260,035	$7,621,516
18	0.704	$400	$700	$6,000	$152,150	$159,250	$8,419,285	$7,733,599
19	0.690	$400	$700	$400	$134,050	$135,550	$8,554,835	$7,827,159
20	0.677	$16,060	$14,760	$6,000	$151,120	$187,940	$8,742,775	$7,954,372
21	0.664	$400	$700	$400	$133,020	$134,520	$8,877,295	$8,043,667
22	0.651	$400	$700	$400	$150,320	$151,820	$9,029,115	$8,142,498
23	0.638	$400	$700	$400	$132,130	$133,630	$9,162,745	$8,227,807
24	0.626	$400	$700	$400	$149,130	$150,630	$9,313,375	$8,322,111
25	0.614	$16,060	$896,140	$6,000	$131,180	$1,049,380	$10,362,755	$8,966,391
26	0.602	$400	$3,400	$400	$148,410	$152,610	$10,515,365	$9,058,278
27	0.590	$400	$3,400	$400	$130,820	$135,020	$10,650,385	$9,138,002
28	0.579	$400	$3,400	$400	$148,050	$152,250	$10,802,635	$9,226,163
29	0.568	$400	$3,400	$400	$130,460	$134,660	$10,937,295	$9,302,632
30	0.557	$71,320	$90,800	$29,570	$20,760	$212,450	$11,149,745	$9,420,944
31	0.546	$0	$0	$0	$3,170	$3,170	$11,152,915	$9,422,675
32	0.536	$0	$0	$0	$20,760	$20,760	$11,173,675	$9,433,793
33	0.525	$0	$0	$0	$3,170	$3,170	$11,176,845	$9,435,458
34	0.515	$0	$0	$0	$20,760	$20,760	$11,197,605	$9,446,151
35	0.505	$0	$0	$0	$3,170	$3,170	$11,200,775	$9,447,753
36	0.495	$0	$0	$0	$20,760	$20,760	$11,221,535	$9,458,036
37	0.486	$0	$0	$0	$3,170	$3,170	$11,224,705	$9,459,576
38	0.476	$0	$0	$0	$20,760	$20,760	$11,245,465	$9,469,467
39	0.467	$0	$0	$0	$3,170	$3,170	$11,248,635	$9,470,948
40	0.458	$0	$0	$0	-$117,660	-$117,660	$11,130,975	$9,417,039
Total	-	$1,185,890	$1,436,735	$1,919,050	$6,589,300	$11,130,975	$11,130,975	$9,417,039

Alternative 1: Reference - Upper Vadose Zone
Pulsed SVE, then MNA

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 30 Years
Date: April 2016

Description (*shared SVE costs are captured in LVZ alternatives*)

-Pulsed SVE for 10 years, quarterly one-week operational events, then MNA of UVZ vapor wells until Year 30, then Site Closure
-Install 4 additional shallow locations and monitor 36 individual wells initially
-Refine to 25 individual wells and reduce sampling frequency
-No further action after Year 30

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Monitoring Well Installation**				**$10,850**
1.01	Work Plan & Coordination - UVZ	LS	$4,000	1	$4,000
1.02	Drilling and Installation Services - UVZ	well	$600	4	$2,400
1.03	Oversight & Reporting - UVZ	well	$640	4	$2,560
1.04	*Project Management Fee*	*%*		*10*	*$900*
1.05	*Contingency*	*%*		*10*	*$990*
2.00	**Initiate SVE in UVZ - Capital Costs**				**$38,820**
2.01	Work Plan & Coordination	LS	$2,500	*1*	$2,500
2.02	Modify/Submit Air Permit	EA	$5,000	*in LVZ*	$0
2.03	Maintenance and reconnect SVE wells	well	$2,500	4	$10,000
2.04	Purchase SVE Blower	LS	$20,000	1	$20,000
2.05	*Project Management Fee*	*%*		*10*	*$1,250*
2.06	*Contingency*	*%*		*15*	*$5,070*
3.00	**Pulsed SVE Operation in UVZ - Annual O&M Costs**				**$67,060**
3.01	Maintenance and Monitoring	qtr	$9,500	*in LVZ*	$0
3.02	GAC and Hydrosil Replacement	qtr	$12,700	4	$50,800
3.03	Annual Air Permit Fee to PDEQ	yr	$4,444	*in LVZ*	$0
3.04	Electrical	qtr	$200	*in LVZ*	$0
3.05	*Project Management Fee*	*%*		*10*	*$5,080*
3.06	*Contingency*	*%*		*20*	*$11,180*
4.00	**Vapor Monitoring & Reporting (Years 0 to 12) - Annual**				**$21,540**
4.01	Labor and supplies to sample UVZ vapor monitoring wells	well	$190	36	$6,840
4.02	Vapor analytical - TO-15 for COCs	sample	$200	40	$8,000
4.03	Evaluation and Reporting - UVZ	LS	$3,800	1	$3,800
4.04	*Project Management Fee*	*%*		*10*	*$1,870*
4.05	*Contingency*	*%*		*5*	*$1,030*
5.00	**Vapor Monitoring & Reporting (Years 12 to 30 years)**				**$15,660**
5.01	Labor and supplies to sample UVZ vapor monitoring wells	well	$190	25	$4,750
5.02	Vapor analytical - TO-15 for COCs	sample	$200	28	$5,600
5.03	Evaluation and Reporting - UVZ	LS	$3,200	1	$3,200
5.04	*Project Management Fee*	*%*		*10*	*$1,360*
5.05	*Contingency*	*%*		*5*	*$750*
6.00	**Annual CoT Access Fees**				**$400**
6.01	CoT Agreement Fee	well	$100	4	$400
7.00	**Site Closeout**				**$55,660**
7.01	Evaluation and Coordination	LS	$16,800	1	$16,800
7.02	Well Abandonment - UVZ	well	$200	36	$7,200
7.03	Reporting and Closeout	LS	$20,000	1	$20,000
7.04	*Project Management Fee*	*%*		*10*	*$4,400*
7.05	*Contingency*	*%*		*15*	*$7,260*

Alternative 1: Reference - Upper Vadose Zone
Pulsed SVE, then MNA

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 30 Years
Date: April 2016

Description (*shared SVE costs are captured in LVZ alternatives*)
-Pulsed SVE for 10 years, quarterly one-week operational events, then MNA of UVZ vapor wells until Year 30, then Site Closure
-Install 4 additional shallow locations and monitor 36 individual wells initially
-Refine to 25 individual wells and reduce sampling frequency
-No further action after Year 30

PROJECT COST SCHEDULE (30 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
8.00	**O&M Cost**					
8.00	Vapor Monitoring, Well Installation, & Pulsed SVE Operation	0	$138,670	$138,670	1.000	$138,670
8.01	Vapor Monitoring & Pulsed SVE Operation	1	$89,000	$227,670	0.981	$87,280
8.02	Vapor Monitoring & Pulsed SVE Operation	2	$89,000	$316,670	0.962	$85,594
8.03	Vapor Monitoring & Pulsed SVE Operation	3	$89,000	$405,670	0.943	$83,940
8.04	Vapor Monitoring & Pulsed SVE Operation	4	$89,000	$494,670	0.925	$82,318
8.05	Vapor Monitoring & Pulsed SVE Operation	5	$89,000	$583,670	0.907	$80,727
8.06	Vapor Monitoring & Pulsed SVE Operation	6	$89,000	$672,670	0.890	$79,167
8.07	Vapor Monitoring & Pulsed SVE Operation	7	$89,000	$761,670	0.872	$77,637
8.08	Vapor Monitoring & Pulsed SVE Operation	8	$89,000	$850,670	0.855	$76,137
8.09	Vapor Monitoring & Pulsed SVE Operation	9	$89,000	$939,670	0.839	$74,666
8.10	Vapor Monitoring & Pulsed SVE Operation	10	$89,000	$1,028,670	0.823	$73,223
8.11	Vapor Monitoring	11	$16,060	$1,044,730	0.807	$12,958
8.12	No Action	12	$400	$1,045,130	0.791	$316
8.13	Vapor Monitoring	13	$16,060	$1,061,190	0.776	$12,462
8.14	No Action	14	$400	$1,061,590	0.761	$304
8.15	Vapor Monitoring	15	$16,060	$1,077,650	0.746	$11,985
8.16	No Action	16	$400	$1,078,050	0.732	$293
8.17	No Action	17	$400	$1,078,450	0.718	$287
8.18	No Action	18	$400	$1,078,850	0.704	$282
8.19	No Action	19	$400	$1,079,250	0.690	$276
8.20	Vapor Monitoring	20	$16,060	$1,095,310	0.677	$10,871
8.21	No Action	21	$400	$1,095,710	0.664	$266
8.22	No Action	22	$400	$1,096,110	0.651	$260
8.23	No Action	23	$400	$1,096,510	0.638	$255
8.24	No Action	24	$400	$1,096,910	0.626	$250
8.25	Vapor Monitoring	25	$16,060	$1,112,970	0.614	$9,860
8.26	No Action	26	$400	$1,113,370	0.602	$241
8.27	No Action	27	$400	$1,113,770	0.590	$236
8.28	No Action	28	$400	$1,114,170	0.579	$232
8.29	No Action	29	$400	$1,114,570	0.568	$227
8.30	Vapor Monitoring and Site Closeout	30	$71,320	$1,185,890	0.557	$39,718
TOTAL COSTS			**$1,185,890**			**$1,040,936**

Alternative 2: Less Aggressive - Upper Vadose Zone
MNA

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 30 Years
Date: April 2016

Description
-MNA of UVZ vapor wells for 30 years, then no action
-Install 4 additional shallow locations and monitor 36 individual wells initially
-Refine to 25 individual wells and reduce sampling frequency
-No further action after Year 30

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Monitoring Well Installation**				**$10,850**
1.01	Work Plan & Coordination - UVZ	LS	$4,000	1	$4,000
1.02	Drilling and Installation Services - UVZ	well	$600	4	$2,400
1.03	Oversight & Reporting - UVZ	well	$640	4	$2,560
1.04	*Project Management Fee*	*%*		*10*	*$900*
1.05	*Contingency*	*%*		*10*	*$990*
2.00	**Vapor Monitoring & Reporting (first 5 years)**				**$21,540**
2.01	Labor and supplies to sample UVZ vapor monitoring wells	well	$190	36	$6,840
2.02	Vapor analytical - TO-15 for COCs	sample	$200	40	$8,000
2.03	Evaluation and Reporting - UVZ	LS	$3,800	1	$3,800
2.04	*Project Management Fee*	*%*		*10*	*$1,870*
2.05	*Contingency*	*%*		*5*	*$1,030*
3.00	**Vapor Monitoring & Reporting (5 to 30 years)**				**$15,660**
3.01	Labor and supplies to sample UVZ vapor monitoring wells	well	$190	25	$4,750
3.02	Vapor analytical - TO-15 for COCs	sample	$200	28	$5,600
3.03	Evaluation and Reporting - UVZ	LS	$3,200	1	$3,200
3.04	*Project Management Fee*	*%*		*10*	*$1,360*
3.05	*Contingency*	*%*		*5*	*$750*
4.00	**Annual CoT Access Fees**				**$400**
4.01	CoT Agreement Fee	well	$100	4	$400
5.00	**Site Closeout**				**$55,660**
5.01	Evaluation and Coordination	LS	$16,800	1	$16,800
5.02	Well Abandonment - UVZ	well	$200	36	$7,200
5.03	Reporting and Closeout	LS	$20,000	1	$20,000
5.04	*Project Management Fee*	*%*		*10*	*$4,400*
5.05	*Contingency*	*%*		*15*	*$7,260*

Alternative 2: Less Aggressive - Upper Vadose Zone
MNA

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 30 Years
Date: April 2016

Description
-MNA of UVZ vapor wells for 30 years, then no action
-Install 4 additional shallow locations and monitor 36 individual wells initially
-Refine to 25 individual wells and reduce sampling frequency
-No further action after Year 30

PROJECT COST SCHEDULE (30 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
6.00	**O&M Cost**					
6.00	Vapor Monitoring and Well Installation	0	$32,790	$32,790	1.000	$32,790
6.01	Vapor Monitoring	1	$21,940	$54,730	0.981	$21,516
6.02	Vapor Monitoring	2	$21,940	$76,670	0.962	$21,100
6.03	Vapor Monitoring	3	$21,940	$98,610	0.943	$20,693
6.04	Vapor Monitoring	4	$21,940	$120,550	0.925	$20,293
6.05	Vapor Monitoring	5	$16,060	$136,610	0.907	$14,567
6.06	No action	6	$400	$137,010	0.890	$356
6.07	Vapor Monitoring	7	$16,060	$153,070	0.872	$14,010
6.08	No action	8	$400	$153,470	0.855	$342
6.09	Vapor Monitoring	9	$16,060	$169,530	0.839	$13,473
6.10	No action	10	$400	$169,930	0.823	$329
6.11	Vapor Monitoring	11	$16,060	$185,990	0.807	$12,958
6.12	No action	12	$400	$186,390	0.791	$316
6.13	Vapor Monitoring	13	$16,060	$202,450	0.776	$12,462
6.14	No action	14	$400	$202,850	0.761	$304
6.15	Vapor Monitoring	15	$16,060	$218,910	0.746	$11,985
6.16	No action	16	$400	$219,310	0.732	$293
6.17	No action	17	$400	$219,710	0.718	$287
6.18	No action	18	$400	$220,110	0.704	$282
6.19	No action	19	$400	$220,510	0.690	$276
6.20	Vapor Monitoring	20	$16,060	$236,570	0.677	$10,871
6.21	No action	21	$400	$236,970	0.664	$266
6.22	No action	22	$400	$237,370	0.651	$260
6.23	No action	23	$400	$237,770	0.638	$255
6.24	No action	24	$400	$238,170	0.626	$250
6.25	Vapor Monitoring	25	$16,060	$254,230	0.614	$9,860
6.26	No action	26	$400	$254,630	0.602	$241
6.27	No action	27	$400	$255,030	0.590	$236
6.28	No action	28	$400	$255,430	0.579	$232
6.29	No action	29	$400	$255,830	0.568	$227
6.30	Vapor Monitoring and Site Closeout	30	$71,320	$327,150	0.557	$39,718
TOTAL COSTS			**$327,150**			**$261,047**

Alternative 3: More Aggressive - Upper Vadose Zone
SVE as Vapor Control, then MNA

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 35 Years
Date: April 2016

Description (*shared SVE costs are captured in LVZ alternatives*)
-SVE in MPE wells as vapor control for sparging in PA for 5 years
-Pulsed SVE from Year 5 to 10 with quarterly one-week operational events
-Install 4 additional shallow locations and monitor 36 individual wells initially
-Refine to 25 individual wells and reduce sampling frequency
-MNA of UVZ vapor wells until Year 35, then no further action

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Monitoring Well Installation**				**$10,850**
1.01	Work Plan & Coordination - UVZ	LS	$4,000	1	$4,000
1.02	Drilling and Installation Services - UVZ	well	$600	4	$2,400
1.03	Oversight & Reporting - UVZ	well	$640	4	$2,560
1.04	*Project Management Fee*	*%*		*10*	*$900*
1.05	*Contingency*	*%*		*10*	*$990*
2.00	**Initiate SVE in UVZ - Capital Costs**				**$28,470**
2.01	Work Plan & Coordination	LS	$2,500	1	$2,500
2.02	Modify/Submit Air Permit	EA	$5,000	*in LVZ*	$0
2.03	Purchase SVE Blower	LS	$20,000	1	$20,000
2.04	*Project Management Fee*	*%*		*10*	*$2,250*
2.05	*Contingency*	*%*		*15*	*$3,720*
3.00	**SVE Operation in UVZ - Annual O&M Costs (continuous operation to Year 5)**				**$305,720**
3.01	Maintenance and Monitoring (beyond LVZ operation)	EA	$9,500	8	$76,000
3.02	GAC and Hydrosil Replacement (beyond LVZ operation)	EA	$19,100	8	$152,800
3.03	Annual Air Permit Fee to PDEQ	yr	$4,444	*in LVZ*	$0
3.04	Electrical (beyond LVZ operation)	qtr	$700	4	$2,800
3.05	*Project Management Fee*	*%*		*10*	*$23,160*
3.06	*Contingency*	*%*		*20*	*$50,960*
4.00	**Pulsed SVE Operation in UVZ - Annual O&M Costs (Years 5 to 10)**				**$67,060**
4.01	Maintenance and Monitoring	qtr	$9,500	*in LVZ*	$0
4.02	GAC and Hydrosil Replacement	qtr	$12,700	4	$50,800
4.02	Annual Air Permit Fee to PDEQ	yr	$4,444	*in LVZ*	$0
4.03	Electrical	qtr	$200	*in LVZ*	$0
4.04	*Project Management Fee*	*%*	*$0*	*10*	*$5,080*
4.05	*Contingency*	*%*	*$0*	*20*	*$11,180*
5.00	**Vapor Monitoring & Reporting (Years 0 to 10)**				**$21,540**
5.01	Labor and supplies to sample UVZ vapor monitoring wells	well	$190	36	$6,840
5.02	Vapor analytical - TO-15 for COCs	sample	$200	40	$8,000
5.03	Evaluation and Reporting - UVZ	LS	$3,800	1	$3,800
5.04	*Project Management Fee*	*%*		*10*	*$1,870*
5.05	*Contingency*	*%*		*5*	*$1,030*
6.00	**Vapor Monitoring & Reporting (Years 11 to 35 years)**				**$15,660**
6.01	Labor and supplies to sample UVZ vapor monitoring wells	well	$190	25	$4,750
6.02	Vapor analytical - TO-15 for COCs	sample	$200	28	$5,600
6.03	Evaluation and Reporting - UVZ	LS	$3,200	1	$3,200
6.04	*Project Management Fee*	*%*		*10*	*$1,360*
6.05	*Contingency*	*%*		*5*	*$750*
7.00	**Annual CoT Access Fees**				**$400**
7.01	CoT Agreement Fee	well	$100	4	$400
8.00	**Site Closeout**				**$55,660**
8.01	Evaluation and Coordination	LS	$16,800	1	$16,800
8.02	Well Abandonment - UVZ	well	$200	36	$7,200
8.03	Reporting and Closeout	LS	$20,000	1	$20,000
8.04	*Project Management Fee*	*%*		*10*	*$4,400*
8.05	*Contingency*	*%*		*15*	*$7,260*

Alternative 3: More Aggressive - Upper Vadose Zone
SVE as Vapor Control, then MNA

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 35 Years
Date: April 2016

Description (*shared SVE costs are captured in LVZ alternatives*)
-SVE in MPE wells as vapor control for sparging in PA for 5 years
-Pulsed SVE from Year 5 to 10 with quarterly one-week operational events
-Install 4 additional shallow locations and monitor 36 individual wells initially
-Refine to 25 individual wells and reduce sampling frequency
-MNA of UVZ vapor wells until Year 35, then no further action

PROJECT COST SCHEDULE (35 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
9.00	**O&M Cost**					
9.00	Vapor Monitoring, Well Installation, & Cont. SVE Operation	0	$366,980	$366,980	1.000	$366,980
9.01	Vapor Monitoring & Continuous SVE Operation	1	$327,660	$694,640	0.981	$321,328
9.02	Vapor Monitoring & Continuous SVE Operation	2	$327,660	$1,022,300	0.962	$315,119
9.03	Vapor Monitoring & Continuous SVE Operation	3	$327,660	$1,349,960	0.943	$309,030
9.04	Vapor Monitoring & Continuous SVE Operation	4	$327,660	$1,677,620	0.925	$303,058
9.05	Vapor Monitoring & Pulsed SVE Operation	5	$89,000	$1,766,620	0.907	$80,727
9.06	Vapor Monitoring & Pulsed SVE Operation	6	$89,000	$1,855,620	0.890	$79,167
9.07	Vapor Monitoring & Pulsed SVE Operation	7	$89,000	$1,944,620	0.872	$77,637
9.08	Vapor Monitoring & Pulsed SVE Operation	8	$89,000	$2,033,620	0.855	$76,137
9.09	Vapor Monitoring & Pulsed SVE Operation	9	$89,000	$2,122,620	0.839	$74,666
9.10	Vapor Monitoring & Pulsed SVE Operation	10	$89,000	$2,211,620	0.823	$73,223
9.11	Vapor Monitoring	11	$16,060	$2,227,680	0.807	$12,958
9.12	No Action	12	$400	$2,228,080	0.791	$316
9.13	Vapor Monitoring	13	$16,060	$2,244,140	0.776	$12,462
9.14	No Action	14	$400	$2,244,540	0.761	$304
9.15	Vapor Monitoring	15	$16,060	$2,260,600	0.746	$11,985
9.16	No Action	16	$400	$2,261,000	0.732	$293
9.17	No Action	17	$400	$2,261,400	0.718	$287
9.18	No Action	18	$400	$2,261,800	0.704	$282
9.19	No Action	19	$400	$2,262,200	0.690	$276
9.20	Vapor Monitoring	20	$16,060	$2,278,260	0.677	$10,871
9.21	No Action	21	$400	$2,278,660	0.664	$266
9.22	No Action	22	$400	$2,279,060	0.651	$260
9.23	No Action	23	$400	$2,279,460	0.638	$255
9.24	No Action	24	$400	$2,279,860	0.626	$250
9.25	Vapor Monitoring	25	$16,060	$2,295,920	0.614	$9,860
9.26	No Action	26	$400	$2,296,320	0.602	$241
9.27	No Action	27	$400	$2,296,720	0.590	$236
9.28	No Action	28	$400	$2,297,120	0.579	$232
9.29	No Action	29	$400	$2,297,520	0.568	$227
9.30	Vapor Monitoring	30	$16,060	$2,313,580	0.557	$8,944
9.31	No Action	31	$400	$2,313,980	0.546	$218
9.32	No Action	32	$400	$2,314,380	0.536	$214
9.33	No Action	33	$400	$2,314,780	0.525	$210
9.34	No Action	34	$400	$2,315,180	0.515	$206
9.35	Vapor Monitoring and Site Closeout	35	$71,320	$2,386,500	0.505	$36,026
TOTAL COSTS			**$2,386,500**			**$2,184,752**

Alternative 1: Reference - Perched Aquifer
MNA for 200 years

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-MNA of PA wells for 200 years
-Install 7 additional locations and monitor initially 30 individual wells
-Refine network to 20 wells and reduce sampling frequency
-No further action after Year 200

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Monitoring Well Installation**				**$221,750**
1.01	Work Plan & Coordination - PA	LS	$9,000	1	$9,000
1.02	Drilling and Installation Services - PA	well	$12,520	7	$87,640
1.03	Oversight, Development, & Reporting - PA	well	$3,200	7	$22,400
1.04	Well Bond to CoT	well	$10,000	7	$70,000
1.05	*Project Management Fee*	*%*		*10*	*$18,910*
1.06	*Contingency*	*%*		*10*	*$13,800*
2.00	**Plume Monitoring & Reporting (first 5 years)**				**$19,705**
2.01	Labor and supplies to sample PA groundwater monitoring wells	well	$300	30	$9,000
2.02	Groundwater analytical - 8260B for COCs	sample	$65	33	$2,145
2.03	Groundwater analytical - RSK-175	sample	$85	6	$510
2.04	Evaluation and Reporting - PA	LS	$5,400	1	$5,400
2.05	*Project Management Fee*	*%*		*10*	*$1,710*
2.06	*Contingency*	*%*		*5*	*$940*
3.00	**Plume Monitoring & Reporting (5 to 200 years)**				**$14,060**
3.01	Labor and supplies to sample PA groundwater monitoring wells	well	$300	20	$6,000
3.02	Groundwater analytical - 8260B for COCs	sample	$65	22	$1,430
3.03	Groundwater analytical - RSK-175	sample	$85	4	$340
3.04	Evaluation and Reporting - PA	LS	$4,400	1	$4,400
3.05	*Project Management Fee*	*%*		*10*	*$1,220*
3.06	*Contingency*	*%*		*5*	*$670*
4.00	**Annual CoT Access Fees**				**$700**
4.01	CoT Agreement Fee	well	$100	7	$700
5.00	**Site Closeout**				**$31,660**
5.01	Evaluation and Coordination	LS	$16,800	1	$16,800
5.02	Well Abandonment - PA	well	$1,320	33	$43,560
5.03	Reporting and Closeout	LS	$20,000	1	$20,000
5.04	*Project Management Fee*	*%*		*10*	*$8,040*
5.05	*Contingency*	*%*		*15*	*$13,260*
5.06	Refund of Well Bonds from CoT	well	($10,000)	7	($70,000)

Alternative 1: Reference - Perched Aquifer
MNA for 200 years

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-MNA of PA wells for 200 years
-Install 7 additional locations and monitor initially 30 individual wells
-Refine network to 20 wells and reduce sampling frequency
-No further action after Year 200

PROJECT COST SCHEDULE (200 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
6.00	**O&M Cost**					
6.00	Plume Monitoring and Well Installation	0	$242,155	$242,155	1.000	$242,155
6.01	Plume Monitoring	1	$20,405	$262,560	0.981	$20,011
6.02	Plume Monitoring	2	$20,405	$282,965	0.962	$19,624
6.03	Plume Monitoring	3	$20,405	$303,370	0.943	$19,245
6.04	Plume Monitoring	4	$20,405	$323,775	0.925	$18,873
6.05	Plume Monitoring	5	$14,760	$338,535	0.907	$13,388
6.06	No action	6	$700	$339,235	0.890	$623
6.07	Plume Monitoring	7	$14,760	$353,995	0.872	$12,876
6.08	No action	8	$700	$354,695	0.855	$599
6.09	Plume Monitoring	9	$14,760	$369,455	0.839	$12,383
6.10	No action	10	$700	$370,155	0.823	$576
6.11	Plume Monitoring	11	$14,760	$384,915	0.807	$11,909
6.12	No action	12	$700	$385,615	0.791	$554
6.13	Plume Monitoring	13	$14,760	$400,375	0.776	$11,453
6.14	No action	14	$700	$401,075	0.761	$533
6.15	Plume Monitoring	15	$14,760	$415,835	0.746	$11,015
6.16	No action	16	$700	$416,535	0.732	$512
6.17	No action	17	$700	$417,235	0.718	$502
6.18	No action	18	$700	$417,935	0.704	$493
6.19	No action	19	$700	$418,635	0.690	$483
6.20	Plume Monitoring	20	$14,760	$433,395	0.677	$9,991
6.21	No action	21	$700	$434,095	0.664	$465
6.22	No action	22	$700	$434,795	0.651	$456
6.23	No action	23	$700	$435,495	0.638	$447
6.24	No action	24	$700	$436,195	0.626	$438
6.25	Plume Monitoring	25	$14,760	$450,955	0.614	$9,062
6.26	No action	26	$700	$451,655	0.602	$421
6.27	No action	27	$700	$452,355	0.590	$413
6.28	No action	28	$700	$453,055	0.579	$405
6.29	No action	29	$700	$453,755	0.568	$398
6.30	Plume Monitoring	30	$14,760	$468,515	0.557	$8,220
6.31	No action	31	$700	$469,215	0.546	$382
6.32	No action	32	$700	$469,915	0.536	$375
6.33	No action	33	$700	$470,615	0.525	$368
6.34	No action	34	$700	$471,315	0.515	$361
6.35	Plume Monitoring	35	$14,760	$486,075	0.505	$7,456
6.36	No action	36	$700	$486,775	0.495	$347
6.37	No action	37	$700	$487,475	0.486	$340
6.38	No action	38	$700	$488,175	0.476	$333
6.39	No action	39	$700	$488,875	0.467	$327
6.40	Plume Monitoring	40	$14,760	$503,635	0.458	$6,763
6.41	No action	41	$700	$504,335	0.449	$315
6.42	No action	42	$700	$505,035	0.441	$308
6.43	No action	43	$700	$505,735	0.432	$302
6.44	No action	44	$700	$506,435	0.424	$297
6.45	Plume Monitoring	45	$14,760	$521,195	0.416	$6,134
6.46	No action	46	$700	$521,895	0.408	$285
6.47	No action	47	$700	$522,595	0.400	$280
6.48	No action	48	$700	$523,295	0.392	$274
6.49	No action	49	$700	$523,995	0.384	$269
6.50	Plume Monitoring	50	$14,760	$538,755	0.377	$5,564
6.51	No action	51	$700	$539,455	0.370	$259
6.52	No action	52	$700	$540,155	0.363	$254

Alternative 1: Reference - Perched Aquifer

MNA for 200 years

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-MNA of PA wells for 200 years
-Install 7 additional locations and monitor initially 30 individual wells
-Refine network to 20 wells and reduce sampling frequency
-No further action after Year 200

6.53	No action	53	$700	$540,855	0.356	$249
6.54	No action	54	$700	$541,555	0.349	$244
6.55	Plume Monitoring	55	$14,760	$556,315	0.342	$5,047
6.56	No action	56	$700	$557,015	0.335	$235
6.57	No action	57	$700	$557,715	0.329	$230
6.58	No action	58	$700	$558,415	0.322	$226
6.59	No action	59	$700	$559,115	0.316	$221
6.60	Plume Monitoring	60	$14,760	$573,875	0.310	$4,577
6.61	No action	61	$700	$574,575	0.304	$213
6.62	No action	62	$700	$575,275	0.298	$209
6.63	No action	63	$700	$575,975	0.292	$205
6.64	No action	64	$700	$576,675	0.287	$201
6.65	Plume Monitoring	65	$14,760	$591,435	0.281	$4,152
6.66	No action	66	$700	$592,135	0.276	$193
6.67	No action	67	$700	$592,835	0.271	$189
6.68	No action	68	$700	$593,535	0.265	$186
6.69	No action	69	$700	$594,235	0.260	$182
6.70	Plume Monitoring	70	$14,760	$608,995	0.255	$3,766
6.71	No action	71	$700	$609,695	0.250	$175
6.72	No action	72	$700	$610,395	0.245	$172
6.73	No action	73	$700	$611,095	0.241	$168
6.74	No action	74	$700	$611,795	0.236	$165
6.75	Plume Monitoring	75	$14,760	$626,555	0.231	$3,416
6.76	No action	76	$700	$627,255	0.227	$159
6.77	No action	77	$700	$627,955	0.223	$156
6.78	No action	78	$700	$628,655	0.218	$153
6.79	No action	79	$700	$629,355	0.214	$150
6.80	Plume Monitoring	80	$14,760	$644,115	0.210	$3,098
6.81	No action	81	$700	$644,815	0.206	$144
6.82	No action	82	$700	$645,515	0.202	$141
6.83	No action	83	$700	$646,215	0.198	$139
6.84	No action	84	$700	$646,915	0.194	$136
6.85	Plume Monitoring	85	$14,760	$661,675	0.190	$2,810
6.86	No action	86	$700	$662,375	0.187	$131
6.87	No action	87	$700	$663,075	0.183	$128
6.88	No action	88	$700	$663,775	0.180	$126
6.89	No action	89	$700	$664,475	0.176	$123
6.90	Plume Monitoring	90	$14,760	$679,235	0.173	$2,549
6.91	No action	91	$700	$679,935	0.169	$119
6.92	No action	92	$700	$680,635	0.166	$116
6.93	No action	93	$700	$681,335	0.163	$114
6.94	No action	94	$700	$682,035	0.160	$112
6.95	Plume Monitoring	95	$14,760	$696,795	0.157	$2,312
6.96	No action	96	$700	$697,495	0.154	$108
6.97	No action	97	$700	$698,195	0.151	$105
6.98	No action	98	$700	$698,895	0.148	$103
6.99	No action	99	$700	$699,595	0.145	$101
7.00	Plume Monitoring	100	$14,760	$714,355	0.142	$2,097
7.01	No action	101	$700	$715,055	0.139	$98
7.02	No action	102	$700	$715,755	0.137	$96
7.03	No action	103	$700	$716,455	0.134	$94
7.04	No action	104	$700	$717,155	0.131	$92
7.05	Plume Monitoring	105	$14,760	$731,915	0.129	$1,902
7.06	No action	106	$700	$732,615	0.126	$88
7.07	No action	107	$700	$733,315	0.124	$87
7.08	No action	108	$700	$734,015	0.122	$85
7.09	No action	109	$700	$734,715	0.119	$83
7.10	Plume Monitoring	110	$14,760	$749,475	0.117	$1,725

Alternative 1: Reference - Perched Aquifer

MNA for 200 years

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-MNA of PA wells for 200 years
-Install 7 additional locations and monitor initially 30 individual wells
-Refine network to 20 wells and reduce sampling frequency
-No further action after Year 200

7.11	No action	111	$700	$750,175	0.115	$80
7.12	No action	112	$700	$750,875	0.112	$79
7.13	No action	113	$700	$751,575	0.110	$77
7.14	No action	114	$700	$752,275	0.108	$76
7.15	Plume Monitoring	115	$14,760	$767,035	0.106	$1,565
7.16	No action	116	$700	$767,735	0.104	$73
7.17	No action	117	$700	$768,435	0.102	$71
7.18	No action	118	$700	$769,135	0.100	$70
7.19	No action	119	$700	$769,835	0.098	$69
7.20	Plume Monitoring	120	$14,760	$784,595	0.096	$1,420
7.21	No action	121	$700	$785,295	0.094	$66
7.22	No action	122	$700	$785,995	0.092	$65
7.23	No action	123	$700	$786,695	0.091	$63
7.24	No action	124	$700	$787,395	0.089	$62
7.25	Plume Monitoring	125	$14,760	$802,155	0.087	$1,288
7.26	No action	126	$700	$802,855	0.086	$60
7.27	No action	127	$700	$803,555	0.084	$59
7.28	No action	128	$700	$804,255	0.082	$58
7.29	No action	129	$700	$804,955	0.081	$56
7.30	Plume Monitoring	130	$14,760	$819,715	0.079	$1,168
7.31	No action	131	$700	$820,415	0.078	$54
7.32	No action	132	$700	$821,115	0.076	$53
7.33	No action	133	$700	$821,815	0.075	$52
7.34	No action	134	$700	$822,515	0.073	$51
7.35	Plume Monitoring	135	$14,760	$837,275	0.072	$1,059
7.36	No action	136	$700	$837,975	0.070	$49
7.37	No action	137	$700	$838,675	0.069	$48
7.38	No action	138	$700	$839,375	0.068	$47
7.39	No action	139	$700	$840,075	0.066	$46
7.40	Plume Monitoring	140	$14,760	$854,835	0.065	$961
7.41	No action	141	$700	$855,535	0.064	$45
7.42	No action	142	$700	$856,235	0.063	$44
7.43	No action	143	$700	$856,935	0.061	$43
7.44	No action	144	$700	$857,635	0.060	$42
7.45	Plume Monitoring	145	$14,760	$872,395	0.059	$872
7.46	No action	146	$700	$873,095	0.058	$41
7.47	No action	147	$700	$873,795	0.057	$40
7.48	No action	148	$700	$874,495	0.056	$39
7.49	No action	149	$700	$875,195	0.055	$38
7.50	Plume Monitoring	150	$14,760	$889,955	0.054	$791
7.51	No action	151	$700	$890,655	0.053	$37
7.52	No action	152	$700	$891,355	0.052	$36
7.53	No action	153	$700	$892,055	0.051	$35
7.54	No action	154	$700	$892,755	0.050	$35
7.55	Plume Monitoring	155	$14,760	$907,515	0.049	$717
7.56	No action	156	$700	$908,215	0.048	$33
7.57	No action	157	$700	$908,915	0.047	$33
7.58	No action	158	$700	$909,615	0.046	$32
7.59	No action	159	$700	$910,315	0.045	$31
7.60	Plume Monitoring	160	$14,760	$925,075	0.044	$650
7.61	No action	161	$700	$925,775	0.043	$30
7.62	No action	162	$700	$926,475	0.042	$30
7.63	No action	163	$700	$927,175	0.042	$29
7.64	No action	164	$700	$927,875	0.041	$29
7.65	Plume Monitoring	165	$14,760	$942,635	0.040	$590
7.66	No action	166	$700	$943,335	0.039	$27
7.67	No action	167	$700	$944,035	0.038	$27
7.68	No action	168	$700	$944,735	0.038	$26

Alternative 1: Reference - Perched Aquifer

MNA for 200 years

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-MNA of PA wells for 200 years
-Install 7 additional locations and monitor initially 30 individual wells
-Refine network to 20 wells and reduce sampling frequency
-No further action after Year 200

7.69	No action	169	$700	$945,435	0.037	$26
7.70	Plume Monitoring	170	$14,760	$960,195	0.036	$535
7.71	No action	171	$700	$960,895	0.036	$25
7.72	No action	172	$700	$961,595	0.035	$24
7.73	No action	173	$700	$962,295	0.034	$24
7.74	No action	174	$700	$962,995	0.034	$23
7.75	Plume Monitoring	175	$14,760	$977,755	0.033	$485
7.76	No action	176	$700	$978,455	0.032	$23
7.77	No action	177	$700	$979,155	0.032	$22
7.78	No action	178	$700	$979,855	0.031	$22
7.79	No action	179	$700	$980,555	0.030	$21
7.80	Plume Monitoring	180	$14,760	$995,315	0.030	$440
7.81	No action	181	$700	$996,015	0.029	$20
7.82	No action	182	$700	$996,715	0.029	$20
7.83	No action	183	$700	$997,415	0.028	$20
7.84	No action	184	$700	$998,115	0.028	$19
7.85	Plume Monitoring	185	$14,760	$1,012,875	0.027	$399
7.86	No action	186	$700	$1,013,575	0.027	$19
7.87	No action	187	$700	$1,014,275	0.026	$18
7.88	No action	188	$700	$1,014,975	0.026	$18
7.89	No action	189	$700	$1,015,675	0.025	$18
7.90	Plume Monitoring	190	$14,760	$1,030,435	0.025	$362
7.91	No action	191	$700	$1,031,135	0.024	$17
7.92	No action	192	$700	$1,031,835	0.024	$17
7.93	No action	193	$700	$1,032,535	0.023	$16
7.94	No action	194	$700	$1,033,235	0.023	$16
7.95	Plume Monitoring	195	$14,760	$1,047,995	0.022	$329
7.96	No action	196	$700	$1,048,695	0.022	$15
7.97	No action	197	$700	$1,049,395	0.021	$15
7.98	No action	198	$700	$1,050,095	0.021	$15
7.99	No action	199	$700	$1,050,795	0.021	$14
8.00	Plume Monitoring and Site Closeout	200	$45,720	$1,096,515	0.020	$923
TOTAL COSTS			**$1,096,515**			**$521,844**

Alternative 2: Less Aggressive - Perched Aquifer
MNA for 30 years

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-MNA of PA wells for 30 years
Phase:	Draft FS Costing	-Install 7 additional locations and monitor initially 30 individual wells
Year 0:	2016	-Refine network to 20 wells and reduce sampling frequency
For:	30 Years	-Implement contingency measure by installing an 800-foot long PlumeStop barrier
Date:	April 2016	-No further action after Year 30

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Monitoring Well Installation**				**$221,750**
1.01	Work Plan & Coordination - PA	LS	$9,000	1	$9,000
1.02	Drilling and Installation Services - PA	well	$12,520	7	$87,640
1.03	Oversight, Development, & Reporting - PA	well	$3,200	7	$22,400
1.04	Well Bond to CoT	well	$10,000	7	$70,000
1.05	*Project Management Fee*	*%*		*10*	*$18,910*
1.06	*Contingency*	*%*		*10*	*$13,800*
2.00	**Plume Monitoring & Reporting (first 5 years)**				**$19,705**
2.01	Labor and supplies to sample PA groundwater monitoring wells	well	$300	30	$9,000
2.02	Groundwater analytical - 8260B for COCs	sample	$65	33	$2,145
2.03	Groundwater analytical - RSK-175	sample	$85	6	$510
2.04	Evaluation and Reporting - PA	LS	$5,400	1	$5,400
2.05	*Project Management Fee*	*%*		*10*	*$1,710*
2.06	*Contingency*	*%*		*5*	*$940*
3.00	**Plume Monitoring & Reporting (5 to 30 years)**				**$14,060**
3.01	Labor and supplies to sample PA groundwater monitoring wells	well	$300	20	$6,000
3.02	Groundwater analytical - 8260B for COCs	sample	$65	22	$1,430
3.03	Groundwater analytical - RSK-175	sample	$85	4	$340
3.04	Evaluation and Reporting - PA	LS	$4,400	1	$4,400
3.05	*Project Management Fee*	*%*		*10*	*$1,220*
3.06	*Contingency*	*%*		*5*	*$670*
4.00	**Annual CoT Access Fees**				**$700**
4.01	CoT Agreement Fee	well	$100	7	$700
5.00	**Implement PlumeStop Barrier Contingency**				**$881,380**
5.01	Pilot Test Work Plan & Coordination	LS	$18,700	1	$18,700
5.02	Implement & Evaluate Pilot Test	LS	$26,500	1	$26,500
5.03	Remedial Design, Work Plan, & Coordination	LS	$30,000	1	$30,000
5.04	Access Agreements and Planning	well	$1,400	27	$37,800
5.05	Geophysics (GeoTrax)	LS	$107,400	1	$107,400
5.06	Install Temporary Injection Wells	well	$8,140	27	$219,780
5.07	Well Installation Oversight & Reporting	well	$1,610	27	$43,470
5.08	PlumeStop Product	LS	$96,000	1	$96,000
5.09	Injection and Extraction Services - Regenesis (1 crew)	day	$2,800	6	$16,800
5.10	Injection Oversight	day	$880	6	$5,280
5.11	Geophysics (GeoTrax)	LS	$71,000	1	$71,000
5.12	Reporting and Evaluation	LS	$24,000	1	$24,000
5.11	*Project Management Fee*	*%*		*10*	*$69,680*
5.12	*Contingency*	*%*		*15*	*$114,970*
6.00	**Site Closeout**				**$76,740**
6.01	Evaluation and Coordination	LS	$16,800	1	$16,800
6.02	Well Abandonment - PA	well	$1,320	60	$79,200
6.03	Reporting and Closeout	LS	$20,000	1	$20,000
6.04	*Project Management Fee*	*%*		*10*	*$11,600*
6.05	*Contingency*	*%*		*15*	*$19,140*
6.06	Refund of Well Bonds from CoT	well	($10,000)	7	($70,000)

Alternative 2: Less Aggressive - Perched Aquifer
MNA for 30 years

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 30 Years
Date: April 2016

Description
-MNA of PA wells for 30 years
-Install 7 additional locations and monitor initially 30 individual wells
-Refine network to 20 wells and reduce sampling frequency
-Implement contingency measure by installing an 800-foot long PlumeStop barrier
-No further action after Year 30

PROJECT COST SCHEDULE (30 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
7.00	**O&M Cost**					
7.00	Plume Monitoring and Well Installation	0	$242,155	$242,155	1.000	$242,155
7.01	Plume Monitoring	1	$20,405	$262,560	0.981	$20,011
7.02	Plume Monitoring	2	$20,405	$282,965	0.962	$19,624
7.03	Plume Monitoring	3	$20,405	$303,370	0.943	$19,245
7.04	Plume Monitoring	4	$20,405	$323,775	0.925	$18,873
7.05	Plume Monitoring	5	$14,760	$338,535	0.907	$13,388
7.06	No action	6	$700	$339,235	0.890	$623
7.07	Plume Monitoring	7	$14,760	$353,995	0.872	$12,876
7.08	No action	8	$700	$354,695	0.855	$599
7.09	Plume Monitoring	9	$14,760	$369,455	0.839	$12,383
7.10	No action	10	$700	$370,155	0.823	$576
7.11	Plume Monitoring	11	$14,760	$384,915	0.807	$11,909
7.12	No action	12	$700	$385,615	0.791	$554
7.13	Plume Monitoring	13	$14,760	$400,375	0.776	$11,453
7.14	No action	14	$700	$401,075	0.761	$533
7.15	Plume Monitoring	15	$14,760	$415,835	0.746	$11,015
7.16	No action	16	$700	$416,535	0.732	$512
7.17	No action	17	$700	$417,235	0.718	$502
7.18	No action	18	$700	$417,935	0.704	$493
7.19	No action	19	$700	$418,635	0.690	$483
7.20	Plume Monitoring	20	$14,760	$433,395	0.677	$9,991
7.21	No action	21	$700	$434,095	0.664	$465
7.22	No action	22	$700	$434,795	0.651	$456
7.23	No action	23	$700	$435,495	0.638	$447
7.24	No action	24	$700	$436,195	0.626	$438
7.25	Plume Monitoring & Implement PlumeStop Barrier Contingency	25	$896,140	$1,332,335	0.614	$550,197
7.26	No action	26	$3,400	$1,335,735	0.602	$2,047
7.27	No action	27	$3,400	$1,339,135	0.590	$2,008
7.28	No action	28	$3,400	$1,342,535	0.579	$1,969
7.29	No action	29	$3,400	$1,345,935	0.568	$1,931
7.30	Plume Monitoring and Site Closeout	30	$90,800	$1,436,735	0.557	$50,566
TOTAL COSTS			**$1,436,735**			**$1,018,318**

Alternative 3: More Aggressive - Perched Aquifer Sparging with SVE as Vapor Control

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Modify MPE wells to sparge at base and extract vapor at top of wells
Phase:	Draft FS Costing	-Install 7 additional locations and monitor 30 wells initially
Year 0:	2016	-Sparge and SVE for 5 years, then MNA with 20 wells at reduced frequency
For:	35 Years	-No further action after Year 35
Date:	April 2016	-SVE costs are captured in Alternative 3 for the UVZ

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Monitoring Well Installation**				**$221,750**
1.01	Work Plan & Coordination - PA	LS	$9,000	1	$9,000
1.02	Drilling and Installation Services - PA	well	$12,520	7	$87,640
1.03	Oversight, Development, & Reporting - PA	well	$3,200	7	$22,400
1.04	Well Bond to CoT	well	$10,000	7	$70,000
1.05	*Project Management Fee*	*%*		*10*	*$18,910*
1.06	*Contingency*	*%*		*10*	*$13,800*
2.00	**Air Sparge in MPE Wells - Capital Costs**				**$112,915**
2.01	Work Plan, Coordination, and Modify Permit	LS	$6,000	1	$6,000
2.02	Purchase Sparge Skid	EA	$10,000	1	$10,000
2.03	Freight and Taxes	LS	$3,305	1	$3,305
2.04	System Installation, Electrical Controls, and Trenching	yr	$59,000	1	$59,000
2.05	Retrofit MPE wells for Sparging	well	$2,500	6	$15,000
2.06	*Project Management Fee*	*%*		*10*	*$9,340*
2.07	*Contingency*	*%*		*10*	*$10,270*
3.00	**Air Sparge in MPE Wells - Annual O&M Costs**				**$55,860**
3.01	Utility Services	yr	$11,110	1	$11,110
3.02	Routine Maintenance & Monitoring	mo	$2,600	12	$31,200
3.03	*Project Management Fee*	*%*		*10*	*$4,240*
3.04	*Contingency*	*%*		*20*	*$9,310*
4.00	**Plume Monitoring & Reporting (Years 0 to 9)**				**$19,705**
4.01	Labor and supplies to sample PA groundwater monitoring wells	well	$300	30	$9,000
4.02	Groundwater analytical - 8260B for COCs	sample	$65	33	$2,145
4.03	Groundwater analytical - RSK-175	sample	$85	6	$510
4.04	Evaluation and Reporting - PA	LS	$5,400	1	$5,400
4.05	*Project Management Fee*	*%*		*10*	*$1,710*
4.06	*Contingency*	*%*		*5*	*$940*
5.00	**Plume Monitoring & Reporting (Years 10 to 35)**				**$14,060**
5.01	Labor and supplies to sample PA groundwater monitoring wells	well	$300	20	$6,000
5.02	Groundwater analytical - 8260B for COCs	sample	$65	22	$1,430
5.03	Groundwater analytical - RSK-175	sample	$85	4	$340
5.04	Evaluation and Reporting - PA	LS	$4,400	1	$4,400
5.05	*Project Management Fee*	*%*		*10*	*$1,220*
5.06	*Contingency*	*%*		*5*	*$670*
6.00	**Annual CoT Access Fees**				**$700**
6.01	CoT Agreement Fee	well	$100	7	$700
7.00	**Site Closeout**				**$31,660**
7.01	Evaluation and Coordination	LS	$16,800	1	$16,800
7.02	Well Abandonment - PA	well	$1,320	33	$43,560
7.03	Reporting and Closeout	LS	$20,000	1	$20,000
7.04	*Project Management Fee*	*%*		*10*	*$8,040*
7.05	*Contingency*	*%*		*15*	*$13,260*
7.06	Refund of Well Bonds from CoT	well	($10,000)	7	($70,000)

Alternative 3: More Aggressive - Perched Aquifer Sparging with SVE as Vapor Control

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Modify MPE wells to sparge at base and extract vapor at top of wells
Phase:	Draft FS Costing	-Install 7 additional locations and monitor 30 wells initially
Year 0:	2016	-Sparge and SVE for 5 years, then MNA with 20 wells at reduced frequency
For:	35 Years	-No further action after Year 35
Date:	April 2016	-SVE costs are captured in Alternative 3 for the UVZ

PROJECT COST SCHEDULE (35 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
8.00	**O&M Cost**					
8.00	Plume Monitoring, Well Installation, & Sparging	0	$410,930	$410,930	1.000	$410,930
8.01	Plume Monitoring & Sparging	1	$76,265	$487,195	0.981	$74,791
8.02	Plume Monitoring & Sparging	2	$76,265	$563,460	0.962	$73,346
8.03	Plume Monitoring & Sparging	3	$76,265	$639,725	0.943	$71,929
8.04	Plume Monitoring & Sparging	4	$76,265	$715,990	0.925	$70,539
8.05	Plume Monitoring	5	$20,405	$736,395	0.907	$18,508
8.06	Plume Monitoring	6	$20,405	$756,800	0.890	$18,151
8.07	Plume Monitoring	7	$20,405	$777,205	0.872	$17,800
8.08	Plume Monitoring	8	$20,405	$797,610	0.855	$17,456
8.09	Plume Monitoring	9	$20,405	$818,015	0.839	$17,119
8.10	Plume Monitoring	10	$14,760	$832,775	0.823	$12,143
8.11	No Action	11	$700	$833,475	0.807	$565
8.12	Plume Monitoring	12	$14,760	$848,235	0.791	$11,679
8.13	No Action	13	$700	$848,935	0.776	$543
8.14	Plume Monitoring	14	$14,760	$863,695	0.761	$11,232
8.15	No Action	15	$700	$864,395	0.746	$522
8.16	Plume Monitoring	16	$14,760	$879,155	0.732	$10,802
8.17	No Action	17	$700	$879,855	0.718	$502
8.18	Plume Monitoring	18	$14,760	$894,615	0.704	$10,388
8.19	No Action	19	$700	$895,315	0.690	$483
8.20	Plume Monitoring	20	$14,760	$910,075	0.677	$9,991
8.21	No Action	21	$700	$910,775	0.664	$465
8.22	No Action	22	$700	$911,475	0.651	$456
8.23	No Action	23	$700	$912,175	0.638	$447
8.24	No Action	24	$700	$912,875	0.626	$438
8.25	Plume Monitoring	25	$14,760	$927,635	0.614	$9,062
8.26	No Action	26	$700	$928,335	0.602	$421
8.27	No Action	27	$700	$929,035	0.590	$413
8.28	No Action	28	$700	$929,735	0.579	$405
8.29	No Action	29	$700	$930,435	0.568	$398
8.30	Plume Monitoring	30	$14,760	$945,195	0.557	$8,220
8.31	No Action	31	$700	$945,895	0.546	$382
8.32	No Action	32	$700	$946,595	0.536	$375
8.33	No Action	33	$700	$947,295	0.525	$368
8.34	No Action	34	$700	$947,995	0.515	$361
8.35	Plume Monitoring & Site Closeout	35	$46,420	$994,415	0.505	$23,448
TOTAL COSTS			**$994,415**			**$905,077**

Alternative 1: Reference - Lower Vadose Zone
SVE ERA & Expanded LTM

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 30 Years
Date: April 2016

Description
-Install 4 additional monitoring locations and operate pulsed SVE for 10 years
-System runs one week per quarter (two O&M visits per quarter)
-Annual initial monitoring of LVZ vapor wells to assess post-SVE rebound
-Infrequent LTM to assess vertical migration of PA contamination through aquitard
-No further action after Year 30

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Annual Pulsed SVE Operation (first 10 years)**				**$118,974**
1.01	Maintenance and Monitoring	qtr	$9,500	4	$38,000
1.02	GAC and Hydrosil Replacement	qtr	$12,700	4	$50,800
1.03	Electrical	qtr	$200	4	$800
1.04	Annual Air Permit Fee to PDEQ	yr	$4,444	1	$4,444
1.05	*Project Management Fee*	*%*		*10*	*$9,410*
1.06	*Contingency*	*%*		*15*	*$15,520*
2.00	**Air Permit Application & Renewal (every 5 years)**				**$5,000**
2.01	Modify/Submit Air Permit	EA	$5,000	1	$5,000
3.00	**Monitoring Well Installation**				**$404,140**
3.01	Work Plan & Coordination - LVZ	LS	$12,500	1	$12,500
3.02	Drilling and Installation Services - LVZ	cluster	$66,200	4	$264,800
3.03	Oversight & Reporting - LVZ	cluster	$5,000	4	$20,000
3.04	Well Bond to CoT	well	$10,000	4	$40,000
3.05	*Project Management Fee*	*%*		*10*	*$33,730*
3.06	*Contingency*	*%*		*10*	*$33,110*
4.00	**Rebound Vapor Monitoring & Reporting (first 15 years)**				**$22,320**
4.01	Labor and supplies to sample LVZ vapor monitoring wells	well	$290	26	$7,540
4.02	Vapor analytical - TO-15 for COCs	sample	$200	29	$5,800
4.03	Evaluation and Reporting - LVZ	LS	$5,100	1	$5,100
4.04	*Project Management Fee*	*%*		*10*	*$1,850*
4.05	*Contingency*	*%*		*10*	*$2,030*
5.00	**LTM Vapor Monitoring & Reporting (15 to 30 years)**				**$5,600**
5.01	Labor and supplies to sample LVZ vapor monitoring wells	well	$290	6	$1,740
5.02	Vapor analytical - TO-15 for COCs	sample	$200	7	$1,400
5.03	Evaluation and Reporting - LVZ	LS	$1,700	1	$1,700
5.04	*Project Management Fee*	*%*		*10*	*$490*
5.05	*Contingency*	*%*		*5*	*$270*
6.00	**Annual CoT Access Fees**				**$400**
6.01	CoT Agreement Fee	well	$100	4	$400
7.00	**Site Closeout**				**$23,570**
7.01	Evaluation and Coordination	LS	$16,800	1	$16,800
7.02	Well Abandonment - LVZ	cluster	$1,920	7	$13,440
7.03	Reporting and Closeout	LS	$20,000	1	$20,000
7.04	*Project Management Fee*	*%*		*10*	*$5,030*
7.05	*Contingency*	*%*		*15*	*$8,300*
7.06	Refund of Well Bonds from CoT	well	($10,000)	4	($40,000)

Alternative 1: Reference - Lower Vadose Zone
SVE ERA & Expanded LTM

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 30 Years
Date: April 2016

Description
-Install 4 additional monitoring locations and operate pulsed SVE for 10 years
-System runs one week per quarter (two O&M visits per quarter)
-Annual initial monitoring of LVZ vapor wells to assess post-SVE rebound
-Infrequent LTM to assess vertical migration of PA contamination through aquitard
-No further action after Year 30

PROJECT COST SCHEDULE (30 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
8.00	**O&M Cost**					
8.00	Operate SVE, Vapor Monitoring, and Install Wells	0	$550,834	$550,834	1.000	$550,834
8.01	Operate SVE & Vapor Monitoring	1	$141,694	$692,528	0.981	$138,956
8.02	Operate SVE & Vapor Monitoring	2	$141,694	$834,222	0.962	$136,271
8.03	Operate SVE & Vapor Monitoring	3	$141,694	$975,916	0.943	$133,638
8.04	Operate SVE & Vapor Monitoring	4	$141,694	$1,117,610	0.925	$131,055
8.05	Operate SVE & Vapor Monitoring	5	$146,694	$1,264,304	0.907	$133,058
8.06	Operate SVE & Vapor Monitoring	6	$141,694	$1,405,998	0.890	$126,039
8.07	Operate SVE & Vapor Monitoring	7	$141,694	$1,547,692	0.872	$123,604
8.08	Operate SVE & Vapor Monitoring	8	$141,694	$1,689,386	0.855	$121,215
8.09	Operate SVE & Vapor Monitoring	9	$141,694	$1,831,080	0.839	$118,873
8.10	Rebound Vapor Monitoring	10	$6,000	$1,837,080	0.823	$4,936
8.11	Rebound Vapor Monitoring	11	$6,000	$1,843,080	0.807	$4,841
8.12	Rebound Vapor Monitoring	12	$6,000	$1,849,080	0.791	$4,747
8.13	Rebound Vapor Monitoring	13	$6,000	$1,855,080	0.776	$4,656
8.14	Rebound Vapor Monitoring	14	$6,000	$1,861,080	0.761	$4,566
8.15	No Action	15	$400	$1,861,480	0.746	$299
8.16	LTM Vapor Monitoring	16	$6,000	$1,867,480	0.732	$4,391
8.17	No Action	17	$400	$1,867,880	0.718	$287
8.18	LTM Vapor Monitoring	18	$6,000	$1,873,880	0.704	$4,223
8.19	No Action	19	$400	$1,874,280	0.690	$276
8.20	LTM Vapor Monitoring	20	$6,000	$1,880,280	0.677	$4,061
8.21	No Action	21	$400	$1,880,680	0.664	$266
8.22	No Action	22	$400	$1,881,080	0.651	$260
8.23	No Action	23	$400	$1,881,480	0.638	$255
8.24	No Action	24	$400	$1,881,880	0.626	$250
8.25	LTM Vapor Monitoring	25	$6,000	$1,887,880	0.614	$3,684
8.26	No Action	26	$400	$1,888,280	0.602	$241
8.27	No Action	27	$400	$1,888,680	0.590	$236
8.28	No Action	28	$400	$1,889,080	0.579	$232
8.29	No Action	29	$400	$1,889,480	0.568	$227
8.30	LTM Vapor Monitoring and Site Closeout	30	$29,570	$1,919,050	0.557	$16,467
TOTAL COSTS			**$1,919,050**			**$1,772,944**

Alternative 2: Less Aggressive - Lower Vadose Zone
SVE ERA & Current LTM

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 30 Years
Date: April 2016

Description
-Operate pulsed SVE for 10 years with existing monitoring network
-Annual initial monitoring of LVZ vapor wells to assess post-SVE rebound
-Infrequent LTM to assess vertical migration of PA contamination through aquitard
-No further action after Year 30

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Annual Pulsed SVE Operation (first 10 years)**				**$115,944**
1.01	Maintenance and Monitoring	qtr	$9,500	4	$38,000
1.02	GAC and Hydrosil Replacement	qtr	$12,100	4	$48,400
1.03	Electrical	qtr	$200	4	$800
1.04	Annual Air Permit Fee to PDEQ	yr	$4,444	1	$4,444
1.05	*Project Management Fee*	*%*		*10*	*$9,170*
1.06	*Contingency*	*%*		*15*	*$15,130*
2.00	**Air Permit Application & Renewal (every 5 years)**				**$5,000**
2.01	Modify/Submit Air Permit	EA	$5,000	1	$5,000
4.00	**Rebound Vapor Monitoring & Reporting (first 15 years)**				**$10,290**
4.01	Labor and supplies to sample LVZ vapor monitoring wells	well	$290	10	$2,900
4.02	Vapor analytical - TO-15 for COCs	sample	$200	11	$2,200
4.03	Evaluation and Reporting - LVZ	LS	$3,400	1	$3,400
4.04	*Project Management Fee*	*%*		*10*	*$850*
4.05	*Contingency*	*%*		*10*	*$940*
5.00	**LTM Vapor Monitoring & Reporting (15 to 30 years)**				**$3,330**
5.01	Labor and supplies to sample LVZ vapor monitoring wells	well	$290	2	$580
5.02	Vapor analytical - TO-15 for COCs	sample	$200	3	$600
5.03	Evaluation and Reporting - LVZ	LS	$1,700	1	$1,700
5.04	*Project Management Fee*	*%*		*10*	*$290*
5.05	*Contingency*	*%*		*5*	*$160*
6.00	**Site Closeout**				**$53,850**
6.01	Evaluation and Coordination	LS	$16,800	1	$16,800
6.02	Well Abandonment - LVZ	cluster	$1,920	3	$5,760
6.03	Reporting and Closeout	LS	$20,000	1	$20,000
6.04	*Project Management Fee*	*%*		*10*	*$4,260*
6.05	*Contingency*	*%*		*15*	*$7,030*

Alternative 2: Less Aggressive - Lower Vadose Zone
SVE ERA & Current LTM

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 30 Years
Date: April 2016

Description
-Operate pulsed SVE for 10 years with existing monitoring network
-Annual initial monitoring of LVZ vapor wells to assess post-SVE rebound
-Infrequent LTM to assess vertical migration of PA contamination through aquitard
-No further action after Year 30

PROJECT COST SCHEDULE (30 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
7.00	**O&M Cost**					
7.00	Operate SVE & Vapor Monitoring	0	$131,234	$131,234	1.000	$131,234
7.01	Operate SVE & Vapor Monitoring	1	$126,234	$257,468	0.981	$123,795
7.02	Operate SVE & Vapor Monitoring	2	$126,234	$383,702	0.962	$121,403
7.03	Operate SVE & Vapor Monitoring	3	$126,234	$509,936	0.943	$119,057
7.04	Operate SVE & Vapor Monitoring	4	$126,234	$636,170	0.925	$116,756
7.05	Operate SVE & Vapor Monitoring	5	$131,234	$767,404	0.907	$119,035
7.06	Operate SVE & Vapor Monitoring	6	$126,234	$893,638	0.890	$112,287
7.07	Operate SVE & Vapor Monitoring	7	$126,234	$1,019,872	0.872	$110,117
7.08	Operate SVE & Vapor Monitoring	8	$126,234	$1,146,106	0.855	$107,990
7.09	Operate SVE & Vapor Monitoring	9	$126,234	$1,272,340	0.839	$105,903
7.10	Rebound Vapor Monitoring	10	$10,290	$1,282,630	0.823	$8,466
7.11	Rebound Vapor Monitoring	11	$10,290	$1,292,920	0.807	$8,302
7.12	Rebound Vapor Monitoring	12	$10,290	$1,303,210	0.791	$8,142
7.13	Rebound Vapor Monitoring	13	$10,290	$1,313,500	0.776	$7,985
7.14	Rebound Vapor Monitoring	14	$10,290	$1,323,790	0.761	$7,830
7.15	No Action	15	$0	$1,323,790	0.746	$0
7.16	LTM Vapor Monitoring	16	$3,330	$1,327,120	0.732	$2,437
7.17	No Action	17	$0	$1,327,120	0.718	$0
7.18	LTM Vapor Monitoring	18	$3,330	$1,330,450	0.704	$2,344
7.19	No Action	19	$0	$1,330,450	0.690	$0
7.20	LTM Vapor Monitoring	20	$3,330	$1,333,780	0.677	$2,254
7.21	No Action	21	$0	$1,333,780	0.664	$0
7.22	No Action	22	$0	$1,333,780	0.651	$0
7.23	No Action	23	$0	$1,333,780	0.638	$0
7.24	No Action	24	$0	$1,333,780	0.626	$0
7.25	LTM Vapor Monitoring	25	$3,330	$1,337,110	0.614	$2,044
7.26	No Action	26	$0	$1,337,110	0.602	$0
7.27	No Action	27	$0	$1,337,110	0.590	$0
7.28	No Action	28	$0	$1,337,110	0.579	$0
7.29	No Action	29	$0	$1,337,110	0.568	$0
7.30	LTM Vapor Monitoring and Site Closeout	30	$57,180	$1,394,290	0.557	$31,843
TOTAL COSTS			**$1,394,290**			**$1,249,223**

Alternative 3: More Aggressive - Lower Vadose Zone
Expanded SVE ERA & Expanded LTM

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Install 4 additional monitoring locations and operate pulsed SVE for 11 years
Phase:	Draft FS Costing	-Install additional SVE well at Year 1
Year 0:	2016	-Annual initial monitoring of LVZ vapor wells to assess post-SVE rebound
For:	31 Years	-Infrequent LTM to assess vertical migration of PA contamination through aquitard
Date:	April 2016	-No further action after Year 31

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Annual Pulsed SVE Operation Until Year 10 (including additional SVE well)**				**$128,184**
1.01	Maintenance and Monitoring	qtr	$9,500	4	$38,000
1.02	GAC and Hydrosil Replacement	qtr	$14,520	4	$58,080
1.03	Electrical	qtr	$200	4	$800
1.04	Annual Air Permit Fee to PDEQ	yr	$4,444	1	$4,444
1.05	*Project Management Fee*	*%*		*10*	*$10,140*
1.06	*Contingency*	*%*		*15*	*$16,720*
2.00	**Air Permit Application & Renewal (every 5 years)**				**$5,000**
2.01	Modify/Submit Air Permit	EA	$5,000	1	$5,000
3.00	**Monitoring Well Installation**				**$404,140**
3.01	Work Plan & Coordination - LVZ	LS	$12,500	1	$12,500
3.02	Drilling and Installation Services - LVZ	cluster	$66,200	4	$264,800
3.03	Oversight & Reporting - LVZ	cluster	$5,000	4	$20,000
3.04	Well Bond to CoT	well	$10,000	4	$40,000
3.05	*Project Management Fee*	*%*		*10*	*$33,730*
3.06	*Contingency*	*%*		*10*	*$33,110*
4.00	**Enhance SVE - Additional Extraction Well - Capital Costs**				**$116,430**
4.01	Install and Hookup Additional SVE Well	well	$71,200	1	$71,200
4.02	Installation Oversight, Sampling, & Reporting	well	$11,000	1	$11,000
4.03	Maintenance and Monitoring	qtr	$6,000	1	$6,000
4.04	*Project Management Fee*	*%*		*10*	*$8,820*
4.05	*Contingency*	*%*		*20*	*$19,410*
5.00	**Rebound Vapor Monitoring & Reporting (first 15 years)**				**$22,320**
5.01	Labor and supplies to sample LVZ vapor monitoring wells	well	$290	26	$7,540
5.02	Vapor analytical - TO-15 for COCs	sample	$200	29	$5,800
5.03	Evaluation and Reporting - LVZ	LS	$5,100	1	$5,100
5.04	*Project Management Fee*	*%*		*10*	*$1,850*
5.05	*Contingency*	*%*		*10*	*$2,030*
6.00	**LTM Vapor Monitoring & Reporting (15 to 31 years)**				**$5,600**
6.01	Labor and supplies to sample LVZ vapor monitoring wells	well	$290	6	$1,740
6.02	Vapor analytical - TO-15 for COCs	sample	$200	7	$1,400
6.03	Evaluation and Reporting - LVZ	LS	$1,700	1	$1,700
6.04	*Project Management Fee*	*%*		*10*	*$490*
6.05	*Contingency*	*%*		*5*	*$270*
7.00	**Annual CoT Access Fees**				**$400**
7.01	CoT Agreement Fee	well	$100	4	$400
8.00	**Site Closeout**				**$23,570**
8.01	Evaluation and Coordination	LS	$16,800	1	$16,800
8.02	Well Abandonment - LVZ	cluster	$1,920	7	$13,440
8.03	Reporting and Closeout	LS	$20,000	1	$20,000
8.04	*Project Management Fee*	*%*		*10*	*$5,030*
8.05	*Contingency*	*%*		*15*	*$8,300*
8.06	Refund of Well Bonds from CoT	well	($10,000)	4	($40,000)

Alternative 3: More Aggressive - Lower Vadose Zone
Expanded SVE ERA & Expanded LTM

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 31 Years
Date: April 2016

Description
-Install 4 additional monitoring locations and operate pulsed SVE for 11 years
-Install additional SVE well at Year 1
-Annual initial monitoring of LVZ vapor wells to assess post-SVE rebound
-Infrequent LTM to assess vertical migration of PA contamination through aquitard
-No further action after Year 31

PROJECT COST SCHEDULE (31 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
9.00	**O&M Cost**					
9.00	Operate SVE, Vapor Monitoring, and Install Wells	0	$560,044	$560,044	1.000	$560,044
9.01	Operate SVE, Vapor Monitoring, and Install SVE Well	1	$267,334	$827,378	0.981	$262,168
9.02	Operate SVE & Vapor Monitoring	2	$150,904	$978,282	0.962	$145,128
9.03	Operate SVE & Vapor Monitoring	3	$150,904	$1,129,186	0.943	$142,324
9.04	Operate SVE & Vapor Monitoring	4	$150,904	$1,280,090	0.925	$139,574
9.05	Operate SVE & Vapor Monitoring	5	$155,904	$1,435,994	0.907	$141,412
9.06	Operate SVE & Vapor Monitoring	6	$150,904	$1,586,898	0.890	$134,232
9.07	Operate SVE & Vapor Monitoring	7	$150,904	$1,737,802	0.872	$131,638
9.08	Operate SVE & Vapor Monitoring	8	$150,904	$1,888,706	0.855	$129,094
9.09	Operate SVE & Vapor Monitoring	9	$150,904	$2,039,610	0.839	$126,599
9.10	Operate SVE & Vapor Monitoring	10	$150,904	$2,190,514	0.823	$124,153
9.11	Rebound Vapor Monitoring	11	$22,720	$2,213,234	0.807	$18,331
9.12	Rebound Vapor Monitoring	12	$22,720	$2,235,954	0.791	$17,977
9.13	Rebound Vapor Monitoring	13	$22,720	$2,258,674	0.776	$17,630
9.14	Rebound Vapor Monitoring	14	$22,720	$2,281,394	0.761	$17,289
9.15	LTM Vapor Monitoring	15	$6,000	$2,287,394	0.746	$4,478
9.16	No Action	16	$400	$2,287,794	0.732	$293
9.17	LTM Vapor Monitoring	17	$6,000	$2,293,794	0.718	$4,306
9.18	No Action	18	$400	$2,294,194	0.704	$282
9.19	LTM Vapor Monitoring	19	$6,000	$2,300,194	0.690	$4,141
9.20	No Action	20	$400	$2,300,594	0.677	$271
9.21	LTM Vapor Monitoring	21	$6,000	$2,306,594	0.664	$3,983
9.22	No Action	22	$400	$2,306,994	0.651	$260
9.23	No Action	23	$400	$2,307,394	0.638	$255
9.24	No Action	24	$400	$2,307,794	0.626	$250
9.25	No Action	25	$400	$2,308,194	0.614	$246
9.26	LTM Vapor Monitoring	26	$6,000	$2,314,194	0.602	$3,613
9.27	No Action	27	$400	$2,314,594	0.590	$236
9.28	No Action	28	$400	$2,314,994	0.579	$232
9.29	No Action	29	$400	$2,315,394	0.568	$227
9.30	No Action	30	$400	$2,315,794	0.557	$223
9.31	LTM Vapor Monitoring and Site Closeout	31	$29,570	$2,345,364	0.546	$16,149
TOTAL COSTS			**$2,345,364**			**$2,147,037**

Alternative 1: Reference - Regional Aquifer
In-Situ PlumeStop Barrier

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Install a 850-foot long PlumeStop barrier from 200 to 330 feet bgs along 8th Ave
Phase:	Draft FS Costing	using a series of 8 injection and 9 extraction wells with multiple screened intervals
Year 0:	2016	-Install 5 additional wells for performance monitoring of the barrier
For:	40 Years	-LTM at 25 wells at with reducing frequency
Date:	April 2016	-No further action after Year 40

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Deeper RA Characterization Effort**				**$414,700**
1.01	Work Plan & Coordination	LS	$20,000	1	$20,000
1.02	Drilling and Installation Services	well	$79,000	3	$237,000
1.03	Oversight, Development, & Reporting	well	$19,400	3	$58,200
1.04	Well Bond to CoT	well	$10,000	3	$30,000
1.05	*Project Management Fee*	*%*		*10*	*$34,520*
1.06	*Contingency*	*%*		*10*	*$34,980*
2.00	**Plume Monitoring & Reporting**				**$17,590**
2.01	Labor and supplies to sample RA groundwater monitoring wells	well	$320	25	$8,000
2.02	Groundwater analytical - 8260B for COCs	sample	$65	28	$1,820
2.03	Evaluation and Reporting - RA	LS	$5,400	1	$5,400
2.04	*Project Management Fee*	*%*		*10*	*$1,530*
2.05	*Contingency*	*%*		*5*	*$840*
3.00	**Performance Monitoring Well Installation**				**$547,860**
3.01	Work Plan & Coordination - RA	LS	$17,500	1	$17,500
3.02	Drilling and Installation Services - RA	well	$68,000	5	$340,000
3.03	Oversight, Development, & Reporting - RA	well	$13,800	5	$69,000
3.04	Well Bond to CoT	well	$10,000	5	$50,000
3.05	*Project Management Fee*	*%*		*10*	*$47,650*
3.06	*Contingency*	*%*		*5*	*$23,710*
4.00	**Contaminant & Flow Profiling - Pre-Design**				**$33,400**
4.01	Work Plan and Coordination	LS	$5,000	1	$5,000
4.02	Borehole Flow Logging & Geophysics	well	$700	10	$7,000
4.03	Oversight and Evaluation	LS	$15,600	1	$15,600
4.04	*Project Management Fee*	*%*		*10*	*$2,760*
4.05	*Contingency*	*%*		*10*	*$3,040*
5.00	**Baseline Geophysics**				**$271,730**
5.01	Work Plan and Coordination	LS	$12,000	1	$12,000
5.02	Geophysics (GeoTrax)	LS	$190,000	1	$190,000
5.03	Oversight and Reporting	LS	$12,800	1	$12,800
5.04	*Project Management Fee*	*%*		*10*	*$21,480*
5.05	*Contingency*	*%*		*15*	*$35,450*
5.00	**PlumeStop Barrier Installation**				**$5,885,870**
5.01	Remedial Design, Work Plan, & Coordination	LS	$50,000	1	$50,000
5.02	Access Agreements and Planning	well	$6,000	17	$102,000
5.03	Injection/Extraction Well Installation	well	$77,300	17	$1,314,100
5.04	Well Installation Oversight & Reporting	well	$10,400	17	$176,800
5.05	Well Bond to CoT	well	$10,000	17	$170,000
5.06	Injection and Extraction Tooling/Equipment	crew	$17,400	3	$52,200
5.07	PlumeStop Product, Monitoring, and Oversight - Regenesis	LS	$556,600	1	$556,600
5.08	Injection and Extraction Services - Regenesis (3 crews)	day	$10,850	168	$1,822,800
5.09	Injection Oversight & Reporting	day	$1,280	168	$215,040
5.10	Utility Costs (Generator Rentals)	day	$150	168	$25,200
5.11	*Project Management Fee*	*%*		*10*	*$448,480*
5.12	*Contingency*	*%*		*20*	*$952,650*

Alternative 1: Reference - Regional Aquifer
In-Situ PlumeStop Barrier

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 40 Years
Date: April 2016

Description
-Install a 850-foot long PlumeStop barrier from 200 to 330 feet bgs along 8th Ave using a series of 8 injection and 9 extraction wells with multiple screened intervals
-Install 5 additional wells for performance monitoring of the barrier
-LTM at 25 wells at with reducing frequency
-No further action after Year 40

6.00	**Assess PlumeStop Distribution - Geophysics**				**$223,370**
6.01	Work Plan and Coordination	LS	$3,000	1	$3,000
6.02	Geophysics (GeoTrax)	LS	$170,000	1	$170,000
6.03	Oversight and Reporting	LS	$11,600	1	$11,600
6.04	*Project Management Fee*	*%*		*10*	*$18,460*
6.05	*Contingency*	*%*		*10*	*$20,310*
7.00	**Annual CoT Access Fees**				**$4,870**
7.01	CoT Agreement Fee	well	$100	27	$2,700
7.02	CoT Access Agreement	yr	$2,170	1	$2,170
8.00	**Site Closeout**				**$27,030**
8.01	Evaluation and Coordination	LS	$16,800	1	$16,800
8.02	Well Abandonment - RA	well	$3,960	50	$198,000
8.03	Reporting and Closeout	LS	$20,000	1	$20,000
8.04	*Project Management Fee*	*%*		*10*	*$23,480*
8.05	*Contingency*	*%*		*15*	*$38,750*
8.06	Refund of Well Bonds from CoT	well	($10,000)	27	($270,000)

PROJECT COST SCHEDULE (40 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
9.00	**O&M Cost**					
9.00	Plume Monitoring, Install Wells, Geophysics, & PlumeStop	0	$7,176,020	$7,176,020	1.000	$7,176,020
9.01	Plume Monitoring & Geophysics	1	$245,830	$7,421,850	0.981	$241,080
9.02	Plume Monitoring	2	$22,460	$7,444,310	0.962	$21,600
9.03	Plume Monitoring	3	$22,460	$7,466,770	0.943	$21,183
9.04	Plume Monitoring	4	$22,460	$7,489,230	0.925	$20,774
9.05	Plume Monitoring	5	$22,460	$7,511,690	0.907	$20,372
9.06	No Action	6	$4,870	$7,516,560	0.890	$4,332
9.07	Plume Monitoring	7	$22,460	$7,539,020	0.872	$19,592
9.08	No Action	8	$4,870	$7,543,890	0.855	$4,166
9.09	Plume Monitoring	9	$22,460	$7,566,350	0.839	$18,843
9.10	No Action	10	$4,870	$7,571,220	0.823	$4,007
9.11	Plume Monitoring	11	$22,460	$7,593,680	0.807	$18,121
9.12	No Action	12	$4,870	$7,598,550	0.791	$3,853
9.13	Plume Monitoring	13	$22,460	$7,621,010	0.776	$17,428
9.14	No Action	14	$4,870	$7,625,880	0.761	$3,706
9.15	Plume Monitoring	15	$22,460	$7,648,340	0.746	$16,761
9.16	No Action	16	$4,870	$7,653,210	0.732	$3,564
9.17	No Action	17	$4,870	$7,658,080	0.718	$3,495
9.18	No Action	18	$4,870	$7,662,950	0.704	$3,428
9.19	No Action	19	$4,870	$7,667,820	0.690	$3,361
9.20	Plume Monitoring	20	$22,460	$7,690,280	0.677	$15,203
9.21	No Action	21	$4,870	$7,695,150	0.664	$3,233
9.22	No Action	22	$4,870	$7,700,020	0.651	$3,170
9.23	No Action	23	$4,870	$7,704,890	0.638	$3,109
9.24	No Action	24	$4,870	$7,709,760	0.626	$3,049
9.25	Plume Monitoring	25	$22,460	$7,732,220	0.614	$13,790
9.26	No Action	26	$4,870	$7,737,090	0.602	$2,932
9.27	No Action	27	$4,870	$7,741,960	0.590	$2,876
9.28	No Action	28	$4,870	$7,746,830	0.579	$2,820
9.29	No Action	29	$4,870	$7,751,700	0.568	$2,766
9.30	Plume Monitoring	30	$22,460	$7,774,160	0.557	$12,508

Alternative 1: Reference - Regional Aquifer
In-Situ PlumeStop Barrier

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-Install a 850-foot long PlumeStop barrier from 200 to 330 feet bgs along 8th Ave
Phase:	Draft FS Costing	using a series of 8 injection and 9 extraction wells with multiple screened intervals
Year 0:	2016	-Install 5 additional wells for performance monitoring of the barrier
For:	40 Years	-LTM at 25 wells at with reducing frequency
Date:	April 2016	-No further action after Year 40

9.31	No Action	31	$4,870	$7,779,030	0.546	$2,660
9.32	No Action	32	$4,870	$7,783,900	0.536	$2,608
9.33	No Action	33	$4,870	$7,788,770	0.525	$2,558
9.34	No Action	34	$4,870	$7,793,640	0.515	$2,508
9.35	Plume Monitoring	35	$22,460	$7,816,100	0.505	$11,345
9.36	No Action	36	$4,870	$7,820,970	0.495	$2,412
9.37	No Action	37	$4,870	$7,825,840	0.486	$2,366
9.38	No Action	38	$4,870	$7,830,710	0.476	$2,320
9.39	No Action	39	$4,870	$7,835,580	0.467	$2,275
9.40	Plume Monitoring and Site Closeout	40	$49,490	$7,885,070	0.458	$22,675
TOTAL COSTS			**$7,885,070**			**$7,744,868**

Alternative 2: Less Aggressive - Regional Aquifer
MNA with Wellhead Treatment

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-MNA at approximately 20 RA groundwater wells for 200 years
Phase:	Draft FS Costing	-Monthly monitoring at UA production wells when PCE exceeds 0.25 ppb
Year 0:	2016	-Wellhead treatment when extracted PCE concentration exceeds 2.5 ppb
For:	200 Years	-Assumes that CoT will not withdraw impacted groundwater
Date:	April 2016	-Install & abandon 10 wells every 30 years; No further action after Year 200

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Deeper RA Characterization Effort**				**$414,700**
1.01	Work Plan & Coordination	LS	$20,000	1	$20,000
1.02	Drilling and Installation Services	well	$79,000	3	$237,000
1.03	Oversight, Development, & Reporting	well	$19,400	3	$58,200
1.04	Well Bond to CoT	well	$10,000	3	$30,000
1.05	*Project Management Fee*	*%*		*10*	*$34,520*
1.06	*Contingency*	*%*		*10*	*$34,980*
2.00	**Plume Monitoring & Reporting**				**$15,290**
2.01	Labor and supplies to sample RA groundwater monitoring wells	well	$320	20	$6,400
2.02	Groundwater analytical - 8260B for COCs	sample	$65	22	$1,430
2.03	Evaluation and Reporting - RA	LS	$5,400	1	$5,400
2.04	*Project Management Fee*	*%*		*10*	*$1,330*
2.05	*Contingency*	*%*		*5*	*$730*
3.00	**Episodic Monitoring Well Installation & Abandonment**				**$1,019,410**
3.01	Work Plan & Coordination - RA	LS	$25,000	1	$25,000
3.02	Drilling and Installation Services - RA	well	$68,000	10	$680,000
3.03	Oversight, Development, & Reporting - RA	well	$13,800	10	$138,000
3.04	Well Abandonment - RA	well	$3,960	10	$39,600
3.05	*Project Management Fee*	*%*		*10*	*$88,260*
3.06	*Contingency*	*%*		*5*	*$48,550*
4.00	**UA Wellhead Treatment - Capital Costs per System**				**$520,270**
4.01	System Design, Permitting, and Coordination	EA	$24,000	1	$24,000
4.02	System Purchase - 2 GAC vessels (500 gpm) with 10 tons carbon	EA	$220,000	1	$220,000
4.03	Pressure Relief Valves, Sampling Ports, and Bag Filters	EA	$27,000	1	$27,000
4.04	System Installation (assume underground)	EA	$103,760	1	$103,760
4.04	Electrical & Controls	EA	$35,000	1	$35,000
4.05	Freight and Taxes	EA	$20,210	1	$20,210
4.06	*Project Management Fee*	*%*		*10*	*$43,000*
4.07	*Contingency*	*%*		*10*	*$47,300*
5.00	**Wellhead Treatment - Annual O&M Costs per Well**				**$16,900**
5.01	Utility Services	yr	$2,400	1	$2,400
5.02	Routine Maintenance	qtr	$2,600	4	$10,400
5.03	*Project Management Fee*	*%*		*10*	*$1,280*
5.04	*Contingency*	*%*		*20*	*$2,820*
6.00	**Changeout GAC (10,000 lbs)**	EA	$35,500	1	**$35,500**
7.00	**Wellhead Treatment - Annual Monitoring Costs per Well**				**$23,170**
7.01	Labor and supplies to sample water supply well and system	mo	$600	12	$7,200
7.02	Groundwater analytical - 8260B for COCs	sample	$65	36	$2,340
7.03	Evaluation and Reporting	yr	$9,600	1	$9,600
7.04	*Project Management Fee*	*%*		*10*	*$1,920*
7.05	*Contingency*	*%*		*10*	*$2,110*
8.00	**Annual CoT Access Fees**				**$3,670**
8.01	CoT Agreement Fee	well	$100	15	$1,500
8.02	CoT Access Agreement	yr	$2,170	1	$2,170

Alternative 2: Less Aggressive - Regional Aquifer
MNA with Wellhead Treatment

Site:	Park Euclid WQARF Site	**Description**
Location:	Tucson, AZ	-MNA at approximately 20 RA groundwater wells for 200 years
Phase:	Draft FS Costing	-Monthly monitoring at UA production wells when PCE exceeds 0.25 ppb
Year 0:	2016	-Wellhead treatment when extracted PCE concentration exceeds 2.5 ppb
For:	200 Years	-Assumes that CoT will not withdraw impacted groundwater
Date:	April 2016	-Install & abandon 10 wells every 30 years; No further action after Year 200

9.00	**Site Closeout**				**$136,820**
9.01	Evaluation and Coordination	LS	$16,800	1	$16,800
9.02	Well Abandonment - RA	well	$3,960	28	$110,880
9.03	Reporting and Closeout	LS	$20,000	1	$20,000
9.04	*Project Management Fee*	*%*		*10*	*$14,770*
9.05	*Contingency*	*%*		*15*	*$24,370*
9.06	Refund of Well Bonds from CoT	well	($10,000)	5	($50,000)

PROJECT COST SCHEDULE (200 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
10.00	**O&M Cost**					
10.00	Plume Monitoring & Deep RA Characterization	0	$433,660	$433,660	1.000	$433,660
10.01	No Action	1	$3,670	$437,330	0.981	$3,599
10.02	Plume Monitoring	2	$18,960	$456,290	0.962	$18,234
10.03	No Action	3	$3,670	$459,960	0.943	$3,461
10.04	Plume Monitoring	4	$18,960	$478,920	0.925	$17,536
10.05	No Action	5	$3,670	$482,590	0.907	$3,329
10.06	Plume Monitoring	6	$18,960	$501,550	0.890	$16,865
10.07	No Action	7	$3,670	$505,220	0.872	$3,201
10.08	Plume Monitoring	8	$18,960	$524,180	0.855	$16,220
10.09	No Action	9	$3,670	$527,850	0.839	$3,079
10.10	Plume Monitoring	10	$18,960	$546,810	0.823	$15,599
10.11	No Action	11	$3,670	$550,480	0.807	$2,961
10.12	No Action	12	$3,670	$554,150	0.791	$2,904
10.13	No Action	13	$3,670	$557,820	0.776	$2,848
10.14	No Action	14	$3,670	$561,490	0.761	$2,793
10.15	Plume Monitoring	15	$18,960	$580,450	0.746	$14,149
10.16	No Action	16	$3,670	$584,120	0.732	$2,686
10.17	No Action	17	$3,670	$587,790	0.718	$2,634
10.18	No Action	18	$3,670	$591,460	0.704	$2,583
10.19	No Action	19	$3,670	$595,130	0.690	$2,533
10.20	Plume Monitoring	20	$18,960	$614,090	0.677	$12,834
10.21	No Action	21	$3,670	$617,760	0.664	$2,436
10.22	No Action	22	$3,670	$621,430	0.651	$2,389
10.23	No Action	23	$3,670	$625,100	0.638	$2,343
10.24	No Action	24	$3,670	$628,770	0.626	$2,298
10.25	Plume Monitoring	25	$18,960	$647,730	0.614	$11,641
10.26	No Action	26	$3,670	$651,400	0.602	$2,210
10.27	No Action	27	$3,670	$655,070	0.590	$2,167
10.28	No Action	28	$3,670	$658,740	0.579	$2,125
10.29	No Action	29	$3,670	$662,410	0.568	$2,084
10.30	Plume Monitoring & Install Wells	30	$1,038,370	$1,700,780	0.557	$578,260
10.31	Wellhead Monitoring (x1)	31	$26,840	$1,727,620	0.546	$14,658
10.32	Plume & Wellhead Monitoring (x1)	32	$42,130	$1,769,750	0.536	$22,564
10.33	Wellhead Monitoring (x1)	33	$26,840	$1,796,590	0.525	$14,097
10.34	Plume & Wellhead Monitoring (x1)	34	$42,130	$1,838,720	0.515	$21,700
10.35	Wellhead Monitoring (x1)	35	$26,840	$1,865,560	0.505	$13,558
10.36	Plume & Wellhead Monitoring (x1)	36	$42,130	$1,907,690	0.495	$20,870
10.37	Wellhead Monitoring (x1)	37	$26,840	$1,934,530	0.486	$13,039
10.38	Plume & Wellhead Monitoring (x1)	38	$42,130	$1,976,660	0.476	$20,071
10.39	Wellhead Monitoring (x1)	39	$26,840	$2,003,500	0.467	$12,540
10.40	Plume & Wellhead Monitoring (x1)	40	$42,130	$2,045,630	0.458	$19,303

Alternative 2: Less Aggressive - Regional Aquifer

MNA with Wellhead Treatment

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-MNA at approximately 20 RA groundwater wells for 200 years
-Monthly monitoring at UA production wells when PCE exceeds 0.25 ppb
-Wellhead treatment when extracted PCE concentration exceeds 2.5 ppb
-Assumes that CoT will not withdraw impacted groundwater
-Install & abandon 10 wells every 30 years; No further action after Year 200

10.41	Wellhead Monitoring (x1)	41	$26,840	$2,072,470	0.449	$12,060
10.42	Plume & Wellhead Monitoring (x1)	42	$42,130	$2,114,600	0.441	$18,564
10.43	Wellhead Monitoring (x1)	43	$26,840	$2,141,440	0.432	$11,598
10.44	Plume & Wellhead Monitoring (x1)	44	$42,130	$2,183,570	0.424	$17,853
10.45	Wellhead Monitoring (x1)	45	$26,840	$2,210,410	0.416	$11,154
10.46	Plume & Wellhead Monitoring (x1)	46	$42,130	$2,252,540	0.408	$17,170
10.47	Wellhead Monitoring (x1) & Treatment (x1)	47	$564,010	$2,816,550	0.400	$225,421
10.48	Plume & Wellhead Monitoring (x1), Treatment (x1)	48	$59,030	$2,875,580	0.392	$23,137
10.49	Wellhead Monitoring (x1) & Treatment (x1)	49	$43,740	$2,919,320	0.384	$16,813
10.50	Plume & Wellhead Monitoring (x1), Treatment (x1)	50	$59,030	$2,978,350	0.377	$22,251
10.51	Wellhead Monitoring (x1) & Treatment (x1)	51	$43,740	$3,022,090	0.370	$16,169
10.52	Plume & Wellhead Monitoring (x1), Treatment (x1)	52	$59,030	$3,081,120	0.363	$21,400
10.53	Wellhead Monitoring (x1)	53	$26,840	$3,107,960	0.356	$9,542
10.54	Plume & Wellhead Monitoring (x1)	54	$42,130	$3,150,090	0.349	$14,689
10.55	Wellhead Monitoring (x1)	55	$26,840	$3,176,930	0.342	$9,177
10.56	Plume & Wellhead Monitoring (x1)	56	$42,130	$3,219,060	0.335	$14,126
10.57	Wellhead Monitoring (x1)	57	$26,840	$3,245,900	0.329	$8,826
10.58	Plume & Wellhead Monitoring (x1)	58	$42,130	$3,288,030	0.322	$13,586
10.59	Wellhead Monitoring (x1)	59	$26,840	$3,314,870	0.316	$8,488
10.60	Plume & Wellhead Monitoring (x1); Install Wells	60	$1,061,540	$4,376,410	0.310	$329,214
10.61	Wellhead Monitoring (x1)	61	$26,840	$4,403,250	0.304	$8,163
10.62	Plume & Wellhead Monitoring (x1)	62	$42,130	$4,445,380	0.298	$12,566
10.63	Wellhead Monitoring (x1)	63	$26,840	$4,472,220	0.292	$7,851
10.64	Plume & Wellhead Monitoring (x1)	64	$42,130	$4,514,350	0.287	$12,085
10.65	Wellhead Monitoring (x1)	65	$26,840	$4,541,190	0.281	$7,550
10.66	Plume & Wellhead Monitoring (x1)	66	$42,130	$4,583,320	0.276	$11,622
10.67	Wellhead Monitoring (x1)	67	$26,840	$4,610,160	0.271	$7,261
10.68	Plume & Wellhead Monitoring (x1)	68	$42,130	$4,652,290	0.265	$11,177
10.69	Wellhead Monitoring (x1)	69	$26,840	$4,679,130	0.260	$6,983
10.70	Plume & Wellhead Monitoring (x2)	70	$65,300	$4,744,430	0.255	$16,661
10.71	Wellhead Monitoring (x2)	71	$50,010	$4,794,440	0.250	$12,514
10.72	Plume & Wellhead Monitoring (x2)	72	$65,300	$4,859,740	0.245	$16,024
10.73	Wellhead Monitoring (x2)	73	$50,010	$4,909,750	0.241	$12,035
10.74	Plume & Wellhead Monitoring (x2)	74	$65,300	$4,975,050	0.236	$15,410
10.75	Wellhead Monitoring (x2)	75	$50,010	$5,025,060	0.231	$11,574
10.76	Plume & Wellhead Monitoring (x2)	76	$65,300	$5,090,360	0.227	$14,821
10.77	Wellhead Monitoring (x1)	77	$26,840	$5,117,200	0.223	$5,974
10.78	Plume & Wellhead Monitoring (x1)	78	$42,130	$5,159,330	0.218	$9,196
10.79	Wellhead Monitoring (x1)	79	$26,840	$5,186,170	0.214	$5,745
10.80	Plume & Wellhead Monitoring (x1)	80	$42,130	$5,228,300	0.210	$8,844
10.81	Wellhead Monitoring (x1)	81	$26,840	$5,255,140	0.206	$5,525
10.82	Plume & Wellhead Monitoring (x1)	82	$42,130	$5,297,270	0.202	$8,505
10.83	Wellhead Monitoring (x1)	83	$26,840	$5,324,110	0.198	$5,314
10.84	Plume & Wellhead Monitoring (x1)	84	$42,130	$5,366,240	0.194	$8,180
10.85	Wellhead Monitoring (x1)	85	$26,840	$5,393,080	0.190	$5,111
10.86	Plume & Wellhead Monitoring (x1)	86	$42,130	$5,435,210	0.187	$7,867
10.87	Wellhead Monitoring (x1)	87	$26,840	$5,462,050	0.183	$4,915
10.88	Plume & Wellhead Monitoring (x1)	88	$42,130	$5,504,180	0.180	$7,566
10.89	Wellhead Monitoring (x1)	89	$26,840	$5,531,020	0.176	$4,727
10.90	Plume & Wellhead Monitoring (x1); Install Wells	90	$1,061,540	$6,592,560	0.173	$183,336

Alternative 2: Less Aggressive - Regional Aquifer

MNA with Wellhead Treatment

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-MNA at approximately 20 RA groundwater wells for 200 years
-Monthly monitoring at UA production wells when PCE exceeds 0.25 ppb
-Wellhead treatment when extracted PCE concentration exceeds 2.5 ppb
-Assumes that CoT will not withdraw impacted groundwater
-Install & abandon 10 wells every 30 years; No further action after Year 200

10.91	Wellhead Monitoring (x1)	91	$26,840	$6,619,400	0.169	$4,546
10.92	Plume & Wellhead Monitoring (x1)	92	$42,130	$6,661,530	0.166	$6,998
10.93	Wellhead Monitoring (x1)	93	$26,840	$6,688,370	0.163	$4,372
10.94	Plume & Wellhead Monitoring (x1)	94	$42,130	$6,730,500	0.160	$6,730
10.95	Wellhead Monitoring (x1)	95	$26,840	$6,757,340	0.157	$4,205
10.96	Plume & Wellhead Monitoring (x1)	96	$42,130	$6,799,470	0.154	$6,472
10.97	Wellhead Monitoring (x1)	97	$26,840	$6,826,310	0.151	$4,044
10.98	Plume & Wellhead Monitoring (x1)	98	$42,130	$6,868,440	0.148	$6,225
10.99	Wellhead Monitoring (x1)	99	$26,840	$6,895,280	0.145	$3,889
11.00	Plume & Wellhead Monitoring (x1)	100	$42,130	$6,937,410	0.142	$5,986
11.01	Wellhead Monitoring (x1)	101	$26,840	$6,964,250	0.139	$3,740
11.02	Plume & Wellhead Monitoring (x1)	102	$42,130	$7,006,380	0.137	$5,757
11.03	Wellhead Monitoring (x1)	103	$26,840	$7,033,220	0.134	$3,597
11.04	Plume & Wellhead Monitoring (x1)	104	$42,130	$7,075,350	0.131	$5,537
11.05	Wellhead Monitoring (x1)	105	$26,840	$7,102,190	0.129	$3,459
11.06	Plume & Wellhead Monitoring (x1)	106	$42,130	$7,144,320	0.126	$5,325
11.07	Wellhead Monitoring (x1)	107	$26,840	$7,171,160	0.124	$3,327
11.08	Plume & Wellhead Monitoring (x1)	108	$42,130	$7,213,290	0.122	$5,121
11.09	Wellhead Monitoring (x1)	109	$26,840	$7,240,130	0.119	$3,200
11.10	Plume & Wellhead Monitoring (x1)	110	$42,130	$7,282,260	0.117	$4,925
11.11	Wellhead Monitoring (x2)	111	$50,010	$7,332,270	0.115	$5,733
11.12	Plume & Wellhead Monitoring (x2)	112	$65,300	$7,397,570	0.112	$7,342
11.13	Wellhead Monitoring (x2)	113	$50,010	$7,447,580	0.110	$5,514
11.14	Plume & Wellhead Monitoring (x2)	114	$65,300	$7,512,880	0.108	$7,061
11.15	Wellhead Monitoring (x2)	115	$50,010	$7,562,890	0.106	$5,303
11.16	Plume & Wellhead Monitoring (x2)	116	$65,300	$7,628,190	0.104	$6,790
11.17	Wellhead Monitoring (x2)	117	$50,010	$7,678,200	0.102	$5,100
11.18	Plume & Wellhead Monitoring (x2)	118	$65,300	$7,743,500	0.100	$6,530
11.19	Wellhead Monitoring (x2)	119	$50,010	$7,793,510	0.098	$4,905
11.20	Plume & Wellhead Monitoring (x2); Install Wells	120	$1,084,710	$8,878,220	0.096	$104,327
11.21	Wellhead Monitoring (x1)	121	$26,840	$8,905,060	0.094	$2,532
11.22	Plume & Wellhead Monitoring (x1)	122	$42,130	$8,947,190	0.092	$3,897
11.23	Wellhead Monitoring (x1)	123	$26,840	$8,974,030	0.091	$2,435
11.24	Plume & Wellhead Monitoring (x1)	124	$42,130	$9,016,160	0.089	$3,748
11.25	Wellhead Monitoring (x1)	125	$26,840	$9,043,000	0.087	$2,341
11.26	Plume & Wellhead Monitoring (x1)	126	$42,130	$9,085,130	0.086	$3,604
11.27	Wellhead Monitoring (x1)	127	$26,840	$9,111,970	0.084	$2,252
11.28	Plume & Wellhead Monitoring (x1)	128	$42,130	$9,154,100	0.082	$3,466
11.29	Wellhead Monitoring (x1)	129	$26,840	$9,180,940	0.081	$2,166
11.30	Plume & Wellhead Monitoring (x1); Treatment (x1)	130	$579,300	$9,760,240	0.079	$45,840
11.31	Wellhead Monitoring (x1); Treatment (x1)	131	$43,740	$9,803,980	0.078	$3,394
11.32	Plume & Wellhead Monitoring (x1); Treatment (x1)	132	$59,030	$9,863,010	0.076	$4,492
11.33	Wellhead Monitoring (x1); Treatment (x1)	133	$43,740	$9,906,750	0.075	$3,264
11.34	Plume & Wellhead Monitoring (x1); Treatment (x1)	134	$94,530	$10,001,280	0.073	$6,919
11.35	Wellhead Monitoring (x1); Treatment (x1)	135	$43,740	$10,045,020	0.072	$3,139
11.36	Plume & Wellhead Monitoring (x1); Treatment (x1)	136	$59,030	$10,104,050	0.070	$4,155
11.37	Wellhead Monitoring (x1); Treatment (x1)	137	$43,740	$10,147,790	0.069	$3,019
11.38	Plume & Wellhead Monitoring (x1); Treatment (x1)	138	$59,030	$10,206,820	0.068	$3,996
11.39	Wellhead Monitoring (x1); Treatment (x1)	139	$79,240	$10,286,060	0.066	$5,260
11.40	Plume & Wellhead Monitoring (x1); Treatment (x1)	140	$59,030	$10,345,090	0.065	$3,843
11.41	Wellhead Monitoring (x1); Treatment (x1)	141	$43,740	$10,388,830	0.064	$2,793
11.42	Plume & Wellhead Monitoring (x1); Treatment (x1)	142	$59,030	$10,447,860	0.063	$3,696
11.43	Wellhead Monitoring (x1); Treatment (x1)	143	$79,240	$10,527,100	0.061	$4,865
11.44	Plume & Wellhead Monitoring (x1); Treatment (x1)	144	$59,030	$10,586,130	0.060	$3,554
11.45	Wellhead Monitoring (x1); Treatment (x1)	145	$43,740	$10,629,870	0.059	$2,583

Alternative 2: Less Aggressive - Regional Aquifer
MNA with Wellhead Treatment

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-MNA at approximately 20 RA groundwater wells for 200 years
-Monthly monitoring at UA production wells when PCE exceeds 0.25 ppb
-Wellhead treatment when extracted PCE concentration exceeds 2.5 ppb
-Assumes that CoT will not withdraw impacted groundwater
-Install & abandon 10 wells every 30 years; No further action after Year 200

11.46	Plume & Wellhead Monitoring (x1); Treatment (x1)	146	$59,030	$10,688,900	0.058	$3,418
11.47	Wellhead Monitoring (x1); Treatment (x1)	147	$79,240	$10,768,140	0.057	$4,500
11.48	Plume & Wellhead Monitoring (x1); Treatment (x1)	148	$59,030	$10,827,170	0.056	$3,288
11.49	Wellhead Monitoring (x1); Treatment (x1)	149	$43,740	$10,870,910	0.055	$2,389
11.50	Plume & Wellhead Monitoring (x1), Treatment (x1); Install Wells	150	$1,078,440	$11,949,350	0.054	$57,763
11.51	Wellhead Monitoring (x1); Treatment (x1)	151	$43,740	$11,993,090	0.053	$2,298
11.52	Plume & Wellhead Monitoring (x1); Treatment (x1)	152	$94,530	$12,087,620	0.052	$4,869
11.53	Wellhead Monitoring (x1); Treatment (x1)	153	$43,740	$12,131,360	0.051	$2,210
11.54	Plume & Wellhead Monitoring (x1); Treatment (x1)	154	$59,030	$12,190,390	0.050	$2,924
11.55	Wellhead Monitoring (x1); Treatment (x1)	155	$43,740	$12,234,130	0.049	$2,125
11.56	Plume & Wellhead Monitoring (x1); Treatment (x1)	156	$59,030	$12,293,160	0.048	$2,812
11.57	Wellhead Monitoring (x1); Treatment (x1)	157	$79,240	$12,372,400	0.047	$3,702
11.58	Plume & Wellhead Monitoring (x1); Treatment (x1)	158	$59,030	$12,431,430	0.046	$2,705
11.59	Wellhead Monitoring (x1); Treatment (x1)	159	$43,740	$12,475,170	0.045	$1,965
11.60	Plume & Wellhead Monitoring (x1)	160	$42,130	$12,517,300	0.044	$1,857
11.61	Wellhead Monitoring (x1)	161	$26,840	$12,544,140	0.043	$1,160
11.62	Plume & Wellhead Monitoring (x1)	162	$42,130	$12,586,270	0.042	$1,785
11.63	Wellhead Monitoring (x1)	163	$26,840	$12,613,110	0.042	$1,116
11.64	Plume & Wellhead Monitoring (x1)	164	$42,130	$12,655,240	0.041	$1,717
11.65	Wellhead Monitoring (x1)	165	$26,840	$12,682,080	0.040	$1,073
11.66	Plume & Wellhead Monitoring (x1)	166	$42,130	$12,724,210	0.039	$1,651
11.67	Wellhead Monitoring (x1)	167	$26,840	$12,751,050	0.038	$1,032
11.68	Plume & Wellhead Monitoring (x1)	168	$42,130	$12,793,180	0.038	$1,588
11.69	Wellhead Monitoring (x1)	169	$26,840	$12,820,020	0.037	$992
11.70	Plume & Wellhead Monitoring (x1)	170	$42,130	$12,862,150	0.036	$1,527
11.71	Wellhead Monitoring (x1)	171	$26,840	$12,888,990	0.036	$954
11.72	Plume & Wellhead Monitoring (x1)	172	$42,130	$12,931,120	0.035	$1,469
11.73	Wellhead Monitoring (x1)	173	$26,840	$12,957,960	0.034	$918
11.74	Plume & Wellhead Monitoring (x1)	174	$42,130	$13,000,090	0.034	$1,413
11.75	Wellhead Monitoring (x1)	175	$26,840	$13,026,930	0.033	$883
11.76	Plume & Wellhead Monitoring (x1)	176	$42,130	$13,069,060	0.032	$1,359
11.77	Wellhead Monitoring (x1)	177	$26,840	$13,095,900	0.032	$849
11.78	Plume & Wellhead Monitoring (x1)	178	$42,130	$13,138,030	0.031	$1,307
11.79	Wellhead Monitoring (x1)	179	$26,840	$13,164,870	0.030	$816
11.80	Plume & Wellhead Monitoring (x1), Install Wells	180	$1,061,540	$14,226,410	0.030	$31,664
11.81	Wellhead Monitoring (x1)	181	$26,840	$14,253,250	0.029	$785
11.82	Plume & Wellhead Monitoring (x1)	182	$42,130	$14,295,380	0.029	$1,209
11.83	Wellhead Monitoring (x1)	183	$26,840	$14,322,220	0.028	$755
11.84	Plume & Wellhead Monitoring (x1)	184	$42,130	$14,364,350	0.028	$1,162
11.85	Wellhead Monitoring (x1)	185	$26,840	$14,391,190	0.027	$726
11.86	Plume & Wellhead Monitoring (x1)	186	$42,130	$14,433,320	0.027	$1,118
11.87	Wellhead Monitoring (x1)	187	$26,840	$14,460,160	0.026	$698
11.88	Plume & Wellhead Monitoring (x1)	188	$42,130	$14,502,290	0.026	$1,075
11.89	Wellhead Monitoring (x1)	189	$26,840	$14,529,130	0.025	$672
11.90	Plume & Wellhead Monitoring (x1)	190	$42,130	$14,571,260	0.025	$1,034
11.91	Wellhead Monitoring (x1)	191	$26,840	$14,598,100	0.024	$646
11.92	Plume & Wellhead Monitoring (x1)	192	$42,130	$14,640,230	0.024	$994
11.93	Wellhead Monitoring (x1)	193	$26,840	$14,667,070	0.023	$621
11.94	Plume Monitoring	194	$18,960	$14,686,030	0.023	$430
11.95	No Action	195	$3,670	$14,689,700	0.022	$82
11.96	Plume Monitoring	196	$18,960	$14,708,660	0.022	$414
11.97	No Action	197	$3,670	$14,712,330	0.021	$79
11.98	Plume Monitoring	198	$18,960	$14,731,290	0.021	$398
11.99	No Action	199	$3,670	$14,734,960	0.021	$76
12.00	Plume Monitoring and Closeout	200	$155,780	$14,890,740	0.020	$3,145
TOTAL COSTS			**$14,890,740**			**$3,197,927**

Alternative 3A: More Aggressive - Regional Aquifer Groundwater Extraction & Delivery to UA

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 40 Years
Date: April 2016

Description
-Install an extraction well screened from 200 to 330 feet bgs between PER-28 and UAM-2 and operate at 50 gpm for 30 years
-Convey treated water to UA cooling towers via piping/directional drilling
-Install 4 additional wells (for chemical and potentiometric control)
-LTM at 25 wells at annual then biannual frequency; no further action after Year 40

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Deeper RA Characterization Effort**				**$414,700**
1.01	Work Plan & Coordination	LS	$20,000	1	$20,000
1.02	Drilling and Installation Services	well	$79,000	3	$237,000
1.03	Oversight, Development, & Reporting	well	$19,400	3	$58,200
1.04	Well Bond to CoT	well	$10,000	3	$30,000
1.05	*Project Management Fee*	*%*		*10*	*$34,520*
1.06	*Contingency*	*%*		*10*	*$34,980*
2.00	**Plume Monitoring & Reporting**				**$17,590**
2.01	Labor and supplies to sample RA groundwater monitoring wells	well	$320	25	$8,000
2.02	Groundwater analytical - 8260B for COCs	sample	$65	28	$1,820
2.03	Evaluation and Reporting - RA	LS	$5,400	1	$5,400
2.04	*Project Management Fee*	*%*		*10*	*$1,530*
2.05	*Contingency*	*%*		*5*	*$840*
3.00	**Performance Monitoring Well Installation**				**$444,070**
3.01	Work Plan & Coordination - RA	LS	$19,000	1	$19,000
3.02	Drilling and Installation Services - RA	well	$68,000	4	$272,000
3.03	Oversight, Development, & Reporting - RA	well	$13,800	4	$55,200
3.04	Well Bond to CoT	well	$10,000	4	$40,000
3.05	*Project Management Fee*	*%*		*10*	*$38,620*
3.06	*Contingency*	*%*		*5*	*$19,250*
4.00	**Extraction Well Installation**				**$327,030**
4.01	Work Plan & Coordination & Beneficial Use Study	LS	$24,000	1	$24,000
4.02	Drilling and Installation Services	well	$121,900	1	$121,900
4.03	Well Bond to CoT	well	$10,000	1	$10,000
4.04	Aquifer Testing and Pump Sizing	LS	$23,500	1	$23,500
4.05	Deploy Pump and Connect Utilities/Piping	LS	$41,700	1	$41,700
4.06	Well Development & IDW	well	$13,400	1	$13,400
4.07	Oversight & Reporting	LS	$25,200	1	$25,200
4.08	*Project Management Fee*	*%*		*10*	*$25,970*
4.09	*Contingency*	*%*		*15*	*$41,360*
5.00	**Extracted Water Treatment - Capital Costs**				**$1,404,000**
5.01	System Design, Permitting, and Coordination	EA	$85,000	1	$85,000
5.02	Purchase Property Parcel	EA	$309,000	1	$309,000
5.03	System Purchase - 2 GAC vessels (100 gpm) with 2 tons carbon	EA	$130,000	1	$130,000
5.04	Pressure Relief Valves, Sampling Ports, and Bag Filters	EA	$17,000	1	$17,000
5.05	System Installation & Electrical Controls	LS	$96,260	1	$96,260
5.06	Directional Drilling to Install Piping to UA Cooling Towers	LS	$314,900	1	$314,900
5.07	Trenching & Property Rental	LS	$45,000	1	$45,000
5.08	Oversight and Reporting	LS	$54,000	1	$54,000
5.09	Freight and Taxes	EA	$12,470	1	$12,470
5.10	*Project Management Fee*	*%*		*10*	*$106,370*
5.11	*Contingency*	*%*		*20*	*$234,000*

Alternative 3A: More Aggressive - Regional Aquifer Groundwater Extraction & Delivery to UA

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 40 Years
Date: April 2016

Description
-Install an extraction well screened from 200 to 330 feet bgs between PER-28 and UAM-2 and operate at 50 gpm for 30 years
-Convey treated water to UA cooling towers via piping/directional drilling
-Install 4 additional wells (for chemical and potentiometric control)
-LTM at 25 wells at annual then biannual frequency; no further action after Year 40

6.00	**Extracted Water Treatment - Annual O&M Costs per Well**				**$67,390**
6.01	Utility Services	yr	$13,200	1	$13,200
6.02	Discharge, Servicing, and Permitting Fees (inc. ADWR)	yr	$7,000	1	$7,000
6.03	Routine Maintenance & Repairs	qtr	$7,500	4	$30,000
6.04	Property Taxes and Maintenance	yr	$5,490	1	$5,490
6.05	*Project Management Fee*	*%*		*10*	*$5,570*
6.06	*Contingency*	*%*		*10*	*$6,130*
7.00	**Changeout GAC (2,000 lbs)**	EA	$9,500	1	**$9,500**
8.00	**Annual Wellhead Monitoring (monthly frequency)**				**$23,170**
8.01	Labor and supplies to sample water supply well and system	mo	$600	12	$7,200
8.02	Groundwater analytical - 8260B for COCs	sample	$65	36	$2,340
8.03	Evaluation and Reporting	yr	$9,600	1	$9,600
8.04	*Project Management Fee*	*%*		*10*	*$1,920*
8.05	*Contingency*	*%*		*10*	*$2,110*
9.00	**Annual CoT Access Fees**				**$3,170**
9.01	CoT Agreement Fee	well	$100	10	$1,000
9.02	CoT Access Agreement	yr	$2,170	1	$2,170
10.00	**Site Closeout**				**($114,260)**
10.01	Evaluation and Coordination	LS	$16,800	1	$16,800
10.02	Well Abandonment - RA	well	$3,960	32	$126,720
10.03	Reporting and Closeout	LS	$20,000	1	$20,000
10.04	System Decommission & Abandon Piping	LS	$33,100	1	$33,100
10.05	*Project Management Fee*	*%*		*10*	*$19,670*
10.06	*Contingency*	*%*		*15*	*$32,450*
10.07	Property Resale	EA	($263,000)	1	($263,000)
10.08	Refund of Well Bonds from CoT	well	($10,000)	10	($100,000)

Alternative 3A: More Aggressive - Regional Aquifer Groundwater Extraction & Delivery to UA

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 40 Years
Date: April 2016

Description
-Install an extraction well screened from 200 to 330 feet bgs between PER-28 and UAM-2 and operate at 50 gpm for 30 years
-Convey treated water to UA cooling towers via piping/directional drilling
-Install 4 additional wells (for chemical and potentiometric control)
-LTM at 25 wells at annual then biannual frequency; no further action after Year 40

PROJECT COST SCHEDULE (40 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
11.00	**O&M Cost**					
11.00	Plume & Wellhead Monitoring, Install Wells & Extraction Setup	0	$2,714,960	$2,714,960	1.000	$2,714,960
11.01	Plume and Wellhead Monitoring, Treatment	1	$127,060	$2,842,020	0.981	$124,605
11.02	Plume and Wellhead Monitoring, Treatment	2	$127,060	$2,969,080	0.962	$122,197
11.03	Plume and Wellhead Monitoring, Treatment	3	$126,930	$3,096,010	0.943	$119,713
11.04	Plume and Wellhead Monitoring, Treatment	4	$126,790	$3,222,800	0.925	$117,270
11.05	Wellhead Monitoring & Treatment	5	$109,070	$3,331,870	0.907	$98,931
11.06	Plume and Wellhead Monitoring, Treatment	6	$125,700	$3,457,570	0.890	$111,812
11.07	Wellhead Monitoring & Treatment	7	$107,020	$3,564,590	0.872	$93,357
11.08	Plume and Wellhead Monitoring, Treatment	8	$123,660	$3,688,250	0.855	$105,788
11.09	Wellhead Monitoring & Treatment	9	$104,980	$3,793,230	0.839	$88,072
11.10	Plume and Wellhead Monitoring, Treatment	10	$121,610	$3,914,840	0.823	$100,052
11.11	Wellhead Monitoring & Treatment	11	$103,610	$4,018,450	0.807	$83,596
11.12	Plume and Wellhead Monitoring, Treatment	12	$120,790	$4,139,240	0.791	$95,574
11.13	Wellhead Monitoring & Treatment	13	$102,790	$4,242,030	0.776	$79,760
11.14	Plume and Wellhead Monitoring, Treatment	14	$119,980	$4,362,010	0.761	$91,300
11.15	Wellhead Monitoring & Treatment	15	$101,980	$4,463,990	0.746	$76,103
11.16	Plume and Wellhead Monitoring, Treatment	16	$119,290	$4,583,280	0.732	$87,300
11.17	Wellhead Monitoring & Treatment	17	$101,190	$4,684,470	0.718	$72,623
11.18	Plume and Wellhead Monitoring, Treatment	18	$118,270	$4,802,740	0.704	$83,241
11.19	Wellhead Monitoring & Treatment	19	$100,170	$4,902,910	0.690	$69,139
11.20	Plume and Wellhead Monitoring, Treatment	20	$117,240	$5,020,150	0.677	$79,358
11.21	Wellhead Monitoring & Treatment	21	$99,140	$5,119,290	0.664	$65,809
11.22	Plume and Wellhead Monitoring, Treatment	22	$116,440	$5,235,730	0.651	$75,800
11.23	Wellhead Monitoring & Treatment	23	$98,250	$5,333,980	0.638	$62,723
11.24	Plume and Wellhead Monitoring, Treatment	24	$115,250	$5,449,230	0.626	$72,154
11.25	Wellhead Monitoring & Treatment	25	$97,300	$5,546,530	0.614	$59,739
11.26	Plume and Wellhead Monitoring, Treatment	26	$114,530	$5,661,060	0.602	$68,958
11.27	Wellhead Monitoring & Treatment	27	$96,940	$5,758,000	0.590	$57,240
11.28	Plume and Wellhead Monitoring, Treatment	28	$114,170	$5,872,170	0.579	$66,111
11.29	Wellhead Monitoring & Treatment	29	$96,580	$5,968,750	0.568	$54,844
11.30	Plume Monitoring (biannual)	30	$20,760	$5,989,510	0.557	$11,561
11.31	No Action	31	$3,170	$5,992,680	0.546	$1,731
11.32	Plume Monitoring (biannual)	32	$20,760	$6,013,440	0.536	$11,119
11.33	No Action	33	$3,170	$6,016,610	0.525	$1,665
11.34	Plume Monitoring (biannual)	34	$20,760	$6,037,370	0.515	$10,693
11.35	No Action	35	$3,170	$6,040,540	0.505	$1,601
11.36	Plume Monitoring (biannual)	36	$20,760	$6,061,300	0.495	$10,284
11.37	No Action	37	$3,170	$6,064,470	0.486	$1,540
11.38	Plume Monitoring (biannual)	38	$20,760	$6,085,230	0.476	$9,890
11.39	No Action	39	$3,170	$6,088,400	0.467	$1,481
11.40	Plume Monitoring (biannual) & Site Closure	40	($93,500)	$5,994,900	0.458	-$42,839
TOTAL COSTS			**$5,994,900**			**$5,216,853**

Alternative 3B: More Aggressive - Regional Aquifer Groundwater Extraction & Discharge to High School Wash

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 40 Years
Date: April 2016

Description
-Install an extraction well screened from 200 to 330 feet bgs between PER-28 and UAM-2 and operate at 50 gpm for 30 years
-Discharge treated water to High School Wash
-Install 4 additional wells (for chemical and potentiometric control)
-LTM at 25 wells at annual then biannual frequency; no further action after Year 40

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Deeper RA Characterization Effort**				**$414,700**
1.01	Work Plan & Coordination	LS	$20,000	1	$20,000
1.02	Drilling and Installation Services	well	$79,000	3	$237,000
1.03	Oversight, Development, & Reporting	well	$19,400	3	$58,200
1.04	Well Bond to CoT	well	$10,000	3	$30,000
1.05	*Project Management Fee*	*%*		*10*	*$34,520*
1.06	*Contingency*	*%*		*10*	*$34,980*
2.00	**Plume Monitoring & Reporting**				**$17,590**
2.01	Labor and supplies to sample RA groundwater monitoring wells	well	$320	25	$8,000
2.02	Groundwater analytical - 8260B for COCs	sample	$65	28	$1,820
2.03	Evaluation and Reporting - RA	LS	$5,400	1	$5,400
2.04	*Project Management Fee*	*%*		*10*	*$1,530*
2.05	*Contingency*	*%*		*5*	*$840*
3.00	**Performance Monitoring Well Installation**				**$444,070**
3.01	Work Plan & Coordination - RA	LS	$19,000	1	$19,000
3.02	Drilling and Installation Services - RA	well	$68,000	4	$272,000
3.03	Oversight, Development, & Reporting - RA	well	$13,800	4	$55,200
3.04	Well Bond to CoT	well	$10,000	4	$40,000
3.05	*Project Management Fee*	*%*		*10*	*$38,620*
3.06	*Contingency*	*%*		*5*	*$19,250*
4.00	**Extraction Well Installation**				**$327,030**
4.01	Work Plan & Coordination & Beneficial Use Study	LS	$24,000	1	$24,000
4.02	Drilling and Installation Services	well	$121,900	1	$121,900
4.03	Well Bond to CoT	well	$10,000	1	$10,000
4.04	Aquifer Testing and Pump Sizing	LS	$23,500	1	$23,500
4.05	Deploy Pump and Connect Utilities/Piping	LS	$41,700	1	$41,700
4.06	Well Development & IDW	well	$13,400	1	$13,400
4.07	Oversight & Reporting	LS	$25,200	1	$25,200
4.08	*Project Management Fee*	*%*		*10*	*$25,970*
4.09	*Contingency*	*%*		*15*	*$41,360*
5.00	**Extracted Water Treatment - Capital Costs**				**$1,006,160**
5.01	System Design, Permitting, and Coordination	EA	$111,500	1	$111,500
5.02	Purchase Property Parcel	EA	$309,000	1	$309,000
5.03	System Purchase - 2 GAC vessels (100 gpm) with 2 tons carbon	EA	$130,000	1	$130,000
5.04	Pressure Relief Valves, Sampling Ports, and Bag Filters	EA	$17,000	1	$17,000
5.05	System Installation & Electrical Controls	LS	$96,260	1	$96,260
5.06	Outfall Design/Install & Erosion Controls	LS	$35,000	1	$35,000
5.07	Trenching & Piping	LS	$18,000	1	$18,000
5.08	Oversight and Reporting	LS	$33,000	1	$33,000
5.09	Freight and Taxes	EA	$12,470	1	$12,470
5.10	*Project Management Fee*	*%*		*10*	*$76,230*
5.11	*Contingency*	*%*		*20*	*$167,700*

Alternative 3B: More Aggressive - Regional Aquifer Groundwater Extraction & Discharge to High School Wash

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 40 Years
Date: April 2016

Description
-Install an extraction well screened from 200 to 330 feet bgs between PER-28 and UAM-2 and operate at 50 gpm for 30 years
-Discharge treated water to High School Wash
-Install 4 additional wells (for chemical and potentiometric control)
-LTM at 25 wells at annual then biannual frequency; no further action after Year 40

6.00	**Extracted Water Treatment - Annual O&M Costs per Well**				**$79,490**
6.01	Utility Services	yr	$13,200	1	$13,200
6.02	Discharge, Servicing, and Permitting Fees (inc. ADWR)	yr	$7,000	1	$7,000
6.03	Routine Maintenance & Repairs & Erosion/Mosquito Control	qtr	$10,000	4	$40,000
6.04	Property Taxes and Maintenance	yr	$5,490	1	$5,490
6.05	*Project Management Fee*	*%*		*10*	*$6,570*
6.06	*Contingency*	*%*		*10*	*$7,230*
7.00	**Changeout GAC (2,000 lbs)**	EA	$9,500	1	**$9,500**
8.00	**Annual Wellhead Monitoring (monthly frequency)**				**$44,950**
8.01	Labor and supplies to sample water supply well and system	mo	$600	12	$7,200
8.02	Groundwater analytical - 8260B for COCs	sample	$65	36	$2,340
8.03	Evaluation and Reporting	yr	$9,600	1	$9,600
8.04	AZPDES Monitoring & Reporting	yr	$18,000	1	$18,000
8.05	*Project Management Fee*	*%*		*10*	*$3,720*
8.06	*Contingency*	*%*		*10*	*$4,090*
9.00	**Annual CoT Access Fees**				**$3,170**
9.01	CoT Agreement Fee	well	$100	10	$1,000
9.02	CoT Access Agreement	yr	$2,170	1	$2,170
10.00	**Site Closeout**				**($138,420)**
10.01	Evaluation and Coordination	LS	$16,800	1	$16,800
10.02	Well Abandonment - RA	well	$3,960	32	$126,720
10.03	Reporting and Closeout	LS	$20,000	1	$20,000
10.04	System Decommission & Remove Infrastructure	LS	$14,000	1	$14,000
10.05	*Project Management Fee*	*%*		*10*	*$17,760*
10.06	*Contingency*	*%*		*15*	*$29,300*
10.07	Property Resale	EA	($263,000)	1	($263,000)
10.08	Refund of Well Bonds from CoT	well	($10,000)	10	($100,000)

Alternative 3B: More Aggressive - Regional Aquifer Groundwater Extraction & Discharge to High School Wash

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 40 Years
Date: April 2016

Description
-Install an extraction well screened from 200 to 330 feet bgs between PER-28 and UAM-2 and operate at 50 gpm for 30 years
-Discharge treated water to High School Wash
-Install 4 additional wells (for chemical and potentiometric control)
-LTM at 25 wells at annual then biannual frequency; no further action after Year 40

PROJECT COST SCHEDULE (40 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
11.00	**O&M Cost**					
11.00	Plume & Wellhead Monitoring, Install Wells & Extraction Setup	0	$2,351,000	$2,351,000	1.000	$2,351,000
11.01	Plume and Wellhead Monitoring, Treatment	1	$160,940	$2,511,940	0.981	$157,830
11.02	Plume and Wellhead Monitoring, Treatment	2	$160,940	$2,672,880	0.962	$154,780
11.03	Plume and Wellhead Monitoring, Treatment	3	$160,810	$2,833,690	0.943	$151,667
11.04	Plume and Wellhead Monitoring, Treatment	4	$160,670	$2,994,360	0.925	$148,606
11.05	Wellhead Monitoring & Treatment	5	$142,950	$3,137,310	0.907	$129,662
11.06	Plume and Wellhead Monitoring, Treatment	6	$159,580	$3,296,890	0.890	$141,949
11.07	Wellhead Monitoring & Treatment	7	$140,900	$3,437,790	0.872	$122,911
11.08	Plume and Wellhead Monitoring, Treatment	8	$157,540	$3,595,330	0.855	$134,771
11.09	Wellhead Monitoring & Treatment	9	$138,860	$3,734,190	0.839	$116,495
11.10	Plume and Wellhead Monitoring, Treatment	10	$155,490	$3,889,680	0.823	$127,926
11.11	Wellhead Monitoring & Treatment	11	$137,490	$4,027,170	0.807	$110,931
11.12	Plume and Wellhead Monitoring, Treatment	12	$154,670	$4,181,840	0.791	$122,381
11.13	Wellhead Monitoring & Treatment	13	$136,670	$4,318,510	0.776	$106,049
11.14	Plume and Wellhead Monitoring, Treatment	14	$153,860	$4,472,370	0.761	$117,081
11.15	Wellhead Monitoring & Treatment	15	$135,860	$4,608,230	0.746	$101,386
11.16	Plume and Wellhead Monitoring, Treatment	16	$153,170	$4,761,400	0.732	$112,095
11.17	Wellhead Monitoring & Treatment	17	$135,070	$4,896,470	0.718	$96,938
11.18	Plume and Wellhead Monitoring, Treatment	18	$152,150	$5,048,620	0.704	$107,086
11.19	Wellhead Monitoring & Treatment	19	$134,050	$5,182,670	0.690	$92,524
11.20	Plume and Wellhead Monitoring, Treatment	20	$151,120	$5,333,790	0.677	$102,291
11.21	Wellhead Monitoring & Treatment	21	$133,020	$5,466,810	0.664	$88,299
11.22	Plume and Wellhead Monitoring, Treatment	22	$150,320	$5,617,130	0.651	$97,855
11.23	Wellhead Monitoring & Treatment	23	$132,130	$5,749,260	0.638	$84,351
11.24	Plume and Wellhead Monitoring, Treatment	24	$149,130	$5,898,390	0.626	$93,364
11.25	Wellhead Monitoring & Treatment	25	$131,180	$6,029,570	0.614	$80,540
11.26	Plume and Wellhead Monitoring, Treatment	26	$148,410	$6,177,980	0.602	$89,358
11.27	Wellhead Monitoring & Treatment	27	$130,820	$6,308,800	0.590	$77,245
11.28	Plume and Wellhead Monitoring, Treatment	28	$148,050	$6,456,850	0.579	$85,729
11.29	Wellhead Monitoring & Treatment	29	$130,460	$6,587,310	0.568	$74,084
11.30	Plume Monitoring (biannual)	30	$20,760	$6,608,070	0.557	$11,561
11.31	No Action	31	$3,170	$6,611,240	0.546	$1,731
11.32	Plume Monitoring (biannual)	32	$20,760	$6,632,000	0.536	$11,119
11.33	No Action	33	$3,170	$6,635,170	0.525	$1,665
11.34	Plume Monitoring (biannual)	34	$20,760	$6,655,930	0.515	$10,693
11.35	No Action	35	$3,170	$6,659,100	0.505	$1,601
11.36	Plume Monitoring (biannual)	36	$20,760	$6,679,860	0.495	$10,284
11.37	No Action	37	$3,170	$6,683,030	0.486	$1,540
11.38	Plume Monitoring (biannual)	38	$20,760	$6,703,790	0.476	$9,890
11.39	No Action	39	$3,170	$6,706,960	0.467	$1,481
11.40	Plume Monitoring (biannual) & Site Closure	40	($117,660)	$6,589,300	0.458	-$53,908
TOTAL COSTS			**$6,589,300**			**$5,584,841**

Alternative 3C: More Aggressive - Regional Aquifer
Groundwater Extraction & Reinjection - Injection Location Selection Evaluation

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 40 Years
Date: April 2016

Description
-3C.1: Reinject at adjacent deeper locations
-3C.2: Reinject at downgradient locations (7th & N Santa Rita Ave)
-3C.3: Reinject at crossgradient locations (8th & N Tyndall Ave)
-3C.4: Reinject at upgradient locations (along Manlove between Park and Fremont)

INCREMENTAL COSTS BETWEEN ALTERNATIVES

COST ELEMENT (INCLUDES OVERSIGHT)	UNIT	UNIT COST	3C.1	3C.2	3C.3	3C.4
Deeper Injection Well Installation (to 630 ft bgs)	well	$39,000	$78,000	$0	$0	$0
Trenching Distance	*ft*	*NA*	*10*	*780*	*200*	*850*
Trenching Cost (inc. traffic control)	ft	$80	$800	$62,400	$16,000	$68,000
Directional Drilling Distance	*ft*	*NA*	*0*	*0*	*1500*	*2400*
Directional Drilling Cost	ft	$130	$0	$0	$195,000	$312,000
Years Relative to Year 26.75 (Base Case)	*yr*	*NA*	*0.25*	*2.00*	*0.75*	*(1.50)*
Annual Operational & Programmatic Cost	yr	$128,000	$32,000	$256,000	$96,000	($192,000)
Connection to to Mission Plant	LS	$40,000	$0	$0	$0	$40,000
Access Fees & Coordination Effort	LS	varied	$5,000	$30,000	$40,000	$35,000
TOTAL INCREMENTAL COST			**$115,800**	**$348,400**	**$347,000**	**$263,000**

Alternative 3C: More Aggressive - Regional Aquifer Groundwater Extraction & Downgradient Reinjection (3C-2)

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 40 Years
Date: April 2016

Description
-Install an extraction well screened from 200 to 330 feet bgs between PER-28 and UAM-2 and operate at 50 gpm for 30 years
-Reinject treated water at two downgradient wells near 7th & N Santa Rita Ave
-Install 4 additional wells (for chemical and potentiometric control)
-LTM at 25 wells at annual then biannual frequency; no further action after Year 40

ALTERNATIVE COMPONENTS:

Item No.	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL (ROUNDED)
1.00	**Deeper RA Characterization Effort**				**$414,700**
1.01	Work Plan & Coordination	LS	$20,000	1	$20,000
1.02	Drilling and Installation Services	well	$79,000	3	$237,000
1.03	Oversight, Development, & Reporting	well	$19,400	3	$58,200
1.04	Well Bond to CoT	well	$10,000	3	$30,000
1.05	*Project Management Fee*	*%*		*10*	*$34,520*
1.06	*Contingency*	*%*		*10*	*$34,980*
2.00	**Plume Monitoring & Reporting**				**$17,590**
2.01	Labor and supplies to sample RA groundwater monitoring wells	well	$320	25	$8,000
2.02	Groundwater analytical - 8260B for COCs	sample	$65	28	$1,820
2.03	Evaluation and Reporting - RA	LS	$5,400	1	$5,400
2.04	*Project Management Fee*	*%*		*10*	*$1,530*
2.05	*Contingency*	*%*		*5*	*$840*
3.00	**Performance Monitoring Well Installation**				**$444,070**
3.01	Work Plan & Coordination - RA	LS	$19,000	1	$19,000
3.02	Drilling and Installation Services - RA	well	$68,000	4	$272,000
3.03	Oversight, Development, & Reporting - RA	well	$13,800	4	$55,200
3.04	Well Bond to CoT	well	$10,000	4	$40,000
3.05	*Project Management Fee*	*%*		*10*	*$38,620*
3.06	*Contingency*	*%*		*5*	*$19,250*
4.00	**Extraction Well Installation**				**$324,500**
4.01	Work Plan & Coordination & Beneficial Use Study	LS	$22,000	1	$22,000
4.02	Drilling and Installation Services	well	$121,900	1	$121,900
4.03	Well Bond to CoT	well	$10,000	1	$10,000
4.04	Aquifer Testing and Pump Sizing	LS	$23,500	1	$23,500
4.05	Deploy Pump and Connect Utilities/Piping	LS	$41,700	1	$41,700
4.06	Well Development & IDW	well	$13,400	1	$13,400
4.07	Oversight & Reporting	LS	$25,200	1	$25,200
4.08	*Project Management Fee*	*%*		*10*	*$25,770*
4.09	*Contingency*	*%*		*15*	*$41,030*
5.00	**Treatment, Conveyance, & Injection - Capital Costs**				**$1,318,520**
5.01	Treatment System Design, Permitting, and Coordination	EA	$85,000	1	$85,000
5.02	Purchase Property Parcel (extraction & treatment loc)	EA	$309,000	1	$309,000
5.03	System Purchase - 2 GAC vessels (100 gpm) with 2 tons carbon	EA	$130,000	1	$130,000
5.04	Pressure Relief Valves, Sampling Ports, and Bag Filters	EA	$17,000	1	$17,000
5.05	System Installation & Electrical Controls	LS	$19,000	1	$19,000
5.06	Freight and Taxes	EA	$12,470	1	$12,470
5.07	Trenching/Piping Install to Injection Wells	LS	$62,400	1	$62,400
5.08	Oversight and Reporting	LS	$29,000	1	$29,000
5.09	Injection Well Design & Work Plan	LS	$15,000	1	$15,000
5.10	Drilling and Installation Services	well	$150,000	2	$300,000
5.11	Well Bond to CoT	well	$10,000	2	$20,000
5.10	*Project Management Fee*	*%*		*10*	*$99,890*
5.11	*Contingency*	*%*		*20*	*$219,760*

Alternative 3C: More Aggressive - Regional Aquifer Groundwater Extraction & Downgradient Reinjection (3C-2)

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 40 Years
Date: April 2016

Description
-Install an extraction well screened from 200 to 330 feet bgs between PER-28 and UAM-2 and operate at 50 gpm for 30 years
-Reinject treated water at two downgradient wells near 7th & N Santa Rita Ave
-Install 4 additional wells (for chemical and potentiometric control)
-LTM at 25 wells at annual then biannual frequency; no further action after Year 40

6.00	**Extracted Water Treatment & Reinjection - Annual O&M Costs per Well**				**$127,890**
6.01	Utility Services	yr	$13,200	1	$13,200
6.02	Discharge, Servicing, and Permitting Fees (inc. ADWR)	yr	$7,000	1	$7,000
6.03	Routine Maintenance & Repairs	qtr	$7,500	4	$30,000
6.04	Injection Well Rehab (Backflushing) - both wells	ea	$25,000	2	$50,000
6.05	Property Taxes and Maintenance	yr	$5,490	1	$5,490
6.06	*Project Management Fee*	*%*		*10*	*$10,570*
6.07	*Contingency*	*%*		*10*	*$11,630*
7.00	**Changeout GAC (2,000 lbs)**	EA	$9,500	1	**$9,500**
8.00	**Annual Wellhead Monitoring (monthly frequency)**				**$23,170**
8.01	Labor and supplies to sample water supply well and system	mo	$600	12	$7,200
8.02	Groundwater analytical - 8260B for COCs	sample	$65	36	$2,340
8.03	Evaluation and Reporting	yr	$9,600	1	$9,600
8.04	*Project Management Fee*	*%*		*10*	*$1,920*
8.05	*Contingency*	*%*		*10*	*$2,110*
9.00	**Annual CoT Access Fees**				**$3,170**
9.01	CoT Agreement Fee	well	$100	10	$1,000
9.02	CoT Access Agreement	yr	$2,170	1	$2,170
10.00	**Site Closeout**				**($134,260)**
10.01	Evaluation and Coordination	LS	$16,800	1	$16,800
10.02	Well Abandonment - RA	well	$3,960	32	$126,720
10.03	Reporting and Closeout	LS	$20,000	1	$20,000
10.04	System Decommission & Abandon Piping	LS	$33,100	1	$33,100
10.05	*Project Management Fee*	*%*		*10*	*$19,670*
10.06	*Contingency*	*%*		*15*	*$32,450*
10.07	Property Resale	EA	($263,000)	1	($263,000)
10.08	Refund of Well Bonds from CoT	well	($10,000)	12	($120,000)

Alternative 3C: More Aggressive - Regional Aquifer Groundwater Extraction & Downgradient Reinjection (3C-2)

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 40 Years
Date: April 2016

Description
-Install an extraction well screened from 200 to 330 feet bgs between PER-28 and UAM-2 and operate at 50 gpm for 30 years
-Reinject treated water at two downgradient wells near 7th & N Santa Rita Ave
-Install 4 additional wells (for chemical and potentiometric control)
-LTM at 25 wells at annual then biannual frequency; no further action after Year 40

PROJECT COST SCHEDULE (40 Year Period of Analysis):

Item No.	DESCRIPTION	YEAR	PERIOD O&M COST	CUMULATIVE O&M COST	DISCOUNT FACTOR	PERIOD NET PRESENT VALUE
11.00	**O&M Cost**					
11.00	Plume & Wellhead Monitoring, Install Wells & Extraction Setup	0	$2,687,450	$2,687,450	1.000	$2,687,450
11.01	Plume and Wellhead Monitoring, Treatment	1	$187,020	$2,874,470	0.981	$183,406
11.02	Plume and Wellhead Monitoring, Treatment	2	$187,020	$3,061,490	0.962	$179,862
11.03	Plume and Wellhead Monitoring, Treatment	3	$187,020	$3,248,510	0.943	$176,386
11.04	Plume and Wellhead Monitoring, Treatment	4	$187,020	$3,435,530	0.925	$172,978
11.05	Wellhead Monitoring & Treatment	5	$169,430	$3,604,960	0.907	$153,681
11.06	Plume and Wellhead Monitoring, Treatment	6	$186,060	$3,791,020	0.890	$165,503
11.07	Wellhead Monitoring & Treatment	7	$167,660	$3,958,680	0.872	$146,255
11.08	Plume and Wellhead Monitoring, Treatment	8	$184,290	$4,142,970	0.855	$157,655
11.09	Wellhead Monitoring & Treatment	9	$165,750	$4,308,720	0.839	$139,054
11.10	Plume and Wellhead Monitoring, Treatment	10	$182,520	$4,491,240	0.823	$150,165
11.11	Wellhead Monitoring & Treatment	11	$164,520	$4,655,760	0.807	$132,740
11.12	Plume and Wellhead Monitoring, Treatment	12	$181,570	$4,837,330	0.791	$143,665
11.13	Wellhead Monitoring & Treatment	13	$163,570	$5,000,900	0.776	$126,922
11.14	Plume and Wellhead Monitoring, Treatment	14	$180,750	$5,181,650	0.761	$137,543
11.15	Wellhead Monitoring & Treatment	15	$162,750	$5,344,400	0.746	$121,452
11.16	Plume and Wellhead Monitoring, Treatment	16	$180,070	$5,524,470	0.732	$131,781
11.17	Wellhead Monitoring & Treatment	17	$162,200	$5,686,670	0.718	$116,409
11.18	Plume and Wellhead Monitoring, Treatment	18	$179,280	$5,865,950	0.704	$126,181
11.19	Wellhead Monitoring & Treatment	19	$161,440	$6,027,390	0.690	$111,429
11.20	Plume and Wellhead Monitoring, Treatment	20	$178,510	$6,205,900	0.677	$120,830
11.21	Wellhead Monitoring & Treatment	21	$160,410	$6,366,310	0.664	$106,481
11.22	Plume and Wellhead Monitoring, Treatment	22	$177,490	$6,543,800	0.651	$115,542
11.23	Wellhead Monitoring & Treatment	23	$159,640	$6,703,440	0.638	$101,914
11.24	Plume and Wellhead Monitoring, Treatment	24	$176,640	$6,880,080	0.626	$110,587
11.25	Wellhead Monitoring & Treatment	25	$158,460	$7,038,540	0.614	$97,289
11.26	Plume and Wellhead Monitoring, Treatment	26	$175,750	$7,214,290	0.602	$105,819
11.27	Wellhead Monitoring & Treatment	27	$157,800	$7,372,090	0.590	$93,175
11.28	Plume and Wellhead Monitoring, Treatment	28	$175,390	$7,547,480	0.579	$101,560
11.29	Wellhead Monitoring & Treatment	29	$157,440	$7,704,920	0.568	$89,405
11.30	Plume Monitoring (biannual)	30	$20,760	$7,725,680	0.557	$11,561
11.31	No Action	31	$3,170	$7,728,850	0.546	$1,731
11.32	Plume Monitoring (biannual)	32	$20,760	$7,749,610	0.536	$11,119
11.33	No Action	33	$3,170	$7,752,780	0.525	$1,665
11.34	Plume Monitoring (biannual)	34	$20,760	$7,773,540	0.515	$10,693
11.35	No Action	35	$3,170	$7,776,710	0.505	$1,601
11.36	Plume Monitoring (biannual)	36	$20,760	$7,797,470	0.495	$10,284
11.37	No Action	37	$3,170	$7,800,640	0.486	$1,540
11.38	Plume Monitoring (biannual)	38	$20,760	$7,821,400	0.476	$9,890
11.39	No Action	39	$3,170	$7,824,570	0.467	$1,481
11.40	Plume Monitoring (biannual) & Site Closure	40	($113,500)	$7,711,070	0.458	-$52,002
TOTAL COSTS			$7,711,070			$6,512,683

Regional Aquifer - GAC Consumption Estimation
Alternatives 2 and 3

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-GAC consumption estimates are based off simulated PCE concentrations in extracted groundwater and predicted flow/pumping rates to calculate mass loading rates. Mass loading rates are used to derive GAC consumption from vendor-provided isotherms. Also assumes that naturally occuring constituents in ground-water increase consumption by 20%.
-Note: Architecture is monitored quarterly from Years 70 to 120, but never receives treatment.

YEAR	ANTICIPATED PUMPING RATES AND PCE CONCENTRATIONS						ESTIMATED GAC CONSUMPTION & CHANGEOUTS PER YEAR				
	ALTERNATIVE 2				ALTERNATIVE 3		ALTERNATIVE 2			ALTERNATIVE 3 CHANGEOUT	
	AGGIE		S-HOSP		3A/B	3C-2	AGGIE	S-HOSP	CHANGEOUT	3A/B	3C-2
	GPM	PPB	GPM	PPB	50 GPM	50 GPM	(LB-GAC/YR)		10,000-LB	2,000-LB	2,000-LB
0	78	-	89	-	63	63	-	-	0	1.46	1.46
1	79	-	90	-	77	73	-	-	0	1.66	1.60
2	79	-	91	-	77	73	-	-	0	1.66	1.60
3	79	-	91	-	76	73	-	-	0	1.64	1.60
4	80	-	124	-	75	73	-	-	0	1.63	1.60
5	80	-	125	-	74	73	-	-	0	1.61	1.60
6	81	-	125	-	67	66	-	-	0	1.51	1.50
7	81	-	126	-	59	60	-	-	0	1.40	1.41
8	81	-	126	-	52	53	-	-	0	1.30	1.31
9	82	-	127	-	44	46	-	-	0	1.18	1.21
10	82	-	128	-	37	40	-	-	0	1.08	1.13
11	82	-	128	-	34	37	-	-	0	1.04	1.08
12	83	-	129	-	31	33	-	-	0	1.00	1.03
13	84	-	130	-	28	30	-	-	0	0.95	0.98
14	84	-	130	-	25	27	-	-	0	0.91	0.94
15	84	-	131	-	22	24	-	-	0	0.87	0.90
16	85	-	131	-	20	22	-	-	0	0.84	0.87
17	85	-	132	-	18	20	-	-	0	0.78	0.84
18	86	-	133	-	16	18	-	-	0	0.73	0.78
19	86	-	133	-	14	17	-	-	0	0.68	0.76
20	87	-	134	-	12	15	-	-	0	0.62	0.70
21	87	-	135	-	10	13	-	-	0	0.57	0.65
22	87	-	135	-	9	11	-	-	0	0.54	0.60
23	88	-	136	-	7	10	-	-	0	0.48	0.57
24	88	-	136	-	5	8	-	-	0	0.41	0.51
25	89	0.0	137	-	3.9	6.0	-	-	0	0.38	0.44
26	89	0.1	137	-	3.4	5.2	-	-	0	0.34	0.41
27	89	0.1	137	-	2.9	4.4	-	-	0	0.34	0.38
28	89	0.1	137	-	2.4	3.6	-	-	0	0.30	0.38
29	89	0.2	137	-	1.9	2.8	-	-	0	0.30	0.34
30	89	0.2	137	-	1.4	2.0	-	-	0	-	-
31	89	0.4	137	-	1.4	2.0	-	-	0	-	-
32	89	0.5	137	-	1.4	2.0	-	-	0	-	-
33	89	0.7	137	-	1.4	2.0	-	-	0	-	-
34	89	0.9	137	-	1.4	2.0	-	-	0	-	-
35	89	1.1	137	-	1.4	2.0	-	-	0	-	-
36	89	1.2	137	-	1.4	2.0	-	-	0	-	-
37	89	1.4	137	-	1.4	2.0	-	-	0	-	-
38	89	1.6	137	-	1.4	2.0	-	-	0	-	-
39	89	1.8	137	-	1.4	2.0	-	-	0	-	-
40	89	1.9	137	-	1.4	1.9	-	-	0	-	-
41	89	2.0	137	-	1.3	1.8	-	-	0	-	-
42	89	2.1	137	-	1.3	1.7	-	-	0	-	-
43	89	2.2	137	-	1.2	1.6	-	-	0	-	-
44	89	2.3	137	-	1.1	1.5	-	-	0	-	-
45	89	2.3	137	-	1.1	1.4	-	-	0	-	-
46	89	2.4	137	-	1.0	1.2	-	-	0	-	-
47	89	2.5	137	-	0.9	1.1	1,063	-	0	-	-
48	89	2.6	137	-	0.9	1.0	1,197	-	0	-	-
49	89	2.7	137	-	0.8	0.9	1,197	-	0	-	-
50	89	2.7	137	-	0.7	0.8	1,197	-	0	-	-
51	89	2.6	137	-	-	-	1,197	-	0	-	-
52	89	2.5	137	-	-	-	1,063	-	0	-	-

Regional Aquifer - GAC Consumption Estimation
Alternatives 2 and 3

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-GAC consumption estimates are based off simulated PCE concentrations in extracted groundwater and predicted flow/pumping rates to calculate mass loading rates. Mass loading rates are used to derive GAC consumption from vendor-provided isotherms. Also assumes that naturally occuring constituents in ground-water increase consumption by 20%.
-Note: Architecture is monitored quarterly from Years 70 to 120, but never receives treatment.

YEAR	ANTICIPATED PUMPING RATES AND PCE CONCENTRATIONS						ESTIMATED GAC CONSUMPTION & CHANGEOUTS PER YEAR				
	ALTERNATIVE 2				ALTERNATIVE 3		ALTERNATIVE 2			ALTERNATIVE 3 CHANGEOUT	
	AGGIE		S-HOSP		3A/B	3C-2	AGGIE	S-HOSP	CHANGEOUT	3A/B	3C-2
	GPM	PPB	GPM	PPB	50 GPM	50 GPM	(LB-GAC/YR)		10,000-LB	2,000-LB	2,000-LB
53	89	2.4	137	-	-	-	-	-	0	-	-
54	89	2.2	137	-	-	-	-	-	0	-	-
55	89	2.1	137	-	-	-	-	-	0	-	-
56	89	2.0	137	-	-	-	-	-	0	-	-
57	89	1.9	137	-	-	-	-	-	0	-	-
58	89	1.7	137	-	-	-	-	-	0	-	-
59	89	1.6	137	-	-	-	-	-	0	-	-
60	89	1.5	137	-	-	-	-	-	0	-	-
61	89	1.4	137	-	-	-	-	-	0	-	-
62	89	1.3	137	-	-	-	-	-	0	-	-
63	89	1.2	137	-	-	-	-	-	0	-	-
64	89	1.1	137	-	-	-	-	-	0	-	-
65	89	1.0	137	-	-	-	-	-	0	-	-
66	89	0.9	137	-	-	-	-	-	0	-	-
67	89	0.8	137	-	-	-	-	-	0	-	-
68	89	0.7	137	-	-	-	-	-	0	-	-
69	89	0.6	137	-	-	-	-	-	0	-	-
70	89	0.5	137	-	-	-	-	-	0	-	-
71	89	0.4	137	-	-	-	-	-	0	-	-
72	89	0.4	137	-	-	-	-	-	0	-	-
73	89	0.4	137	-	-	-	-	-	0	-	-
74	89	0.3	137	-	-	-	-	-	0	-	-
75	89	0.3	137	-	-	-	-	-	0	-	-
76	89	0.3	137	-	-	-	-	-	0	-	-
77	89	0.2	137	-	-	-	-	-	0	-	-
78	89	0.2	137	-	-	-	-	-	0	-	-
79	89	0.1	137	-	-	-	-	-	0	-	-
80	89	0.1	137	-	-	-	-	-	0	-	-
81	89	0.1	137	-	-	-	-	-	0	-	-
82	89	0.1	137	-	-	-	-	-	0	-	-
83	89	0.1	137	-	-	-	-	-	0	-	-
84	89	0.1	137	-	-	-	-	-	0	-	-
85	89	0.1	137	-	-	-	-	-	0	-	-
86	89	0.1	137	-	-	-	-	-	0	-	-
87	89	0.1	137	-	-	-	-	-	0	-	-
88	89	0.0	137	-	-	-	-	-	0	-	-
89	89	0.0	137	-	-	-	-	-	0	-	-
90	89	0.0	137	-	-	-	-	-	0	-	-
91	89	-	137	-	-	-	-	-	0	-	-
92	89	-	137	-	-	-	-	-	0	-	-
93	89	-	137	-	-	-	-	-	0	-	-
94	89	-	137	-	-	-	-	-	0	-	-
95	89	-	137	-	-	-	-	-	0	-	-
96	89	-	137	-	-	-	-	-	0	-	-
97	89	-	137	-	-	-	-	-	0	-	-
98	89	-	137	-	-	-	-	-	0	-	-
99	89	-	137	-	-	-	-	-	0	-	-
100	89	-	137	0.0	-	-	-	-	0	-	-
101	89	-	137	0.0	-	-	-	-	0	-	-
102	89	-	137	0.1	-	-	-	-	0	-	-
103	89	-	137	0.1	-	-	-	-	0	-	-
104	89	-	137	0.1	-	-	-	-	0	-	-
105	89	-	137	0.1	-	-	-	-	0	-	-

Regional Aquifer - GAC Consumption Estimation
Alternatives 2 and 3

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-GAC consumption estimates are based off simulated PCE concentrations in extracted groundwater and predicted flow/pumping rates to calculate mass loading rates. Mass loading rates are used to derive GAC consumption from vendor-provided isotherms. Also assumes that naturally occuring constituents in ground-water increase consumption by 20%.
-Note: Architecture is monitored quarterly from Years 70 to 120, but never receives treatment.

YEAR	ANTICIPATED PUMPING RATES AND PCE CONCENTRATIONS						ESTIMATED GAC CONSUMPTION & CHANGEOUTS PER YEAR				
	ALTERNATIVE 2				ALTERNATIVE 3		ALTERNATIVE 2			ALTERNATIVE 3 CHANGEOUT	
	AGGIE		S-HOSP		3A/B	3C-2	AGGIE	S-HOSP	CHANGEOUT	3A/B	3C-2
	GPM	PPB	GPM	PPB	50 GPM	50 GPM	(LB-GAC/YR)		10,000-LB	2,000-LB	2,000-LB
106	89	-	137	0.1	-	-	-	-	0	-	-
107	89	-	137	0.1	-	-	-	-	0	-	-
108	89	-	137	0.2	-	-	-	-	0	-	-
109	89	-	137	0.2	-	-	-	-	0	-	-
110	89	-	137	0.2	-	-	-	-	0	-	-
111	89	-	137	0.3	-	-	-	-	0	-	-
112	89	-	137	0.4	-	-	-	-	0	-	-
113	89	-	137	0.4	-	-	-	-	0	-	-
114	89	-	137	0.5	-	-	-	-	0	-	-
115	89	-	137	0.6	-	-	-	-	0	-	-
116	89	-	137	0.7	-	-	-	-	0	-	-
117	89	-	137	0.8	-	-	-	-	0	-	-
118	89	-	137	0.8	-	-	-	-	0	-	-
119	89	-	137	0.9	-	-	-	-	0	-	-
120	89	-	137	1.0	-	-	-	-	0	-	-
121	89	-	137	1.2	-	-	-	-	0	-	-
122	89	-	137	1.3	-	-	-	-	0	-	-
123	89	-	137	1.5	-	-	-	-	0	-	-
124	89	-	137	1.6	-	-	-	-	0	-	-
125	89	-	137	1.8	-	-	-	-	0	-	-
126	89	-	137	2.0	-	-	-	-	0	-	-
127	89	-	137	2.1	-	-	-	-	0	-	-
128	89	-	137	2.3	-	-	-	-	0	-	-
129	89	-	137	2.4	-	-	-	-	0	-	-
130	89	-	137	2.6	-	-	-	1,850	0	-	-
131	89	-	137	2.7	-	-	-	1,850	0	-	-
132	89	-	137	2.8	-	-	-	1,850	0	-	-
133	89	-	137	3.0	-	-	-	1,850	0	-	-
134	89	-	137	3.1	-	-	-	1,850	1	-	-
135	89	-	137	3.2	-	-	-	1,850	0	-	-
136	89	-	137	3.3	-	-	-	1,850	0	-	-
137	89	-	137	3.5	-	-	-	1,850	0	-	-
138	89	-	137	3.6	-	-	-	2,057	0	-	-
139	89	-	137	3.7	-	-	-	2,057	1	-	-
140	89	-	137	3.8	-	-	-	2,057	0	-	-
141	89	-	137	3.8	-	-	-	2,057	0	-	-
142	89	-	137	3.8	-	-	-	2,057	0	-	-
143	89	-	137	3.8	-	-	-	2,057	1	-	-
144	89	-	137	3.7	-	-	-	2,057	0	-	-
145	89	-	137	3.7	-	-	-	2,057	0	-	-
146	89	-	137	3.7	-	-	-	2,057	0	-	-
147	89	-	137	3.7	-	-	-	2,057	1	-	-
148	89	-	137	3.6	-	-	-	2,057	0	-	-
149	89	-	137	3.6	-	-	-	2,057	0	-	-
150	89	-	137	3.6	-	-	-	2,057	0	-	-
151	89	-	137	3.5	-	-	-	1,850	0	-	-
152	89	-	137	3.4	-	-	-	1,850	1	-	-
153	89	-	137	3.2	-	-	-	1,850	0	-	-
154	89	-	137	3.1	-	-	-	1,850	0	-	-
155	89	-	137	3.0	-	-	-	1,850	0	-	-
156	89	-	137	2.9	-	-	-	1,850	0	-	-
157	89	-	137	2.8	-	-	-	1,850	1	-	-
158	89	-	137	2.7	-	-	-	1,850	0	-	-

Regional Aquifer - GAC Consumption Estimation
Alternatives 2 and 3

Site: Park Euclid WQARF Site
Location: Tucson, AZ
Phase: Draft FS Costing
Year 0: 2016
For: 200 Years
Date: April 2016

Description
-GAC consumption estimates are based off simulated PCE concentrations in extracted groundwater and predicted flow/pumping rates to calculate mass loading rates. Mass loading rates are used to derive GAC consumption from vendor-provided isotherms. Also assumes that naturally occuring constituents in ground-water increase consumption by 20%.
-Note: Architecture is monitored quarterly from Years 70 to 120, but never receives treatment.

YEAR	ANTICIPATED PUMPING RATES AND PCE CONCENTRATIONS						ESTIMATED GAC CONSUMPTION & CHANGEOUTS PER YEAR				
	ALTERNATIVE 2				ALTERNATIVE 3		ALTERNATIVE 2			ALTERNATIVE 3 CHANGEOUT	
	AGGIE		S-HOSP		3A/B	3C-2	AGGIE	S-HOSP	CHANGEOUT	3A/B	3C-2
	GPM	PPB	GPM	PPB	50 GPM	50 GPM	(LB-GAC/YR)		10,000-LB	2,000-LB	2,000-LB
159	89	-	137	2.5	-	-	-	1,850	0	-	-
160	89	-	137	2.4	-	-	-	-	0	-	-
161	89	-	137	2.3	-	-	-	-	0	-	-
162	89	-	137	2.2	-	-	-	-	0	-	-
163	89	-	137	2.1	-	-	-	-	0	-	-
164	89	-	137	2.0	-	-	-	-	0	-	-
165	89	-	137	1.9	-	-	-	-	0	-	-
166	89	-	137	1.8	-	-	-	-	0	-	-
167	89	-	137	1.6	-	-	-	-	0	-	-
168	89	-	137	1.5	-	-	-	-	0	-	-
169	89	-	137	1.4	-	-	-	-	0	-	-
170	89	-	137	1.3	-	-	-	-	0	-	-
171	89	-	137	1.2	-	-	-	-	0	-	-
172	89	-	137	1.2	-	-	-	-	0	-	-
173	89	-	137	1.1	-	-	-	-	0	-	-
174	89	-	137	1.0	-	-	-	-	0	-	-
175	89	-	137	1.0	-	-	-	-	0	-	-
176	89	-	137	0.9	-	-	-	-	0	-	-
177	89	-	137	0.8	-	-	-	-	0	-	-
178	89	-	137	0.8	-	-	-	-	0	-	-
179	89	-	137	0.7	-	-	-	-	0	-	-
180	89	-	137	0.6	-	-	-	-	0	-	-
181	89	-	137	0.6	-	-	-	-	0	-	-
182	89	-	137	0.6	-	-	-	-	0	-	-
183	89	-	137	0.5	-	-	-	-	0	-	-
184	89	-	137	0.5	-	-	-	-	0	-	-
185	89	-	137	0.5	-	-	-	-	0	-	-
186	89	-	137	0.4	-	-	-	-	0	-	-
187	89	-	137	0.4	-	-	-	-	0	-	-
188	89	-	137	0.4	-	-	-	-	0	-	-
189	89	-	137	0.3	-	-	-	-	0	-	-
190	89	-	137	0.3	-	-	-	-	0	-	-
191	89	-	137	0.3	-	-	-	-	0	-	-
192	89	-	137	0.3	-	-	-	-	0	-	-
193	89	-	137	0.3	-	-	-	-	0	-	-
194	89	-	137	0.2	-	-	-	-	0	-	-
195	89	-	137	0.2	-	-	-	-	0	-	-
196	89	-	137	0.2	-	-	-	-	0	-	-
197	89	-	137	0.2	-	-	-	-	0	-	-
198	89	-	137	0.2	-	-	-	-	0	-	-
199	89	-	137	0.2	-	-	-	-	0	-	-
200	89	-	137	0.2	-	-	-	-	0	-	-
Total	NA						6,915	58,195	6	28	29

Denotes monitoring without treatment
Denotes monitoring and treatment

Appendix K

Discharge to High School Wash Considerations

This appendix summarizes the various components and procedures that are associated with discharging treated groundwater to the adjacent wash. High School Wash is a drainage used for flood control and is identified as subject to the watercourse amenities, safety, and habit regulations, described in Chapter 29 of the Tucson Code of Ordinances (Energy and Environment). In addition, some of the requirements for development within a floodway set forth in Chapter 26 of the Tucson Code are applicable. From these two referenced ordinances, among other regulations, elements that need to be addressed include:

- Alterations or development within a floodplain
- Hazardous waste handling
- Alterations to a channel deemed waters of the United States
- Sediment and erosion transport
- Impacts to riparian habitat
- Mosquito abatement
- Discharge permitting and monitoring requirements
- Beneficial use evaluation

Overall, none of the identified requirements are believed to be obstructive to implementing this option for handling extracted groundwater. The requirements and anticipated actions are briefly summarized in the subsections below.

ALTERATIONS TO THE FLOODPLAIN

The proposed well location and treatment equipment are well within the 1% annual chance flood hazard zone (also known as the 100-year floodplain). As such, any alterations made to the channel or within the floodplain that would impact conveyance and/or flood elevations would require approval by various agencies.

Based on our current understanding of project conditions and these requirements, we do not believe any of these requirements to be unreasonable to achieve. Firstly, many of the requirements are applicable to development within a floodway (Zone AO). The reach of High School Wash adjacent to the proposed extraction location is within Zone AE (detailed Special Flood Hazard Area [SFHA]), but there is not a floodway (Zone AO) in the project vicinity. Per Sec. 26-5.3 of the code:

> *In areas of special flood hazards, the minimum criteria for approval of any development shall require compliance with all applicable regulations adopted by these regulations, the ADWR and FEMA, whichever is more restrictive.*

These regulations are not clearly spelled out, but are less stringent than what is required for development within a floodway. The two subsections below detail what common requirements working with the Federal Emergency Management Agency (FEMA) and on floodplain development projects.

Base Flood Elevation Rise or Obstructing Floodwaters

Given the minimal footprint anticipated for the extraction well and associated granular activated carbon (GAC) treatment vessels, there are no anticipated unacceptable impacts to the floodplain. Specifically, the base flood elevations would likely not rise as a result of this incremental

development that would obstruct the flow of floodwaters. One mitigation action that could be implemented to reduce the impact on floodwaters would be to elevate the GAC vessels on piers or stilts, such that their base is above the base flood elevation for the 1% annual chance reoccurrence interval.

To demonstrate the suitability of developing in the floodplain, the effective hydraulic model from the FEMA Mapping Information Platform (MIP) would be evaluated with respect to how the project surroundings are simulated. In the event that the proposed well extraction and treatment structures are consistent with how the surrounding land use is characterized, a letter could be written to the City of Tucson explaining why no unacceptable rise would be anticipated and the project might be approved without the need for hydraulic modeling. If modeling were required, the High School Wash effective model would need to be updated to reflect current conditions and then a comparison of modeling results from pre- and post-construction would be conducted. It is anticipated that this activity would be performed after the FS during development of the Proposed Remedial Action Plan (PRAP).

Development Restrictions in Zone AE

Upon review of the floodplain development restrictions in areas noted as Zone AE, but outside of the floodway, this project would fall under minor improvements. A Site plan showing the location and elevations of the treatment equipment would be required and the base of the chain link fence would be elevated 6 inches above grade.

Changes to Flow

The 1% annual chance peak discharge for High School Wash near the Site was estimated at 2,098 cubic feet per second (cfs) per the Flood Insurance Study (FIS) report. Therefore, contributing 50 gallons per minute (gpm), or 0.1 cfs, from our extraction well would be negligible during flooding, representing only 0.003% of the total flow. Furthermore, consistent wetting of a stretch of the channel is not believed to be a concern for increased runoff as the hydrology is largely influenced by basin size and land use. Saturating a narrow stretch of the channel would not meaningfully influence the basin runoff properties that are determined by the larger basin, having a drainage area of approximately 1.0 square mile near the Site.

HAZARDOUS WASTE HANDLING

If the spent activated carbon used to treat groundwater is classified as a hazardous waste, the design of the wellhead and treatment system must meet requirements for hazardous materials handling as presented in the International Building Code and International Fire Code (these requirements will apply no matter the disposition of the treated water or location of the treatment compound). It is possible that a waiver of classification as hazardous waste for the spent activated carbon might be granted from the State of Arizona.

CHANNEL ALTERATIONS

Any alteration to channel properties involving the removal, addition, dredging, or disturbance of fill within a channel deemed as a waters of the United States requires approval from the United States Army Corps of Engineers (USACE) per Section 404 of the Clean Water Act. This process and associated requirements are typically referred to as 404 Permitting. Based on our

understanding of the permitting process, this project would necessitate a Preliminary Jurisdictional Delineation and a Nationwide Permit that should be approved by USACE without delaying project progress. Consultation with the USACE would be required to determine which Nationwide Permit is preferred by USACE. Following approval of the permit, there should not be any long-term maintenance or monitoring requirements in association with the 404 Permit.

SEDIMENT TRANSPORT AND EROSION

The discharge mechanism will be designed at a later stage, but is likely to be a standard outfall design, such as a concrete apron with armored channel banks and base that is designed to reduce erosion and prevent scouring. An analysis could be performed to optimize the outfall design based on sediment properties and flow conditions.

RIPARIAN HABITAT

The City of Tucson regulates and maps riparian habitats. Upon review of the riparian zones, High School Wash is classified as Category B Riparian Habitat; however, the proposed well location site is located outside and west of a riparian zone. Therefore, no impacts are anticipated to the riparian zone and the habitat regulations would not apply to this project.

MOSQUITO ABATEMENT

Tucson has historically had issues with malaria and mosquitos when the rivers previously flowed prior to significant pumping and lowering of the water table, and encounters mosquito issues when stagnant water is present. The City of Tucson sets forth various mosquito control and abatement measures in their watercourse maintenance ordinance and mitigation documents. Although there is not a specific permit required for mosquito abatement, the City does require that mosquito control be addressed in the general permitting process. It is possible that the City would perform the mosquito control activities for a fee.

DISCHARGE PERMITTING AND MONITORING

Discharge to surface water is regulated by the Arizona Department of Environmental Quality (ADEQ) under the Arizona Pollutant Discharge Elimination System (AZPDES). Based on discussions with ADEQ, a groundwater remediation system is considered to be either a major or minor Industrial Facility and requires an individual permit under the AZPDES Program. The groundwater remediation system is likely to be considered a minor Industrial Facility. This permit would require routine monitoring and reporting to demonstrate that surface water quality standards are being met. Analysis of naturally occurring compounds (e.g., arsenic) would likely be required to assure that the extracted groundwater is of sufficient quality to meet the surface water quality standards without additional treatment. In evaluating the AZPDES permit, ADEQ is required to consider the CWA 208 Water Quality Management Plan. The Pima County Association of Governments is the agency that oversees the Water Quality Management Plan in this area.

BENEFICIAL USE EVALUATION

If water is discharged to the surface, it is likely that a portion of the water discharged will evaporate, while a portion of the water discharged will result in recharge to the aquifer. It is

likely that ADWR will require a beneficial use evaluation and an evaluation of whether the discharge of the water complies with the Water Management Plan for the Tucson Active Management Area.