FINAL

FIVE-YEAR REVIEW REPORT
OPERABLE UNITS 1 AND 2
MARINE CORPS AIR STATION
YUMA, ARIZONA

Contract No.: N68711-01-D-6009
Task Order: 008
DCN: BATL-6009-0008-0017

Prepared for:

Naval Facilities Engineering Command

Naval Facilities Engineering Command Southwest
1220 Pacific Highway
San Diego, California 92132-5190

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Columbus, Ohio 43201

June 2010

Signature Page

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Colonel Mark A. Werth — Date
Commanding Officer
MCAS Yuma
United States Marine Corps

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ABBREVIATIONS AND ACRONYMS

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
ARS	Arizona Revised Statutes
AS	air sparge
AS/SVE	air sparge/soil vapor extraction
ATSDR	Agency for Toxic Substances and Disease Registry
AWQS	Aquifer Water Quality Standards
bgs	below ground surface
BNI	Bechtel National, Inc.
CALA	Combat Aircraft Loading Area
Cal/EPA	California Environmental Protection Agency
CAOC	CERCLA Area of Concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CHC	chlorinated hydrocarbon
COC	contaminant of concern
COPC	contaminant of potential concern
COPEC	contaminant of potential ecological concern
DCE	dichloroethene
DEUR	Declaration of Environmental Use Restrictions
DoD	United States Department of Defense
DON	United States Department of the Nay
ELCR	excess lifetime cancer risk
EMS	Environmental Management System
FFA	Federal Facility Agreement
FFAAP	Federal Facilities Agreement Assessment Program
FS	Feasibility Study
GAC	granular activated carbon
gpm	gallons per minute
HBGL	health-based guidance level
HI	hazard index
HQ	hazard quotient

ICs	institutional controls
ICP	institutional control plan
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
J&E	Johnson & Ettinger
JEG	Jacobs Engineering Group, Inc.
JSF	joint strike fighter
KTUA	Kawasaki, Theilacker, Ueno and Associates
LEPA	leading edge of the plume area
LTM	long-term monitoring
LUC	land use control
LUCIP	Land Use Control Implementation Plan
LUST	Leaking Underground Storage Tank
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
MCLGs	maximum contaminant level goals
MNA	monitored natural attenuation
MRP	Munitions Response Program
NAVFAC	Naval Facilities Engineering Command
NCP	National Oil and Hazardous Substances Contingency Plan
NFA	No Further Action
NPL	National Priorities List
O&M	operation and maintenance
ODF	Ordnance Distribution Facility
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
POC	point of compliance
POTW	publicly owned treatment works
PRG	preliminary remediation goal
RA	Remedial Action
RAO	Remedial Action Objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation

ROD	Record of Decision
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RSL	Regional Screening Level
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SRL	soil remediation level
STRAP	Source Treatment/Reduction Alternatives Plan
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
SWDIV	Southwest Division Naval Facilities Engineering Command
TCE	trichloroethene
TLV	threshold limit value
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
USBR	United States Bureau of Reclamation
U.S.C.	United States Code
USDA	United States Department of Agriculture
U.S. EPA	United States Environmental Protection Agency
UST	underground storage tank
VI	vapor intrusion
VOC	volatile organic compound
VCT	vertical circulation treatment
VEMUR	Voluntary Environmental Mitigation Use Restriction

EXECUTIVE SUMMARY

This report provides the results of the third Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) five-year review conducted for the Operable Units (OUs) at Marine Corps Air Station (MCAS) Yuma, Arizona. This review was conducted in accordance with the Department of the Navy's (DON's) *Navy/Marine Corps Policy for Conducting CERCLA Statutory Five-Year Reviews* (DON, 2004) and the United States Environmental Protection Agency (U.S. EPA) *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001). The purposes of this review are to evaluate the performance of the remedies implemented at OU-1 and OU-2 to ensure that they remain protective of human health and the environment, and to recommend actions for improvement if the remedies have not performed as designed or are no longer effectively protective.

This five-year review comprises document and data reviews, site inspections, station personnel interviews, regulatory comment reviews, and report development. Because these remedies would not result in site conditions suitable for unlimited use and unrestricted exposure (i.e., residential use) at the time of this five-year review and because the Records of Decision (RODs) for OU-1 and OU-2 were signed after October 17, 1986, the effective date of the Superfund Amendments and Reauthorization Act (SARA), this statutory review is required by and conducted according to the applicable laws. The scheduled completion date for this review is November 16, 2009, as dictated by the date when the previous five-year reviews for OU-1 and OU-2 were completed — November 16, 2004.

OU-1 was defined by a Federal Facilities Agreement (FFA) to include chlorinated hydrocarbon (CHC) groundwater plumes more than 10 ft below ground surface (bgs). The plumes were identified as Areas 1, 2, 3, 4, 5 and 6, with the largest plume in Area 1. OU-1 Areas 4 and 5 were later identified as fuel sites, rather than CERCLA sites, and were assigned to the state of Arizona's Leaking Underground Storage Tank (LUST) Program with oversight by the Arizona Department of Environmental Quality (ADEQ). The remedy selected for the remaining Areas of OU-1, as described in the ROD, consisted of a full-scale air sparge/soil vapor extraction (AS/SVE) system in the Building 230 "Hot Spot" of Area 1; a vertical circulation treatment (VCT) system in the leading edge of the plume area (LEPA) of Area 1; monitored natural attenuation (MNA) in Areas 1, 2, 3, and 6; and institutional controls (ICs) in the form of restrictions on groundwater use for all OU-1 areas. The OU-1 remedial action objectives (RAOs), as stated in the ROD, are to reach U.S. EPA maximum contaminant levels (MCLs) for the contaminated groundwater in Areas 1, 2, 3 and 6 and to prevent off-site migration of CHC concentrations at levels exceeding MCLs.

Groundwater monitoring has been performed for OU-1 areas on a quarterly basis since the signing of the ROD on October 5, 2000. Sampling has indicated that all plumes have been shrinking in size and concentration due to the implemented remedies, and that none of the plumes are migrating offsite. Areas 2, 3, and 6 have all achieved the MCL goals and have been closed with concurrence by U.S. EPA and ADEQ, and no further action (NFA) is required in these areas.

Active remediation systems were installed and operated in the Area 1 plume. A VCT system was operated in the LEPA from June 2000 to May 2003. The VCT system reduced CHC concentrations to meet MCLs and prevented any off-site migration of the plume at concentrations exceeding MCLs. The VCT system was placed in temporarily shutdown status in May 2003 after MCLs had been achieved and modeling indicated that groundwater would not reach the station boundary at concentrations exceeding the MCLs. Permanent shutdown of the VCT system occurred in December 2005 with concurrence by U.S. EPA and ADEQ.

An AS/SVE system was installed in the Building 230 vicinity to remediate the groundwater in the most highly contaminated area of OU-1. The AS/SVE system reduced the CHC "Hot Spot" in both size and magnitude such that modeling indicated that CHCs would not migrate offsite at concentrations greater than MCLs. The system was operated relatively continuously from November 1999 to May 2007 when it was placed in temporary shutdown status with concurrence by U.S. EPA and ADEQ.

MNA has been applied to all OU-1 areas through the development of a long-term monitoring (LTM) plan, as stipulated in the ROD. With the closure of OU-1 Areas 2, 3 and 6, the LTM plan has been revised to focus on monitoring the natural attenuation of CHCs in Area 1. The Area 1 plume will continue to be monitored until the CHC concentrations decrease below MCLs for a minimum of two years, at which point area closure may be requested.

ICs were required by the ROD to limit use and restrict exposure to any contaminated groundwater at OU-1 Areas 1, 2, 3 and 6. The ICs were established in the revised MCAS Yuma Master Plan and implemented through the Final Land Use Control Implementation Plan (LUCIP). MCAS Yuma Station Order 5090 (issued on January 10, 2002) formally directed tenants and contractors to incorporate the land use controls (LUCs) provided in the MCAS Yuma Master Plan and the Final LUCIP into their existing land use planning and management programs. The ICs established for OU-1 Area 1 are still effective and are to remain until Area 1 as a whole has met its cleanup goals (i.e., MCLs).

OU-2 was defined by an FFA to include soil contamination down to 10 feet bgs. The FFA identified 18 CERCLA Areas of Concern (CAOCs), 12 of which required NFA. Three of the remaining six were remediated to residential land use standards in 1999, with NFA required. The remaining three CAOCs (1, 8A and 10) were described in the Final OU-2 ROD as requiring ICs to prevent unlimited use and unrestricted exposure.

ICs, required by the ROD, were established in the revised MCAS Yuma Master Plan and implemented through the Final LUCIP. MCAS Yuma Station Order 5090 (issued on January 10, 2002) formally directed tenants and contractors to incorporate the LUCs provided in the MCAS Yuma Master Plan and the Final LUCIP into their existing land use planning and management programs. The ICs established for OU-2 remain effective. The MCAS Yuma Environmental Department continues to review and coordinate all plans for future activities at CAOCs 1, 8A, and 10, in consultation with U.S. EPA and ADEQ as necessary, to ensure continued compatibility with the ICs as specified in the OU-2 ROD.

The following U.S. EPA Five-Year Review Summary Form provides additional information regarding the review assessment results and future effectiveness of the remedy as implemented.

Five-Year Review Summary Form – Page 1

SITE IDENTIFICATION		
Site name: Marine Corps Air Station Yuma, Operable Units 1 and 2		
EPA ID: AZ0971590062 (MCAS Yuma)		
EPA Region: 09	**State:** AZ	**City/County:** Yuma / 027 Yuma
SITE STATUS		
NPL status: ☑ Final ☐ Deleted ☐ Other (specify)		
Remediation status (choose all that apply): ☐ Under Construction ☑ Operating ☐ Complete		
Multiple OUs? ☑ YES ☐ NO		**Construction completion date:** 16-Nov-1999
Has site been put into reuse? ☐ YES ☑ NO		
REVIEW STATUS		
Lead agency: ☐ EPA ☐ State ☐ Tribe ☑ Other Federal Agency U.S. Department of the Navy		
Author name: Naval Facilities Engineering Command Southwest		
Author title:		**Author affiliation:** U.S. Department of Defense
Review period: 16 November 2004 to 16 November 2009		
Date(s) of site inspection: 09 June 2009 to 11 June 2009 and 28 July 2009		
Type of review: ☑ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion		
Review number: ☐ 1 (first) ☐ 2 (second) ☑ 3 (third) ☐ Other		
Triggering action: ☐ Actual RA Onsite Construction at OU ☐ Actual RA Start ☐ Construction Completion ☑ Previous Five-Year Review Report ☐ Other (specify): ______		
Triggering action date: 16 November 2004		
Due date ***(five years after triggering action date)*****:** 16 November 2009		

Five-Year Review Summary Form – Page 2

Issues:

1	While base personnel have indicated the possibility of a future land use change for OU-2 CAOC 8A, documentation of that land use change is needed; should a change in land use be needed for OU-2 CAOC 8A, communication with the regulatory agencies, prior to the change, will occur as stipulated in the ROD.
2	U.S. EPA raised the following issue for OU-2: while DEURs have been proposed, they have not been registered with Arizona and thus the ICs are not complete (see Attachment 1).
3	U.S. EPA raised the following issue for OU-1: the most recent (June 2009) data presented in Figures 4-6 and 4-7 indicate that there has been recent plume migration in the LEPA and Hot Spot areas. The significance of this recent movement on remedy effectiveness needs to be evaluated.
4	An evaluation of the progress of an MNA remedy in meeting RAOs should be undertaken as part of every 5YR where MNA is the remedy. Since the transition to MNA was recently adopted for OU-1 Area 1, an evaluation was not performed for this five-year review.
5	Note that on January 7, 2010, U.S. EPA published draft guidance on Interim PRGs for dioxin in soil at CERCLA and RCRA sites. If adopted, this proposal will lower the dioxin PRG significantly. Please confirm the activities evaluated to address potential dioxin at CAOC 8A. If dioxin is a concern, we suggest that the 5YR include a discussion of this issue.
6	During the five-year review, inconsistencies were indentified between figures provided in the recently revised MCAS Yuma Master Plan (KTUA, 2007) and the Final LUCIP (SWDIV, 2002a).
7	The indoor air exposure pathway is incomplete for all three CAOCs in OU-2 based on current land use of these areas; thus, the ICs are appropriate. However, if these areas were to be redeveloped in the future for office and/or residential use, the ICs may not be protective.
8	U.S. EPA raised the following issue for OU-1 Area 1: the document should address any vadose zone contamination that may be of concern to the VI pathway.

Recommendations and Follow-up Actions:

1	While base personnel have indicated the possibility of a future land use change for OU-2 CAOC 8A, documentation of that land use change is needed; should a change in land use be needed for OU-2 CAOC 8A, communication with the regulatory agencies, prior to the change, will occur as stipulated in the ROD.
2	Evaluate the LUCIP and ensure that the plan is up-to-date, continues to provide effective processes for LUC implementation, and continues to provide long-term protectiveness. Also, discussions should be initiated between ADEQ, U.S. EPA, and Navy legal counsel to determine how to best address and resolve the DEUR issue.
3	Evaluate the progress of plume remediation and potential rebound, and review the AS/SVE shutdown criteria and make a recommendation regarding system operation.
4	An evaluation of MNA progress in subsequent five-year reviews should be performed, including modeling groundwater under the MNA scenario to predict when MNA would result in reaching MCLs.
5	U.S. EPA's dioxin reassessment has been developed and undergone review over many years with the participation of scientific experts in EPA and other federal agencies, as well as scientific experts in the private sector and academia. The Agency followed current cancer guidelines and incorporated the latest data and physiological/biochemical research into the assessment. The results of the assessment have currently not been finalized or adopted into state or federal standards. U.S. EPA anticipates that a final revision to the dioxin toxicity numbers may be released by the end of 2010. In addition, U.S. EPA/OSWER has proposed to revise the interim preliminary remediation goals (PRGs) for dioxin and dioxin-like compounds, based on technical assessment of scientific and environmental data. However, U.S. EPA has not made any final decisions on interim PRGs at the time of this five-year review. Therefore, the dioxin toxicity reassessment for this site (CAOC 8A) should be updated during the next Five-Year Review.
6	The DON and MCAS Yuma should reconcile the discrepancies between the figures in the Final LUCIP (SWDIV, 2002a) and the MCAS Yuma Master Plan (KTUA, 2007).
7	An evaluation of the ICs and the protectiveness of the LUCIP should be performed with regards to the VI pathway for all OU-2 CAOCs in the event of changes to the current land use status.
8	An analysis of soil gas data from previous soil investigations should be performed to compare to VI screening levels to ensure that the only potential VI source is groundwater.

Protectiveness Statement:
The remedy at OU-1 is currently and will continue to be protective of human health and the environment because of the implementation of remedial measures and control of exposure pathways that may result in unacceptable risks. These methods are being applied as follows:

1) Remediation systems were installed and operated in the Area 1 plume. A VCT system was operated in the LEPA from June 2000 to May 2003. The system has reduced CHC concentrations to near MCLs and contained any off-site migration of the plume in this area. An AS/SVE system was installed in the Building 230 area to remediate the groundwater in the most highly contaminated area of OU-1. The system operated relatively continuously between November 1999 and May 2007. The AS/SVE system has reduced the CHC "Hot Spot" in both size and magnitude such that the COCs will not migrate offsite at concentrations greater than MCLs.

2) MNA is currently applied at all active regions of Area 1. MNA has been demonstrated to reduce contaminant concentrations through natural processes and has indicated that the plumes are not migrating. Groundwater monitoring required for the MNA program has been implemented through the LTM plan for OU-1 at MCAS Yuma. Plumes will continue to be monitored through MNA of the LTM plan until they decrease in concentrations below MCLs.

3) ICs are in place to restrict exposure to any contaminated groundwater at Area 1 through MCAS Yuma Station Order 5090 (issued on January 10, 2002). This order formally directs tenants and contractors to incorporate the LUCs provided in the MCAS Yuma Master Plan and the Final LUCIP into their existing land use planning and management programs.

The MCAS Yuma Environmental Department will continue to review and coordinate all plans for future activities at OU-1 in consultation with U.S. EPA and ADEQ as necessary, to ensure application of the measures specified in the OU-1 ROD (Southwest Division Naval Facilities Engineering Command [SWDIV], 2000).

The remedy at OU-2 is currently and will continue to be protective of human health and the environment because exposure pathways that may result in unacceptable risks are being controlled as follows:

1) ICs are in place to restrict exposure to contaminants in soil at CAOCs 1, 8A and 10 through MCAS Yuma Station Order 5090 (issued on January 10, 2002). This order formally directed tenants and contractors to incorporate the LUCs provided in the MCAS Yuma Master Plan (Kawasaki, Theilacker, Ueno and Associates [KTUA], 2007) and the Final LUCIP (SWDIV, 2002a) into their existing land use planning and management programs.

2) The "modified Declaration of Environmental Use Restrictions (DEURs)" for CAOCs 1, 8A and 10 have been proposed to satisfy the requirements specified in the OU-2 ROD (Uribe & Associates, 1997b) for registration of the sites with the State of Arizona.

The MCAS Yuma Environmental Department will continue to review and coordinate all plans for future activities at CAOCs 1, 8A, and 10, in consultation with U.S. EPA and ADEQ as necessary, to ensure continued compatibility with the land use restrictions specified in the OU-2 ROD (Uribe & Associates, 1997b).

1.0 INTRODUCTION

1.1 Purpose of the Five-Year Review

The purpose of five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and provides recommendations to address them.

1.2 Authority for Conducting this Five-Year Review

The United States Department of the Navy (DON) is preparing this five-year review pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) and the National Oil and Hazardous Substances Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The United States Environmental Protection Agency (U.S. EPA) and the DON interpret this requirement further in the NCP, Title 40 *Code of Federal Regulations* (CFR) Section (§) 300.430(f)(4)(ii) (implemented by 42 *United States Code* [U.S.C.] § 9621[c]), which states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

1.3 Lead Agency Conducting the Five-Year Review

Consistent with Executive Order 12580, the Secretary of Defense is responsible for ensuring that five-year reviews are conducted at all qualifying Department of Defense (DoD) cleanup sites. The DON is the lead agency for conducting five-year reviews at Navy and Marine Corps installations. As such, the DON has conducted a five-year review of the remedial actions implemented at Operable Unit 1 (OU-1) and OU-2 at Marine Corps Air Station (MCAS) Yuma. This review was conducted from April 2009 through November 2009 in accordance with the following documents:

- *Navy/Marine Corps Policy for Conducting CERCLA Statutory Five-Year Reviews* (DON, 2004).
- *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001). (This guidance document includes the report template used in preparing this Five-Year Review Report.)

This report documents the results of the review. For the purposes of completing the five-year review, the DON tasked Battelle, under Task Order 008 of Contract Number N68711-01-D-6009, to provide site analysis and document development.

1.4 Five-Year Review Characteristics

This five-year review is a statutory review because:

- the remedies selected in the Record of Decision (ROD) for OU-1 and OU-2 do not result in site conditions being suitable for unlimited use and unrestricted exposure, and
- the RODs for OU-1 and OU-2 were each signed after October 17, 1986, the effective date of the SARA.

This is the third five-year review for the OUs at MCAS Yuma. The triggering action for this review was the completion of the previous five-year review dated November 16, 2004 (Southwest Division Naval Facilities Engineering Command [SWDIV], 2004). The first five-year review was completed on December 11, 2002 (SWDIV, 2002b) and was triggered by the development of institutional controls (ICs) established in the OU-2 ROD, which was signed on December 2, 1997 (Uribe & Associates, 1997b). The second five-year review was completed in 2004. The second five-year review was triggered by the start-up operations of the Remedial Action (RA) at OU-1; specifically the start up of an air sparge/soil vapor extraction (AS/SVE) system, described in Section 4.1.2.1. The AS/SVE system began operation on November 16, 1999 and represents the original triggering date of the OU-1 five-year review schedule. The second five-year review included a mid-sequence update to the first five-year review and was included in the first five-year review for OU-1 so that both OUs may be reviewed on the same five-year review schedule (SWDIV, 2004).

2.0 SITE CHRONOLOGY

This section summarizes events in the development of the Installation Restoration Program (IRP) at MCAS Yuma with emphasis on the history of contaminant detection, characterization, and remediation at OU-1 and OU-2. Table 2-1 presents these events in chronological order. Appendix A presents the list of all documents reviewed during this five-year review.

Table 2-1. Chronology of Significant Events

Event	Date
Initial Assessment Study was conducted to investigate past disposal practices at MCAS Yuma (Stearns, Conrad, Schmidt and Landau Associates, 1985a).	1985
MCAS Yuma was placed on Superfund National Priorities List (NPL).	02/1990
Site inspection was completed at MCAS Yuma (Malcolm Pirnie, Inc., 1990).	06/1990
The DON entered into a Federal Facilities Agreement (FFA) with U.S. EPA and Arizona Department of Environmental Quality (ADEQ). OUs were established, along with a schedule and framework for implementing environmental investigations and appropriate cleanup activities.	01/1992
Remedial Investigation (RI; Jacobs Engineering Group [JEG], 1996a) identified six groundwater plumes as CERCLA Areas of Concern (CAOC) for OU-1 and 18 CAOCs in near-surface soils of which 12 required no further action (NFA) for OU-2.	03/1996
Source Treatment/Reduction Alternatives Plan (STRAP) to address contamination in the Leading Edge Plume Area (LEPA) and Building 230 (Hot Spot) Area (JEG, 1996b).	04/1996
A soil sampling program for polycyclic aromatic hydrocarbons (PAHs) was performed at CAOC 10 (Uribe & Associates, 1996a) to better define the extent of the contaminants reported in surface soil during the RI.	08/1996
Feasibility Study (FS) of OU-2 (Uribe & Associates, 1996b) recommended RA for CAOCs 1, 4, 7, 8A, 9 and 10.	12/1996
Supplemental soil sampling program for PAHs was completed at CAOC 10 (Uribe & Associates, 1997a).	02/1997
Proposed Plan was issued for OU-2.	03/1997
Final ROD for OU-2 signed with ICs selected as the RA for CAOCs 1, 8A and 10 (Uribe & Associates, 1997b).	12/1997
OU-1 (FS) identified and evaluated remediation options for the six groundwater CAOCs (JEG, 1998a).	07/1998
Draft ROD prepared finalizing RAs and allowing construction and operation of remedial systems for OU-1 (JEG, 1998b).	09/1998
Full-scale AS/SVE system installed in the Building 230 part of OU-1 Area 1.	06-11/1999
Land survey conducted at OU-2 CAOCs 1, 8A and 10 for implementation of ICs.	07/1999
Final RA Report for OU-2 issued with recommended addendum to the MCAS Yuma Base Master Plan containing ICs and Voluntary Environmental Mitigation Use Restrictions (VEMURs) for CAOCs 1, 8A, and 10 (GEOFON, 1999).	09/1999
Full-scale AS/SVE system operation started in the Building 230 part of OU-1 Area 1.	11/1999
Full-scale vertical circulation treatment (VCT) system installed in the LEPA of OU-1 Area 1.	02-06/2000
Full-scale VCT operations started in the LEPA of OU-1 Area 1.	06/2000
Arizona Laws 2000, Chapter 225 amended *Arizona Revised Statutes* § 49-152 (Title 49, Chapter 1, Article 4) to eliminate VEMURs and replace them with Declarations of Environmental Use Restrictions (DEURs) as the appropriate document for recording a property's environmental land use restrictions with the state of Arizona.	07/2000
Temporary AS/SVE systems installed in OU-1 Areas 2 and 3.	09/2000
Final OU-1 ROD signed by DON, U.S. EPA, and ADEQ (SWDIV, 2000).	10/2000
MCAS Yuma Master Plan revised to include land use restrictions and recording of environmental-	09/2001

Table 2-1. Chronology of Significant Events (Continued)

Event	Date
use restrictions required in ICs for OU-1 and OU-2 (Kawasaki, Theilacker, Ueno and Associates [KTUA], 2001).	
Draft (Revision 1) Land Use Control Implementation Plan (LUCIP) was issued as an addendum to the MCAS Yuma Master Plan to provide additional ICs and steps for implementation and monitoring for OUs 1 and 2, Federal Facilities Agreement Assessment Program (FFAAP) Area of Concern A, and conditions for closure of Former Underground Storage Tanks (USTs) at the Former Exchange Gas Station.	12/2001
MCAS Station Order 5090 implemented LUCs provided in Draft LUCIP.	01/2002
Work Plan for Long-Term Monitoring (LTM) at OU-1 completed (Bechtel National, Inc. [BNI], 2002).	06/2002
Final Land Use Implementation Plan for MCAS Yuma OU-1 and OU-2 finalized, detailing ICs and monitoring (SWDIV, 2002a). The report formalizes the MCAS Yuma LUC agreement among DON, U.S. EPA, and ADEQ.	09/2002
First Five-Year Review completed for OU-2 (SWDIV, 2002b).	12/2002
OU-1 VCT system at Area 1 LEPA placed in temporary shutdown with concurrence from U.S. EPA and ADEQ.	05/2003
OU-1 Area 6 received NFA closure from U.S. EPA and ADEQ.	11/2003
OU-1 Area 6 wells were decommissioned.	03/2004
First Five-Year Review completed for OU-1 and an update included for OU-2 allowed both OUs to be placed on the same five-year review schedule (SWDIV, 2004).	11/2004
OU-1 VCT system at Area 1 LEPA placed in permanent shutdown with concurrence from U.S. EPA and ADEQ.	12/2005
OU-1 Area 3 received NFA closure from U.S. EPA and ADEQ.	02/2006
OU-1 Area 2 received NFA closure from U.S. EPA and ADEQ.	05/2006
OU-1 Area 2 wells were decommissioned.	08/2006
OU-1 Area 3 wells were decommissioned.	10/2006
OU-1 AS/SVE system at the Building 230 "Hot-Spot" placed in temporary shutdown with concurrence from U.S. EPA and ADEQ.	05/2007
OU-1 Area 1, 37 selected Area 1 wells decommissioned.	09/2007

3.0 BACKGROUND

This section describes the fundamental aspects of the station, providing a description of site characteristics. The purpose of this section is to identify the threat posed to the public and environment identified at the time of the OU-1 ROD (SWDIV, 2000) and OU-2 ROD (Uribe & Associates, 1997b), so that the performance of the remedy can be easily compared with the site conditions that the remedy was intended to address. Information provided by the OU-1 and OU-2 RODs regarding station history and site history have been updated in this section with information provided in the Remedial Action Reports, Semi-Annual Groundwater Monitoring Reports, the Final LUCIP (SWDIV, 2002a), and the revised Master Plan (KTUA, 2007).

3.1 Station History

On February 21, 1928, Yuma County, Arizona, leased 640 acres of desert land near the city of Yuma from the federal government for use as an airfield. The airfield was established in the same year. Through the United States Bureau of Reclamation (USBR), Yuma County leased the acreage for 20 years with an option for an additional 20 years. In 1937, Yuma County constructed a small aircraft hangar and runway.

From 1941 to 1946, the U.S. Army Air Corps leased the facility for pilot and bomber crew training. During this period, the facility was one of the busiest flight schools in the Army Air Corps. Flight activity ceased with the end of World War II, and the area was returned to the control of the USBR. In 1948, Yuma County obtained rights from the USBR to use the airfield, pursuant to Section 16 of the Federal Airport Act.

On July 7, 1951, the U.S. Air Force reactivated the site as a weapons proficiency center for fighter-interceptor units, and the site was declared a permanent Air Force installation in 1954. The Air Force reestablished joint use of the airfield with Yuma County in 1956.

In January 1959, the site and its associated range facilities were transferred to the DON. MCAS Yuma was then established on January 10, 1959 to maintain and operate the facilities and provide services and materials to support operations of the Marine Aircraft Wing and its subordinate units.

Since 1959, major improvements have included construction of a 13,300-foot-runway, development of the Instrumented Special Weapons System, and addition of a Tactical Aircrew Combat Training System. MCAS Yuma currently operates the airport facility as a joint military/civilian airport with the Yuma County Airport Authority.

3.2 Physical Characteristics

MCAS Yuma consists of approximately 4,800 acres located in the city and county of Yuma, Arizona (Figure 3-1). The station is located at an average elevation of 180 feet above mean sea level, on the northern portion of Yuma Mesa, and is approximately 60 to 70 feet above and 4 miles east of the Colorado River. MCAS Yuma is on the northern portion of the Yuma Mesa,

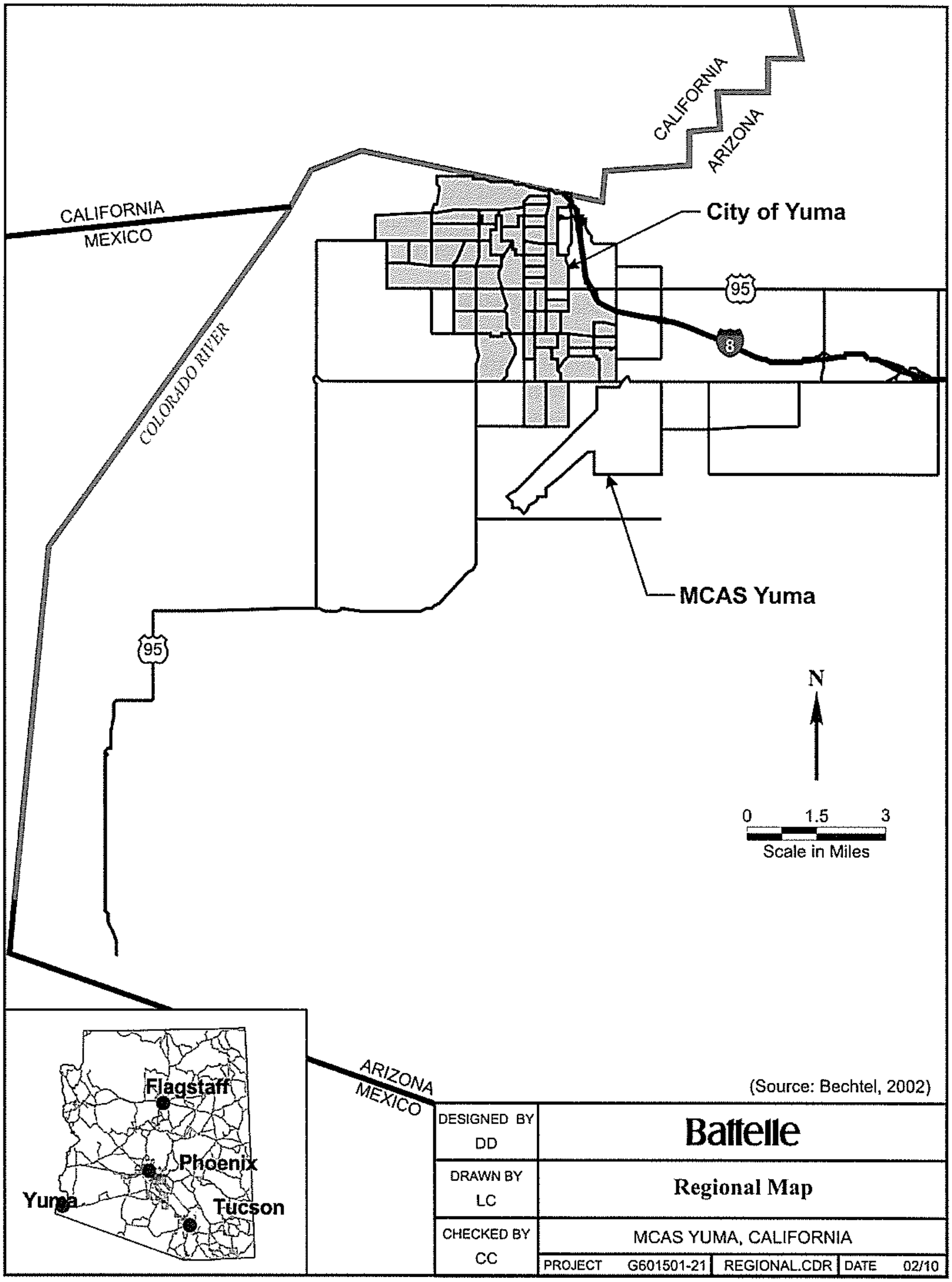

Figure 3-1. Regional Map

situated approximately 60 to 70 feet above the adjacent Colorado River Valley. Yuma Mesa is separated from the Colorado River Valley by a north-trending bluff approximately 5 miles west of MCAS Yuma. The climate is arid and the land type is desert. The following subsections describe the regional and local geology and hydrogeology associated with MCAS Yuma.

3.2.1 Geology. MCAS Yuma is on the northern portion of the Yuma Mesa, situated approximately 60 to 70 feet above the adjacent Colorado River Valley. Yuma Mesa is separated from the Colorado River Valley by a north-trending bluff approximately 5 miles west of MCAS Yuma. The climate is arid and the land type is desert.

Sedimentary deposits on Yuma Mesa are predominantly alluvial (stream) deposits interbedded with some aeolian (windblown) deposits in the upper 180 to 200 feet below ground surface (bgs). Most of the interbedded deposits consist of alluvium from Colorado River deposition that has been reworked by local ephemeral streams and sheetflow. The alluvium is highly variable and ranges in grain size from silt and fine sand up to very coarse gravel.

Locally at MCAS Yuma, silt and clay deposits form small discontinuous lenses that retard the vertical migration of groundwater. The primary stratigraphic units underlying MCAS Yuma are "younger alluvium" including minor aeolian sand and "older alluvium." The bottom of the older alluvium may extend more than 2,000 feet bgs in some areas. These alluvial units appear to directly overlie pre-Tertiary bedrock at MCAS Yuma.

Granitic bedrock crops out in the Yuma area as a series of north- to northwest-trending low hills known as the "Yuma Hills." The bedrock outcrops on and adjacent to the station indicate that relatively shallow bedrock zones exist in this region.

According to the Yuma Soil Conservation Service (U.S. Department of Agriculture [USDA], 1980), the principal soil type occurring at MCAS Yuma is Superstition Sand. This soil is deep and somewhat excessively drained. Permeability of the Superstition Sand is rapid and the available water capacity is low to moderate.

3.2.2 Hydrogeology. The principal stratigraphic units containing groundwater usable for agricultural and domestic applications are the alluvial deposits. These unconsolidated deposits are divided into (1) the upper fine-grained zone, (2) the coarse gravel zone, and (3) the wedge zone (Olmsted et al., 1973).

The upper, fine-grained zone includes the vadose zone and shallow groundwater and extends approximately 180 to more than 200 feet bgs. This zone comprises the majority of the younger alluvial stratigraphic unit and may include the upper portion of the older alluvium. The upper fine-grained zone represents alluvial and, to a lesser degree, aeolian deposits. The upper fine-grained zone consists of sand and silt with interbeds of sandy clay and sandy gravel.

Water quality in the upper fine-grained zone is highly variable, probably as a result of the shallow depth to water (40 to 80 feet) and the presence of irrigated agriculture in the area. Groundwater is generally unconfined in the upper fine-grained zone over much of Yuma Mesa. However, locally confined conditions associated with fine-grained lenses have been reported

(Olmsted et al., 1973). Figure 3-2 shows the distribution of the water table (i.e., groundwater surface contours) in the upper fine-grained zone across MCAS Yuma from the April-June 2009 groundwater monitoring report (Battelle, 2010).

Underlying the upper fine-grained zone is the coarse gravel zone, which includes the basal gravel of the younger alluvium and the upper coarse gravel of the older alluvium. In addition to gravel, the coarse gravel zone contains interbeds of sand and fine-grained lithologies. The coarse gravel zone is the most permeable groundwater reservoir in the Yuma area and provides the primary groundwater supply source. The top of this zone is approximately 180 to more than 200 feet bgs, and it ranges in thickness from 0 to 100 feet. Water quality in this zone is saline (Olmsted et al., 1973).

The wedge zone underlies the coarse gravel zone and makes up most of the older alluvium stratigraphic unit. This zone may extend to 2,000 feet bgs. Lithologies in the wedge zone range from gravel to clay with generally coarser lithologies in the upper portion (Olmsted et al., 1973). The wedge zone contains water that is generally fresher than the water in the overlying coarse gravel zone (Olmsted et al., 1973).

3.3 Land and Resource Use

MCAS Yuma is comprised of land use categories that are defined by specific uses or combinations of uses occurring in these areas. The station has 14 distinct land use categories or districts: air operations, aircraft maintenance, training, general maintenance, weapons, supply, public safety, administration, medical/dental, bachelor quarters, family housing, community support, recreation and communications/utilities. The following is a brief description of each district as provided by the MCAS Yuma Master Plan (KTUA, 2007):

<u>Air Operations</u>
Air operations include the airfield, taxiways, towways, parking aprons, flight equipment testing facilities, and air operations logistical facilities.

<u>Aircraft Maintenance</u>
Aircraft maintenance includes facilities generally located along the flight line, such as hangars, wash racks, engine test cells, and aircraft parts repair shops.

<u>Training</u>
The training land use primarily includes facilities that contain classrooms, lecture halls, educational workspaces/shops, and potentially specialized trainers and simulators.

<u>General Maintenance</u>
General maintenance includes facilities that provide varying levels of service to ground-based equipment and vehicles.

<u>Weapons</u>
The weapons land use includes a wide array of facility types, from the expansive area of the Combat Aircraft Loading Apron (CALA) to the confined area of an armory storeroom.

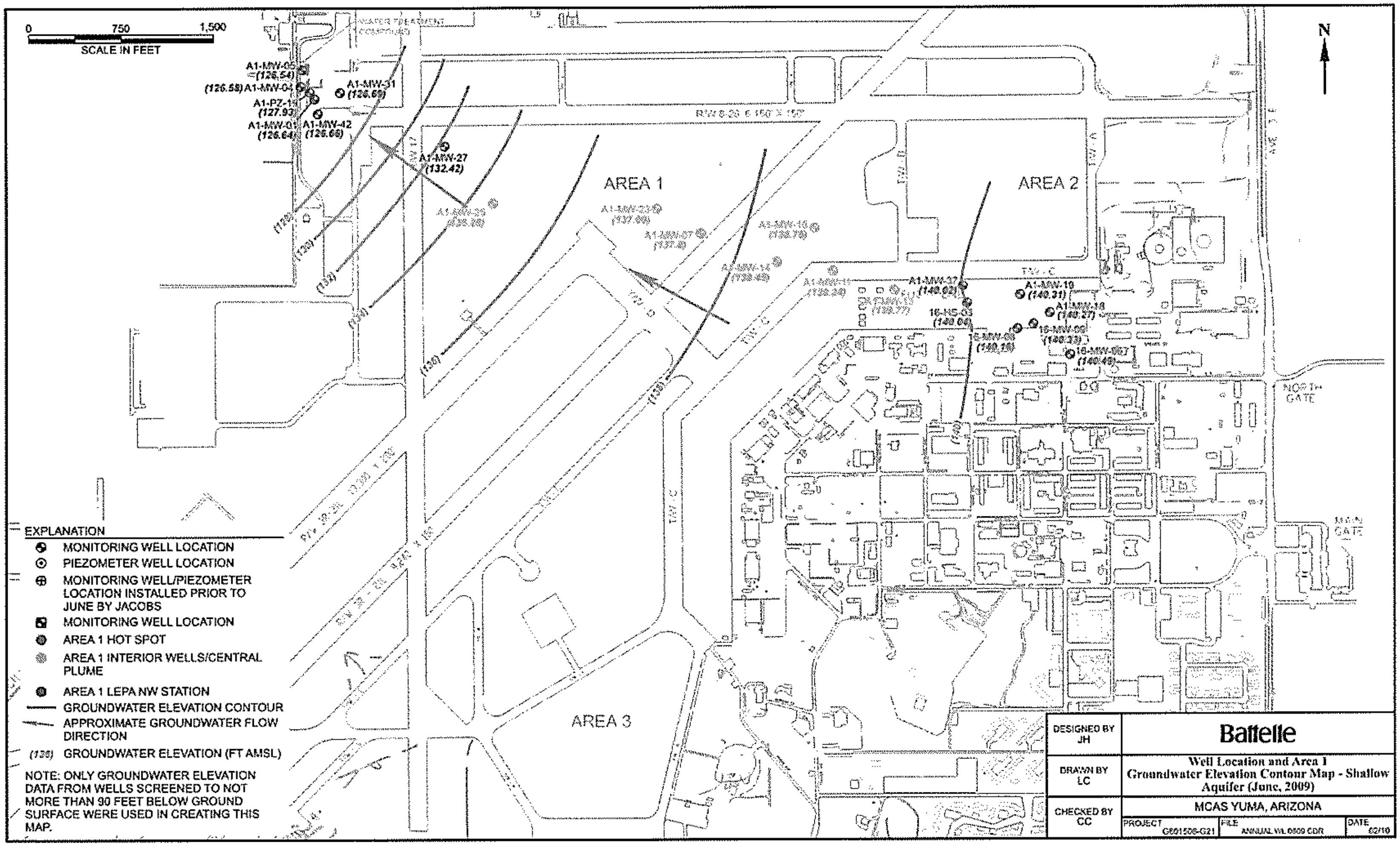

Figure 3-2. Groundwater Contour Map from the June 2009 Quarterly Report

Supply

Supply refers primarily to warehouse-type facilities and storage lots that serve as a staging area for materials either being redistributed elsewhere on base or awaiting use by a particular unit. The supply land use also includes fueling storage and dispensing facilities.

Public Safety

The public safety land use includes facilities used for the protection of physical assets and maintenance of order on an installation (e.g., police stations, fire stations, etc.).

Administration

Administration includes the facilities primarily composed of office spaces and other related functions to support all levels of command.

Medical/Dental

The medical/dental land use includes facilities provided for medical and dental services.

Bachelor Quarters

The bachelor quarters land use is almost entirely housing related, characterized by all types of barracks and the facilities that support them.

Family Housing

The family housing land use is comprised of on-base neighborhoods, including apartment-style and single family attached and detached homes.

Community Support

This land use includes facilities used by the base as a whole (e.g., library, exchange, recreation buildings, etc.).

Recreation

Recreational facilities may be considered a subset of the community support land use, although they are usually characterized by outdoor facilities (e.g., playing courts, fields, parks, etc.)

Communications/Utilities

This land use includes facilities used for the operation or oversight of the station's communications and utilities infrastructure (e.g., office space, equipment monitoring buildings, and the physical infrastructure).

Resource uses such as electrical, natural gas and water resources at MCAS Yuma are operated and maintained by the Installation and Logistics Department. The following is a brief description of the source(s) and distribution of each resource as provided by the MCAS Yuma Master Plan (KTUA, 2007):

Electrical

Electricity is provided by Arizona Public Service and Western Area Power Administration and is fed to the MCAS Yuma substation located near the centrally located MCAS Yuma water tower. Five overhead circuits distribute the power to various station components.

Natural Gas

Natural gas is purchased through the Defense Fuel Support Contract Program, which allows the station to competitively purchase gas from various suppliers at reduced rates. Gas is metered near the station boundary, south of the Main Gate, and is delivered by Southwest Gas Corporation lines to the station distribution system.

Water

Surface water is obtained from the USBR, which transports surface water from the Colorado River to the station via canals maintained by the Yuma Mesa Irrigation and Drainage District. Surface water is taken from a branch canal at the eastern boundary of the station and transported to the station's water treatment facility.

Groundwater is obtained through one on-base production well located at the water treatment facility. A new well was installed in February 2008, adjacent to an old production well that had been failing and is now used as a back-up well. Both wells are upgradient from the known groundwater contamination of the station. The water produced from the well is analyzed for volatile organic compounds (VOCs) and other potential contaminants in accordance with ADEQ requirements. The new well is currently producing approximately 650,000 gallons per day and the water produced is run through the water treatment facility where it is blended with surface water prior to station distribution (Shepherd, 2010). The nearest downgradient domestic wells are approximately 0.8 to 0.9 mile from the station boundary. The nearest municipal well is approximately 0.7 mile upgradient of the station.

The water treatment facility has three settling basins which have a total capacity of 7.5 million gallons of water. Water is processed via rapid sand filtration, clarification and disinfection with chlorine. Five electric pumps, with a total capacity of 6,500 gallons per minute, pump processed water into two elevated water storage tanks. The two tanks have a capacity of 500,000 gallons each. Water is distributed from the storage tanks through the station's water distribution network comprised of 6 to 16 inch pipes.

3.4 History of Contamination

During its 70 years of operation, MCAS Yuma has generated industrial wastes such as used oil, fuels, solvents, paint residues, battery acid, pesticides, herbicides, and polychlorinated biphenyls (PCBs). In the early years, some of these wastes were disposed in landfills, burn pits, and other areas located throughout MCAS Yuma. Construction and improvement activities also generated construction debris, which was disposed in undeveloped portions of MCAS Yuma.

It is believed that chlorinated hydrocarbons (CHCs) have occasionally been spilled on the ground surface during previous routine aircraft maintenance. It is also possible that tanks or drums of CHC solvents may have leaked onto the surface or into the subsurface in the past. CHCs could then have migrated into the groundwater through infiltration and percolation.

3.5 Initial Response

In 1985, the DON began evaluating its installations under the IRP (DON, 1992). Several studies were conducted at MCAS Yuma, including an Initial Assessment Study (Stearns, Conrad, Schmidt and Landau Associates, 1985a); the former Marine Wing Weapon Unit Site Characterization (Stearns, Conrad, Schmidt and Landau Associates, 1985b); a Confirmation Study, Verification Phase (Malcolm Pirnie, 1988); and a Site Inspection (Malcolm Pirnie, 1990). These early studies found the presence of various contaminants in the soil and chlorinated solvents in groundwater underlying MCAS Yuma, which led to its inclusion on U.S. EPA's NPL, or Superfund list, on February 21, 1990.

In 1990, following MCAS Yuma's listing on the NPL, the DON entered into an FFA with U.S. EPA and ADEQ to establish a framework and schedule for implementing environmental investigations and appropriate cleanup actions. The Final FFA was signed in January 1992. The FFA team agreed to subdivide the MCAS Yuma into two OUs (i.e., OU-1 and OU-2). Areas with potential groundwater contamination and soil contamination deeper than 10 feet bgs were designated as OU-1. 18 CAOCs, titled CAOC 1 through CAOC 18, containing potential soil contamination shallower than 10 feet bgs were designated as OU-2.

The OU-1 RI was conducted to determine areas of groundwater contamination that required either evaluation of remedial action or NFA as well as to assess the potential impacts of the contamination on human health and the environment (JEG, 1996a). The RI conducted for OU-2 investigated all 18 CAOCs and included human-health and ecological risk assessments to assess the potential impacts of the hazardous substances reported on both potential human and environmental receptors (JEG, 1996a).

3.6 Basis for Taking Action

The following subsections present a discussion of the RI findings and subsequent investigations performed for OU-1 and OU-2, respectively, which provide the basis for taking action.

3.6.1 Operable Unit 1. Based on the results of the OU-1 RI, six areas of groundwater contamination were identified that exceeded maximum contaminant levels (MCLs) established by the U.S. EPA for drinking water standards. Four of the plume areas (Areas 1, 2, 3 and 6) that had CHC contamination were assigned to the DON's IRP under the CERCLA cleanup program. The two other areas of groundwater contamination, primarily containing fuel constituents, were assigned to the state of Arizona's Leaking Underground Storage Tank (LUST) Program. These non-CERCLA areas were located in the Fuel Farm (Area 4) and the Motor Transportation Pool (Area 5) (Bechtel, 2002). Subsequent to the RI, fuel constituents exceeding MCLs were identified at the Exchange Service Station (Subarea 5A), which was also investigated under the LUST Program (BNI, 2002). As Areas 4 and 5 and subarea 5A were part of the LUST Program and not associated with CERCLA, their inclusion in this five-year review is not required, and therefore no further discussion will be presented for these areas. Figure 3-3 shows the locations of OU-1 Areas 1, 2, 3, and 6 within MCAS Yuma and other general site characteristics (i.e., roads, fence lines, and buildings).

The OU-1 STRAP was conducted under the DON remedial action contract to evaluate the use of innovative in situ groundwater treatment technologies (JEG, 1996b). Based on the OU-1 RI and STRAP findings, remedial alternatives were evaluated for the CHC plumes in Areas 1, 2, 3, and 6 in the OU-1 FS (JEG, 1998a). In September 1998, a draft ROD for OU-1, which documented the remedial action plan for OU-1, including selected and contingent remedial actions for groundwater impacted by CHCs (JEG, 1998b), was prepared. In addition, the nature and extent of the primary CHC groundwater plumes were further investigated in several sampling phases (OHM Remediation Services Corp., 1996-1997; GEOFON, 2002).

The contaminants of concern (COCs) in the OU-1 CHC groundwater plumes consisted predominantly of 1,1-dichloroethene (DCE), trichloroethene (TCE), and tetrachloroethene (PCE) at levels exceeding the MCLs for U.S. EPA drinking water standards (i.e., 7 μg/L for 1,1-DCE, 5 μg/L for TCE, and 5 μg/L for PCE). The following subsections provide detailed information regarding the location, source and extent of CHC contamination in OU-1 Areas 1, 2, 3 and 6.

3.6.1.1 Area 1 Groundwater Plume. OU-1 Area 1 has been the largest CHC-contaminated groundwater plume, underlying an area of approximately 60 acres, and extending from the Building 230 area to the northwest station boundary (Figure 3-3). The Area 1 contamination was separated into the following three distinct plume regions subsequent to the RI: the "Hot Spot" plume near Building 230; the interior/central plume area near the northeast portion of the runway; and the LEPA near the northwest boundary of the station (Figure 3-3). The highest concentrations of groundwater contamination were identified northwest (downgradient) of the Building 230 area or "Hot Spot" with CHC concentrations detected at greater than 200 μg/L.

Two USTs were removed from the vicinity of the building, and the surrounding area has been paved. TCE was detected in soils beneath one of the USTs, which collected discharges from the floor drain of the Building 230 paint shop. Four dry wells, located within 200 feet of the building, were also identified and likely collected water from the vicinity of the building, allowing the water to infiltrate the soils and potentially into the groundwater. Although there is no conclusive evidence regarding the source of the Area 1 CHC plume, it appears to be related to activities associated with Building 230. Following the RI, results of passive and active soil-gas and vadose zone sampling suggested that there was no remaining source of CHCs in the vadose zone of the Building 230 area (SWDIV, 2000).

The Area 1 plume is limited to the upper portion of the unconfined aquifer; however, the plume appears to have a slight downward gradient from the Building 230 Hot Spot towards the LEPA (SWDIV, 2000). Based on groundwater sampling performed between 1998 and 1999, the extent of the Hot Spot was approximately 1,000 feet long by 400 feet wide. The maximum concentrations of TCE and PCE decreased during this time as well (SWDIV, 2000).

The subsurface lithology in the source area is relatively heterogeneous with sediment sizes including silts, fine to coarse sands, and gravels. Lithologic logging in the vicinity of Building 230 encountered several discontinuous clay lenses of a few inches up to 5 feet thick, which began approximately 30 feet bgs and were observed above and below the groundwater table

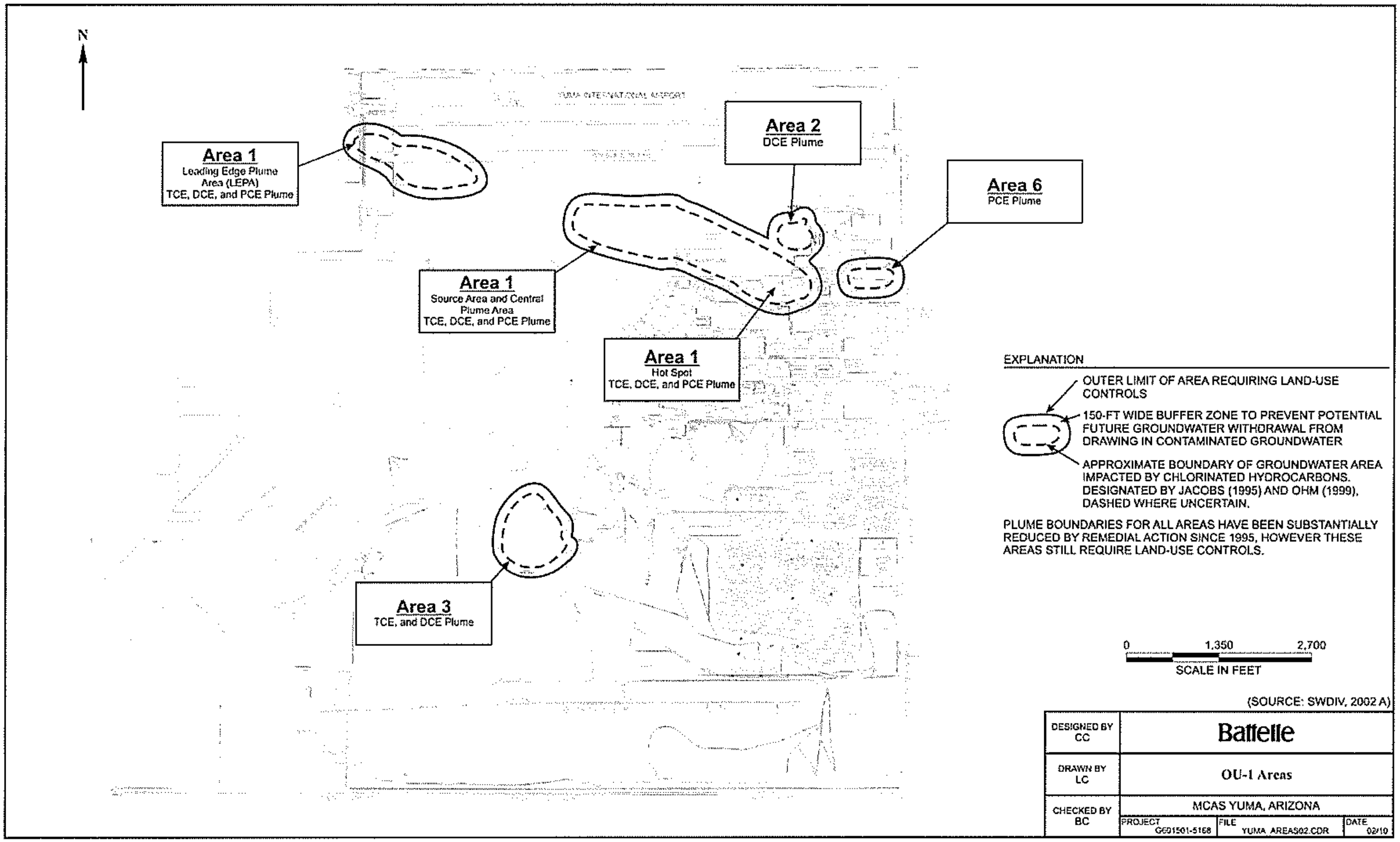

Figure 3-3. Location Map of OU-1 Areas

(SWDIV, 2000). The presence of these clay lenses suggested a limited vertical migration mechanism for contaminants in this area.

Additional groundwater sampling at the LEPA indicated concentrations of CHCs exceeding MCLs present to depths up to 180 feet bgs. Following the RI, CHCs were identified in groundwater beyond the western boundary of MCAS Yuma beneath property controlled by the Yuma Airport Authority. In September 1999, the horizontal and vertical extent of TCE- and DCE-impacted groundwater in the deep aquifer (30 to 190 feet below the groundwater table) had been fully delineated (OHM Remediation Services Corp., 1999a).

The coarse gravel zone has not been investigated recently under the IR program. However, the OU-1 and OU-2 RI reports evaluated the potential for vertical migration of contamination. Groundwater at MCAS Yuma was identified as a separate OU, requiring a separate RI study and DQO development. However, groundwater was also identified as likely to be a medium of concern at individual OU-2 CAOCs. Therefore, the RI for OU-2 evaluated the potential for future groundwater contamination from subsurface soils. The OU-2 RI evaluated subsurface stratigraphy using cone penetrometer equipment, delineating the horizontal and vertical extent of clay lenses. The process provided a continuous lithologic profile of the subsurface, allowing cross sections and three-dimensional lithologic models to be constructed for each CAOC. Soil samples were also collected for testing such as grain-size distribution and hydraulic conductivity to provide supporting data for evaluating COPC mobility and to provide data for remedial design. Results of the lithologic logging were used to identify optimum soil sampling depths. The OU-1 RI was integrated with the groundwater-related information developed from the RI activities for OU-2. The OU-1 RI included installation of a well screened at a depth of 130 to 145 feet below groundwater surface to evaluate the potential for vertical flow of contamination and for the presence of DNAPL. In addition, wells were installed for the OU-1 RI at various depths in CAOCs to evaluate the vertical distribution of contaminants in the aquifer. Nested wells were also installed in Area 1 of OU-1 to determine the vertical extent of contamination. Groundwater data from the OU-1 RI showed the contamination is confined to the upper 20 to 30 feet of the water table. A subsequent study of perimeter well groundwater monitoring results (Jacobs, 1995) showed that the deeper zone of the upper fine-grained zone was not impacted by contamination.

All of the chemicals identified in Area 1 during the RI and subsequent investigations prior to the Final ROD that exceeded their respective background levels (except for: metals considered essential human nutrients; nonsite-related metals within naturally occurring background levels; and trihalomethanes historically detected in groundwater throughout the Yuma area) were evaluated as contaminants of potential concern (COPCs) in the human-health risk assessment. Table 3-1 lists the COPCs that exceeded MCLs and were major risk contributors in Area 1. The Area 1 risk assessment results for cancer (excess lifetime cancer risk [ELCR]) and noncancer (hazard index [HI]) were as follows:

- Residential exposure scenario based on 1995 RI data (JEG, 1996a)
  - ELCR: 4.72×10^{-3}
  - Cancer risk driver(s): 1,1-DCE (93.2% of risk) and TCE (6.4% of risk)
  - HI: 15.9

- Noncancer hazard driver(s): 1,1-DCE (19.5% of hazard) and TCE (78.6% of hazard)

- Residential exposure scenario based on August 1999 data (SWDIV, 2000)
  - ELCR: 1.75×10^{-3}
  - Cancer risk driver(s): 1,1-DCE (91.4% of risk) and TCE (8.6% of risk)
  - HI: 2.7
  - Noncancer hazard driver(s): 1,1-DCE (40.7% of hazard) and TCE (59.3% of hazard)

The cancer risk associated with groundwater exposure from Area 1 contamination, for the residential scenario from both datasets, exceeded the generally accepted range (10^{-6} to 10^{-4}). The HI exceeded the acceptable criterion of 1.0 in both datasets as well (SWDIV, 2000).

3.6.1.2 Area 2 Groundwater Plume. The OU-1 Area 2 contaminated groundwater plume was located northeast of the flight line along the easternmost taxiway, downgradient of the Fuel Farm Area and about 200 feet downgradient of Building 303, a jet engine testing cell (Figure 3-3). The footprint of the plume covered an area of approximately 4 acres and was confined on-station. Building 303 was associated with a suspected leach field, which is a possible source of the small plume in Area 2. The contamination at Area 2 consisted primarily of 1,1-DCE, however, CHCs were not detected in the vadose zone surrounding Area 2 and the source of contamination remains in question. A clay zone encountered about 80 feet bgs (i.e., 20 feet below the groundwater table) was thought to likely prevent significant downward migration of contaminants (SWDIV, 2000).

Table 3-1. OU-1 Area 1 Maximum Detected Concentrations of COPCs

Area 1 COPC	Maximum Reported Conc.[1]	Federal Primary Drinking Water Standards (MCLs)	Federal Maximum Contaminant Level Goals (MCLGs)	Arizona MCLs for Organic Chemicals	Arizona Numeric Aquifer Water Quality Standards (AWQS)	Required Cleanup Conc.[2]	Major Human Health Risk	Major Human Health Hazard
1,1-DCE	170	7	7	7	7	7	yes	yes
TCE	450	5	0	5	5	5	yes	yes
PCE	16	5	0	5	5	5	no	no

Based on summary information presented in Table 2-6 of the OU-1 ROD (SWDIV, 2000).
All concentrations in micrograms per liter (µg/L).
[1] Maximum reported concentrations were based on information from the RI (JEG, 1996a).
[2] Required cleanup concentrations based on the most conservative standards at the time of the investigation (i.e., MCLs based on Federal Drinking Water Standards).

The shallow, small plume of Area 2 centered on monitoring well FF-MW-24 had a maximum detected 1,1-DCE concentration of 210 µg/L reported in the RI (JEG, 1996a). The plume was relatively stable following the RI with no significant horizontal migration identified (SWDIV, 2000). 1,1-DCE concentrations were shown to decrease to 130 µg/L in June 1998 and to 26 µg/L in August 1999 (SWDIV, 2000).

All of the chemicals identified in Area 2 during the RI and subsequent investigations prior to the Final ROD that exceeded their respective background levels were evaluated as COPCs in the human-health risk assessment. Table 3-2 lists the contaminants that exceeded MCLs and were major risk contributors in Area 2. The Area 2 risk assessment results for cancer (i.e., ELCR) and noncancer (i.e., HI) were as follows:

- Residential exposure scenario based on 1995 RI data (JEG, 1996a)
  - ELCR: 4.6×10^{-3}
  - Cancer risk driver(s): 1,1-DCE
  - HI: 3.3
  - Noncancer hazard driver(s): 1,1-DCE
- Residential exposure scenario based on August 1999 data (SWDIV, 2000)
  - ELCR: 6.7×10^{-4}
  - Cancer risk driver(s): 1,1-DCE
  - HI: 0.5

The cancer risk associated with groundwater exposure from Area 2 contamination, for the residential scenario from both datasets, exceeded the generally accepted range (10^{-6} to 10^{-4}). The HI exceeded the acceptable criterion of 1.0 following the RI; however, as concentrations decreased in 1999, the HI dropped below the acceptable threshold (SWDIV, 2000).

Table 3-2. OU-1 Area 2 Maximum Detected Concentrations of COPCs

Area 2 COPC	Maximum Reported Conc.[1]	Federal Primary Drinking Water Standards (MCLs)	Federal Maximum Contaminant Level Goals (MCLGs)	Arizona MCLs for Organic Chemicals	Arizona Numeric Aquifer Water Quality Standards (AWQS)	Required Cleanup Conc.[2]	Major Human Health Risk	Major Human Health Hazard
1,1-DCE	180	7	7	7	7	7	yes	yes

Based on summary information presented in Table 2-6 of the OU-1 ROD (SWDIV, 2000).
All concentrations in micrograms per liter (µg/L).
[1] Maximum reported concentrations were based on information from the RI (JEG, 1996a).
[2] Required cleanup concentrations based on the most conservative standards at the time of the investigation (i.e., MCLs based on Federal Drinking Water Standards).

3.6.1.3 Area 3 Groundwater Plume. The OU-1 Area 3 contaminated groundwater plume was located north of the CALA near a former unlined fire training pit that was used from 1976 to 1985 to practice extinguishing various types of fires (Figure 3-3). The footprint of the plume covered an area of approximately 10 acres and was confined on-station. The contamination at Area 3 consisted primarily of TCE and 1,1-DCE. The detected CHC compounds in groundwater were limited to the immediate vicinity of the former fire pit; they did not appear to have an upgradient source and were not migrating significantly downgradient.

The maximum concentrations of TCE and 1,1-DCE reported in the RI were 13 and 10.2 µg/L, respectively, at monitoring well W-5 (JEG, 1996a). The CHC concentrations decreased following the RI where groundwater monitoring results documented 1,1-DCE, TCE, and PCE concentrations dropped below the MCLs in 1999 at all Area 3 monitoring wells.

All of the chemicals identified in Area 3 during the RI and subsequent investigations prior to the Final ROD that exceeded their respective background levels were evaluated as COPCs in the human-health risk assessment. Table 3-3 lists the contaminants that exceeded MCLs and were major risk contributors in Area 3. The Area 3 risk assessment results for cancer (i.e., ELCR) and noncancer (i.e., HI) were as follows:

- Residential exposure scenario based on 1995 RI data (JEG, 1996a)
  - ELCR: 2.69×10^{-4}
  - Cancer risk driver(s): 1,1-DCE (96.8% of risk) and TCE (3.2% of risk)
  - HI: 0.6
- Residential exposure scenario based on August 1999 data (SWDIV, 2000)
  - ELCR: 1.43×10^{-5}
  - Cancer risk driver(s): 1,1-DCE (90.9% of risk) and TCE (9.1% of risk)
  - HI: 0.7

The cancer risk associated with groundwater exposure from Area 3 contamination, for the residential scenario, exceeded the accepted range (10^{-6} to 10^{-4}) following the RI, but was within the accepted range following the 1999 sampling. The HI was below the acceptable threshold of 1.0 for both datasets (SWDIV, 2000).

Table 3-3. OU-1 Area 3 Maximum Detected Concentrations of COPCs

Area 3 COPC	Maximum Reported Conc.[1]	Federal Primary Drinking Water Standards (MCLs)	Federal Maximum Contaminant Level Goals (MCLGs)	Arizona MCLs for Organic Chemicals	Arizona Numeric Aquifer Water Quality Standards (AWQS)	Required Cleanup Conc.[2]	Major Human Health Risk	Major Human Health Hazard
1,1-DCE	10.2	7	7	7	7	7	yes	no
TCE	12.8	5	0	5	5	5	no	no

Based on summary information presented in Table 2-6 of the OU-1 ROD (SWDIV, 2000).
All concentrations in micrograms per liter (µg/L).
[1] Maximum reported concentrations were based on information from the RI (JEG, 1996a).
[2] Required cleanup concentrations based on the most conservative standards at the time of the investigation (i.e., MCLs based on Federal Drinking Water Standards).

3.6.1.4 ***Area 6 Groundwater Plume.*** The OU-1 Area 6 contaminated groundwater plume was located south of the Central Receiving Warehouse (Building 328), where a small plume, primarily PCE, was detected in the vicinity of three suspected diesel-fuel USTs associated with former Building 335 (Figure 3-3). The original source of contamination, however, remains unknown. The footprint of the plume covered an area of less than 1 acre and was confined on-station. The maximum concentration of PCE reported in the RI was 7.1 μg/L at monitoring well 335-MW-04, however, the CHC plume was considered to be stable with respect to concentration and areal extent (SWDIV, 2000).

Elevated concentrations of total petroleum hydrocarbons (TPH) as diesel (14,000 milligrams per kilogram [mg/kg]) and as gasoline (770 mg/kg) were detected in the soil, but TPH was virtually absent in groundwater with only one monitoring well out of five having detected TPH (0.25 milligrams per liter [mg/L]).

Based on results from sampling conducted in April 1998, it appeared that the PCE concentration in well 335-MW-04 had fallen to 4 μg/L, while the PCE concentration in the nearby monitoring well 317-MW-01 was 9 μg/L. Further results from sampling conducted in October 1998 documented that the PCE concentration in well 335-MW-04 had fallen to 2 μg/L, while the concentration of PCE (7 μg/L) in well 317-MW-01 had dropped, but remained in excess of the MCL. Sampling conducted in August 1999 showed that the concentration of PCE in well 317-MW-01 was 8.6 μg/L. The Area 6 PCE concentrations remained essentially stable following the RI, at levels slightly in excess of the MCL, but less than the 10^{-4} risk level and the noncancer risk-based concentration (RBC).

All of the chemicals identified in Area 6 during the RI and subsequent investigations prior to the Final ROD, which exceeded their respective background levels, were evaluated as COPCs in the human-health risk assessment. Table 3-4 lists the contaminants that exceeded MCLs and were major risk contributors in Area 6. The Area 6 risk assessment results for cancer (i.e., ELCR) and noncancer (i.e., HI) were as follows:

- Residential exposure scenario based on 1995 RI data (JEG, 1996a)
  - ELCR: 8.60×10^{-6}
  - HI: 0.1
- Residential exposure scenario based on August 1999 data (SWDIV, 2000)
  - ELCR: 1.00×10^{-5}
  - HI: 0.1

The cancer risk associated with groundwater exposure from Area 6 contamination, for the residential scenario, was within the accepted range (10^{-6} to 10^{-4}) following the RI and the 1999 sampling. The HI was below the acceptable threshold of 1.0 for both datasets, as well (SWDIV, 2000).

Table 3-4. OU-1 Area 6 Maximum Detected Concentrations of COPCs

Area 6 COPC	Maximum Reported Conc.[1]	Federal Primary Drinking Water Standards (MCLs)	Federal Maximum Contaminant Level Goals (MCLGs)	Arizona MCLs for Organic Chemicals	Arizona Numeric Aquifer Water Quality Standards (AWQS)	Required Cleanup Conc.[2]	Major Human Health Risk	Major Human Health Hazard
PCE	7.1	5	0	5	5	5	no	no

Based on summary information presented in Table 2-6 of the OU-1 ROD (SWDIV, 2000).
All concentrations in micrograms per liter (μg/L).
[1] Maximum reported concentrations were based on information from the RI (JEG, 1996a).
[2] Required cleanup concentrations based on the most conservative standards at the time of the investigation (i.e., MCLs based on Federal Drinking Water Standards).

3.6.2 Operable Unit 2. Based on the results of the RI conducted across the 18 CAOCs of OU-2, the FFA team agreed that 12 of the CAOCs required NFA. The six remaining CAOCs (i.e., CAOCs 1, 4, 7, 8, 9 and 10) required remedial actions (JEG, 1996a). The results of the ecological risk assessment conducted as part of the RI (JEG, 1996a) indicated that chemicals detected in the soil and surface water did not pose a significant risk to ecological receptors at MCAS Yuma. With the exception of migratory birds that were observed in the air over MCAS Yuma, no state or federally listed threatened or endangered species were known to be present at MCAS Yuma. No critical habitats or habitats of endangered species were found to be affected by contaminants of potential ecological concern (COPEC) at OU-2.

The FS conducted for the remaining six CAOCs (Uribe & Associates, 1996b) focused on remedial action for CAOCs 4, 7, and 9, where surface disposal of asbestos-bearing waste was confirmed, which would allow unrestricted use of the sites. Remediation to residential land use standards was completed in 1999 for OU-2 CAOCs 4, 7, and 9 (GEOFON, 1999); therefore, these CAOCs and the 12 OU-2 CAOCs that achieved NFA status are not required to be included in further discussion.

A discussion of the remaining OU-2 CAOCs (i.e., CAOCs 1, 8A and 10), including site description, history of contamination, response actions, and the basis for taking remedial action, is provided below. The COCs of the remaining Areas of OU-2 are PAHs and PCBs and do not represent a source of contamination for any OU-1 areas. Figure 3-4 shows the locations of OU-2 CAOCs 1, 8A and 10 within MCAS Yuma and other general site characteristics (i.e., roads, fence lines, and buildings).

3.6.2.1 CERCLA Area of Concern 1. CAOC 1 consists of the pre-1960 flight line (tarmac, runways, aprons, and taxiways) and associated aircraft-maintenance hangar facilities. This site is located within the footprint of the existing flight line in the north-central portion of MCAS Yuma and occupies approximately 170 acres (Figure 3-4). In the 1940s, used oil was routinely drained from aircraft engines directly to the ground surface on which the aircraft were parked. In the 1950s, 1960s, and 1970s, waste oil was used for dust control around hangars, taxiways, and apron edges. The RI focused on the flight line areas where source areas of contamination were expected to be found, such as aircraft and vehicle wash racks, oil/water separators, fuel storage bladder locations, dry wells, miscellaneous stained soil areas, and maintenance and storage yards (JEG, 1996a).

The results of the RI revealed the widespread detection of total recoverable petroleum hydrocarbons (TRPH) in surface soils and localized occurrences around the flight line. PAHs were also reported in localized surface soils. PCBs, formerly used as coolant for electric transformers, were reported at the northern edge of the flight line and existing wash rack. Solvents, containing VOCs and semi-volatile organic compounds (SVOCs), pesticides and metals, were reported in shallow soil samples throughout the flight line (Uribe & Associates, 1997b). The results of the investigation did not reveal significant soil contamination in the areas of the specific units included in the investigation (e.g., drywells, oil/water separators, wash racks, etc.). PAHs were the major COPCs posing unacceptable health risk to exposure from CAOC 1 soils.

All of the chemicals identified at CAOC 1 during the RI, including metals that exceeded their respective background levels (i.e., arsenic, beryllium, and cadmium), were evaluated as COPCs in the human-health risk assessment as industrial and residential land use scenarios. Table 3-5 lists the maximum detected concentrations of the COPCs, identifies the residential and industrial risk-based criteria used in the RI, and identifies the threshold limit values (TLVs) established for metals within the soils of CAOC 1. The CAOC 1 risk assessment results for cancer (i.e., ELCR) and noncancer risk (i.e., HI) were as follows:

- Residential exposure scenario
  - ELCR: 2.19×10^{-4}
  - Risk driver(s): PAHs, 83 percent of the cancer risk
- Industrial exposure scenario
  - ELCR: 6.48×10^{-5}
  - Cancer Risk driver(s): PAHs, 90 percent of the cancer risk
  - HI: 1.86
  - Noncancer Risk driver(s): metals

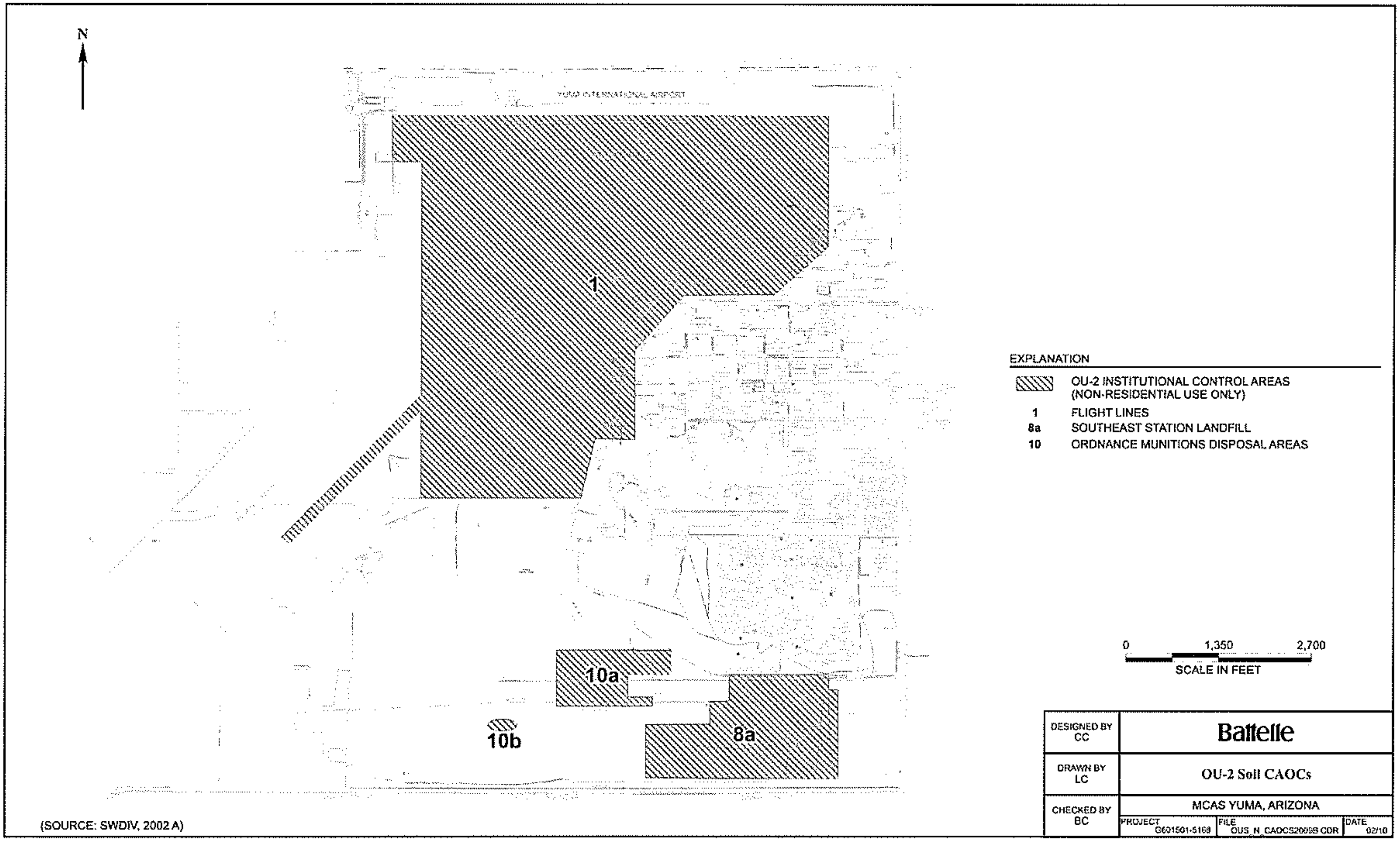

Figure 3-4. Location Map of OU-2 CERCLA Areas of Concern

Table 3-5. OU-2 CAOC 1 Maximum Detected Concentrations of COPCs

CAOC 1 COPC	Maximum Reported Conc.[1]	Residential Risk-Based Criteria		Industrial Risk-Based Criteria		TLV
		Cancer	Noncancer	Cancer	Noncancer	
VOCs						
2-Butanone	2.31	--	2,770	--	3,070	na
Chloromethane	0.11	3.17	--	5.82	--	na
Methylene Chloride	0.16	6.44	1,930	12	1,930	na
Xylene	0.09	--	1,930	--	1,930	na
SVOCs						
1-Methyl-2-Pyrrolidinone	0.16	NA	NA	NA	NA	na
2-Cyclohexen-1-Ol	0.1	NA	NA	NA	NA	na
2-Cyclohexen-1-One	0.095	NA	NA	NA	NA	na
2-Methylnaphthalene	54	--	608	--	608	na
2-Pentanone, 4-Hydroxy-4-Methyl	9.8	NA	NA	NA	NA	na
7H-Benz(DE)Anthracen-7-One	1.7	NA	NA	NA	NA	na
9,10-Anthracenedione	1.6	NA	NA	NA	NA	na
Acenaphthene	0.034	--	55.6	--	55.6	na
Acenaphthylene	0.045	NA	NA	NA	NA	na
Anthracene	0.26	--	1.76	--	1.76	na
Benzo(e) Pyrene	0.17	NA	NA	NA	NA	na
Benzo(a) Anthracene	3.6	0.391	--	1.23	--	na
Benzo(a) Pyrene	4.5	0.0391	--	0.123	--	na
Benzo(b) Fluoranthene	10	0.391	--	1.23	--	na
Benzo(g,h,i) Perylene	2	NA	NA	NA	NA	na
Benzo(k) Fluoranthene	4.2	3.91	--	12.3	--	na
Benzo(b) Naphtho(2,3-D)Furan	0.18	NA	NA	NA	NA	na
Bis(2-Ethylhexyl) Phthalate	2.7	20.4	780	64.1	6,400	na
Butyl Benzyl Phthalate	0.25	--	7,800	--	64,000	na
Carbazole	0.77	14.3	--	44.9	--	na
Chrysene	5.6	39.1	--	123	--	na
Cyclopenta(def) Phenanthrenon	0.62	NA	NA	NA	NA	na
Di-n-Octylphthalate	0.24	--	780	--	6,400	na
Di-n-Butylphthalate	1.78	--	3,900	--	32,000	na
Dibenzo(a,h) Antracene	0.97	0.0391	--	0.123	--	na
Dibenzofuran	0.05	NA	NA	NA	NA	na
Ethanone, 1-Oxiranyl	0.071	NA	NA	NA	NA	na
Ethylene Glycol	170	--	78,000	--	100,000	na
Fluoranthene	8.3	--	1,560	--	12,800	na
Fluorene	0.044	--	47.6	--	47.6	na
Hexanedioic Acid, Bis(2-Ethyl)	5.1	NA	NA	NA	NA	na
Indeno (1,2,3-cd) Pyrene	2.5	0.391	--	1.23	--	na
Naphthalene	70	--	124	--	124	na
Phenanthrene	2.3	--	42	--	42	na
Phenol	0.064	--	18,700	--	100,000	na
Pyrene	8	--	1,170	--	9,600	na
Total Petroleum Hydrocarbons						
Diesel	5,100	--	--	--	--	na
Gasoline	48	--	--	--	--	na
Total Petroleum Hydrocarbons	4,200	--	--	--	--	na

Table 3-5. OU-2 CAOC 1 Maximum Detected Concentrations of COPCs (Continued)

CAOC 1 COPC	Maximum Reported Conc.[1]	Residential Risk-Based Criteria		Industrial Risk-Based Criteria		TLV
		Cancer	Noncancer	Cancer	Noncancer	
Pesticides and PCBs						
4,4-DDD	0.21	0.935	--	2.63	--	na
4,4-DDE	0.14	0.66	--	1.86	--	na
4,4-DDT	0.026	0.66	15.6	1.86	113	na
aldrin	0.000088	0.0132	0.973	0.0371	6.76	na
aroclor 1254	0.02	0.0473	--	0.176	--	na
aroclor 1260	0.39	0.0473	--	0.176	--	na
dieldrin	0.014	0.014	1.56	0.0395	11.3	na
endosulfan II	0.015	--	1.56	--	11.3	na
endosulfan sulfate	0.013	--	1.56	--	11.3	na
endrin	0.0067	--	9.37	--	67.6	na
endrin aldehyde	0.0097	--	9.37	--	67.6	na
endrin ketone	0.018	--	9.37	--	67.6	na
heptachlor epoxide	0.0065	0.0247	0.406	0.0694	2.93	na
alpha-benzene hexachloride	0.00027	0.0453	--	0.143	--	na
alpha-chlordane	0.17	0.173	1.87	0.486	13.5	na
delta-benzene hexachloride	0.0063	0.158	--	0.499	--	na
gamma-chlordane	0.14	0.173	1.87	0.486	13.5	na
methoxychlor	0.063	--	156	--	1,130	na
Metals						
Aluminum	26,200	--	71,100	--	100,000	20,800
Arsenic	16	0.302	21.3	1.9	399	8.59
Barium	437	--	1,520	--	12,400	187
Beryllium	0.43	0.129	356	0.859	6,650	1.97
Cadmium	6.2	26.5	35.6	45.4	665	1.04
Chromium	32.2	--	71,100	--	100,000	49.2
Cobalt	16.6	--	4,540	--	29,600	12.2
Copper	47.1	--	2,630	--	49,200	15.4
Lead[2]	102	--	--	--	--	15.8
Manganese	727	--	136	--	1,180	319
Mercury	1.3	--	21	--	382	nd
Nickel	39.3	--	1,420	--	26,600	19.5
Selenium	0.59	--	356	--	6,650	2.26
Silver	42.1	--	356	--	6,650	1.15
Thallium	0.5	--	4.98	--	93.1	4.21
Vanadium	56.7	--	498	--	9,310	37.7
Zinc	101	--	21,300	--	100,000	37.9

Based on summary information presented in Tables 2-1 through 2-5 of the OU-2 ROD (Uribe & Associates, 1997b).
All concentrations in milligrams per kilogram (mg/kg).

-- indicates that this constituent did not have cancer and/or noncancer toxicity.
NA indicates that no toxicity data were available at the time of the RI.
na indicates that a TLV was not applicable for the constituent.
nd indicates that no data were obtained for the TLV calculations.
XX indicates that the maximum detected concentration of the constituent exceeded this criterion.

[1] Maximum reported concentrations were based on information from the RI (JEG, 1996a).

[2] U.S. EPA Region IX residential and industrial soil screening levels for lead were 400 and 1,200 mg/kg at the time of the RI, respectively. Concentrations below these values were not considered to impact health.

The cancer risk for the residential scenario exceeded the generally accepted range (10^{-6} to 10^{-4}), which precluded unrestricted exposure or residential land use. The cancer risk for the industrial scenario was within the acceptable range; therefore, no restrictions were needed for this land use. The HI exceeded the acceptable criterion of 1.0 (primarily attributed to metals); however, none of the individual target organs or organ systems HI values exceeded the criterion (JEG, 1996a).

3.6.2.2 CERCLA Area of Concern 8A. CAOC 8A is located in the southeastern portion of MCAS Yuma, between North Ordnance Road and the southern MCAS Yuma property line (Figure 3-4). CAOC 8A is the site of a former landfill and surface disposal areas. The site is vacant land, except for ordnance and munitions storage bunkers on the portion of the site within the Ordnance Distribution Facility (ODF). During the RI, this area was investigated as part of the greater CAOC 8. CAOC 8 was a 68-acre area used primarily for the disposal of municipal wastes generated at MCAS Yuma from 1953 to 1961 (Uribe & Associates, 1997b). A portion of the area was also used for rubble disposal and as a borrow area for fill soil. The wastes were burned prior to disposal in 10 to 20 disposal pits at CAOC 8A. The waste streams potentially associated with this disposal area include vehicle- and fuel-related wastes, used oils, solvents, paints, thinners, pesticides, and herbicides. The disposal pits were backfilled and no longer provide an opportunity for direct human exposure to contaminated soil. The CAOC 8A landfill is inactive, and no disposal or other use is authorized for the site. The portion of the site within the ODF is used for ordnance and munitions storage within storage bunkers.

Drilling within the landfill at CAOC 8A was not performed during the RI because of potential drilling hazards and difficult drilling conditions caused by buried construction debris. Therefore, the landfill investigation was directed at evaluating the exposure scenario for the present site conditions and future (capped) conditions. The analytical results from the RI surface soil sampling and analysis program for CAOC 8 indicated the presence of TRPH, PAHs, PCBs, solvents, pesticides and metals. These contaminants were generally found in the portion of CAOC 8 assigned to CAOC 8A (i.e., south of North Ordnance Road). Low levels of TCE, PCE, xylenes and methane were also detected in soil gas samples. PCBs detected in surface soil at CAOC 8A were the major COPC posing a potential human risk.

The human-health risk assessment subdivided CAOC 8, based on current and anticipated future land use, into CAOC 8A and CAOC 8B, and evaluated each separately. CAOC 8B is the MCAS Yuma residential housing area located between North Ordnance Road and Loesch Street. The assessment estimated the human-health risks at CAOC 8B for both the industrial and residential scenarios to be within the acceptable range (JEG, 1996a). Table 3-6 lists the maximum detected concentrations of the COPCs, identifies the residential and industrial risk-based criteria used in the RI, and identifies the TLVs established for metals within the soils of CAOC 8A. The RI risk assessment results for CAOC 8A were as follows:

- Residential exposure scenario
  - ELCR: 9.94×10^{-5}
  - HI: 0.35
  - Risk driver(s): PAHs and PCBs; with 74 percent of the cancer risk attributed to Aroclor 1254 (a PCB, reported at three sample locations)

Table 3-6. OU-2 CAOC 8A Maximum Detected Concentrations of COPCs

CAOC 8A COPC	Maximum Reported Conc.[1]	Residential Risk-Based Criteria		Industrial Risk-Based Criteria		TLV
		Cancer	Noncancer	Cancer	Noncancer	
SVOCs						
1-Methyl-2-Pyrrolidinone	0.13	NA	NA	NA	NA	na
Benzo(a) Anthracene	0.2	0.391	--	1.23	--	na
Benzo(a) Pyrene	0.24	0.0391	--	0.123	--	na
Benzo(b) Fluoranthene	0.42	0.391	--	1.23	--	na
Benzo(g,h,i) Perylene	0.035	NA	NA	NA	NA	na
Benzo(k) Fluoranthene	0.2	3.91	--	12.3	--	na
Bis(2-Ethylhexyl) Phthalate	0.387	20.4	780	64.1	6,400	na
Chrysene	0.27	39.1	--	123	--	na
Di-n-Butylphthalate	4.038	--	3,900	--	32,000	na
Fluoranthene	0.344	--	1,560	--	12,800	na
Indeno (1,2,3-cd) Pyrene	0.074	0.391	--	1.23	--	na
N-Nitrosodiphenylamine	0.049	58.2	--	183	--	na
Phenanthrene	0.14	--	42	--	42	na
Pyrene	0.344	--	1,170	--	9,600	na
Total Petroleum Hydrocarbons						
Diesel	860	--	--	--	--	na
Pesticides and PCBs						
4,4-DDD	0.00805	0.935	--	2.63	--	na
4,4-DDE	0.0079	0.66	--	1.86	--	na
4,4-DDT	0.0023	0.66	15.6	1.86	113	na
aldrin	0.00248	0.0132	0.973	0.0371	6.76	na
aroclor 1254	4.045	0.0473	--	0.176	--	na
dieldrin	0.0695	0.014	1.56	0.0395	11.3	na
endosulfan I	0.00136	--	1.56	--	11.3	na
endosulfan II	0.0027	--	1.56	--	11.3	na
endosulfan sulfate	0.00098	--	1.56	--	11.3	na
endrin	0.04176	--	9.37	--	67.6	na
endrin aldehyde	0.0174	--	9.37	--	67.6	na
endrin ketone	0.01142	--	9.37	--	67.6	na
alpha-chlordane	0.05873	0.173	1.87	0.486	13.5	na
beta-benzene hexachloride	0.00041	0.158	--	0.499	--	na
gamma-chlordane	0.00756	0.173	1.87	0.486	13.5	na
gamma-benzene hexachloride (lindane)	0.00072	0.173	9.37	0.486	67.6	na
Metals						
Aluminum	11,700	--	71,100	--	100,000	7,770
Antimony	8.5	--	28.4	--	532	6
Arsenic	4.7	0.302	21.3	1.9	399	9.68
Barium	160	--	1,520	--	12,400	133
Beryllium	0.14	0.129	356	0.859	6,650	0.28
Cadmium	1.2	26.5	35.6	45.4	665	0.8
Chromium	15.7	--	71,100	--	100,000	10.6
Chromium VI	0.22	4.07	356	6.97	6,650	nd
Cobalt	6.5	--	4,540	--	29,600	6.12
Copper	582	--	2,630	--	49,200	21.7
Lead[2]	659	--	--	--	--	8.79

Table 3-6. OU-2 CAOC 8A Maximum Detected Concentrations of COPCs (Continued)

CAOC 8A COPC	Maximum Reported Conc.[1]	Residential Risk-Based Criteria		Industrial Risk-Based Criteria		TLV
		Cancer	Noncancer	Cancer	Noncancer	
Manganese	278	--	136	--	1,180	137
Mercury	0.17	--	21	--	382	nd
Nickel	14.9	--	1,420	--	26,600	6.7
Selenium	0.98	--	356	--	6,650	1.89
Silver	10.2	--	356	--	6,650	1.47
Thallium	0.5	--	4.98	--	93.1	6.76
Vanadium	28	--	498	--	9,310	22.6
Zinc	58.9	--	21,300	--	100,000	28.0

Based on summary information presented in Tables 2-1 through 2-5 of the OU-2 ROD (Uribe & Associates, 1997b).
All concentrations in milligrams per kilogram (mg/kg).
-- indicates that this constituent did not have cancer and/or noncancer toxicity.
NA indicates that no toxicity data were available at the time of the RI.
na indicates that a TLV was not applicable for the constituent.
nd indicates that no data were obtained for the TLV calculations.
$\boxed{XX}$ indicates that the maximum detected concentration of the constituent exceeded this criterion.
[1] Maximum reported concentrations were based on information from the RI (JEG, 1996a).
[2] U.S. EPA Region IX residential and industrial soil screening levels for lead were 400 and 1,200 mg/kg at the time of the RI, respectively. Concentrations below these values were not considered to impact health.

  - Lead: detected at 659 milligrams per kilogram (mg/kg) in surface soil, which exceeded the U.S. EPA Region 9 residential soil screening value of 400 mg/kg and caused lead to be identified as a potential residential health risk (Uribe & Associates, 1997b).

- Industrial exposure scenario
  - ELCR: 3.02×10^{-5}
  - Cancer Risk driver(s): PAHs and PCBs
  - HI: 0.41

Because soil sample results were not available for the landfill contents, exposure to the landfill contents was not assessed for CAOC 8A. The cancer risk estimate for residential exposure at the site surface was at the high end of the generally acceptable range. Exposure to surface soil did not pose an unacceptable level of risk under an industrial land use scenario. Based on both this information and that the risks associated with exposure to the landfill interior are not known, U.S. EPA, ADEQ, and the DON made a risk management decision to restrict the use of CAOC 8A to the current use (inactive landfill and industrial use of former surface disposal areas) and prohibit any land use that could potentially disturb the contents of the landfill (Uribe & Associates, 1997b).

3.6.2.3 CERCLA Area of Concern 10. CAOC 10, consisting of subareas 10A and 10B (Figure 3-4), is located within the secured and existing ODF (CAOC 10A) and the fenced area adjacent to CAOC 8A (CAOC 10B) in the southeastern portion of MCAS Yuma. CAOC 10 was used during World War II as a shooting range for bomber gun crews. Since the early 1950s, ordnance materials have been stored in the magazines around the central portion of the Ordnance

Loop (North and South Ordnance Roads). The area has also been used for surface tank and drum storage. Surface spills, including liquid residues from ordnance-mixing operations, have been reported within this area. CAOC 10 continued to be used for the storage and handling of ordnance as part of the station's ordnance distribution facility. Suspected waste associated with this area includes used oils, ordnance waste associated with nitroaromatics, fuel-related wastes, and metals.

The primary finding of the RI field sampling and analysis program was TRPH, PAHs in surface soil, and one lead result reported above the site background concentration. PAHs were detected in surface soil at four locations during the RI. The risk assessment results from CAOC 10 indicated both the industrial and residential exposure scenarios had potential cancer risk within the generally accepted range; benzo(a)pyrene, a PAH, contributed 74 percent of the cancer risk for the residential exposure scenario.

The risk assessment results for CAOC 10 were later revised with results from additional soil sampling for PAHs conducted in August 1996 (Uribe & Associates, 1996a) and February 1997 (Uribe & Associates, 1997a). The August 1996 sample results showed one to two orders of magnitude higher total PAH concentrations, which led to supplemental soil sampling to fully define the extent of PAHs in the soil areas then designated as CAOCs 10A and 10B (Uribe & Associates, 1997a). Initially, this second risk assessment used RBCs calculated during the RI with 1993 U.S. EPA-approved dermal exposure factors, instead of the promulgated 1996 dermal exposure factors. Recalculating the RBCs using the dermal exposure factors valid for 1996 resulted in RBCs for PAHs that were identical to the 1996 U.S. EPA preliminary remediation goals (PRGs). Using the recalculated RBC values to estimate human health risk for CAOC 10 yielded the following results:

- Residential exposure scenario
  - ELCR: 2.9×10^{-4}
  - Risk driver(s): PAHs, greater than 74 percent of the cancer risk
- Industrial exposure scenario
  - ELCR: 7.0×10^{-5}
  - Cancer Risk driver(s): PAHs

The recalculated cancer risk for residential exposure exceeded the generally acceptable range, whereas the cancer risk for industrial exposure was in the middle of the range. For this reason, the risk for the site was considered potentially higher than acceptable for unrestricted exposure or residential land use, but acceptable for industrial land use. Table 3-7 lists the maximum detected concentrations of the COPCs, identifies the residential and industrial risk-based criteria used in the RI, and identifies the TLVs established for metals within the soils of CAOC 10.

Table 3-7. OU-2 CAOC 10 Maximum Detected Concentrations of COPCs

CAOC 10 COPC	Maximum Reported Conc.[1]	Residential Risk-Based Criteria		Industrial Risk-Based Criteria		TLV
		Cancer	Noncancer	Cancer	Noncancer	
SVOCs						
Acenaphthene	0.166	--	55.6	--	55.6	na
Anthracene	0.388	--	1.76	--	1.76	na
Benzo(a) Anthracene	2.718	$\boxed{0.391}$	--	$\boxed{1.23}$	--	na
Benzo(a) Pyrene	2.197	$\boxed{0.0391}$	--	$\boxed{0.123}$	--	na
Benzo(b) Fluoranthene	3.482	$\boxed{0.391}$	--	$\boxed{1.23}$	--	na
Benzo(g,h,i) Perylene	0.322	NA	NA	NA	NA	na
Carbazole	0.19	14.3	--	44.9	--	na
Chrysene	2.873	39.1	--	123	--	na
Di-n-Butylphthalate	3.359	--	3,900	--	32,000	na
Fluoranthene	4.132	--	1,560	--	12,800	na
Fluorene	0.044	--	47.6	--	47.6	na
Indeno (1,2,3-cd) Pyrene	1.531	$\boxed{0.391}$	--	$\boxed{1.23}$	--	na
Naphthalene	0.112	--	124	--	124	na
Phenanthrene	1.746	--	42	--	42	na
Pyrene	4.057	--	1,170	--	9,600	na
TPH						
Total Petroleum Hydrocarbons	25	--	--	--	--	na
Pesticides and PCBs						
4,4-DDE	0.002	0.66	--	1.86	--	na
dieldrin	0.00079	0.014	1.56	0.0395	11.3	na
endrin	0.00137	--	9.37	--	67.6	na
beta-benzene hexachloride	0.00067	0.158	--	0.499	--	na
Metals						
Aluminum	5,290	--	71,100	--	100,000	6,310
Arsenic	3.9	$\boxed{0.302}$	21.3	$\boxed{1.9}$	399	8.99
Barium	85.3	--	1,520	--	12,400	184
Beryllium	0.67	$\boxed{0.129}$	356	0.859	6,650	0.28
Cadmium	1.7	26.5	35.6	45.4	665	$\boxed{1.64}$
Chromium	11.2	--	71,100	--	100,000	25.1
Cobalt	3.7	--	4,540	--	29,600	7.31
Copper	5.5	--	2,630	--	49,200	5.83
Lead[2]	31	--	--	--	--	$\boxed{6.79}$
Manganese	176	--	$\boxed{136}$	--	1,180	$\boxed{157}$
Nickel	6.8	--	1,420	--	26,600	9.83
Selenium	0.63	--	356	--	6,650	1.9
Silver	0.78	--	356	--	6,650	1.14
Vanadium	22.3	--	498	--	9,310	26.9
Zinc	157	--	21,300	--	100,000	$\boxed{30.2}$

Based on summary information presented in Tables 2-1 through 2-5 of the OU-2 ROD (Uribe & Associates, 1997b).

All concentrations in milligrams per kilogram (mg/kg).

-- indicates that this constituent did not have cancer and/or noncancer toxicity.
NA indicates that no toxicity data were available at the time of the RI.
na indicates that a TLV was not applicable for the constituent.
nd indicates that no data were obtained for the TLV calculations.
$\boxed{XX}$ indicates that the maximum detected concentration of the constituent exceeded this criterion.

[1] Maximum reported concentrations were based on information from the RI (JEG, 1996a).

[2] U.S. EPA Region IX residential and industrial soil screening levels for lead were 400 and 1,200 mg/kg at the time of the RI, respectively. Concentrations below these values were not considered to impact health.

4.0 REMEDIAL ACTIONS

This section discusses the results of events identified in the chronology, listed in Section 2, that define the remedies for OU-1 and OU-2, from the signing of the RODs to the present. The section discusses remedy selection, remedy implementation, and remedy performance, and identifies any changes to or problems associated with the components of the remedy. Table 4-1 provides a summary list of all sites including the type of site, the current status, and the past and present remedial actions associated with OU-1 and OU-2.

Table 4-1. Summary of IR Sites Associated with OU-1 and OU-2

Site ID	Operable Unit	Type of Site	Current Status (Active or Closed [Year Closed])	Remedial Actions Taken
Area 1	OU-1	Groundwater	Active	ICs, AS/SVE, VCT, MNA,
Area 2	OU-1	Groundwater	Closed [2006]	ICs, temporary AS/SVE, MNA
Area 3	OU-1	Groundwater	Closed [2006]	ICs, temporary AS/SVE, MNA
Area 6	OU-1	Groundwater	Closed [2003]	ICs, MNA
CAOC 1	OU-2	Soil	Active	ICs
CAOC 2	OU-2	Soil	Closed [1996]	NFA
CAOC 3	OU-2	Soil	Closed [1996]	NFA
CAOC 4	OU-2	Soil	Closed [1999]	Asbestos Remediation
CAOC 5	OU-2	Soil	Closed [1996]	NFA
CAOC 6	OU-2	Soil	Closed [1996]	NFA
CAOC 7	OU-2	Soil	Closed [1999]	Asbestos Remediation
CAOC 8A	OU-2	Soil	Active	ICs
CAOC 8B	OU-2	Soil	Closed [1996]	NFA
CAOC 9	OU-2	Soil	Closed [1999]	Asbestos Remediation
CAOC 10A	OU-2	Soil	Active	ICs
CAOC 10B	OU-2	Soil	Active	ICs
CAOC 11	OU-2	Soil	Closed [1996]	NFA
CAOC 12	OU-2	Soil	Closed [1996]	NFA
CAOC 13	OU-2	Soil	Closed [1996]	NFA
CAOC 14	OU-2	Soil	Closed [1996]	NFA
CAOC 15	OU-2	Soil	Closed [1996]	NFA
CAOC 16	OU-2	Soil	Closed [1996]	NFA
CAOC 17	OU-2	Soil	Closed [1996]	NFA
CAOC 18	OU-2	Soil	Closed [1996]	NFA

4.1 Remedial Actions for Operable Unit 1

This section discusses the remedy selection, the remedy implementation, and the remedy performance for OU-1 and identifies any changes to or problems with the components of the remedy.

4.1.1 OU-1 Remedy Selection. This section describes the purpose for remediation, the remedial alternatives developed and evaluated in the OU-1 FS (JEG, 1998a) against the nine

CERCLA evaluation criteria for remedial alternatives, and the remedy selected in the Final ROD (SWDIV, 2000).

4.1.1.1 OU-1 Remedial Action Objective. Remedial action objectives (RAOs) for all of the OU-l groundwater CHC plumes included containment of all the plumes within the facility boundary and to reduce groundwater contamination to meet applicable drinking water standards. Groundwater RAOs applicable for VOCs were established to ensure that any person exposed in the future would not be exposed to unsafe levels of CHCs. These RAOs were based on detailed analysis of chemical-specific applicable or relevant and appropriate requirements (ARARs) and health risk-based criteria that were consistent with the beneficial uses of the affected aquifer at the time of remediation and of its projected use.

4.1.1.2 OU-1 Applicable or Relevant and Appropriate Requirements. Federal drinking water standards were identified in the OU-1 ROD as applicable or relevant and appropriate chemical-specific requirements for the remediation of OU-1 groundwater plumes. The U.S. EPA had promulgated MCLs under the Safe Drinking Water Act (SDWA) to protect public health from contaminants that may be in drinking water sources (40 CFR, Part 141). Although these requirements were applicable only at the tap for water provided directly to 25 or more people or that would be supplied to 15 or more service connections, they were relevant and appropriate since the state of Arizona had designated all aquifers in the state as potential sources of drinking water (unless reclassification is obtained). Nonzero maximum contaminant level goals (MCLGs) were also relevant and appropriate to remedial actions that were required to meet drinking water standards. Federal MCLs and nonzero MCLGs were, therefore, chemical-specific ARARs for meeting RAOs.

State MCLs were the maximum permissible levels for treated groundwater delivered to users of water systems (§§ R18-4-205 and R18-4-211). They were applicable since the state of Arizona had designated all aquifers in the state to be potential sources of drinking water (Arizona Revised Statutes [ARS] § 49 through 224B). However, no state MCL equivalents (i.e., Aquifer Water Quality Standards [AWQS] for the State of Arizona) were more stringent than the federal MCLs or nonzero MCLGs.

While none of the groundwater extraction and treatment alternatives transfer treated groundwater to a public water-supply agency, the groundwater could be considered as a potential future drinking water supply. If the treated groundwater is to be used as a potable water supply, it would be considered an off-site, post-remedy activity and would have to comply with all legal drinking water requirements in existence at the time the water is used.

Portions of the Resource Conservation and Recovery Act (RCRA) groundwater protection standards contained in ARS Title 49 (Laws Relating to Environmental Quality) and Arizona Administrative Code (AAC) Title 18 were considered to be relevant and appropriate for the groundwater plumes being addressed by OU-l remedial actions because the hazardous constituents being addressed were similar or identical to those found in RCRA hazardous waste. In addition to concentration limits for groundwater, a groundwater-quality monitoring program was required to demonstrate the effectiveness of a corrective action program (40 CFR 264.100).

Discharge by industrial users to a publicly owned treatment works (POTW) was considered an off-site activity, which required compliance with the substantive and procedural requirements of the federal pretreatment program (40 CFR Part 403). In general, the discharges could not cause either a violation of any requirement of the POTW's National Pollutant Discharge Elimination System permit or prevention of sewage sludge use or disposal.

The SDWA provided federal authority over injection wells (42 U.S.C. § 300f et seq.). The Federal Underground Injection Control Plan prohibits injection wells such as those located at OU-l from causing a violation of primary MCLs in the receiving waters and adversely affecting human health (40 CFR § 144.12). The federal reinjection regulation states that contaminated groundwater that has been treated may be reinjected into the formation from which it was withdrawn if such reinjection was conducted pursuant to a CERCLA cleanup and was approved by the U.S. EPA (40 CFR § 144.13). These regulations were applicable to any OU-l treated groundwater that was reinjected into the aquifer.

RCRA Section 3020 was also applicable to the OU-l remedial actions. The RCRA states that the ban that prohibits the disposal of hazardous waste into a formation that contains an underground source of drinking water does not apply to the injection of contaminated groundwater into the aquifer if:

(1) such injection is part of a response action under CERCLA;

(2) such contaminated groundwater is treated to substantially reduce hazardous constituents before such injection; and

(3) such response action would, upon completion, be sufficient to protect human health and the environment (42 U.S.C. § 6939b).

Arizona's Aquifer Protection Permit Program would apply to the reinjection of treated groundwater (ARS § 49-243). Under this program, MCAS Yuma would implement best available demonstrated control technology, processes, operating methods, or other alternatives and include, where practicable, a technology permitting no discharge of pollutants; the facility must not cause or contribute to a violation of aquifer water quality standards at the applicable point of compliance (POC), or further degrade aquifer water quality with respect to a pollutant at the POC if the quality of the aquifer already violates the applicable aquifer water-quality standard for that pollutant.

4.1.1.3 OU-1 Selected Remedy. Twelve remedial alternatives were developed for OU-1 to address a range of responses from no action to active removal of contaminants from the groundwater. All of the alternatives were based on the Area 1 plume, which was the primary plume area requiring remediation. In the Hot Spot where the highest concentrations of VOCs were reported (i.e., downgradient of Building 230), more aggressive alternatives to decrease the contaminant mass in the source area (in addition to plume containment) were included to provide options that would reduce the overall timeframe required to meet the RAOs. Eight alternatives were retained for detailed analyses in the FS for OU-l (JEG, 1998a).

The selected remedy as defined in the Final OU-1 ROD (SWDIV, 2000) consisted of "containment of the LEPA by VCT, Hot Spot removal by AS/SVE, with ICs and potential monitored natural attenuation (MNA) if the treatment systems do not reduce COC concentrations to MCLs" for the Area 1 plume and "ICs and MNA" for the Area 2, 3 and 6 plumes. The DON developed decision-making processes to evaluate the requirements for implementing contingency alternatives for both of the OU-1 selected remedies as well.

The major components of the selected Area 1 remedy included the following:

- Implement a groundwater containment/treatment system at the LEPA using a VCT system to prevent further off-site migration.
- Treat the groundwater at the Hot Spot in the vicinity of Building 230 with an AS/SVE system to reduce contaminant mass in the area and accelerate remediation time for the entire plume.
- Transport, regenerate, recycle, and/or dispose of spent granular activated charcoal (GAC) units associated with the operation of the VCT and AS/SVE systems.
- Perform groundwater modeling to demonstrate that VOC concentrations will reach the base boundary equal to or less than MCLs. If so demonstrated, then MNA will be performed to verify VOCs are approaching MCLs.
- Implement ICs to restrict access to contaminated groundwater. Amend the MCAS Yuma Master Plan to reflect groundwater access and use restrictions, including contamination that has moved off MCAS Yuma, and established mechanisms to control changes that would not interfere with or adversely affect remedial actions.
- Implement an LTM plan, which includes MNA of COCs in the portions of Area 1 where active remediation (i.e., remedial system operations) was not taking place, and evaluate the results to determine the effectiveness of the selected remedies.
- Implement an institutional control plan (ICP) to facilitate training and education of personnel involved with the enforcement of the required ICs. The ICP documents all of the required institutional and engineering controls as well as details the procedures for any required monitoring programs. The ICP also documents procedures for the review of digging and building permits, establishes procedures for ensuring regular checks and balances are in place, includes provisions for annual review (and updates as necessary) of the MCAS Yuma Master Plan, and provides for inspection and enforcement measures to ensure that the required ICs are correctly implemented and enforced. Additionally, the ICP establishes procedures that require the regulatory agencies to be notified in the event any major change in land use is proposed.
- Remediate all contaminated groundwater to MCLs (i.e., 7 µg/L for 1,1-DCE, 5 µg/L for TCE, and 5 µg/L for PCE).
- Terminate system operation (refer to Termination Criteria below).

The major components of the selected Area 2, 3 and 6 remedy included the following:

- Implement ICs on MCAS Yuma.

- Implement a LTM plan that includes MNA of COCs (i.e., 1,1-DCE, TCE and PCE) in selected groundwater monitoring wells.
- Close areas when COCs achieve MCLs for two consecutive years (refer to Termination Criteria below).

To ensure protection of human health and the environment, ICs were required to restrict access to OU-1 contaminated groundwater and prevent its use on MCAS Yuma. The DON was required to provide county agencies with information of any off-station groundwater contamination associated with Area 1 at the time of the ROD.

Stipulations were provided in the ROD for written concurrence to be obtained from the FFA team for any actions taken that were inconsistent with the prohibited groundwater use. Also, if the DON intended to excess the property, it must notify the ADEQ and U.S. EPA in advance of the execution of any transfer. The DON would again consult with the ADEQ and U.S. EPA in revisiting the existing land use classification and restrictions for the areas involved to determine if the foreseeable future land use would differ from the assumptions made at the time of the ROD. A reevaluation of the ICs would be performed if necessary at that time.

The MCAS Yuma Master Plan was required to be amended to: prohibit the use of groundwater from OU-1; describe the risk to human health and the environment of contaminated groundwater use; and, reference the OU-1 ROD.

4.1.1.4 OU-1 Termination Criteria. Criteria for termination of the groundwater containment/treatment systems for OU-1 Area 1 were defined in the ROD (Sections 2.13.1.4. and 2.13.2. of SWDIV, 2000) and summarized below.

Selected monitoring wells located both upgradient and downgradient of the groundwater treatment systems would be monitored during the remedial action in accordance with the LTM plan. The DON would evaluate the results to verify that the remedial systems were effectively containing and treating the plume and, in the case of AS/SVE, to verify that the systems were effectively reducing contaminant mass in the treatment area. The groundwater containment/treatment systems would remain in operation until one of the following criteria was reached:

(1) Representative groundwater concentrations measured in the designated wells upgradient and downgradient of the VCT system had achieved groundwater cleanup standards (MCLs).

(2) Remaining CHC concentrations in Area 1 groundwater would reach the station boundary at concentrations equal to or less than MCLs. (This would require groundwater modeling results indicating that remaining contaminants above MCLs would reach the station boundary at concentrations equal to or less than MCLs followed by MNA to remedy the remaining VOCs). Modeling would be performed only after CHC concentrations upgradient and downgradient of the VCT system had reached MCLs. After MCLs were attained and the VCT system had been temporarily

shut down, if CHCs rebounded above MCLs, modeling would be performed to determine whether CHCs would reach the station boundary at or below MCLs.

(3) The AS/SVE system was no longer removing mass (i.e., asymptotic condition was permanently reached) after system optimization. Modeling of the Hot Spot would also be required, indicating CHCs would reach the station boundary at or below MCLs to terminate operation of the VCT well system.

The DON would demonstrate the above conditions through collection of groundwater samples from the monitoring wells designated in the LTM plan. When the monitoring data indicated that any of the above conditions had been met, the DON could propose a temporary shutdown of the remediation system. Shutdown would be subject to U.S. EPA and ADEQ concurrence. The groundwater LTM program would continue for a period of up to 2 years. If it was demonstrated in this period that the representative groundwater concentrations of CHCs met the groundwater cleanup standards, the parties agreed that the system operation would be shut down permanently.

If, during temporary shutdown of the remediation system, monitoring wells upgradient from the base boundary indicated a rebound in VOC concentrations to above MCLs, operation of the remediation system would be restarted. The DON could then attempt to demonstrate through groundwater modeling that remaining groundwater contaminants would reach the station boundary at concentrations equal to or less than MCLs. Groundwater modeling results would be subject to U.S. EPA and ADEQ concurrence. If demonstrated, the DON could then propose permanent shutdown of the remediation system, subject to U.S. EPA and ADEQ concurrence. MNA of the Area 1 plume would be implemented to confirm VOCs were approaching MCLs. If MNA was not progressing adequately, the remediation system would be operated as needed.

If it was determined that criteria 1 and 2 could not be met, the DON would demonstrate that VOCs in groundwater had been removed to the extent technically and economically feasible as set forth in item 3, by analyzing the following:

(1) Whether the mass removal rate was approaching asymptotic levels after temporary shutdown periods and appropriate system optimization,

(2) The additional cost of continuing to operate the system at concentrations approaching asymptotic mass levels,

(3) Whether discontinuing the system would significantly prolong the time to attain the groundwater cleanup standard.

The criteria for closure at Areas 2, 3 and 6 included demonstration that MCLs had been met at the sites through at least two years of quarterly groundwater monitoring as specified in the LTM plan. If monitoring indicated that MCLs had not been met in accordance with these criteria, the groundwater monitoring would continue until MCLs were achieved. When monitoring indicated that VOC concentrations had decreased to MCLs, the LTM program would continue for a minimum of two additional years. If there was no significant rebound in VOC concentrations above MCLs, the DON could propose that the LTM program be terminated.

Discontinuation of the LTM as well as closure of the individual OU-1 areas (i.e., Areas 1, 2, 3 and 6) would require U.S. EPA and ADEQ concurrence. ICs for each area would also be maintained until the individual areas had met the closure criteria with concurrence by U.S. EPA and ADEQ. Following the closure of an individual area, the ICs for that area would no longer be required. Five-Year Reviews would also be required for all active areas undergoing remediation until cleanup standards (i.e., MCLs) have been achieved.

4.1.2 OU-1 Remedy Implementation. The following sections discuss the steps taken post-ROD to implement the remedies selected for OU-1 Area 1 (containment plus Hot Spot removal by AS/SVE) and Areas 2, 3 and 6 (ICs and MNA) at MCAS Yuma.

4.1.2.1 Area 1 Containment and Removal Systems. Implementation of the remedy for OU-1 began with the installation of the AS/SVE system in the Building 230 area of OU-1 Area 1 in June 1999. The AS/SVE system combined two technologies: an air sparge (AS) system and a soil vapor extraction (SVE) system. The AS system was composed of 46 AS wells, configured in five banks (i.e., Rows 29, 39, 49, 59, and 70; shown in Figure 4-1), designed to inject air into the phreatic (or saturated) zone to strip VOCs from groundwater. The SVE system was composed of 15 SVE wells designed to create a vacuum in the vadose (or unsaturated) zone, capture the sparge air and soil vapor, and remove the stripped contaminants from the subsurface. The contaminated vapor stream would then be treated above ground using a GAC system prior to discharge to the atmosphere.

A blower rated at 400 cubic feet per minute (cfm) was installed to deliver the injection air to the AS wells, while the SVE system used a separate blower, rated at 500 cfm, to extract sparge air and soil vapors from the extraction wells. The injection and extraction blowers, the vapor treatment system, and associated equipment were contained in a treatment compound located west of Building 230. The operation of the AS/SVE system is described in detail in the Addendum to the Final Operation and Maintenance (O&M) Manual (Battelle, 2004c). The AS/SVE system began operation on November 16, 1999, which represents the triggering action of the five-year review process. A schematic diagram of the AS/SVE system is included in Appendix B1.

The VCT system consisted of four injection wells and four extraction wells located in the LEPA of OU-1 Area 1 (Figure 4-2). Submersible pumps in each extraction well were designed to extract groundwater at a flowrate of 30 to 40 gallons per minute (gpm). The extracted groundwater was pumped through various holding tanks and bag filters before being treated with GAC. The VCT GAC was designed to remove organic chemicals (e.g., 1,1-DCE, TCE, PCE, etc.) from the groundwater. After the water had passed through the GAC units, the treated water would be pumped back into the aquifer through the four injection wells, each at a flowrate of 40 gpm. The operation of the VCT system is described in detail in the Addendum to the Final O&M Manual (Battelle, 2004c). The VCT system began operation on June 16, 2000. A schematic diagram of the VCT system is included in Appendix B2.

4.1.2.2 OU-1 Long Term Monitoring Plan. The LTM plan was initiated in 1999 (OHM Remediation Services Corp., 1999b) and was finalized in June 2002 (BNI, 2002). The LTM plan formalized the list of monitoring wells that would be sampled on an annual, semi-annual, and quarterly basis; outlined the groundwater monitoring and sampling methods to be used; and established a schedule of reporting the monitoring results. One of the plan objectives was to select monitoring wells necessary to assess the status of the groundwater plumes. Many of the wells at MCAS Yuma were installed for site characterization and for RI and FS studies. Consequently, many wells have demonstrated non-detection and offer no meaningful information on plume status. The LTM plan evaluated the well layout and identified wells necessary to track contamination. The plan originally called for sampling in 31 wells on a quarterly basis and 63 wells on a semiannual basis. Most of the wells were clustered in the Building 230 area, where contamination levels were highest, and the LEPA area, where the possibility of off-station migration existed.

4.1.2.3 MCAS Yuma Master Plan. The MCAS Yuma Master Plan contains a detailed review of all physical conditions, resources, and tenant commands present at MCAS Yuma and the planned development of the station in the foreseeable future. The MCAS Yuma Master Plan was developed to support the MCAS Yuma mission and implement the station's strategic plan. In order to control the areas of potential risk from exposure to groundwater contamination at OU-1 Areas 1, 2, 3 and 6 and ensure that future land use would not result in unacceptable levels of risk to human health or the environment, the necessary restrictions were presented in a revision to the MCAS Yuma Master Plan. The MCAS Yuma Master Plan was revised in September 2001 (KTUA, 2001) and again in November 2007 (KTUA, 2007) to contain the ICs for OU-1 as identified in the Final OU-1 ROD (SWDIV, 2000). Figure 3-3 (based on Figure 5-16 of the updated MCAS Yuma Master Plan [KTUA, 2007]) shows the locations of the OU-1

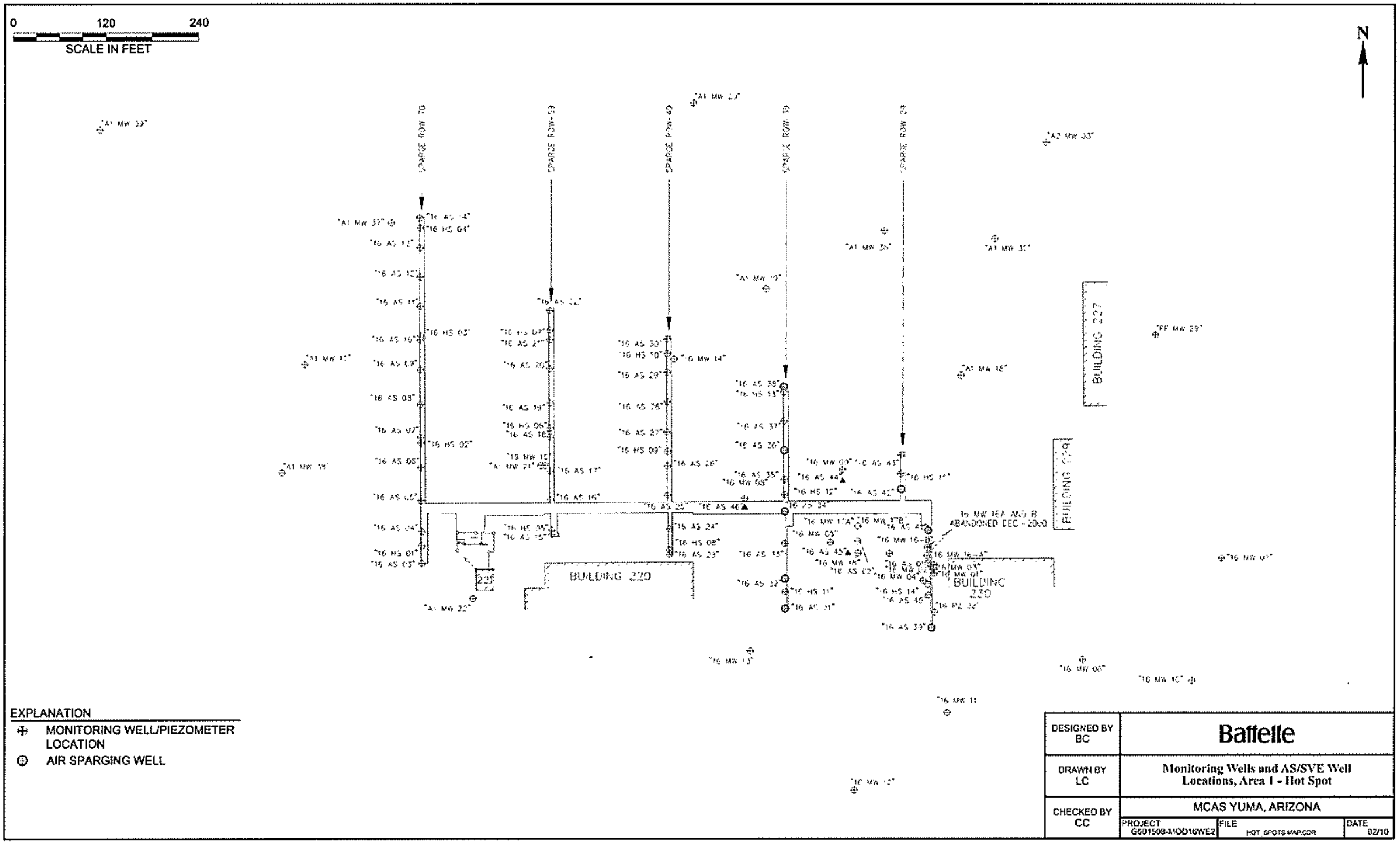

Figure 4-1. OU-1 Area 1 Hot Spot Monitoring Well and AS Well Map

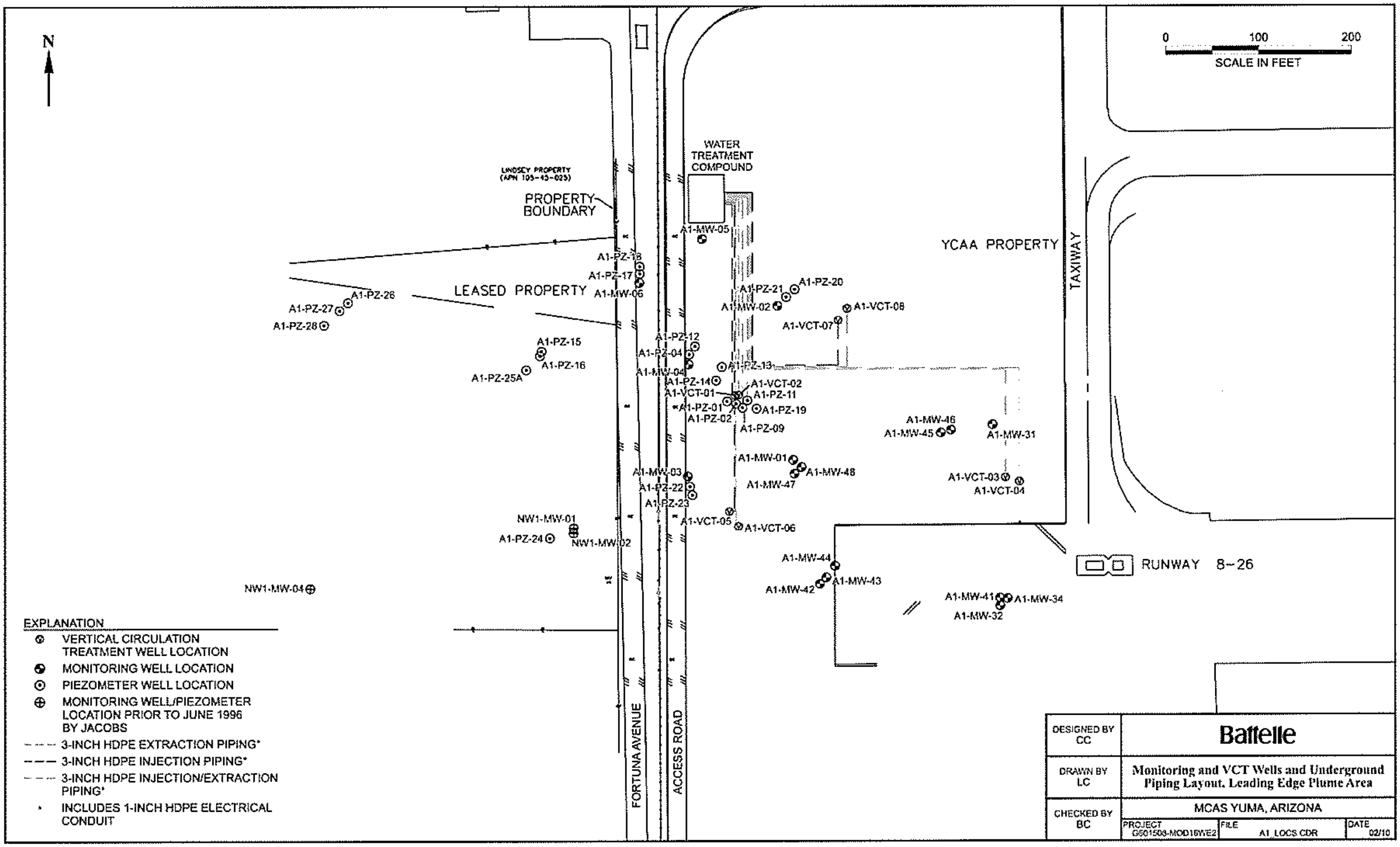

Figure 4-2. OU-1 Area 1 LEPA Monitoring Well and VCT Well Map

areas and the boundaries of the required ICs.

4.1.2.4 ***Land Use Control Implementation Plan.*** The Final LUCIP was issued in September 2002 (SWDIV, 2002a) and addressed all DON, U.S. EPA, and ADEQ comments on the Draft (Revision 1) LUCIP that was issued on December 20, 2001 (Appendix B3). MCAS Yuma Station Order 5090 was issued on January 10, 2002, informing station tenants of the land use restrictions for OU-1 and implementing the other LUCs provided in the Draft LUCIP (Appendix B4). The Draft (Revision 1) LUCIP was originally issued as an addendum to the Master Plan to provide steps for implementation and monitoring of ICs at OU-1 and other station areas. Figure 3-3, based on Figure 2-1 of the Final LUCIP (SWDIV, 2002a), shows the locations of the OU-1 areas and the boundaries of the required ICs.

As stated in the ROD (SWDIV, 2000), LUCs were applied to OU-1 as follows:

- LUCs implemented at OU-1 are to remain throughout the duration of the remedial actions to restrict the use of contaminated groundwater.
- LUCs are not required for soil excavation for utility trenches or building construction.
- MCAS Yuma tenants and assigned organizations will comply with all of the LUCs in force at MCAS Yuma.
- MCAS Yuma tenants and assigned organizations will not use contaminated groundwater underlying the designated plume areas for any purpose including but not limited to: drinking water, irrigation, fire control, dust control, or any other activity.
- MCAS Yuma tenants and assigned organizations will not damage or interfere in any way with groundwater monitoring wells, remedial treatment systems, and/or sampling efforts. Access to monitoring wells, remedial treatment systems, and sampling efforts will be permitted to regulatory agency personnel and individuals specifically contracted by the DON and the MCAS Yuma Environmental Department to perform activities related specifically to the use and maintenance of such wells, systems, and sampling efforts. Access to monitoring wells, remedial treatment systems, and sampling efforts will not be permitted to other MCAS personnel unless specifically authorized by the MCAS Yuma Environmental Department. Access will be required for equipment, including trucks, small loaders, and drill rigs. Alteration or destruction of monitoring wells or remedial treatment systems will require approval from the MCAS Yuma Environmental Department, U.S. EPA, and ADEQ.
- Within 5 working days of discovery, MCAS Yuma tenants and assigned organizations will provide the MCAS Yuma Environmental Department with written notice of failure to comply with the LUCs.
- No later than December 31 of each year, MCAS Yuma tenants and assigned organizations will provide a written report to the MCAS Yuma Environmental Department describing compliance with prohibition of the use of groundwater underlying designated plume areas. A Station Order has been developed to ensure tenant commands comply with LUCs and the Station Order will define requirements for reporting to the MCAS Yuma Environmental Department. In addition, the Station Order will establish authority to enforce by the MCAS Yuma Commanding Officer.

Along with the LUC components bulleted above, OU-1 areas are surrounded by fencing which effectively limit access to the areas.

4.1.3 OU-1 System Operations & Maintenance. This section discusses the O&M activities associated with the remedial systems and the LTM program for OU-1.

4.1.3.1 Area 1 AS/SVE System O&M. The AS/SVE system began operation on November 16, 1999 and operated relatively continuously, except for maintenance and monitoring interruptions, until May 9, 2007, when the system was placed on temporary shutdown, with U.S. EPA concurrence. Before November 2002, the system was operated in a phased approach, whereby the sparged air was alternately directed into the different sparge rows of the well field. Typically, Rows 29, 39, and 59 (see Figure 4-1) were operated together, and Rows 49 and 70 were operated together for alternating 1-month periods. This injection pattern was used to increase the effectiveness of the system by allowing reestablishment of the natural groundwater gradient at the rows that were not operating, thus allowing groundwater to move through the well field. During the time period between November 2002 and temporary system shutdown in May 2007, air injection was focused on the eastern portion of the site, where elevated contaminant concentrations were persistent. This air injection was through Rows 29, 39, and 49 in an attempt to enhance VOC removal in the area. Soil vapor samples were periodically collected and analyzed by U.S. EPA method TO-14 prior to the GAC treatment to monitor system performance, demonstrate air emission compliance, and calculate the cumulative VOC mass removed.

On August 16, 2006, the DON submitted a letter to U.S. EPA and ADEQ, proposing temporary shutdown of the AS/SVE system of Area 1. The request was supported by a technical memorandum demonstrating that the AS/SVE system was no longer removing sufficient mass to justify the continued operation of the system. Further, the technical memorandum described how the temporary shutdown requirements of the ROD (SWDIV, 2000) had been satisfied. Concurrence for shutdown of the Area 1 AS/SVE system was received from U.S. EPA on January 8, 2007 (Appendix B5). The Navy submitted a second letter to ADEQ, with the U.S. EPA concurrence attached, stating that ADEQ concurrence with temporary shutdown of the AS/SVE system would be assumed unless ADEQ responded otherwise within 10 days. No response was received from ADEQ.

The AS/SVE system was placed in temporary shutdown on May 9, 2007 and currently remains in temporary shutdown status. Based on soil vapor sampling associated with the AS/SVE system, approximately 79 lb of COCs were removed from the subsurface between system startup and temporary shutdown. The total mass removal rate remained relatively consistent between January 2002 and temporary shutdown.

4.1.3.2 Area 1 VCT System O&M. The VCT system began operation on June 16, 2000 and operated relatively continuously except for routine maintenance and monitoring, such as replacement of filters and pumps. In September 2002, it was noted that injection well VCT-01 and extraction well VCT-06 were not operational due to a collapsed well casing and a faulty pump, respectively (see Figure 4-2). Consequently, the system was operated in three injection wells and three extraction wells from September 2002 to May 2003. Process water samples, both influent and effluent, were collected during VCT system operation. MCLs were never exceeded in the effluent samples.

On February 24, 2003, the DON submitted a letter to U.S. EPA and ADEQ, proposing the temporary shutdown of the VCT system at the LEPA of Area 1. The request was supported by a technical memorandum describing how temporary shutdown requirements of the ROD had been satisfied for the VCT system at the LEPA. Concurrence for the temporary shutdown of the VCT system was received from U.S. EPA on April 24, 2003, and from ADEQ on April 25, 2003 (Appendix B6). The VCT was placed in temporary shutdown on May 6, 2003, following concurrence by U.S. EPA and ADEQ.

The analytical results from the influent and effluent water samples were used to calculate VOC mass removal by the VCT system. In May 2003 (when the system was placed in temporary shutdown), an estimated 10.7 lb of total mass had been removed from the 136,591,146 gallons of extracted groundwater since system startup. Recent activities associated with the Area 1 VCT system are provided in Section 5.1.3.

On September 6, 2005, the DON submitted a letter to U.S. EPA, proposing permanent shutdown of the VCT system of Area 1. The request was supported by a technical memorandum demonstrating that the COCs in groundwater in the vicinity of the VCT system had remained at or below MCLs for a period greater than 2 years. Groundwater modeling had also demonstrated that remaining CHC concentrations would not migrate off-station above the MCLs. The letter described how the permanent shutdown requirements of the ROD (SWDIV, 2000) had been satisfied. Concurrence for shutdown of the Area 1 VCT system was received from U.S. EPA on December 1, 2005 (Appendix B7). The VCT system was permanently shutdown in December 2005 and currently remains in the permanent shutdown status.

4.1.3.3 Area 1 Groundwater Monitoring. Groundwater monitoring has been performed in Area 1 since remedial actions began. The LTM program has maintained quarterly monitoring events whereby select wells have been monitored for standard water quality parameters and MNA parameters. During the monitoring events, groundwater samples have been collected for laboratory analysis of VOC concentration using U.S. EPA method 8260. The sampling results have been described in quarterly progress and groundwater reports since system startup in 1999.

OHM Remediation Services Corp. initially installed and operated the remedial systems of Area 1 in 1999 and provided groundwater monitoring through September 2000. GEOFON, Inc. was responsible for OU-1 environmental activities from October 2000 to September 2001. Terra Vac assumed responsibility for OU-1 environmental activities from October 2001 to September 2002. Battelle was contracted to perform environmental activities from October 2002 through September 2009. Most recently, Trevet, Inc. has been contracted for the continued groundwater monitoring program beginning in December 2009. The quarterly, semiannual and annual reports are reviewed by the MCAS Yuma Environmental Department and regulators. If any significant changes in plume status are detected, additional wells may be sampled.

Historical and current concentrations of 1,1-DCE, TCE, and PCE in the Hot Spot and LEPA areas of OU-1 Area 1 are shown in Figures 4-3 and 4-4, respectively, while Figure 4-5 shows the current (June 2009) sampling results for the COCs at wells throughout Area 1. Concentrations exceeding the MCL for each COC on the historical and current maps are highlighted in yellow. Figure 4-6 presents a contour map of 1,1-DCE concentrations at Area 1, with a time-series of contours based on semi-annual sampling event results from June 2003, 2005, 2007, and 2009. Similar time-series contours of TCE concentrations are presented in Figure 4-7. Contour maps were not prepared for PCE due to the consistent, below-MCL concentrations observed throughout the five-year review period. Recent activities associated with the Area 1 LTM plan, including the current groundwater sampling schedule, are provided in Section 5.1.3.

4.1.3.4 Area 1 Groundwater Modeling. Groundwater fate and transport modeling was updated for the Area 1 plume to evaluate the effects of the VCT and AS/SVE remediation systems on the behavior of the plumes (BNI, 2002; Battelle, 2004a). An eight-layer flow model that simulated the geologic and hydrologic conditions at the site was prepared. Natural attenuation processes were included in the model using site-specific monitoring and sampling data. In general, the models confirmed historical monitoring results showing that the plumes are slow-moving and are decreasing in size and magnitude. Predictive simulations demonstrated that the plumes would not migrate offsite at concentrations greater than MCLs (Battelle, 2004a).

4.1.3.5 Area 2 Groundwater Monitoring. The Area 2 plume consisted of an isolated zone of mainly 1,1-DCE in the groundwater at low concentrations near the MCL. MNA was selected as the remedy for the Area 2 plume. The LTM program (BNI, 2002) originally monitored 12 wells at the site to evaluate contaminant concentrations and identify and monitor other chemical indicators associated with MNA. Monitoring was performed on a quarterly basis from March 1998 to March 2006, under various contractors (see Area 1 Groundwater Monitoring above). In addition to the MNA activities, a small temporary AS/SVE system was installed in the Area 2 plume in September 2000, but was deemed unnecessary due to the low CHC concentrations.

On March 12, 2006, the DON submitted a letter to U.S. EPA and ADEQ, proposing site closure and an end of LTM at Area 2. The request was supported by a technical memorandum describing how the closure requirements of the ROD had been satisfied at Area 2. Verbal concurrence for closure of Area 2 was received from U.S. EPA on March 30, 2006, followed by a letter dated May 23, 2006 (Appendix B8). The Navy submitted a second letter to ADEQ, with the U.S. EPA concurrence attached, stating that ADEQ concurrence with closure of Area 2 would be assumed unless ADEQ responded otherwise within 10 days. No response was received from ADEQ.

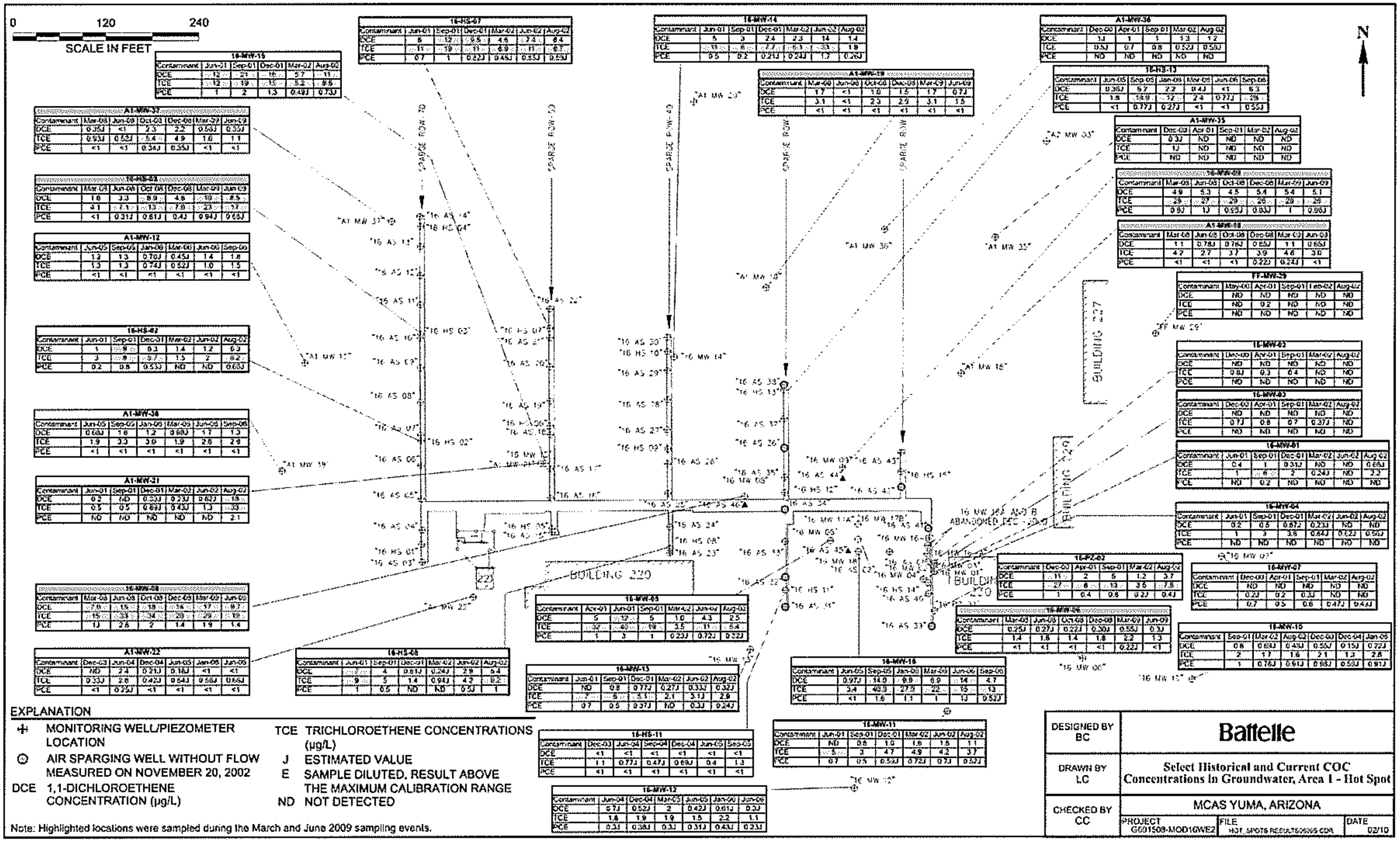

Figure 4-3. Historical Concentrations of 1,1-DCE, TCE, and PCE in the OU-1 Area 1 Hot Spot

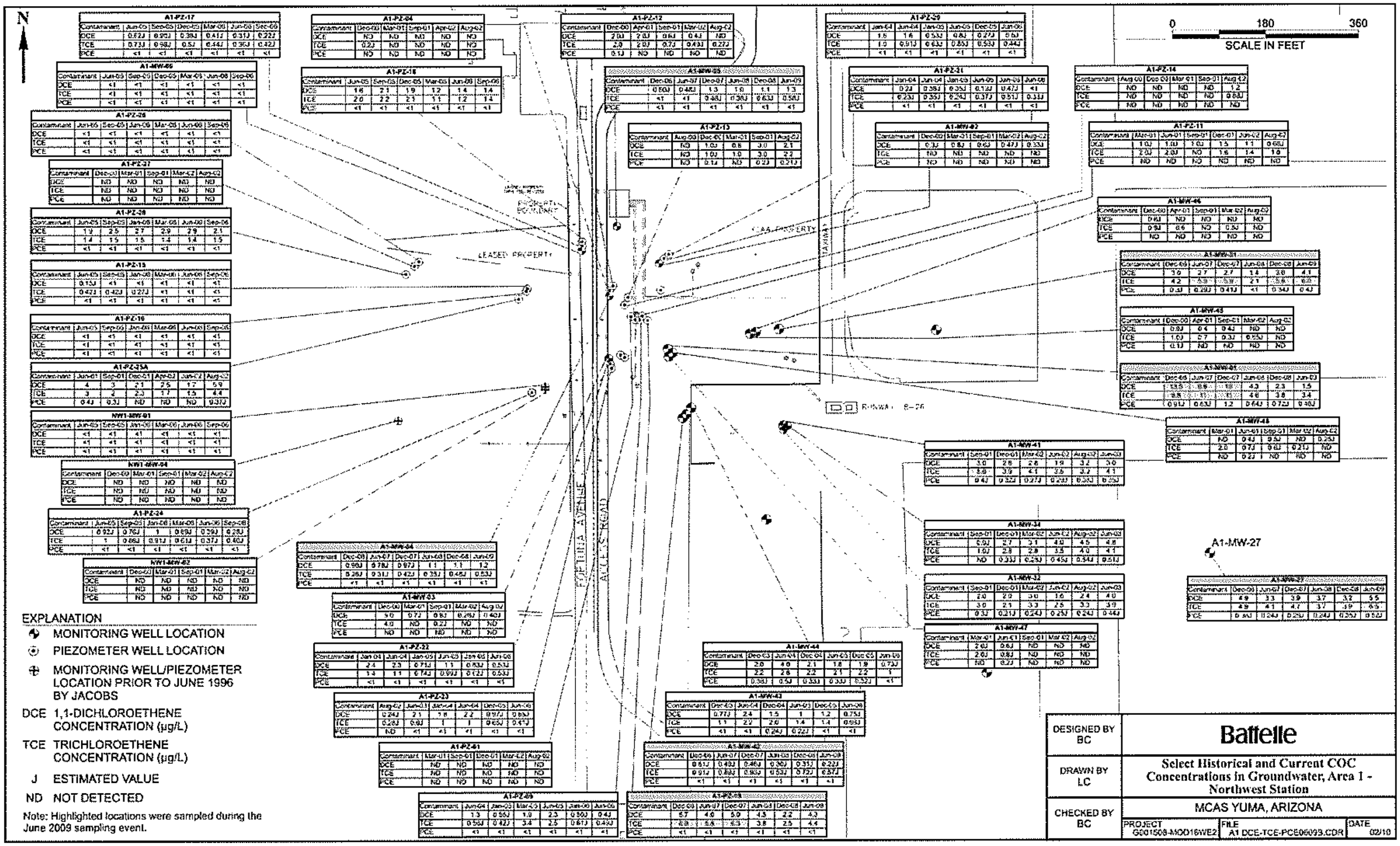

Figure 4-4. Historical Concentrations of 1,1-DCE, TCE and PCE in the OU-1 Area 1 LEPA

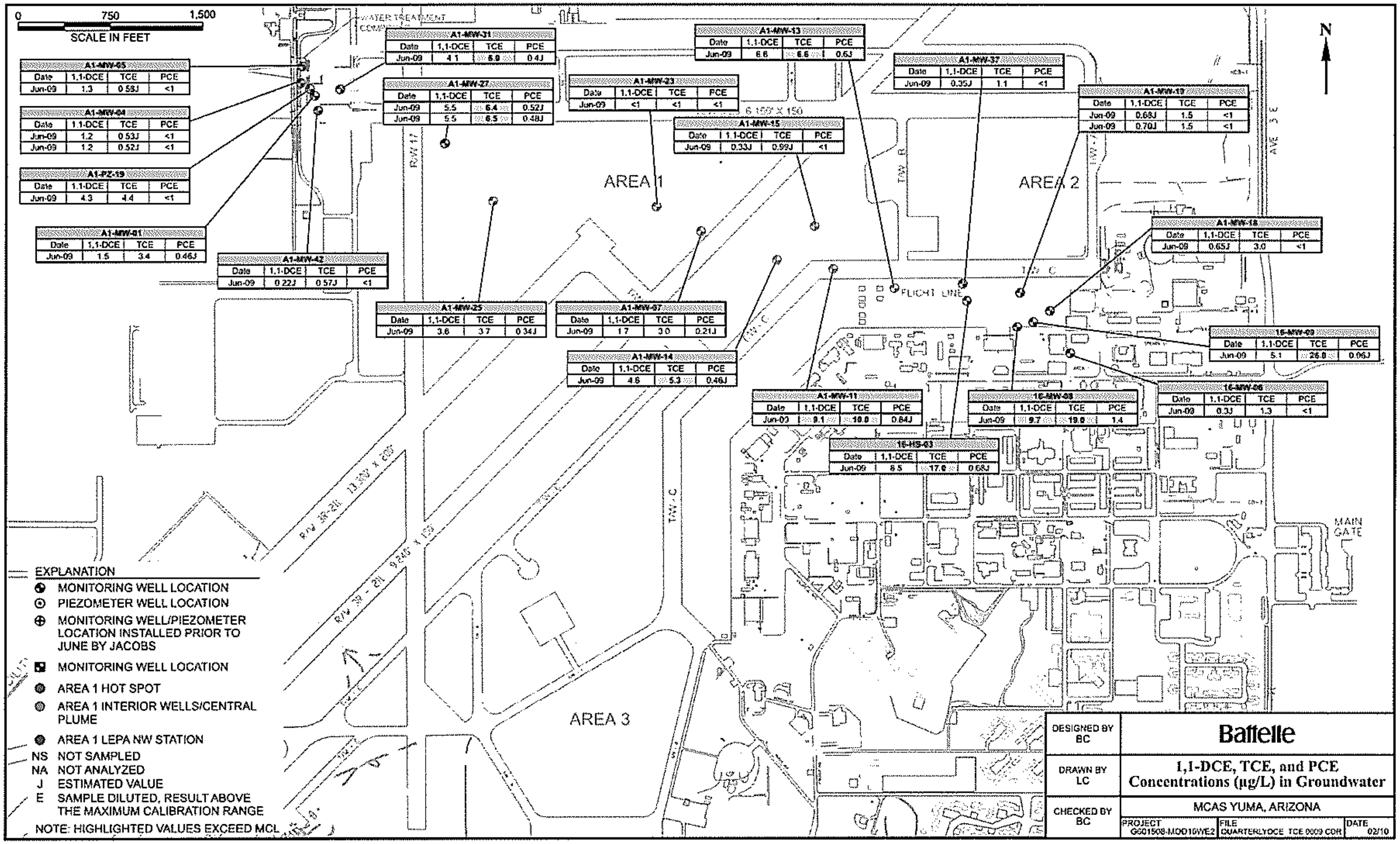

Figure 4-5. Current Concentrations of 1,1-DCE, TCE and PCE in OU-1 Area 1

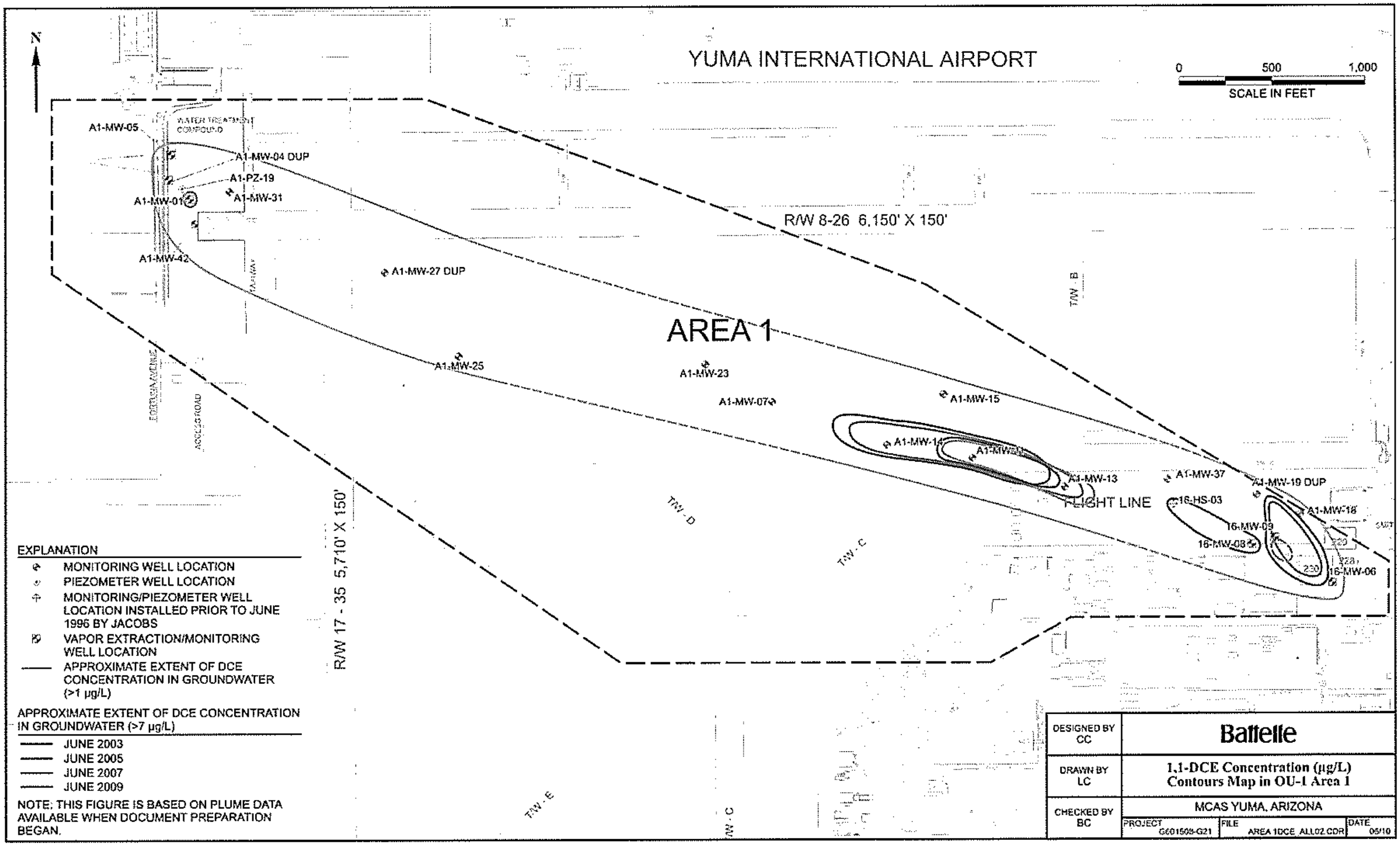

Figure 4-6. Current and Historical Contour Map of 1,1-DCE Concentrations in OU-1 Area 1

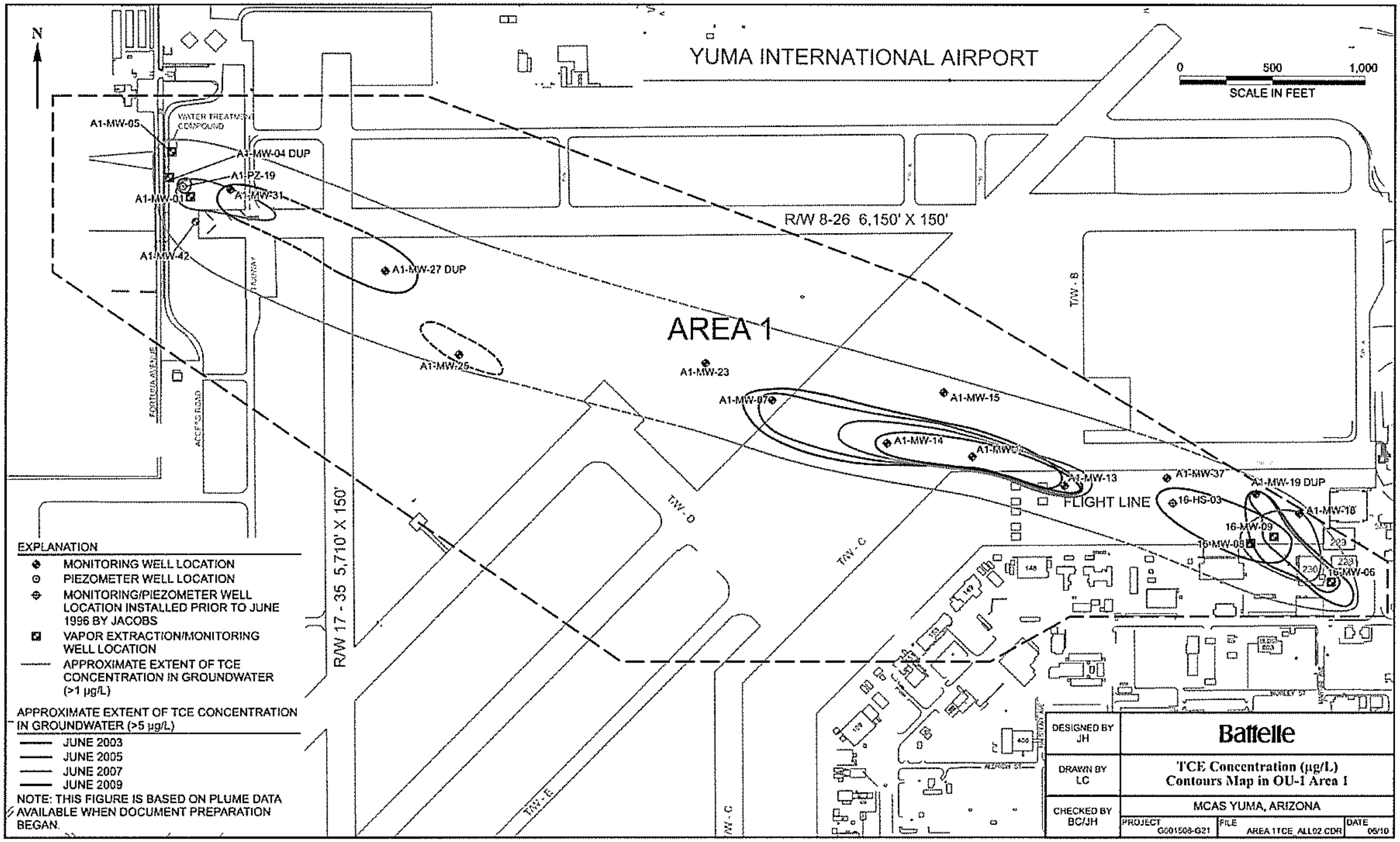

Figure 4-7. Current and Historical Contour Map of TCE Concentrations in OU-1 Area 1

Following the concurrence from U.S. EPA, Area 2 was considered closed with NFA required. All Area 2 wells were decommissioned between August 2, 2006 and August 11, 2006 as outlined in the *Well Abandonment Report for Wells at Area 2, Area 3 and Subarea 5A, Marine Corps Air Station Yuma, AZ* submitted on 20 November 2006 (Battelle, 2006b).

4.1.3.6 Area 3 Groundwater Monitoring. The Area 3 plume consisted of TCE and 1,1-DCE in groundwater at low concentrations near MCLs. MNA was selected as the remedy for the Area 3 plume. The LTM program (BNI, 2002) originally monitored 10 wells at the site to evaluate contaminant concentrations and identify and monitor other chemical indicators associated with MNA. Monitoring was performed on a quarterly basis from March 1998 to December 2005, under various contractors (see Area 1 Groundwater Monitoring above). In addition to the MNA activities, a small temporary AS/SVE system was installed in the Area 3 plume in September 2000, but was deemed unnecessary due to the low CHC concentrations.

Following the identification of free product in Area 3 monitoring well A3-MW-07 in December 2001, the DON developed a two-phased approach for investigation of the free product in a Technical Memorandum submitted to the ADEQ and U.S. EPA on January 6, 2004. The first phase of the investigation was completed in 2004 and included document review, free product sampling and analysis, a free product removal action, and post-removal monitoring. The findings of the first phase of the investigation were documented in the *Report for Investigation of the Presence of Free Product, Monitoring Well A3-MW-07, Marine Corps Air Station (MCAS) Yuma, AZ* (Battelle, 2004d). The information gathered during the first phase of the investigation indicated that further investigation was necessary, and the report recommended that the second phase of the investigation (as described in the Technical Memorandum of January 2004) should be implemented.

A work plan was finalized in February 2005 (Battelle, 2005a) and described the actions to be performed under the second phase of the investigation in greater detail than was originally provided in the Technical Memorandum and the Phase I report. The objectives of the second phase of the investigation were to further delineate the contamination and determine the source of free product found within well A3-MW-07 by: performing a down-well video survey of the well; conducting a geophysical survey to identify any undiscovered drums, tanks or pipelines; collecting vadose zone soil and shallow groundwater samples from 15 locations near the well; and analyze soil and groundwater samples for VOC and TPH concentrations.

The results of the second-phase investigation at MCAS Yuma Area 3 adequately delineated the subsurface contamination and determined the source of free product found within well A3-MW-07. Because no set MCLs were exceeded in the groundwater, the contamination was found at three to four orders of magnitude greater within the soil than the water, and the contamination reached the water table mainly through a conduit created by A3-MW-07; therefore, it was recommended that well A3-MW-07 be abandoned to prevent further contamination from migration through the slotted screened interval and into the groundwater. It was indicated that following the conduit removal, the contamination would be isolated from the water table by a 1 to 4 ft layer of impermeable clay. Further, it was found that, pending the abandonment of A3-MW-07, the results from the investigation warranted the recommendation for site closure for Area 3 at MCAS Yuma. The findings of the second phase of the investigation were documented in the *Final Second Phase Investigation of the Presence of Free Product, Monitoring Well A3-MW-07, Marine Corps Air Station (MCAS) Yuma, AZ* (Battelle, 2005c).

On December 14, 2005, the DON submitted a letter to U.S. EPA and ADEQ, proposing site closure and an end of LTM at Area 3. The request was supported by a technical memorandum describing how the closure requirements of the ROD had been satisfied at Area 3. The U.S. EPA concurred with site closure in a letter dated February 9, 2006 (Appendix B9). The Navy submitted a second letter to ADEQ on February 15, 2006, with U.S. EPA concurrence attached, stating that ADEQ concurrence with closure of Area 3 would be assumed unless ADEQ responded otherwise within 10 days. No response was received from ADEQ.

Following the concurrence from U.S. EPA, Area 3 was considered closed with NFA required. All Area 3 wells were decommissioned between October 3, 2006 and October 6, 2006 as outlined in the *Well Abandonment Report for Wells at Area 2, Area 3 and Subarea 5A, Marine Corps Air Station Yuma, AZ* (Battelle, 2006b).

4.1.3.7 Area 6 Groundwater Monitoring. The Area 6 plume contamination consisted primarily of PCE in groundwater at low concentrations near MCLs. MNA was selected as the remedy for the Area 6 plume. The LTM program (BNI, 2002) originally monitored five wells at the site to evaluate contaminant concentrations and identify and monitor other chemical indicators associated with MNA. Monitoring was performed on a quarterly basis from March 1998 to October 2003, under various contractors (see Area 1 Groundwater Monitoring above).

On September 3, 2003, the DON submitted a letter to U.S. EPA and ADEQ, proposing site closure and an end of LTM at Area 6. The request was supported by a technical memorandum describing how the closure requirements of the ROD had been satisfied at Area 6. A concurrence letter from ADEQ (Appendix B10), dated October 21, 2003, agreed with closing the site and ending LTM in Area 6. The U.S. EPA also agreed with site closure in a memo dated November 20, 2003 (Appendix B10). The DON awarded a contract for the abandonment of the Area 6 monitoring wells to Battelle on March 23, 2004. Recent activities associated with Area 6 are provided in Section 5.1.3.2.

4.1.3.8 Annual System Operations/O&M Costs. Table 4-1 provides the annual system O&M costs for the previous five-years. The total cost values for each time period reflect costs for O&M of the AS/SVE and VCT systems, groundwater monitoring, and preparation of the quarterly progress and groundwater monitoring reports. Costs for work performed beyond these parameters (including well decommissioning activities) are not included in Table 4-1. The decrease in annual costs after 2007 is due to the shutdown of the AS/SVE system in May 2007 and the subsequent end of full-time, on-site staffing.

Table 4-2. Annual System Operation and Maintenance Costs

Dates		Total Annual Costs[1]
From	To	
July 2004	June 2005	$350,000
July 2005	June 2006	$355,000
July 2006	September 2007	$368,000
October 2007	September 2008	$203,000
October 2008	September 2009	$201,000

[1] Total costs are rounded to the nearest $1,000.

4.2 Remedial Actions for Operable Unit 2

This section discusses the remedy selection, the remedy implementation, and the remedy performance for OU-2 and identifies any changes to or problems with the components of the remedy.

4.2.1 OU-2 Remedy Selection. This section describes the purpose for remediation, the remedial alternatives developed and evaluated in the OU-2 FS (Uribe & Associates, 1996b) against the nine CERCLA evaluation criteria for remedial alternatives, and the remedy selected in the ROD (Uribe & Associates, 1997b).

4.2.1.1 OU-2 Remedial Action Objective. The RAO for OU-2 CAOCs 1, 8A and 10 is to minimize the potential for unacceptable human-health risk that could result from a change in land use (Uribe & Associates, 1996b). The RAO was determined as a final result of the human-health risk assessments conducted for each site in the RI (JEG, 1996a) and FS (Uribe & Associates, 1996b). The results indicated that potentially unacceptable cancer risk levels could result from residential land use and unrestricted exposure to surface and shallow subsurface soil at the three sites. However, the cancer risk for the current and anticipated future land use scenario, as areas of industrial land use, was estimated to be within the U.S. EPA acceptable range.

4.2.1.2 OU-2 Applicable or Relevant and Appropriate Requirements. Arizona's Soil Remediation Standards are identified in the OU-2 ROD as relevant and appropriate chemical-specific requirements for the remediation of soil at CAOCs 1, 8A and 10. These rules are relevant and appropriate, but not applicable because the remedial action is being conducted under federal law (e.g., CERCLA) and not as one of the state of Arizona's regulatory programs. For more information, see the OU-2 ROD (Uribe & Associates, 1997b) and the rules as summarized in ARS Title 49, §§ 151 and 152, and the AAC Title 18, Chapter 7, Article 2, Soil Remediation Standards (§§ R18-7-201 through R18-7-209). These rules allow for soil remediation to one of three standards as follows:

- Remediation to background levels;
- Remediation to health-based guidance levels (HBGLs) presented in Appendix A Soil Remediation Levels (SRLs) of AAC Title 18, Chapter 7, Article 2; or

- Remediation to levels derived from a site-specific risk assessment.

In addition, at sites where soil remediation does not meet residential standards or background levels, but rather industrial or site-specific standards, the rules previously required the submittal of a VEMUR. However, in July of 2000, subsequent to the signing of the OU-2 ROD, Arizona's Soil Remediation Standards were amended. The amended rules eliminated the VEMUR and replaced it with a DEUR as the appropriate document for recording a property's environmental land use restrictions with the state of Arizona (see Arizona Laws 2000, Chapter 225 amending ARS § 49-152 [Title 49, Chapter 1, Article 4]). Because soils at CAOCs 1, 8A and 10 meet industrial, but not residential cleanup standards, and because these state rules were determined to be relevant and appropriate in the OU-2 ROD, the DON has proposed "modified DEURs" for CAOCs 1, 8A and 10 in the Final LUCIP to fulfill the substantive requirements of ARS § 49-152. Table 4-2 identifies the HBGLs for ingestion of soil contaminants for COPCs at CAOC 1, 8A and 10 as presented in Appendix A (SRLs) to AAC Title 18, Chapter 7, Article 2 (updated June 1995).

Table 4-3. Health Based Guidance Levels (HBGLs) for Ingestion of COPCs in Soil at OU-2 CAOC 1, 8A and 10

OU-2 COPC	Cancer Group	Residential Oral HBGL (mg/kg)	Non-Residential Oral HBGL (mg/kg)
Acenaphthene	ND	7,000.0	24,500.0
Acenaphthylene (PAH)	D	7,000.0	24,500.0
Anthracene (PAH)	D	35,000.0	122,500.0
Benz[a]anthracene (PAH)	B2	1.1	4.6
Benzo[a]pyrene (PAH) (BaP)	B2	0.19	0.80
Benzo[b]fluoranthene (PAH)	B2	1.1	4.6
Benzo[k]fluoranthene (PAH)	B2	1.1	4.6
Chrysene (PAH)	B2	110.0	462.0
Dibenz[a,h]antracene (PAH)	B2	0.11	0.46
Fluoranthene (PAH)	D	4,700.0	16,450.0
Fluorene (PAH)	D	4,700.0	16,450.0
Indenopyrene (PAH)	B2	1.1	4.6
Naphthalene (PAH)	D	4,700.0	16,450.0
Polychlorinated biphenyls (PCBs)	B2	0.18	0.76
Polychlorinated biphenyls	ND	8.2	28.7
Pyrene (PAH)	D	3,500.0	12,250.0

Table derived from Table 2-8 of the OU-2 ROD (Uribe & Associates, 1997b).
Cancer groups are as follows:
B2 Probable human carcinogen
D Not classifiable as to human carcinogenicity
ND No data available

4.2.1.3 OU-2 Selected Remedy. Two remedial alternatives were developed and evaluated in the FS for OU-2 (Uribe & Associates, 1996b) to address the RAO for CAOCs 1, 8A, and 10: no action and ICs. The no action alternative presented an acceptable risk to human health as long as the current land use remained industrial; however, without controls in place to prevent unrestricted use, future land use could lead to unacceptable levels of human-health risk. Taking public comment on the OU-2 Proposed Plan into consideration, the ROD proposed ICs as the preferred remedy for the three OU-2 CAOCs.

The selected remedy as defined in the ROD consisted of ICs restricting land use of CAOC 1 and CAOC 10 to industrial/commercial use and CAOC 8A to the current use and prevent any activities that may disrupt and expose the landfill interior. The ICs would be implemented through the MCAS Yuma Master Plan (former Base Master Plan), which will reference the OU-2 ROD. The ICs identified in the ROD are as follows:

- Restrict land use at CAOCs 1 and 10 to industrial/commercial use.
- Restrict land use at CAOC 8A to current use and prevent any activities that may disrupt and expose the landfill interior.
- Provide a legal description of site boundaries and a site map for each site.
- Execute and record a VEMUR with the state of Arizona for each site.
  - The VEMUR would contain language clarifying that it was executed and recorded by the federal government "for itself only, and not as a covenant running with the land". In addition, it would clarify that:
    a. No interest in real property on behalf of the state of Arizona is created by the VEMUR or by any notice of cancellation of the VEMUR pursuant to ARS § 49-152, and
    b. The signature of an authorized representative of the ADEQ on the document acknowledges that the remediation of the property was conducted in accordance with the provisions of ARS § 49-152.
- Any future activities planned for the area must be coordinated with and reviewed by the MCAS Yuma Environmental Department, including official consultation with the DON, in consultation with U.S. EPA and ADEQ as necessary.

A change in land use from industrial to residential use would require reevaluation of the remedy for CAOCs 1 and 10. For CAOC 8A, a change in land use that would involve activities that may lead to disruption of the site surface and exposure of the landfill contents would require the reevaluation of the remedy for compatibility with the desired activity. The remedy could be changed pursuant to CERCLA §§ 120 and 121 and NCP § 300.430(f)(4)(iii), and further investigation could be undertaken to determine if remediation is required and if the ROD must be amended.

If the DON intended to excess the property to a nonfederal entity, it must notify the ADEQ and U.S. EPA in advance of the execution of any transfer. The DON would again consult with the ADEQ and U.S. EPA in revisiting the existing land use classification and restrictions for the CAOCs involved to determine if the foreseeable future land use would differ from the assumptions made at the time the original remediation action decision was made. A reevaluation of the ICs would be performed if necessary at that time.

4.2.2 OU-2 Remedy Implementation. The ROD for OU-2 identified ICs for CAOCs 1, 8A and 10. The following subsections discuss the steps taken post-ROD to implement ICs for CAOCs 1, 8A and 10 at MCAS Yuma.

4.2.2.1 OU-2 Remedial Action Report. The Final Remedial Action Report for OU-2 (GEOFON, 1999) included an information summary and ICs for CAOCs 1, 8A and 10 in a recommended addendum to the MCAS Yuma Base Master Plan. A VEMUR application package containing a summary of pertinent site conditions and legal description of the site boundaries was included as a part of the addendum. A land survey of CAOCs 1, 8A and 10 was used to produce the legal descriptions and site maps (Don Peterson Engineers, 1999).

4.2.2.2 MCAS Yuma Master Plan. The MCAS Yuma Master Plan contains a detailed review of all physical conditions, resources, and tenant commands present at MCAS Yuma and the planned development of the station in the foreseeable future. The MCAS Yuma Master Plan was developed to support the MCAS Yuma mission and implement the station's strategic plan. In order to control the areas of potential risk from exposure to soil contamination at OU-2 CAOCs 1, 8A and 10 and ensure that future land use would not result in unacceptable levels of risk to human health or the environment, the necessary restrictions were presented in a revision to the MCAS Yuma Master Plan. The MCAS Yuma Master Plan was revised in September 2001 (KTUA, 2001) and again in November 2007 (KTUA, 2007) to contain the ICs for OU-2 as identified in the ROD and specified in the Master Plan addendum provided in the Final Remedial Action Report for OU-2 (GEOFON, 1999). Figures 5-17 and 5-18 of the updated MCAS Yuma Master Plan (KTUA, 2007) provide the locations of the OU-2 site areas for which ICs would apply and what the controls are.

The MCAS Yuma Master Plan does not include a map of CAOC 8A showing the locations of the former disposal areas, as recommended in the ROD, or a map of the locations of PAHs in soil reported for CAOC 10. However, the site boundaries given for CAOCs 8A and 10 (as CAOCs 10A and 10B) in the Master Plan, for which the listed ICs apply, do incorporate corresponding areas of significance for both sites. Figure 3-4 shows the boundaries of the three CAOCs for which ICs are implemented as they appear in both the revised MCAS Yuma Master Plan (KTUA, 2007) and the Final LUCIP (SWDIV, 2002a).

4.2.2.3 Land Use Control Implementation Plan. The Final LUCIP was issued in September 2002 (SWDIV, 2002a) and addressed all DON, U.S. EPA, and ADEQ comments on the Draft (Revision 1) LUCIP that was issued on December 20, 2001 (Appendix B3). MCAS Yuma Station Order 5090 was issued on January 10, 2002, informing station tenants of the land use restrictions for OU-2 and implementing the other LUCs provided in the Draft LUCIP (Appendix B4). The Draft (Revision 1) LUCIP was originally issued as an addendum to the Master Plan to provide steps for implementation and monitoring of ICs at OU-2 and other station areas. The document also contained complete VEMUR application packages for CAOCs 1, 8A and 10. The Draft LUCIP noted that recordation of a VEMUR had been achieved previously for the MCAS Yuma FFAAP Area of Concern (AOC) A.

The ICs for OU-2 were subsequently updated in the Final LUCIP to provide "modified DEURs" for CAOCs 1, 8A and 10 as follows (see Section 3 of the Final LUCIP; SWDIV, 2002a):

ICs will restrict the land use of CAOCs 1 and 10 to industrial/commercial use and CAOC 8A to its current use (inactive landfill/surface disposal area). ICs for these CAOCs may be recorded in DEURs in accordance with and substantially in the form set out in ARS § 49-152. ICs will also restrict the land use of FFAAP AOC A to industrial/commercial use. ICs for this AOC are recorded as a VEMUR in accordance with and substantially in the form set out in ARS § 49-152. The VEMUR for AOC A was in place prior to the revision of ARS § 49-152, wherein VEMURs were changed to DEURs. The VEMUR and DEURs (if recorded) each contain language clarifying that they were executed and recorded by the federal government "for itself only, and not as a covenant running with the land." In addition, they clarify the following:

a. The parties agree that no interest in real property on behalf of the state of Arizona either is created by this VEMUR or DEUR or by any notice of cancellation of this VEMUR or DEUR pursuant to ARS § 49-152.

b. Changes in activities or land use in these CAOCs or FFAAP AOC A will be coordinated through and reviewed by the MCAS Yuma Environmental Department. In the event that the Navy/Marine Corps plans any future changes in land use at CAOCs 1, 8A or 10 or at the FFAAP AOC A, the DON, in consultation with U.S. EPA and ADEQ, would reevaluate the ICs in light of the intended land use. If the change in land use is not compatible with the ICs, the ICs may be changed pursuant to CERCLA §§ 120 and 121 and the NCP § 300.430(f)(4)(iii), and the ROD for OU-2 may be amended. If the Navy/Marine Corps plans to excess the property to a nonfederal entity, it will notify ADEQ and U.S. EPA in advance of the execution of any such transfer. The Navy/Marine Corps will consult with ADEQ and U.S. EPA in revisiting existing land use classifications/restrictions for the CAOC or FFAAP AOC A (or, in the alternative, the remedial action selection) to determine whether the foreseeable future land use differs from the assumptions made at the time the original remedial action decision was made. At that time, the Navy/Marine Corps, in consultation with ADEQ and U.S. EPA, will undertake a reevaluation of the appropriate ICs and determine if engineering controls and/or other remedial action are necessary.

For CAOCs 1 and 10 and FFAAP AOC A, a change in land use from industrial to residential use would require a reevaluation of the ICs. For CAOC 8A, a change in land use involving any activities that may disrupt and expose the landfill interior would require a reevaluation of the ICs. At the time of these future activities, further investigation may be undertaken to determine whether remediation is required and whether the ROD must be amended.

In the event that OU-2 property is excessed, MCAS Yuma shall notify the transferee or lessee of the land use controls (LUCs) described in this section, and Naval Facilities Engineering Command (NAVFAC) Southwest shall include the restrictions, as shown in Figure 2-2 of the LUCIP, in the transfer or lease. Such notification will be provided at least 45 days in advance of the property transfer or lease conveyance. MCAS Yuma shall comply with § 120(h)(3) of CERCLA in any such transfers (LUCIP Appendix C; SWDIV, 2002a). Transfer or lease of real property out of federal control will follow guidance included in the DoD memorandum, Interim Policy on Land Use Controls Associated With Environmental Restoration Activities (DoD, 2000, as amended) (LUCIP Appendix D; SWDIV, 2002a).

Along with the LUC components listed above, OU-2 areas are surrounded by fencing which effectively limits access to the areas.

5.0 PROGRESS SINCE PREVIOUS FIVE-YEAR REVIEW

This section provides the protectiveness statements from the previous five-year review, any recommendations and follow-up actions identified in the previous five-year review, and the results of implemented actions taken towards resolving the issues including whether they achieved the intended effect. The following subsections identify the progress for OU-1 and OU-2 separately.

5.1 Progress for Operable Unit 1

The following provides the OU-1 protectiveness statement from the five-year review dated November 2004 (SWDIV, 2004), identifies the recommended follow-up actions, and summarizes the results of actions taken.

5.1.1 OU-1 Protectiveness Statement from the 2004 Five-Year Review. "The remedy at OU-1 is currently and will continue to be protective of human health and the environment because of the implementation of remedial measures and control of exposure pathways that may result in unacceptable risks. These methods are being applied as follows:"

(1) "Remediation systems were installed and operated in the Area 1 plume. A VCT system was operated in the LEPA from June 2000 to May 2003. The system has reduced CHC concentrations to near MCLs and contained any off-site migration of the plume in this area. An AS/SVE system was installed in the Building 230 area to remediate the groundwater in the most highly contaminated area of OU-1. The system has operated relatively continuously from November 1999 to present. The AS/SVE system has reduced the CHC Hot Spot in both size and magnitude such that the COCs will not migrate offsite at concentrations greater than MCLs."

(2) "MNA will be applied at all areas to demonstrate the reduction of contaminant concentrations through natural processes and ensure that the plumes are not migrating. Groundwater monitoring required for the MNA program will be implemented through the LTM plan for OU-1 at MCAS Yuma. Plumes will continue to be monitored until they decrease in concentrations below MCLs."

(3) "ICs are in place to restrict exposure to any contaminated groundwater at Areas 1, 2, and 3 through MCAS Yuma Station Order 5090 (issued on January 10, 2002). This order formally directs tenants and contractors to incorporate the LUCs provided in the MCAS Yuma Master Plan and the Final LUCIP into their existing land use planning and management programs."

"The MCAS Yuma Environmental Department will continue to review dig/building permits at Areas 1, 2, and 3" (SWDIV, 2004).

5.1.2 Previous Issues, Recommendations and Follow-up Actions for OU-1. Table 5-1 lists the issues that were identified for the OU-1 areas during the last five-year review (SWDIV, 2004). Table 5-2 summarizes the recommendations and follow-up actions as stated in the last five-year review (SWDIV, 2004).

Table 5-1. Issues Identified During the Previous Five-Year Review

Issues	Affects Current Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
A petroleum sheen was observed in well A3-MW-07 in Area 3. The contamination was first noticed on December 28, 2001 and confirmed in subsequent events. Analysis of the substance indicates that it is mostly diesel contamination that may be related to the materials used in the fire training area. There is no evident source to the contamination, and petroleum hydrocarbon chemicals are not present in surrounding wells. The sheen is isolated and not an immediate threat to human health due to institutional controls on groundwater.	No	No

Table 5-2. Recommendations and Follow-up Actions from the Previous Five-Year Review

Recommendations/Follow-Up Actions	Affects Current Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
Investigate the petroleum hydrocarbon contamination found at Area 3 to evaluate its potential impact on groundwater in Area 3. Continue the monitoring and remediation of the contamination if necessary.	No	No

5.1.3 Actions Taken at OU-1 Since the Previous Five-Year Review. The following subsections identify the actions taken across all of the areas of OU-1 during the past five years. The actions taken to address the recommendations given in Table 5-2 are provided below as well as other actions that have occurred at OU-1, which were not identified in the previous five-year review.

5.1.3.1 Summary of Actions Taken in Response to Previous Five-Year Review Recommendations. Table 5-3 provides a summary of the actions taken to address the recommendations provided in the previous five-year review (SWDIV, 2004).

Table 5-3. Summary of Actions Taken in Response to Previous Five-Year Review Recommendations

Recommendations/ Follow-Up Actions	Party Responsible	Milestone Date	Actions Taken and Outcome	Date of Action
Investigate the petroleum hydrocarbon contamination found at Area 3 to evaluate its potential impact on groundwater in Area 3. Continue the monitoring and remediation of the contamination if necessary.	DON	06-Jan-2004	First phase investigation	12-Nov-2004
			Second phase investigation	15-Nov-2005
			Area 3 closure	09-Feb-2006
			Area 3 Well Abandonment	20-Nov-2006

5.1.3.2 Area 1 Actions Taken

AS/SVE System
As stated in Section 4.1.3.1, the DON proposed temporary shutdown of the AS/SVE system of Area 1 in August 2006 and received concurrence from U.S. EPA and ADEQ (Appendix B5). The AS/SVE was placed in temporary shutdown on May 9, 2007 and currently remains in temporary shutdown status. Based on soil vapor sampling associated with the AS/SVE system, approximately 79 lb of COCs were removed from the subsurface between system startup(November 16, 1999) and temporary shutdown (May 9, 2007). The total mass removal rate remained relatively consistent between January 2002 and temporary shutdown.

VCT System
As stated in Section 4.1.3.2, following the temporary shutdown of the VCT system in May 2003, the DON proposed permanent shutdown of the VCT in September 2005 and received concurrence from U.S. EPA and ADEQ (Appendix B7). The VCT system was permanently shut down in December 2005 and currently remains in the permanent shutdown status. In May 2003, when the system was placed in temporary shutdown, an estimated 10.7 lb of total mass had been removed from the 136,591,146 gallons of extracted groundwater since system startup.

LTM
On July 25, 2006, the DON submitted a letter to U.S. EPA and ADEQ, proposing changes to the LTM plan for OU-1 groundwater contamination, of which only Area 1 monitoring wells remained applicable (see actions taken for Areas 2, 3 and 6 below). The request was supported by a technical memorandum proposing the reduction of sampling frequency and the reduction of the monitoring wells sampled. Concurrence for the changes to the LTM was received from U.S. EPA on January 8, 2007 (Appendix B11). The Navy submitted a second letter to ADEQ, with the U.S. EPA concurrence attached, stating that ADEQ concurrence with the proposed LTM changes would be assumed unless ADEQ responded otherwise within 10 days. No response was received from ADEQ.

Following U.S. EPA concurrence, the LTM plan was modified to sample groundwater on the schedule listed in Table 5-4. The revised groundwater-monitoring schedule was implemented during the annual monitoring event in December 2006. Currently, 21 wells are monitored on an annual, semi-annual, and quarterly basis. Thirty-seven monitoring wells were decommissioned in Area 1 between July and September 2007 as indicated in the *Draft Report for Abandonment of Monitoring Wells at Area 1, MCAS Yuma, AZ* (Battelle, 2007). The wells were decommissioned in accordance with Arizona Department of Water Resources substantive requirements after CHCs were demonstrated to be below their MCLs for the minimum required time of two years.

Table 5-4. Revised Groundwater Monitoring Schedule for MCAS Yuma

Subareas of OU-1 Area 1 Groundwater Contamination	Quarterly VOCs	Semi-Annual VOCs	Annual VOCs	Annual Natural Attenuation Parameters[1]
Area 1 "Hot Spot" Building 230 Area	A1-MW-18	A1-MW-18	A1-MW-18	A1-MW-18
	A1-MW-19	A1-MW-19	A1-MW-19	
	A1-MW-37	A1-MW-37	A1-MW-37	A1-MW-37
	16-MW-06	16-MW-06	16-MW-06	16-MW-06
	16-MW-08	16-MW-08	16-MW-08	16-MW-08
	16-MW-09	16-MW-09	16-MW-09	
	16-HS-03	16-HS-03	16-HS-03	16-HS-03
Area 1 Interior Wells Central Plume Area		A1-MW-07	A1-MW-07	A1-MW-07
		A1-MW-11	A1-MW-11	
		A1-MW-13	A1-MW-13	
		A1-MW-14	A1-MW-14	A1-MW-14
		A1-MW-15	A1-MW-15	
		A1-MW-23	A1-MW-23	
		A1-MW-25	A1-MW-25	
Area 1 "LEPA" Northwest Station Boundary Area		A1-PZ-19	A1-PZ-19	
		A1-MW-01	A1-MW-01	A1-MW-01
		A1-MW-04	A1-MW-04	
		A1-MW-05	A1-MW-05	
		A1-MW-27	A1-MW-27	A1-MW-27
		A1-MW-31	A1-MW-31	
		A1-MW-42	A1-MW-42	

Sampling schedule derived from LTM Technical Memorandum (Battelle, 2006a).
[1] Natural attenuation parameters: chloride, ferrous iron, sulfate, nitrate, pH, dissolved oxygen, redox potential.

5.1.3.3 Area 2 Actions Taken. As stated in Section 4.1.3.5, the DON proposed site closure and the end to LTM at Area 2 in March 2006 and received concurrence from U.S. EPA and ADEQ (Appendix B8). Following the concurrence, Area 2 was considered closed with NFA. All Area 2 wells were decommissioned in August 2006 as outlined in the *Well Abandonment Report for Wells at Area 2, Area 3 and Subarea 5A, Marine Corps Air Station Yuma, AZ* (Battelle, 2006b).

5.1.3.4 Area 3 Actions Taken. As stated in Section 4.1.3.6, following the identification of free product in Area 3 monitoring well A3-MW-07 in December 2001, the DON developed a two-phased approach for investigation of the free product in January 2004. The first phase of the investigation, completed in 2004 (Battelle, 2004d), indicated that further investigation was necessary and that the second phase of the investigation should be implemented.

The second-phase investigation (Battelle, 2005c) found that no MCLs were exceeded in the groundwater, but soil contamination was three to four orders of magnitude greater than the water. The second-phase investigation also determined that the contamination had reached the water table mainly through a conduit created by monitoring well A3-MW-07. It was recommended that well A3-MW-07 be abandoned to prevent further contamination from migration through the slotted screened interval and into the groundwater. In doing so, the contamination would be isolated from the water table by a 1 to 4 ft layer of impermeable clay. Further, it was found that, pending the abandonment of A3-MW-07, the results from the investigation warranted the recommendation for site closure for Area 3 at MCAS Yuma.

The DON proposed site closure and the end to LTM at Area 3 in December 2005 and received concurrence from U.S. EPA and ADEQ (Appendix B9). Following the concurrence, Area 3 was considered closed with NFA required. All Area 3 wells were decommissioned in October 2006 as outlined in the *Well Abandonment Report for Wells at Area 2, Area 3 and Subarea 5A, Marine Corps Air Station Yuma, AZ* (Battelle, 2006b).

5.1.3.5 Area 6 Actions Taken. As stated in Section 4.1.3.7, following concurrence from U.S. EPA and ADEQ, Area 6 was considered closed with NFA in November 2003 (Appendix B10). All Area 6 wells were decommissioned between March 24, 2005 and March 31, 2005 as outlined in the *Well Abandonment Report for Wells at Area 6 and Subarea 5A, Marine Corps Air Station Yuma, AZ* (Battelle, 2005b).

5.2 Progress for Operable Unit 2

This section provides the protectiveness statements from the previous five-year review, the status of recommendations and follow-up actions from the previous five-year review, and the results of implemented actions taken towards resolving the issues including whether they achieved the intended effect. The following subsections identify the progress for OU-1 and OU-2 separately.

5.2.1 OU-2 Protectiveness Statement from the 2004 Five-Year Review. The remedy at OU-2 is currently and will continue to be protective of human health and the environment because exposure pathways that may result in unacceptable risks are being controlled as follows:

(1) ICs are in place to restrict exposure to contaminants in soil at CAOCs 1, 8A, and 10 through MCAS Yuma Station Order 5090 (Appendix B4). This order formally directed tenants and contractors to incorporate the LUCs provided in the MCAS Yuma Master Plan and the Final LUCIP (Appendix B3) into their existing land use planning and management programs.

(2) The "modified DEURs" for CAOCs 1, 8A, and 10 have been proposed to satisfy the requirements specified in the OU-2 ROD for registration of the sites with the state of Arizona.

The MCAS Yuma Environmental Department will continue to review dig/building permits.

5.2.2 Previous Issues, Recommendations and Follow-Up Actions for OU-2. No issues were identified for OU-2 during the previous five-year review (SWDIV, 2004). Consequently, no recommendations or follow-up actions were proposed for OU-2.

5.2.3 Actions Taken at OU-2 Since the Previous Five-Year Review. No actions have taken place within the protected areas defined by OU-2 CAOCs 1, 8A and 10 within the past five years.

6.0 FIVE-YEAR REVIEW PROCESS

This section provides a description of the activities performed during the five-year review process for MCAS Yuma OU-1 and OU-2, as well as a summary of the findings of each step in the process when appropriate.

6.1 Administrative Components of the Five-Year Review Process

Responsibilities for this OU-1 and OU-2 five-year review were developed by the DON and the MCAS Yuma Environmental Department. Table 6-1 summarizes the people involved in the five-year review process.

Table 6-1. Five-Year Review Participants

Name	Title	Organization
Angela Wimberly	Remedial Project Manager	NAVFAC Southwest
Derral VanWinkle	Interim Remedial Project Manager	NAVFAC Southwest
Chris Coonfare	Project Manager	Battelle
Damon DeYoung	Task Manager	Battelle
Dan Nail	IRP Manager	MCAS Yuma Environmental Department
Joe Britain	Environmental Engineer	MCAS Yuma Environmental Department
Chris Kost	EMS Coordinator	MCAS Yuma Environmental Department
Dave Rodriguez	Environmental Director	MCAS Yuma Environmental Department
Jeremy Nevin	ROICC	MCAS Yuma
Joellen Meitl	Project Manager	ADEQ
Delfina C. Olivarez	Project Manager	ADEQ
Martin Hausladen	Project Manager	U.S. EPA

The review team consisted of Chris Coonfare (Battelle) as the primary investigator for the review and Dan Nail (MCAS Yuma Environmental Department) as the station contact responsible for arranging access to Environmental Department documents and to station resources and personnel. Components identified in advance with those responsible for the review included:

- Document review
- Data review
- Site inspection
- Local interviews, and
- Five-year review report development and review.

These components were later modified to include U.S. EPA and ADEQ interview responses. The five-year review, including site inspections and interviews, was conducted between April 2009 and February 2010.

6.2 Community Notification and Involvement

MCAS Yuma personnel and the greater Yuma, Arizona, community were informed of the start of the review in April 2009 in a public notice sent to base personnel and printed in the local area newspaper:

- *The Sun* (Yuma and regional paper) Sunday, May 10, 2009
- MCAS Yuma Basewide E-mail Newsletter Friday, April 3, 2009

The notice stated the purpose of the five-year review at OU-1 and OU-2 under CERCLA; described the remedy for contaminated groundwater at OU-1 and contaminated soils at OU-2; and identified the types of COCs present. The restriction of future groundwater and soil use was identified, as necessary, to prevent unacceptable human-health risk that could result if the sites were used for residential purposes. The notice stated that the ICs for OU-1 and OU-2 were implemented through the Base Master Plan which was issued in September 2001. The public notice is included in Appendix B12.

A second public notice and a fact sheet are planned to notify the community of the findings upon completion of the Five-Year Review Report. In addition, the fact sheet will be sent to regulatory agency personnel and those community representatives who indicated interest in prior mailings concerning environmental restoration activities at MCAS Yuma. The Five-Year Review Report for OU-1 and OU-2 will also be made available at the Yuma County Public Library, 350 South Third Avenue, Yuma, Arizona 85364-3897.

The local community was not directly involved in the five-year review process, because ICs are currently implemented only within the station to limit groundwater use by station tenants. Remedial actions have contained off-site plume migration. During the earlier phases of site RI and remedy selection and evaluation, interested community representatives had the opportunity to provide input on the remedial action. The project was managed to allow exchange of information and partnership among the community, DON, U.S. EPA, and State of Arizona regulatory agencies by reviewing and commenting on technical documents relating to the ongoing environmental cleanup at MCAS Yuma. With remedial activities well underway at OU-1 and OU-2, public interest in CERCLA proceedings has declined.

6.3 Document Review

This five-year review for OU-1 and OU-2 consisted of a review of relevant documents issued prior to and since the construction of the remedial systems (see Appendix A for the complete list of documents reviewed). The documents reviewed included the OU-1 and OU-2 RODs, the Final LUCIP, the MCAS Yuma Master Plan, technical memorandums, remediation progress reports, groundwater-monitoring reports, discharge reports, monitoring well inspections required by the LUCIP, aerial photographs, and compliance documents maintained by the MCAS Yuma Environmental Department. Most documents have focused on remediation system operation and groundwater monitoring. These reports summarize the AS/SVE and VCT systems O&M and emissions monitoring.

During the review process, some inconsistencies were indentified between figures provided in the recently revised MCAS Yuma Master Plan (KTUA, 2007) and the Final LUCIP (SWDIV, 2002a). Specifically, Figure 5-17 of the Master Plan does not show all CAOCs of OU-2 (i.e., CAOC 10B is not represented) and CAOC 1 does not have the correct boundaries as shown in Figure 2-3 of the Final LUCIP. Also, Figure 5-18 should represent all ICs of OU-1 and OU-2 and thus should present a merging of Figures 2-1 and 2-3 of the Final LUCIP; however, Figure 5-18 does not show some of the OU-1 IC areas (e.g., Area 3).

6.4 Data Review

The data review included examination of groundwater-monitoring information, risk assessment information, and regulatory standards to identify any changes to the protectiveness of the selected remedies. The most recent sampling data were used in a screening evaluation of potential change in human-health risk for the areas discussed in detail in Section 7.1.2 of this report.

Review of groundwater-level surveys indicates that there were no major changes in hydraulic gradient direction or magnitude over the review period, although the water table continues to decline overall. It should be noted that if levels decrease below AS well screen intervals, the AS/SVE system will be ineffective. Furthermore, if the levels decrease below monitoring well screen intervals, the LTM program will be ineffective. However, a number of wells are present at great enough depths to deem the LTM program effective for the foreseeable future. Water-quality parameters have also shown only minor changes outside zones where the remediation systems were applied. In general, the plumes have not shown any significant movement or expansion that would indicate any significant changes in the groundwater system.

Overall, contaminant concentrations have declined at OU-1 over the past five years. Table 6-2 summarizes and compares the maximum detected concentration of COCs in Area 1 from the June 2009 sampling event, the most recent semi-annual monitoring event, and the March 2004 sampling event, the results of which were reported in the last five-year review. Chemical concentrations were near MCLs in the Area 1 central/interior plume and LEPA. The only chemical detected at levels significantly higher than its MCL was TCE in the Building 230 "Hot Spot" area.

Following the temporary shutdown of the AS/SVE system slight rebound of COC concentrations was observed in the western portion of the Hot Spot plume. Two wells (i.e., wells 16-HS-03 and 16-MW-08) that were below the 1-1, DCE MCL (7 µg/L) in June 2007 have shown an increase in concentrations to levels above the MCL in June 2009 (Figure 4-6). Similarly, one well (i.e., well 16-HS-03) that was below the TCE MCL (5 µg/L) in June 2007 has shown an increase in concentration to a level above the MCL in June 2009 (Figure 4-7). This migration of 1,1-DCE and TCE to the west-northwest is likely due to the reestablishment of the natural hydraulic gradient in the absence of the AS/SVE system influence. However, even with slight rebound following the AS/SVE temporary shutdown in May 2007, the plume concentrations appear to have stabilized over the past two years (see Figure 4-3) and are substantially lower than the concentrations reported in the previous five-year review (Table 6-2).

Table 6-2. Summary of Maximum Groundwater Concentrations Detected in the March 2004 and June 2009 Monitoring Events

OU-1 Area 1	Maximum Concentration in Groundwater (µg/L)					
	1,1-DCE		TCE		PCE	
	2004[a]	2009[b]	2004[a]	2009[b]	2004[a]	2009[b]
"Hot Spot"	20	9.7	62	26	2.4	1.4
Central/Interior	13	9.1	10	10	<1	<1
LEPA	7.5	5.5	6.3	6.5	<1	<1
MCLs[c]	*7*		*5*		*5*	

[a] Groundwater monitoring data from March 2004 reported in the previous five-year review (SWDIV, 2004).
[b] Groundwater monitoring data from June 2009 (Battelle, 2010).
[c] MCLs based on U.S. EPA National Primary Drinking Water Regulations (U.S. EPA, 2009a).

6.5 Site Inspection

The purpose of the site inspections is to review and document current site conditions at the areas and evaluate visual evidence regarding the protectiveness of the remediation systems, monitoring equipment, and ICs. This effort included inspection of the monitoring wells used to assess the groundwater plumes and review of the monitoring documents concerning OU-1. The U.S. EPA *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001) provides a site inspection checklist, as well as the report template used for the development of this report. The modified site inspection checklists completed during the site inspection for each area are provided to document site conditions in Appendix C. Site photographs are included in Appendix E.

6.5.1 OU-1 Site Inspection. Inspections at OU-1 Area 1 were conducted between June 9 and June 11, 2009 by personnel from Battelle and the MCAS Yuma Environmental Department. The Area 1 plume extends across a large portion of the MCAS Yuma flight line area from the Building 230 area (Hot Spot) to the northwestern border of the station (LEPA). The site inspection for the Area 1 plume consisted of inspection of the AS/SVE system, the VCT system, monitoring wells associated with the area, and general land use. The AS/SVE system and the VCT system were not in operation during the inspection as both systems had reached their shutdown criteria. Monitoring wells were in good condition. The site is contained within the station, and much of Area 1 is located within the flight line area. No activity that would be considered inconsistent with industrial land use was noted at Area 1. Details on the Area 1 inspection are provided in Appendix C.

6.5.2 OU-2 Site Inspection. Inspections at OU-2 CAOCs 1, 8A, and 10 were conducted on July 28, 2009 by personnel from Battelle and the MCAS Yuma Environmental Department to document any changes since the last five-year review. Inspection of the status of OU-2 CAOCs 1, 8A, and 10 indicated that there were no land use changes since the last five-year review. No activity that would be considered inconsistent with industrial land use was noted at the areas. All areas are located in restricted areas with fencing and secured gates. Details on the OU-2 inspection are provided in Appendix C.

6.6 Interviews

Individuals responsible for or familiar with current activities at OU-1 and OU-2 or with activities that took place over the past 5 years were interviewed between July 2009 and February 2010 (Appendix D). An interview documentation form listing the name, title, and organization of the interviewee, along with the date and location where the interviews took place, is provided in Appendix D1; the interview records documenting the interviews are provided in Appendices D2 through D9.

All personnel interviewed noted no significant changes to site conditions or land use at the areas over the past 5 years. A summary presentation of additional observations made during the review's site inspections, personnel interviews, and regulatory agency comments is given below.

<u>Derral VanWinkle, October 21, 2009</u>
Derral VanWinkle is the NAVFAC Southwest Interim Remedial Project Manager (RPM) for MCAS Yuma. Mr. VanWinkle directs OU-1 remediation activities for the Navy. The complete interview record for Mr. VanWinkle is provided in Appendix D2.

- Exposure assumptions presented in the ROD are still valid, although the approach to calculation of the vapor exposure route has changed.
- The toxicity data provided in Tables 2-7 and 2-8 of the OU-1 ROD are likely no longer valid. The slope factors and chronic RfDs for 1,1-DCE, TCE, PCE have changed since publication of the ROD for OU-1 9 years ago. However, even if the slope factors or RfDs have become more conservative since the ROD was signed, the cleanup goals (MCLs) are not risk-based. It is possible that achieving the MCLs will leave a greater risk than originally published in the ROD. This should be explored in more detail in the five-year review.
- No information has come to light that would call into question the remedy's protectiveness. The results indicate that the remedies have prevented any further off-site migration of COCs, and appear to have reduced concentrations to levels meeting the clean-up goals in most areas without significant rebound. Monitoring is currently being conducted to demonstrate that rebound has not significantly occurred such that there would be a threat to human health through migration of the chemicals off base.

<u>Dan Nail, July 28, 2009</u>
Mr. Nail is the IRP Manager for MCAS Yuma Environmental Department in charge of coordinating environmental activities for OU-1. The complete interview record for Mr. Nail is provided in Appendix D3.

- Remediation of COAC 8 will need to be considered, since the southern portion of the base will house a new squadron of fighter jets within the next few years.

Joe Britain, July 28, 2009
Joe Britain is an environmental engineer for the MCAS Yuma Environmental Department. Mr. Britain was mainly involved in engineering support and land use controls at the station. The complete interview record for Mr. Britain is provided in Appendix D4.

- A big concern for MCAS Yuma is still ultimate remediation for CAOC 8 (landfill) due to upcoming joint strike fighter (JSF) construction in that area of base proper.

Chris Kost, August 14, 2009
Mr. Kost is the Environmental Management System (EMS) coordinator at the MCAS Yuma Environmental Department. Mr. Kost worked with OHM Remediation Services Corp. and IT Corp. during OU-1 remediation construction projects. The complete interview record for Mr. Kost is provided in Appendix D5.

- Concern is raised regarding the CAOC 8 and the upcoming JSF construction in the area.

David Rodriguez, August 6, 2009
Mr. Rodriguez is the director of the MCAS Yuma Environmental Department. The complete interview record for Mr. Rodriguez is provided in Appendix D6.

- COAC 8 priority has been elevated. The space will be critical for the introduction of the JSF at MCAS Yuma. In addition, the Munitions Response Program (MRP) sites will also require remediation for same JSF reasons.

Jeremy Nevin, October 28, 2009
Mr. Nevin was the Resident Officer in Charge of Construction (ROICC) until June 2009 and supervised construction projects at the station. The complete interview record for Mr. Nevin is provided in Appendix D7.

- No construction projects required coordination with the MCAS Yuma Environmental Department during the past 5 years.

Joellen Meitl, February 10, 2010
Ms. Meitl is a Project Manager in the Federal Projects Unit of the ADEQ. The complete interview record for Ms. Meitl is provided in Appendix D8.

- It should be verified that the OU-1 groundwater cleanup goals are based on the more conservative of the U.S. EPA MCLs and the Arizona AWQS.

Delfina Olivarez, February 10, 2010
Ms. Olivarez is a Project Manager in the Federal Projects Unit of the ADEQ. The complete interview record for Ms. Olivarez is provided in Appendix D9.

- CAOC 8A shows enough visible ground debris to cause concern of hazardous windblown emissions. Previous reports do not state/address any air analysis work of OU-1 and OU-2 done at MCAS Yuma.

Martin Hausladen

Mr. Hausladen is a Project Manager in the Federal Facilities Superfund Division of the U.S. EPA. No comments were received to the five-year review interview questions prior to the development of this report.

7.0 TECHNICAL ASSESSMENT

The technical assessments for OU-1 and OU-2 are independently presented in the following subsections.

7.1 Technical Assessment of Operable Unit 1

The technical assessment for OU-1 presented in this section describes how each of the three key assessment questions was answered for OU-1. The discussion presented here is a framework for the protectiveness determination that explains the conclusions of the review, based on the information presented in the previous section.

7.1.1 Question A: Is the Remedy for OU-1 Functioning as Intended by the Decision Documents? Yes; a review of documents, site inspections, and interviews of station personnel indicates that the remedies for OU-1 are functioning to protect human health through implementation of the remedial systems and ICs on land and groundwater use. The subsections below provide further detail regarding the remedy efficacy.

7.1.1.1 AS/SVE Performance. The AS/SVE system for Area 1 operated relatively continuously in the Hot Spot area of Building 230 from November 1999 to May 2007. The system was designed to reduce CHC concentrations in the Hot Spot by injecting air into the subsurface in AS wells and recovering the vapors in the SVE wells. Since 1998, maximum TCE concentrations in the Hot Spot have been reduced from 290 μg/L in 1998 to 26 μg/L in June 2009 (see Figures 4-3 and 4-5). Maximum 1,1-DCE concentrations have been reduced from 300 μg/L in 1998 to 9.7 μg/L in June 2009 (see Figures 4-3 and 4-5). The system has removed approximately 79 lb of volatile chemicals from the groundwater. The overall size of the plume in the Hot Spot has also decreased substantially. This information suggests that the AS/SVE system has functioned as intended in remediation of the groundwater plume in the Building 230 area. Consequently, temporary shutdown of the AS/SVE system was approved by U.S. EPA and ADEQ in 2007.

7.1.1.2 VCT Performance. The VCT system operated relatively continuously in the LEPA area from June 2000 to May 2003. The system was designed to reduce CHC concentrations and contain the plume in the LEPA area by withdrawing contaminated groundwater and re-injecting treated water into the aquifer. Monitoring data indicated that CHC concentrations in the LEPA area were sustained below MCLs, so the system was shut down on May 6, 2003. Monitoring of the groundwater continued as part of the LTM during the temporary shutdown period. Permanent shutdown of the VCT system was approved in December 2005 with concurrence from U.S. EPA and ADEQ, following two years of groundwater monitoring performed subsequent to the 2003 temporary shutdown approval.

7.1.1.3 Groundwater Modeling. Groundwater modeling was performed to ensure that the remediation systems selected for the Area 1 plume would work as intended and prevent any migration of the Area 1 plume (BNI, 2002; Battelle, 2004a). The movement and behavior of the plume was simulated with groundwater flow and transport models in light of the effects of the remediation systems. The model suggested that the LEPA plume would not migrate and would be reduced to below MCLs by approximately 2003. This was confirmed by groundwater monitoring, which showed evidence that the LEPA plume was reduced to MCLs (Battelle, 2004b). The modeling also showed that the reductions in plume concentrations at the Building 230 Hot Spot caused by the AS/SVE system would limit plume expansion. Furthermore, predictive simulations indicated that the plume would not migrate offsite and would be reduced to MCLs approximately by the year 2020.

7.1.1.4 ***Monitored Natural Attenuation.*** MNA was the selected remedy for OU-1 Areas 1, 2, 3 and 6. The plumes were monitored for contaminants and MNA chemical indicators. Overall, the monitoring has indicated that the plumes are decreasing in size and magnitude through natural processes. Following the temporary shutdown of the AS/SVE system, slight rebound of COC concentrations has been observed in the western portion of the Hot Spot of the Area 1 plume. This migration of 1,1-DCE and TCE to the west-northwest, as shown in Figures 4-6 and 4-7, is likely due to the reestablishment of the natural hydraulic gradient in the absence of the AS/SVE system influence. However, the plume concentrations appear to have stabilized since 2007 (see Figure 4-3) and are substantially lower than the concentrations reported in the previous five-year review (Table 6-2). Overall, Area 1 continues to show reduction in CHC concentrations indicating that natural attenuation has been effective (see Figures 4-3 and 4-4). Areas 2, 3 and 6 have been granted NFA closure and the monitoring wells have been decommissioned. These successful closures indicate that the remedy for Areas 2, 3, and 6 has worked as intended.

7.1.1.5 ***Implementation of Institutional Controls.*** ICs were selected for all areas of OU-1 to limit the use of groundwater. The MCAS Yuma Master Plan was updated in September 2001 (KTUA, 2001) with the ICs for Areas 1, 2, 3, and 6 in OU-1. The MCAS Yuma Master Plan has subsequently been revised (KTUA, 2007). The final LUCIP, issued in September 2002 (SWDIV, 2002a), was developed to provide the details for implementing LUCs for OU-1, and included a description of the ICs and access and notification provisions (Appendix B3). The LUCs were also formally implemented for MCAS Yuma by Station Order 5090, which directed tenants and contractors to incorporate the LUCs into existing land use planning and management systems. The MCAS Yuma Station Order 5090 was signed in January 2002 (Appendix B4). ICs will be maintained for each OU-1 groundwater plume area until each area has met its closure criteria, as stated in the ROD and summarized in Section 4.1.1.4 of this report.

The final LUCIP also provides for ADEQ access to the sites, prior notification, and reevaluation of the remedy in the event a change to the land use is proposed. The final LUCIP states that ADEQ will be notified in advance if the property associated with these areas is identified as excess by MCAS Yuma and proposed for transfer out of federal ownership.

Annual compliance reports have not been submitted from the MCAS Yuma tenants for this five-year review period. However, within OU-1, MCAS Yuma tenants do not have access to groundwater water resources. The only mechanism for exposure to groundwater is through extraction via groundwater wells. The MCAS Yuma dig permit approval process (which must proceed through the MCAS Yuma Environmental Department) successfully maintains control over the installation of any groundwater wells. No groundwater extraction wells, with the exception of the wells used for environmental remediation, have been installed in the areas within OU-1.

MCAS Yuma Environmental Department personnel routinely visit the secured areas in the course of their regular duties.

7.1.2 Question B: Are the Exposure Assumptions, Toxicity Data, Clean-up levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid?

Yes; the following subsections discuss the information evaluated in answering this question on the basis of human-health and ecological risk assessment, federal and state regulations evaluated as potential ARARs for the remedial action, and achievement of the RAO.

7.1.2.1 ***Changes in Standards.*** The U.S. EPA MCLs for 1,1-DCE, TCE, and PCE remain unchanged since the development of the OU-1 ROD as is shown in U.S. EPA's National Primary Drinking Water Regulations (U.S. EPA, 2009a).

7.1.2.2 ***Changes in Exposure Pathways.*** Vapor intrusion (VI) calculations were not established in the OU-1 ROD and have not been performed in previous five-year reviews. Using the U.S. EPA Johnson & Ettinger (J&E) Model (Version 3.1; 02/04) to calculate the VI risks and hazards of groundwater left in place at concentrations equal to the MCLs for the three COCs of OU-1 Area 1, all COCs pose a risk less than or equal to the 1×10^{-6} threshold and have an associated hazard quotient (HQ) of less than 1 (assuming a conservative soil type of loamy sand). These calculated risks and hazards indicate that the established cleanup goals (i.e., U.S. EPA MCLs) are protective of human health through the VI pathway. Table 7-1 highlights the VI risks and hazards for OU-1 COCs. Table 7-2 identifies the toxicity and concentrations used in the J&E Model for the OU-1 VI calculations. The depth to groundwater used in estimating the VI risk was 60 ft bgs.

Table 7-1. OU-1 Estimated Vapor Intrusion Risk Based on Soil Type

OU-1 COC	Loamy Sand		Sandy Loam	
	Risk	HQ	Risk	HQ
1,1-DCE	NA	4E-3	NA	2E-3
TCE	2E-7	5E-4	1E-7	3E-4
PCE	1E-6	2E-3	5E-7	9E-4

Table 7-2. OU-1 COC Toxicity Values Used in the J&E Model

OU-1 COC	Inhalation Unit Risk (µg/m3)$^{-1}$	Source	Inhalation Reference Concentration (mg/m^3)	Source	MCL[1] (µg/L)
1,1-DCE	NA	--	0.2	U.S. EPA IRIS	7
TCE	2.0E-06	Cal/EPA	0.6	ATSDR[2]	5
PCE	5.9E-06	Cal/EPA	0.27	Cal/EPA	5

NA Not Available

[1] MCLs were used as "Initial Groundwater Concentrations" in the J&E Model to estimate VI risk and hazards.

[2] Source was provided on U.S. EPA Integrated Risk Information System (IRIS) Web site.

The calculated RBC for TCE in groundwater that poses a risk to industrial workers at a distance of 100 ft from the vapor source (a condition met by all buildings in Area 1) is 33 µg/L. Since TCE concentrations within the Hot Spot are below this concentration, the risk through a VI pathway is currently acceptable. Similar results for PCE exist in Area 1.

7.1.2.3 ***Changes in Toxicity and Other Contaminant Characteristics.*** The cancer slope factor and/or oral reference dose (RfD) have changed for the three COCs of OU-1 since the ROD was signed. Toxicity criteria were selected according to the U.S. EPA (2003) Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53, which recommends a hierarchy of human health toxicity values for use in risk assessments at Superfund sites. The hierarchy is as follows:

(1) U.S. EPA's IRIS;

(2) U.S. EPA's Provisional Peer-Reviewed Toxicity Values (Office and Development, National Center for Environmental Assessment, Superfund Health Risk Technical Support Center); and

(3) other sources of information, such as toxicity values from the State of California's Environmental Protection Agency (Cal/EPA) and the Agency for Toxic Substances and Disease Registry's (ATSDR's) minimal risk levels for noncarcinogenic constituents

Per U.S. EPA (2009b), noncancer toxicity values for TCE were not selected, but rather, cancer-risk considerations were used to dominate the evaluation of TCE as they are protective of noncancer risks as well. Table 7-3 summarizes the changes that have been made to the cancer slope factors and oral RfDs for the three COCs of OU-1 Area 1. Recent toxicity reports have been developed for PCE and TCE. However, these reports are in a draft form however and represent a non-citable reference per U.S. EPA direction.

Table 7-3. Summary of Toxicity Changes to the OU-1 COCs

OU-1 COC	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$		Source	Oral Reference Dose (RfD) (mg/kg-day)		Source
	New	Previous		New	Previous	
1,1-DCE	NA	NA	--	5.0E-02	9.0E-03	U.S. EPA IRIS
TCE	5.9E-02	NA	Cal/EPA	NA	NA	U.S. EPA, 2009b
PCE	5.4E-01	NA	Cal/EPA	NU	1.0E-02	U.S. EPA IRIS

Cal/EPA Office of Environmental Health Hazard Assessment's toxicity values [available at http://www.oehha.ca.gov/risk/ChemicalDB/index.asp]
U.S. EPA IRIS Accessed December 2009 [available on IRIS at http://www.epa.gov/iris]
NU Not Updated
NA Not Available

Based on the increased concentration of the 1,1-DCE oral RfD, the current remediation goals (i.e., U.S. EPA MCLs) remain protective of human health. The oral slope factors for TCE and PCE have been established since the last five-year review. For the current review, the U.S. EPA Regional Screening Levels (RSLs) (U.S. EPA, 2009b) for tap water for TCE and PCE were used to assess the protective nature of the current remediation goals. The RSLs are 2 µg/L for TCE and 0.1 µg/L for PCE, both below the 5 µg/L MCL for each compound. However, since the ICs in place at OU-1 prevent a completed exposure pathway from groundwater, the RSLs do not require a modification of the remedial goal. As an ARAR, MCLs remain the remedial goal.

7.1.2.4 Expected Progress Towards Meeting RAOs. The RAOs for all of the OU-1 groundwater CHC plumes are: 1) the containment of all plumes within the facility boundary, and 2) the reduction of groundwater contamination to meet applicable drinking water standards (i.e., U.S. EPA MCLs). The selected remedies have successfully contained all contaminated plumes to within the MCAS Yuma facility boundaries and MNA has demonstrated the continued reduction of CHC concentrations. Three of the four OU-1 areas (i.e., Areas 2, 3 and 6) have met the MCLs and have been subsequently closed with NFA. Area 1 remains under MNA through which declining CHC concentrations are expected to continue.

7.1.3 Question C: Has any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy? No; no additional information has been found that suggests that the remedy selected for OU-1, as currently defined in the ROD (SWDIV, 2000), may not be protective. The selected remedy has been effective as long as groundwater is not used from the sites where RAOs have not been achieved.

7.2 Technical Assessment of Operable Unit 2

The technical assessment for OU-2 presented in this section describes how each of the three key assessment questions was answered for OU-2 CAOCs 1, 8A and 10. The discussion presented here is a framework for the protectiveness determination that explains the conclusions of the review, based on the information presented in the previous section.

7.2.1 Question A: Is the Remedy for OU-2 Functioning as Intended by the Decision Documents?

Yes; a review of documents, site inspections, and interviews of station personnel indicates that the remedy for OU-2 CAOCs 1, 8A and 10 is functioning to protect human health through implementation of ICs on land use. The subsections below provide further detail regarding the remedy efficacy.

7.2.1.1 Remedial Action Performance. The selected remedy as defined in the ROD consisted of ICs restricting land use of CAOC 1 and CAOC 10 to industrial/commercial use and CAOC 8A to its current use as an inactive former landfill as well as prevent any activities that may disrupt and expose the landfill interior. The land surfaces are secured by fencing with locked gates and access to CAOCs 1, 8A and 10 is restricted to MCAS Yuma Environmental Department personnel and MCAS Yuma security personnel. No station activity is currently proceeding at the CAOCs. These measures are functioning to protect human health.

7.2.1.2 Implementation of Institutional Controls. The MCAS Yuma Master Plan was updated in September 2001 (KTUA, 2001) with the ICs for CAOCs 1, 8A and 10 of OU-2. The MCAS Yuma Master Plan has subsequently been revised (KTUA, 2007). The final LUCIP, issued in September 2002 (SWDIV, 2002a), was subsequently developed to provide the details for implementing LUCs for OU-2, and included a description of the ICs and access and notification provisions (Appendix B3). The LUCs were also formally implemented for MCAS Yuma by Station Order 5090, which directed tenants and contractors to incorporate the LUCs into existing land use planning and management systems. The MCAS Yuma Station Order 5090 was signed in January 2002 (Appendix B4).

The final LUCIP also provides for ADEQ access to the sites, prior notification, and reevaluation of the remedy in the event a change to the land use is proposed. The final LUCIP states that ADEQ will be notified in advance if the property associated with these areas is identified as excess by MCAS Yuma and proposed for transfer out of federal ownership.

Annual compliance reports have not been submitted from the MCAS Yuma tenants for this five-year review period. However, OU-2 is effectively isolated from human contact by secured fencing. Any activity within CAOCs 8A and 10 of OU-2 must be coordinated with MCAS Environmental Department personnel. There are no tenants within CAOCs 8A and 10 as well. OU-2 CAOC 1 is within the flight line access control area and all locations with base tenants present are paved, thus preventing contact with OU-2 CAOC 1 soils.

MCAS Yuma Environmental Department personnel routinely visit the secured areas in the course of their regular duties.

7.2.2 Question B: Are the Exposure Assumptions, Toxicity Data, Clean-up Levels, and Remedial Action Objectives (RAOs) used at the Time of Remedy Selection Still Valid?

Yes; the following subsections discuss the information evaluated in answering this question on the basis of human-health and ecological risk assessment, federal and state regulations evaluated as potential ARARs for the remedial action, and achievement of the RAO.

7.2.2.1 ***Changes in Standards.*** Arizona's Soil Remediation Standards are identified in the OU-2 ROD as chemical-specific ARARs for the remediation of soil at CAOCs 1, 8A and 10. ARS Title 49, as implemented in AAC Title 18, Chapter 7, Article 2 requires that soils be remediated to either: 1) background levels; 2) HBGLs; or 3) site-specific risk assessment based levels. HBGLs listed in Appendix A of AAC Title 18, Chapter 7, Article 2 have been updated and included in Table 7-4, with a comparison of the HBGLs given in the ROD (which were last updated in June 1995).

7.2.2.2 ***Changes in Exposure Pathways.*** VI calculations were not established in the OU-2 ROD and have not been performed in previous five-year reviews. Of the COPCs present in OU-2 CAOCs 1, 8A, and 10, naphthalene is the only one where VI may be a potential concern for future workers and only in CAOCs 1 and 10. The U.S. EPA J&E soil VI model (ver 3.1) was used to estimate the noncarcinogenic health hazard for potential exposure to naphthalene in indoor air. Table 7-5 summarizes the HQs for naphthalene in CAOCs 1 and 10 based on the maximum concentration of naphthalene detected in soil in these

Table 7-4. Revised Health Based Guidance Levels for Ingestion of COPCs in Soil at OU-2 CAOC 1, 8A and 10

OU-2 COPC	Cancer Group		Residential Oral HBGL (mg/kg)		Non-Residential Oral HBGL (mg/kg)	
	1995[a]	2007[b]	1995[a]	2007[b]	1995[a]	2007[b]
Acenaphthene	ND	nc	7,000.0	3,700	24,500.0	29,000
Acenaphthylene (PAH)	D	na	7,000.0	na	24,500.0	na
Anthracene (PAH)	D	nc	35,000.0	22,000	122,500.0	240,000
Benz[a]anthracene (PAH)	B2	ca	1.1	0.69	4.6	21
Benzo[a]pyrene (PAH) (BaP)	B2	ca	0.19	0.069	0.80	2.1
Benzo[b]fluoranthene (PAH)	B2	ca	1.1	0.69	4.6	21
Benzo[k]fluoranthene (PAH)	B2	ca	1.1	6.9	4.6	210
Chrysene (PAH)	B2	ca	110.0	68	462.0	2,000
Dibenz[a,h]antracene (PAH)	B2	ca	0.11	0.069	0.46	2.1
Fluoranthene (PAH)	D	nc	4,700.0	2,300	16,450.0	22,000
Fluorene (PAH)	D	nc	4,700.0	2,700	16,450.0	26,000
Indeno[1,2,3-cd]pyrene (PAH)	B2	ca	1.1	0.69	4.6	21
Naphthalene (PAH)	D	nc	4,700.0	56	16,450.0	190
Polychlorinated biphenyls (PCBs) (high risk)	B2	ca, nc	0.18	0.25	0.76	7.4
Polychlorinated biphenyls (low risk)	ND	ca, nc	8.2	3.9	28.7	37
Pyrene (PAH)	D	nc	3,500.0	2,300	12,250.0	29,000

[a] 1995 data given in Tables 2-8 of the OU-2 ROD (Uribe & Associates, 1997b) (also shown in Section 4.2.1.2. of this document).

[b] 2007 data derived from Appendix A to ARS Title 18, Chapter 7, Article 2 updated March 30, 2007.

Cancer Groups are as follows:

B2 Probable human carcinogen
D Not classifiable as to human carcinogenicity
ND No data available
Ca carcinogen
nc noncarcinogen
na not available

CAOCs. An HQ of 1 is deemed acceptable by U.S. EPA and ADEQ. Table 7-6 summarizes the input parameters used to estimate the health hazard.

The HQ for naphthalene in CAOC 1 exceeds the regulatory threshold of 1 for each building scenario, but the HQ is below 1 for CAOC 10. Given that the soil data are more than 10 years old and that naphthalene (as well as the other PAHs) was detected in surficial soil samples associated with the washrack area (an uncovered area exposed to the elements) it is unlikely that the concentrations that may currently be present in CAOC 1 surficial soil would be as high as 70 mg/kg. Historical concentrations of naphthalene in soil in all other sampling locations within CAOC 1 would not be associated with an HQ above 1. Furthermore, receptors are not anticipated to have continuous exposure to the maximum concentration, and U.S. EPA recommends use of exposure point concentrations representative of average site concentrations. If further evaluation was performed, an average value (i.e., 95% upper confidence limit of arithmetic mean) would be used and the resulting HQ would be lower than that calculated here.

Table 7-5. Estimated Vapor Intrusion HQs for Naphthalene at OU-2 CAOCs 1 and 10

Building Size	OU-2 CAOCs	Maximum Concentration Detected (mg/kg)	HQ
32 ft x 32 ft x 10 ft	CAOC 1	70	44
	CAOC 10	0.112	0.07
64 ft x 64 ft x 10 ft	CAOC 1	70	16
	CAOC 10	0.112	0.025

Table 7-6. Input Parameters Used in the J&E Model to Evaluate the Vapor Intrusion Pathway for OU-2 CAOCs 1 and 10

Parameters	Input Value
Average soil/groundwater temperature (degrees C)	20
Depth below grade to bottom of floor (cm)	15
Depth below grade to top of contamination (cm)	15
Depth below grade to bottom of contamination (cm)	305
Soil stratum	A
Thickness of soil stratum (cm)	15
SCS soil type	LS
Soil vapor permeability (cm^2)	Calculated
Soil dry bulk density (g/cm^3)	1.62
Soil total porosity (unitless)	0.39
Soil water-filled porosity (unitless)	0.076
Soil organic carbon fraction (unitless)	0.002
Floor thickness (cm)	15
Soil building pressure differential ($g/cm\text{-}sec^2$)	40
Length of structure (cm)	1000 and 2000[a]
Width of structure (cm)	1000 and 2000[a]
Height of structure (cm)	305
Floor-wall seam crack width (cm)	0.1

Table 7-6. Input Parameters Used in the J&E Model to Evaluate the Vapor Intrusion Pathway for OU-2 CAOCs 1 and 10 (Continued)

Parameters	Input Value
Indoor air exchange rate (1/h)	0.828
Average vapor flow rater into building (L/m)	5
Target cancer risk level (unitless)	1×10^{-6}
Target noncancer Hazard Quotient (unitless)	1
Exposure Frequency (days)	250
Exposure Duration (years)	25

[a] Two building sizes were evaluated to account for the different sizes of buildings that are present within the OU-2 areas.

7.2.2.3 ***Changes in Toxicity and Other Contaminant Characteristics.*** A toxicity investigation of all COPCs for OU-2 CAOCs was not performed as the ICs that are currently present, as set forth in the Final LUCIP (SWDIV, 2002a) and MCAS Yuma Master Plan (KTUA, 2007), do not allow for a complete exposure pathway to site contaminants. The ICs continue to effectively protect human health and the environment.

7.2.2.4 ***Expected Progress Towards Meeting RAOs.*** The RAO for OU-2 CAOCs 1, 8A and 10 is to minimize the potential for unacceptable human-health risk that could result from a change in land use (Uribe & Associates, 1996b). The continued isolation of OU-2 CAOCs, by way of ICs, remains an effective means of meeting the RAO.

7.2.3 Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy? No; no additional information has been found to suggest that the remedy selected for OU-2 CAOCs 1, 8A, and 10, as currently defined in the ROD (Uribe & Associates, 1997), may not be protective. The selected remedy has been effective as long as ICs are maintained. While base personnel have indicated the possibility of a future land use change for OU-2 CAOC 8A, documentation of that land use change is needed; should a change in land use be needed for CAOC 8A, communication with the regulatory agencies, prior to the change, will occur as stipulated in the ROD.

8.0 ISSUES

This section presents issues that have been raised in the past five years. Table 8-1 identifies the site operations, conditions, or activities that may currently prevent the remedy from being protective, or may prevent it from being protective in the future.

Table 8-1. Issues Regarding Remedy Protectiveness

Issue Number	Issues	Affects Current Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
1	While base personnel have indicated the possibility of a future land use change for OU-2 CAOC 8A, documentation of that land use change is needed; should a change in land use be needed for OU-2 CAOC 8A, communication with the regulatory agencies, prior to the change, will occur as stipulated in the ROD.	No	Yes
2	U.S. EPA raised the following issue for OU-2: while DEURs have been proposed, they have not been registered with Arizona and thus the ICs are not complete (see Attachment 1).	No	Yes
3	U.S. EPA raised the following issue for OU-1: the most recent (June 2009) data presented in Figures 4-6 and 4-7 indicate that there has been recent plume migration in the LEPA and Hot Spot areas. The significance of this recent movement on remedy effectiveness needs to be evaluated.	No	Yes
4	An evaluation of the progress of an MNA remedy in meeting RAOs should be undertaken as part of every 5YR where MNA is the remedy. Since the transition to MNA was recently adopted for OU-1 Area 1, an evaluation was not performed for this five-year review.	No	Yes
5	Note that on January 7, 2010, U.S. EPA published draft guidance on Interim PRGs for dioxin in soil at CERCLA and RCRA sites. If adopted, this proposal will lower the dioxin PRG significantly. Please confirm the activities evaluated to address potential dioxin at CAOC 8A. If dioxin is a concern, we suggest that the 5YR include a discussion of this issue.	No	Yes
6	During the five-year review, inconsistencies were indentified between figures provided in the recently revised MCAS Yuma Master Plan (KTUA, 2007) and the Final LUCIP (SWDIV, 2002a).	No	Yes
7	The indoor air exposure pathway is incomplete for all three CAOCs in OU-2 based on current land use of these areas; thus, the ICs are appropriate. However, if these areas were to be redeveloped in the future for office and/or residential use, the ICs may not be protective.	No	Yes
8	U.S. EPA raised the following issue for OU-1 Area 1: the document should address any vadose zone contamination that may be of concern to the VI pathway.	No	Yes

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No recommendations are needed at this point in the remediation of the OUs at MCAS Yuma as the remedial systems and ICs currently in place are effectively protecting human health and the environment.

Table 9-1. Recommendations and Follow-up Actions following the Five-Year Review

Issue Number	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Yes/No; Current and/or Future)
1	While base personnel have indicated the possibility of a future land use change for OU-2 CAOC 8A, documentation of that land use change is needed; should a change in land use be needed for OU-2 CAOC 8A, communication with the regulatory agencies, prior to the change, will occur as stipulated in the ROD.	DON	U.S. EPA	To be determine d	Yes; Future
2	Evaluate the LUCIP and ensure that the plan is up-to-date, continues to provide effective processes for LUC implementation, and continues to provide long-term protectiveness. Also, discussions should be initiated between ADEQ, U.S. EPA, and Navy legal counsel to determine how to best address and resolve the DEUR issue.	DON	U.S. EPA and ADEQ	2015	Yes; Future
3	Evaluate the progress of plume remediation and potential rebound, and review the AS/SVE shutdown criteria and make a recommendation regarding system operation.	DON	U.S. EPA	Ongoing	Yes; Future
4	An evaluation of MNA progress in subsequent five-year reviews should be performed, including modeling groundwater under the MNA scenario to predict when MNA would result in reaching MCLs.	DON	U.S. EPA	2015	Yes; Future

Table 9-1. Recommendations and Follow-up Actions following the Five-Year Review (Continued)

Issue Number	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Yes/No; Current and/or Future)
5	U.S. EPA's dioxin reassessment has been developed and undergone review over many years with the participation of scientific experts in EPA and other federal agencies, as well as scientific experts in the private sector and academia. The Agency followed current cancer guidelines and incorporated the latest data and physiological/biochemical research into the assessment. The results of the assessment have currently not been finalized or adopted into state or federal standards. U.S. EPA anticipates that a final revision to the dioxin toxicity numbers may be released by the end of 2010. In addition, U.S. EPA/OSWER has proposed to revise the interim preliminary remediation goals (PRGs) for dioxin and dioxin-like compounds, based on technical assessment of scientific and environmental data. However, U.S. EPA has not made any final decisions on interim PRGs at the time of this five-year review. Therefore, the dioxin toxicity reassessment for this site (CAOC 8A) should be updated during the next Five-Year Review.	DON	U.S. EPA	2015	Yes; Future
6	The DON and MCAS Yuma should reconcile the discrepancies between the figures in the Final LUCIP (SWDIV, 2002a) and the MCAS Yuma Master Plan (KTUA, 2007).	DON	U.S. EPA	2015	Yes; Future
7	An evaluation of the ICs and the protectiveness of the LUCIP should be performed with regards to the VI pathway for all OU-2 CAOCs in the event of changes to the current land use status.	DON	U.S. EPA	2015	Yes; Future
8	An analysis of soil gas data from previous soil investigations should be performed to compare to VI screening levels to ensure that the only potential VI source is groundwater.	DON	U.S. EPA	2015	Yes; Future

10.0 PROTECTIVENESS STATEMENTS

Protectiveness statements for OU-1 and OU-2 are independently presented in the following subsections.

10.1 Protectiveness Statement for Operable Unit 1

The remedy at OU-1 is currently and will continue to be protective of human health and the environment because of the implementation of remedial measures and control of exposure pathways that may result in unacceptable risks. These methods are being applied as follows:

(1) Remediation systems were installed and operated in the Area 1 plume. A VCT system was operated in the LEPA from June 2000 to May 2003. The system has reduced CHC concentrations to near MCLs and contained any off-site migration of the plume in this area. An AS/SVE system was installed in the Building 230 area to remediate the groundwater in the most highly contaminated area of OU-1. The system operated relatively continuously between November 1999 and May 2007. The AS/SVE system has reduced the CHC "Hot Spot" in both size and magnitude such that the COCs will not migrate offsite at concentrations greater than MCLs.

(2) MNA is currently applied at all active regions of Area 1. MNA has been demonstrated to reduce contaminant concentrations through natural processes and has indicated that the plumes are not migrating. Groundwater monitoring required for the MNA program has been implemented through the LTM plan for OU-1 at MCAS Yuma. Plumes will continue to be monitored through MNA of the LTM plan until they decrease in concentrations below MCLs.

(3) ICs are in place to restrict exposure to any contaminated groundwater at Area 1 through MCAS Yuma Station Order 5090. This order formally directs tenants and contractors to incorporate the LUCs provided in the MCAS Yuma Master Plan (KTUA, 2007) and the Final LUCIP (SWDIV, 2002a) into their existing land use planning and management programs.

The MCAS Yuma Environmental Department will continue to review and coordinate all plans for future activities at OU-1 in consultation with U.S. EPA and ADEQ, as necessary, to ensure application of the measures specified in the OU-1 ROD (SWDIV, 2000).

10.2 Protectiveness Statement for Operable Unit 2

The remedy at OU-2 is currently and will continue to be protective of human health and the environment because exposure pathways that may result in unacceptable risks are being controlled as follows:

(1) ICs are in place to restrict exposure to contaminants in soil at CAOCs 1, 8A and 10 through MCAS Yuma Station Order 5090. This order formally directed tenants and contractors to incorporate the LUCs provided in the MCAS Yuma Master Plan

(KTUA, 2007) and the Final LUCIP (SWDIV, 2002a) into their existing land use planning and management programs.

(2) The "modified DEURs" for CAOCs 1, 8A and 10 have been proposed to satisfy the requirements specified in the OU-2 ROD (Uribe & Associates, 1997b) for registration of the sites with the State of Arizona.

The MCAS Yuma Environmental Department will continue to review and coordinate all plans for future activities at CAOCs 1, 8A, and 10, in consultation with U.S. EPA and ADEQ as necessary, to ensure continued compatibility with the land use restrictions specified in the OU-2 ROD (Uribe & Associates, 1997b).

11.0 NEXT REVIEW

The next five-year review for MCAS Yuma OU-1 and OU-2 will be due in 2015, five years from the date on which this document is signed. Consecutive five-year reviews will be required as long as site groundwater and land conditions remain that do not allow for unlimited use and unrestricted exposure.

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Attachment 1

Response to Comments on the Draft Five-Year Review Report

Response to Comments on the Draft Five-Year Review Report
Operable Units 1 and 2, Marine Corps Air Station Yuma, Arizona
(Dated March 2010)
Contract# N68711-01-D-6009, TO-008

Review Date: 7 May, 2010			Review Organization: U.S. EPA	Reviewer(s): Harold Ball
General Comments			Reviewer's Comments	Response to Comments
Number	Page	Section		
1			**a.** My bottom line recommendation is that the EPA determination should be that the remedies at Yuma are <u>protective in the short term</u> and several issues will have to be addressed going forward in order to ensure long term protectiveness. **b.** For OU-2, the document indicates that while DEURs have been proposed, they have not been registered with Arizona and thus the ICs are not complete (we need comments from Sarah to form a complete position on this point). **c.** For OU-1 Area 1, the most recent (June 2009) data presented in Figures 4-6 and 4-7 indicate that there has been recent plume migration in the LEPA and Hot Spot areas. The significance of this recent movement on remedy effectiveness needs to be evaluated. **d.** In addition, an evaluation of the progress of an MNA remedy in meeting RAOs should be undertaken as part of every 5YR where MNA is the remedy. I recognize that it may be premature to request such an evaluation in this case since the transition to MNA was recent. Perhaps we should put the issue into the record as part of our concurrence letter to the Navy on the final document.	**a.** The Navy appreciates EPA's determination that the remedies are currently protective and looks forward to working with EPA to continue to ensure long-term protectiveness. **b.** The Navy recognizes that this issue has been raised in the past. For example, ADEQ provided comments in 2002 on the Draft Land Use Control Implementation Plan (LUCIP) regarding language in the Navy's DEURs which states that they are executed and recorded by the Federal Government "for itself only and not as a covenant running with the land." ADEQ noted that DEURs must be a covenant that runs with and burdens the property. The Navy's 2002 response noted that pursuant to Federal Land Management Policy, a land holding agency such as a DOD Component cannot burden its land with restrictions that run with the land. The Navy proposed recording the DEUR with the language "for itself only…." to comply with the substantive intent of ARS 49-152(e). Concurrence from ADEQ was never received on this proposal. As a practical matter, even if deed restrictions could be placed on active installation property, the deed restrictions would not be effective for notifying installation personnel of the existence of land use controls because deed restrictions are recorded in local land records offices and title searches are not performed when making land use decisions at active installations. Therefore, for Federal land remaining under Federal ownership and control, alternative methods for institutionalizing LUCs are required. The Final LUCIP provides the methods for institutionalizing LUCs. If the property were determined to be excess, it would be subject to property disposal processes and new requirements for implementation of land use controls. If the property were transferred in the future to a non-federal entity, authority would exist to place the restrictions in covenants that run with the land as required by Arizona law.

Review Date: 7 May, 2010			**Review Organization: U.S. EPA**	**Reviewer(s): Harold Ball**
General Comments			**Reviewer's Comments**	**Response to Comments**
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				A recommendation will be added to evaluate the LUCIP and ensure that the plan is up-to-date, continues to provide effective processes for LUC implementation, and continues to provide long-term protectiveness. A recommendation will also be added to initiate discussion between ADEQ, EPA, and Navy legal counsel to determine how to best address and resolve the DEUR issue. **c.** A recommendation will be added to evaluate the progress of plume remediation and potential rebound, and to review the AS/SVE shutdown criteria and make a recommendation regarding system operation. In addition, OU-1 Area 1 plume maps include an error that is currently being corrected. The DCE contour at A1-MW-27 should not be shown on the figure, as the actual DCE concentration at this point in June 2009 was below the MCL. The corrected figures will indicate a smaller plume footprint. **d.** A recommendation will be added to include an evaluation of MNA progress in subsequent five-year reviews, including modeling groundwater under the MNA scenario to predict when MNA would result in reaching MCLs.
2			In addition to the above, I have three other issues about which I have uncertainty and will need to discuss with you. The first is CAOC 8 and dioxin. EPA has proposed a much more stringent residential dioxin PRG that could approach background levels. The dioxin PRG is due to be final this year. While dioxin was not discussed in the report, some of the compounds in the list of identified contaminants are dioxin precursors when burned, as the landfill	The portion of the CAOC south of North Ordnance Road (CAOC 8A) consists of the primary Station landfill/surface disposal areas referenced in the FAA. The area north of North Ordnance Road (CAOC 8B) consists of small scattered suspected waste disposal spots in the Station housing area. These areas were filled in prior to housing development. The residential areas are characterized by housing, pavement, lawns, and playground areas. During the Remedial Investigation (Jacobs, 1996), soil samples were collected from playground areas 1870, 2208, and 2236 at CAOC 8B. The table attached at the end of these responses presents the chemicals detected in CAOC 8B during the RI in areas targeted for sampling based on the

Review Date: 7 May, 2010			**Review Organization: U.S. EPA**	**Reviewer(s): Harold Ball**
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			discussion indicates was done here. I am more concerned about potential exposure to dioxin residuals in the CAOC 8B residential housing area than the 8A capped landfill area. So, in the absence of specific data, in my detailed comments I request information and suggest some language for the 5YR. Ultimately, I may be premature here but this is a good opportunity to open the discussion with the Navy on the issue so I would like to raise it if possible.	presence of chemicals in previous sampling events. Pesticides and metals were the COPCs identified for CAOC 8B. The risk assessment for CAOC 8B estimated the human health risks for residential and industrial scenarios to be acceptable (JEG, 1996). Based on previous soil sampling, dioxin and precursors of dioxin do not appear to be a concern within CAOC 8B. Dioxin may potentially be present at CAOC 8A given the presence of PAHs and PCBs and warrant concern if land use of CAOC 8A were to change in the future. In that situation, the USEPA dioxin reassessment and revised PRGs would be considered as appropriate.
3			My second issue is directed more at the EPA project team and deals with OU-1 Area 3 groundwater closeout decisions. My concern is whether we can consider the remedy to be protective in the absence of performance monitoring. We need to discuss this item.	On December 14, 2005, the DON submitted a letter to U.S. EPA and ADEQ, proposing site closure and an end of LTM at Area 3. The request was supported by a technical memorandum describing how the closure requirements of the ROD had been satisfied at Area 3. The U.S. EPA concurred with site closure in a letter dated February 9, 2006 (Appendix B9). The Navy submitted a second letter to ADEQ on February 15, 2006, with U.S. EPA concurrence attached, stating that ADEQ concurrence with closure of Area 3 would be assumed unless ADEQ responded otherwise within 10 days. No response was received from ADEQ. Following concurrence from U.S. EPA, Area 3 was considered closed with NFA required. All Area 3 wells were decommissioned between October 3, 2006 and October 6, 2006 as outlined in the *Well Abandonment Report for Wells at Area 2, Area 3 and Subarea 5A, Marine Corps Air Station Yuma, AZ* (Battelle, 2006b).
4			My third issue is vapor intrusion and naphthalene. The document identifies a VI issue for naphthalene in OU-1 Areas 1 and 10 but waves it away saying that the data is old and probably not representative of current conditions. I think this is still an	The Navy notes that VI at OU-2 Areas 1 and 10 is a long-term IC issue. Current operations in Area 1 include fencing, a capped surface and open buildings (airplane hangars, etc). Area 10 is a fenced area restricted to industrial use. Current buildings consist of old bunkers and warehouses. Proposed construction is subject to the Planning process, which must go through the Environmental Department.

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			issue but will need insight about current status of building development in these areas to say whether this is a potential short term exposure issue or a long term IC issue.	The VI hazard quotients (HQs) for naphthalene in Areas 1 and 10 were based on the maximum detected concentration of naphthalene in soil. The VI HQ for naphthalene in Area 1 exceeded the regulatory threshold of 1 but was below 1 for Area 10. As discussed above, Area 1 use does not currently include activities presenting a potential VI issue. Historical concentrations of naphthalene in soil in all other sampling locations within Area 1 would not be associated with an HQ above 1. Furthermore, receptors are not anticipated to have continuous exposure to the maximum concentration, and EPA recommends use of exposure point concentrations representative of average site concentrations. In addition, given that the soil data are more than 10 years old and that naphthalene was detected in surface soil samples associated with the washrack area (an uncovered area exposed to the elements such as extreme summer heat) it is possible that current concentrations in Area 1 surface soil would be lower than previously detected. Regardless, current land uses negate the potential for short-term VI issues.
Detailed Comments			**Reviewer's Comments**	**Response to Comments**
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1	xiv	5-Yr Review Summ. Form	The form indicates that this is the second 5YR for OU-1 and the third 5YR for OU-2. In this combined document, per conversation with our HQ, we consider this to be the third 5YR for the site. Please remove the OU-specific references.	The summary form will be revised to indicate that this is the third five-year review for MCAS Yuma. This change will be global throughout the document.
2	xv and 5-5	OU-2 ICs	The document states that "The "modified Declaration of Environmental Use Restrictions (DEURs)" for CAOCs 1, 8A and 10 have been proposed to satisfy the requirements specified in the OU-2 ROD (Uribe & Associates, 1997b) for	Please see the response to General Comment 1b from Harold Ball.

Detailed Comments			Reviewer's Comments	Response to Comments
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			registration of the sites with the State of Arizona." Until the DEURs are in place, the lack of an enforceable IC presents a long term protectiveness issue for the site that affects the protectiveness statement and should be identified as a 5YR follow-up issue in Sections 8 and 9 and the 5YR Summary Form.	
3	3-20	3.6.2.2	This section of the document states that "CAOC 8 was a 68-acre area used primarily for the disposal of municipal wastes … The wastes were burned prior to disposal in 10 to 20 disposal pits at CAOC 8A. The waste streams potentially associated with this disposal area include vehicle- and fuel-related wastes, used oils, solvents, paints, thinners, pesticides, and herbicides." However, the document does not indicate if the potential for dioxin contamination was evaluated for CAOC 8A or more importantly CAOC 8B where there is the potential for residential exposures. Note that on January 7, 2010, EPA published draft guidance on Interim PRGs for dioxin in soil at CERCLA and RCRA sites. If adopted, this proposal will lower the dioxin PRG significantly. Please confirm the activities evaluated to address potential dioxin at the site. If dioxin is a concern, we suggest that the 5YR include a discussion of this issue. In addition, the following language should be added to the response to Questions B in the Technical	Please see the response to General Comment #2 from Harold Ball. The language provided as the last paragraph of the comment will be provided in the "Recommendations" section of the final document: "EPA's dioxin reassessment has been developed and undergone review over many years with the participation of scientific experts in EPA and other federal agencies, as well as scientific experts in the private sector and academia. The Agency followed current cancer guidelines and incorporated the latest data and physiological/biochemical research into the assessment. The results of the assessment have currently not been finalized or adopted into state or federal standards. EPA anticipates that a final revision to the dioxin toxicity numbers may be released by the end of 2010. In addition, EPA/OSWER has proposed to revise the interim preliminary remediation goals (PRGs) for dioxin and dioxin-like compounds, based on technical assessment of scientific and environmental data. However, EPA has not made any final decisions on interim PRGs at this time. Therefore, the dioxin toxicity reassessment for this Site will be updated during the next Five Year Review."

Detailed Comments			Reviewer's Comments	Response to Comments
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			Assessment Section of the Five-Year Review: "EPA's dioxin reassessment has been developed and undergone review over many years with the participation of scientific experts in EPA and other federal agencies, as well as scientific experts in the private sector and academia. The Agency followed current cancer guidelines and incorporated the latest data and physiological/biochemical research into the assessment. The results of the assessment have currently not been finalized or adopted into state or federal standards. EPA anticipates that a final revision to the dioxin toxicity numbers may be released by the end of 2010. In addition, EPA/OSWER has proposed to revise the interim preliminary remediation goals (PRGs) for dioxin and dioxin-like compounds, based on technical assessment of scientific and environmental data. However, EPA has not made any final decisions on interim PRGs at this time. Therefore, the dioxin toxicity reassessment for this Site will be updated during the next Five Year Review."	

Detailed Comments			Reviewer's Comments	Response to Comments
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4	4-18 and 5-5	Area 3 Groundwater	The document indicates that Area 3 has been closed out with NFA despite the presence of free product in the now closed well A3-MW-07. If the free product was a solvent then typically we would ask for remediation. However, it appears that the CSM indicates that waste left in place is isolated from groundwater. If there will be no further impacts to groundwater then NFA might be supportable. What is not described is how they demonstrated no further impacts to groundwater. I am concerned that there does not appear to be performance monitoring in place to demonstrate no impact. A more typical approach would have been performance monitoring and ICs or LUCs. The current discussion raises a number of flags that need to be addressed.	Please see the response to General Comment 3 from Harold Ball.
5	6-3	Document Review	The document indicates that "During the review process, some inconsistencies were indentified between figures provided in the recently revised MCAS Yuma Master Plan (KTUA, 2007) and the Final LUCIP (SWDIV, 2002a)." Due to the role of the MCAS Yuma Master Plan in the overall IC program, this inconsistency should be identified as a 5YR follow-up issue in Sections 8 and 9 and the 5YR Summary Form.	Section 8 will be revised to include the issue of the inconsistencies in these figures, and Section 9 will include a recommendation that the Navy and MCAS Yuma reconcile these inconsistencies. The Summary Form will be updated to reflect these revisions.

Detailed Comments			Reviewer's Comments	Response to Comments
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6	6-3	Data Review	The document should be revised to include a discussion of the significance of the recently observed (June 2009) anomalous movement of the Area 1 plume boundaries as shown in Figures 4-6 and 4-7.	The DCE contour at A1-MW-27 will no longer be shown on the figure, as the actual DCE concentration at this point in June 2009 was below the MCL. Figures 4-6 and 4-7 will be corrected. The correction results in a smaller plume footprint. Further, a discussion will be added to the document to describe the effect of the shutdown of the Hot Spot AS/SVE system on the groundwater flow direction at the northeast edge of the Hot Spot. Please also see the response to General Comment 1c from Harold Ball.
7	7-1	Tech. Assess. OU-1	The document indicates that "The overall size of the plume in the Hot Spot has also decreased substantially." However, Figures 4-6 and 4-7 do not suggest that there has been much reduction in the plumes since 2003. The document should present and discuss any performance monitoring of the MNA remedy that has been completed and evaluate remedy progress in meeting RAOs.	A suggestion to evaluate the performance of MNA in meeting RAOs in the fourth Five-Year Review will be added to Sections 8 and 9. Please also see the response to comment 1d from Harold Ball. Figures 4-6 and 4-7 will be redrawn to correct an error, which will indicate a smaller plume footprint. The DCE contour at A1-MW-27 will no longer be shown on the figure, as the actual DCE concentration at this point in June 2009 is below the MCL. Further, a discussion will be added to the document to describe the effect of the shutdown of the Hot Spot AS/SVE system on the groundwater flow direction at the northeast edge of the Hot Spot.
8	7-2	Groundwater Modeling	The document indicates that "The model suggested that the LEPA plume would not migrate and would be reduced to below MCLs by approximately 2003. This was confirmed by groundwater monitoring, which showed evidence that the LEPA plume was reduced to MCLs (Battelle, 2004b)." However, the TCE data on p. 6-3 do not support this conclusion. The document also indicates in Section 7.1.1.4 that "There was no indication of significant plume migration (see Figures 4-6 and 4-7)." However, the plume map in Figures 4-6 and 4-7 suggest that in the LEPA and Hot	TCE and DCE concentrations at the LEPA have been just above or below the MCL for several years. Semi-annual groundwater monitoring continues at the LEPA to monitor these concentrations, in accordance with the long-term monitoring plan. See responses to comments 6 and 7 above. Figures 4-6 and 4-7 will be redrawn to correct an error, which will indicate a smaller plume footprint. The DCE contour at A1-MW-27 will no longer be shown on the figure, as the actual DCE concentration at this point in June 2009 is below the MCL. Further, a discussion will be added to the document to describe the effect of the shutdown of the Hot Spot AS/SVE system on the groundwater flow direction at the northeast edge of the Hot Spot. Please also see the responses to General Comment 1c and 1d from Harold Ball.

Detailed Comments			Reviewer's Comments	Response to Comments
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			Spot areas, the plume has moved over the years. The final 5YR should address these inconsistencies.	
9	7-3	OU-1 VI	Regarding the evaluation of vapor intrusion, we note that the document references the correct evaluation when using groundwater as the source term for OU-1. Section 7.1.2.2 should include the depth to groundwater since this is a sensitive parameter for the modeling. Please support whether the decision to use "concentrations equal to the MCLs" as the source term is justified. Although, in Section 7.1.2.4 it is indicated that MCLs were achieved in Areas 2, 3 and 6, MCLs have not been achieved throughout Area 1. The document should address any vadose contamination that may be of concern particularly in Area 3 where a significant vadose source was left in place. If available, the document should analyze confirmation soil gas data from the SVE system monitoring program to compare to VI screening levels in assuring that the only source is groundwater. We would ask that the VI analysis either be put into the report as an Appendix or, if a part of a published site document, cited as a reference.	The MCLs were used as source terms in the indoor air evaluation as a way to support the continued use of MCLs as remedial action objectives (RAOs). Because the indoor air exposure pathway was not considered as a potentially complete exposure at the time MCLs were selected as RAOs, the Navy wanted to ensure that the RAOs remain protective if this potential exposure pathway were complete. The depth to groundwater will be added to the text of Section 7.1.2.2. There is not a complete pathway at Area 3, as the area in question is within the flightline, and no structures are present. This could be a potential long-term issue if construction occurs in this area; however, it does not present a current issue. See Section 7.1.2.2 description of the RBCs with respect to distance from the source. A VI analysis document has not been prepared for this site. The CSM for this site is a single source near Building 230, with solvents descending through the vadose zone to the water table at this location. Any COCs in the soil downgradient of the source would result from volatilization from groundwater. Further, SVE was implemented in the area for 7 years, reducing the likelihood of a soil-based source of COCs for potential VI. Text will be added to describe the SVE influent vapor concentrations prior to the AS/SVE system shutdown in May 2007.

Detailed Comments			Reviewer's Comments	Response to Comments
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10	7-6	OU-2 VI	The document presents an analysis of potential vapor intrusion due to naphthalene and discounts the result based on the fact that the soil data is old and probably not reliable indicator of current conditions. It is not clear to me whether this potential pathway represents a future use scenario or whether there are buildings currently in place that could be affected by this pathway. In the absence of confirmation data to support the conclusion in the 5YR, this potential pathway remains an issue to be identified in the 5YR as either a possible short term or long term issue depending on the status of nearby development.	Please see the response to General Comment 4 from Harold Ball.
Review Date: 7 May, 2010			**Review Organization: U.S. EPA**	**Reviewer(s): Daniel Stralka**
Number	**Page**	**Section**	**Reviewer's Comments**	**Response to Comments**
1			There is a IUR for naphthalene as presented in the RSL tables and this can be used in the J&E modeling which may make AOC 1 and 10 present a problem. However, they are using AZ HGBLs as ARARs and those did not have the carcinogenic naphthalene value and use other than 10-6 as endpoints. Even though this is based on old data and may pose a future VI concern, are the ICs appropriate for vapor intrusion? There do not appear to be any current structures so that limits current exposure but are the ICs protective enough to not have construction	The indoor air exposure pathway is incomplete for all three AOCs in OU-2 based on current land use of these areas; thus, the ICs are appropriate. However, if these areas were to be redeveloped in the future for office and/or residential use, the ICs may not be protective and further evaluation of the indoor air pathway would have to be performed. A statement regarding the ICs potential ineffectiveness for indoor air exposure under a potential future scenario will be added to the report. A recommendation will be added to evaluate the ICs and protectiveness of the LUCIP with regards to the VI pathway.

Review Date: 7 May, 2010			**Review Organization: U.S. EPA**	**Reviewer(s): Daniel Stralka**
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			until/unless the soils are reanalyzed and cleared? It is worth making the comment but not having them spend a lot of time redoing the report.	
2			They did the correct evaluation using gw as the source term. They should include in Section 7.1.2.2 the depth to gw since this is a sensitive parameter for the modeling. Is using MCLs as the source term justified? They do include in Section 7.1.2.4 that MCLs were achieved in areas 2, 3 and 6 but not area 1. That should also be in Section 7.1.2.2 to justify using that as the source term. They did not address if there is any vadose contamination that may be of concern. Since there was an SVE system operational, don't they have confirmation soil gas that they can also compare to VI screening levels to assure that the only source is gw?	Please see the response to Comment #9 from Harold Ball.
Review Date: 11 May, 2010			**Review Organization: U.S. EPA**	**Reviewer(s): Sarah Mueller**
Number	**Page**	**Section**	**Reviewer's Comments**	**Response to Comments**
1			**a.** It looks like the ROD for OU2 actually required execution of the DEUR, so they should explain why they are just proposed. It looks like the 2004 FYR noted that they were proposed as well, so it seems as though nothing has happened since then. Are they just proposed because ADEQ has not signed off on them?	**a.** The OU2 ROD called for execution of a Voluntary Environmental Mitigation Use Restriction (VEMUR) that would state that it was executed and recorded by the federal government "for itself only, and not as a covenant running with the land." The Arizona statute was revised subsequent to the signing of the ROD to reflect DEURs instead of VEMURs. The Navy met with ADEQ in a working group meeting in June 2002 to discuss the DEURs and subsequently submitted responses to ADEQ comments on the LUCIP with a proposal regarding DEURs. The Navy has no record of ADEQ concurrence with their proposal;

Review Date: 11 May, 2010			Review Organization: U.S. EPA	Reviewer(s): Sarah Mueller
Number	**Page**	**Section**	**Reviewer's Comments**	**Response to Comments**
			b. Also, I noted in section 5.5 that they say the ICs are considered to be implemented once the ROD is signed, even though the mechanisms have not been implemented. This is very strange and seems to mean that the remedy is complete and implemented, even though it is not. **c.** I agree that the DEURs should be put in place. Normally at a federal facility I would think that you wouldn't do a DEUR until land passes to a non-federal entity, but it sounds like they had come up with language to support recording a DEUR without a transfer. And there is no reason given for why it hasn't been done. It seems like they don't consider it to be an Issue because they consider all ICs to have been implemented. Do you consider the DEUR in this situation to just be an additional layered IC, or would it be the most important IC mechanism? If it is just an additional layer to provide information, it may not be that important to make sure it gets recorded. However, since the ROD called for it, it is difficult to see how they can say the remedy has been implemented without the DEUR.	therefore, progress on this issue stalled. Please also see the response to General Comment 1b by Harold Ball with regards to the DEUR. **b.** With regards to the text in Section 5.5 (now Section 4.2.2), this was an introductory statement leading to a discussion of the steps taken post-ROD to implement ICs for CAOCs 1, 8A, and 10. The text will be revised to state "The ROD for OU-2 identified ICs for CAOCs 1, 8A and 10. The following subsections discuss the steps taken post-ROD to implement ICs for CAOCs 1, 8A and 10 at MCAS Yuma." **c.** Pursuant to Federal Land Management Policy, a land holding agency such as a DOD Component cannot burden its land with restrictions that run with the land. The OU2 ROD stated that the VEMUR would state that it was executed and recorded by the federal government "for itself only, and not as a covenant running with the land." When the statute was revised to reflect DEURs instead of VEMURs, the Navy proposed recording the DEUR with the language "for itself only…." to comply with the substantive intent of ARS 49-152(e). The Navy has no record of concurrence on this proposal. As a practical matter, even if deed restrictions could be placed on active installation property, the deed restrictions would not be effective for notifying installation personnel of the existence of land use controls because deed restrictions are recorded in local land records offices and installation personnel do not perform title searches when making land use decisions at active installations. Therefore, for Federal land remaining under Federal ownership and control, alternative methods for institutionalizing LUCs are required. The Final LUCIP provides the methods for institutionalizing LUCs. A recommendation will be added to evaluate the LUCIP and ensure that the plan is up-to-date, continues to provide effective processes for LUC implementation, and continues to provide long-term protectiveness. A recommendation will also be added to initiate discussion between ADEQ, EPA, and Navy legal counsel to determine how to best address and resolve the DEUR issue.

Review Date: 11 May, 2010			**Review Organization: U.S. EPA**	**Reviewer(s): U.S. EPA**
Number	**Page**	**Section**	**Reviewer's Comments**	**Response to Comments**
			The Draft Final Five-Year Review Report, March 2010, has been substantially revised and expanded, and many of EPA's comments on the November 2009 Draft Five Year Review Report have been addressed by these revisions. The following comments were generated based on a review of the Responses to Comments and compared to the Draft Final Five-Year Review Report, Operable Units 1 and 2, Marine Corps Air Station, Yuma, Arizona, (the Five-Year Review) dated March 2010. However, certain topics still require further clarification. Unless noted below, responses provided adequately addressed EPA's comments. Remaining concerns are outlined below.	No response required.
EVALUATION OF THE RESPONSES TO GENERAL COMMENTS				
Evaluation of Response to General Comment (GC) 1:			The response does not address the comment. There does not appear to be revisions made to the OU-2 "Institutional Control Areas" on Figure 3-2 which are displayed in blue cross hatch (Figure 3-2 is now called Figure 3-4). Additionally, the OU-2 "Institutional Control Areas" on Figure 3-4 appear to be different than those shown on Enclosure 2 of the Station Order 5090 (Appendix B). It is not apparent which existing site figure was revised to accurately display the boundaries for LUCs. Subsequent discussions with the	Section 8 will be revised to include the issue of the inconsistencies in these figures, and Section 9 will include a recommendation that the Navy and MCAS Yuma reconcile these inconsistencies. The Summary Form will be updated to reflect these revisions.

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EVALUATION OF THE RESPONSES TO GENERAL COMMENTS (Continued)				
			Navy and their contractor indicate they recognize this discrepancy, and this situation is noted in Section 6.3. Please revise one of the existing site figures to accurately display the boundaries for LUCs and resolve the inconsistencies recognized in Section 6.3.	
Evaluation of Response to GC 2:			The response does not address the comment. Section 3 of the Land Use Control Implementation Plan (LUCIP) states that annually the tenants "will provide a written report to the MCAS Yuma Environmental Department describing compliance with prohibition of the use of groundwater underlying designated plume areas," however, the response states that annual compliance reports have not been submitted from the MCAS Yuma tenants for this five year review period. In addition, Section 6.1 does not contain information to demonstrate that MCAS Yuma is successfully managing LUCs. Please revise Section 6.1 to specifically discuss the future schedule that will be maintained for written compliance reports, the tenants and buildings/areas that they occupy, and any written reports of compliance failure, which together will demonstrate that MCAS Yuma is successfully managing LUCs. Please also discuss the frequency at which the	The information discussed is now presented in Section 7.1.1.5. The text has been revised to state that MCAS Yuma tenants do not have access to groundwater water resources. The only mechanism for exposure to groundwater is through extraction via groundwater wells. The MCAS Yuma dig permit approval process (which must proceed through the MCAS Yuma Environmental Department) successfully maintains control over the installation of any groundwater wells. No groundwater extraction wells, with the exception of the wells used for environmental remediation, have been installed in the areas within OU-1. MCAS Yuma Environmental Department personnel routinely visit the secured areas in the course of their regular duties. Construction activities must proceed through the planning and NEPA process, which requires evaluation by the MCAS Yuma Environmental Department. A recommendation will be added to evaluate the LUCIP and ensure that the plan is up-to-date, continues to provide effective processes for LUC implementation (including annual documentation describing implementation of the LUCIP), and continues to provide long-term protectiveness.

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			Environmental Department has audited and documented tenant activities and compliance with site visits, and has documented monitoring of unoccupied sites/areas to ensure that LUCs are maintained.	
EVALUATION OF THE RESPONSES TO SPECIFIC COMMENTS				
Evaluation of Response to Specific Comment (SC) 1:			The response partially addresses the comment. Although the revised document now cites specific sections of the Land-Use Control Implementation Plan (LUCIP), it does not describe the site specific land-use controls (LUCs). For example, Section 4.1.2.4, Land Use Control Implementation Plan, states "Figure 3-3, based on Figure 2-1 of the Final LUCIP (SWDIV, 2002a), shows the locations of the OU-1 areas and the boundaries of the required ICs," however it does not describe the physical characteristics of these LUCs (signage, fences, etc.) LUCs are an important aspect of the remedies for the sites in OU-1 and OU-2, and a description of the LUCs and specific extent of the LUC boundaries should be discussed. Discussions with the Arizona Department of Environmental Quality (ADEQ) indicate that a Declaration of Environmental Use Restriction has not been filed, and therefore LUCs with ongoing external verifications apparently do not exist. Please provide a summary of any LUCs and other land use restrictions	Text will be added to the end of Section 4.1.2.4 to describe the LUCs and their boundaries at OU-1 and OU-2. Please see the response to General Comment 1b by Harold Ball and comment 1a, b, and c by Sarah Mueller.

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			maintained by MCAS Yuma in the text of the Five-Year Report and complete the DEUR process for all LUCs.	
Evaluation of Response to SC 2:			The response partially addresses the comment. The addition of Section 3.4 "Basis for Taking Action" includes a description of all CERCLA Areas of Concern (CAOCs) at MCAS Yuma, the type of site, the current status of the site, and any past or present remedial actions; however, the information for all CAOCs at MCAS Yuma is not included in a table as requested in the comment. Further, the response stated that "A table will be included to address the current status of all areas of OU-1, OU-2 and OU-3," but the Draft Final Five-Year Review makes no mention of OU-3; OU-3 was established and noted in the Draft Five-Year Review Report to include additional CAOCs that may be identified, however, no additional CERCLA sites were identified for purposes of the Draft Five-Year Review. There is no mention of OU-3 in this Draft Final Five-Year Review. Please consider the addition of a table listing all the CAOCs at MCAS Yuma, the type of site, the current status of the site, and any past or present remedial actions would adequately summarize the sites not covered in this Five-Year Report. As appropriate and justified, please delete the reference to OU-3.	A Table will be added to address the current status of the individual Areas within OU-1 and OU-2. All discussion of OU-3 has been deleted from the document.

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Evaluation of Response to SC 4:			The response partially addresses the comment. It is unclear that the reference of 40 to 80 feet below ground surface (ft bgs) refers to regional groundwater. The "upper zone" is not defined in the Five-Year Review, and it could refer to site-specific or regional areas. Please revise the Five-Year Review to either provide a definition of the upper zone, or clarify that reference of 40 to 80 feet below ground surface (ft bgs) refers to regional groundwater.	The text will be revised to clarify that the reference to 40 to 80 feet below ground surface refers to the shallow groundwater underlying MCAS Yuma and not to the coarse gravel zone.
Evaluation of Response to SC 5:			The response partially addresses the comment. The response to comment states that the coarse gravel zone, which ranges in thickness from 0 to 100 ft, exists beneath the zone of interest; however because the coarse gravel zone is the most permeable groundwater reservoir in the Yuma area, a downward vertical gradient could result in rapid lateral movement if groundwater contamination were to reach the coarse gravel zone. Please expand discussion regarding the coarse gravel zone, specifically regarding the portion of the unit present beneath MCAS Yuma and the immediate surrounding area and indicate whether this gravel zone is know to be contaminated.	The coarse gravel zone has not been investigated recently under the IR program. However, the OU1 and OU2 remedial investigation (RI) reports evaluated the potential for vertical migration of contamination. Groundwater at MCAS Yuma was identified as a separate OU, requiring a separate RI study and DQO development. However, groundwater was also identified as likely to be a medium of concern at individual OU2 CAOCs. Therefore, the RI for OU2 evaluated the potential for future groundwater contamination from subsurface soils. The OU2 RI evaluated subsurface stratigraphy using cone penetrometer equipment, delineating the horizontal and vertical extent of clay lenses. The process provided a continuous lithologic profile of the subsurface, allowing cross sections and three-dimensional lithologic models to be constructed for each CAOC. Soil samples were also collected for testing such as grain-size distribution and hydraulic conductivity to provide supporting data for evaluating COPC mobility and to provide data for remedial design. Results of the lithologic logging were used to identify optimum soil sampling depths. The OU1 RI was integrated with the groundwater-related information developed from the RI activities for OU2. The OU1 RI included installation of a well screened at a depth of 130 to 145 feet below groundwater surface to evaluate the potential for vertical flow of contamination and for the presence of

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				DNAPL. In addition, wells were installed for the OU1 RI at various depths in CAOCs to evaluate the vertical distribution of contaminants in the aquifer. Nested wells were also installed in Area 1 of OU1 to determine the vertical extent of contamination. Groundwater data from the OU1 RI showed the contamination is confined to the upper 20 to 30 feet of the water table. A subsequent study of perimeter well groundwater monitoring results (Jacobs, 1995) showed that the deeper zone of the upper fine-grained zone was not impacted by contamination. The Final Long Term Monitoring Plan (Bechtel, 2002) provided a list of wells to be sampled on quarterly, semi-annual, or annual schedules, based on historical groundwater sampling results, including the RI report. The deepest well to be included in the LTM Plan was A1-PZ-19, screened from 230-250 ft bgs. A1-PZ-19 has been included in the LTM Plan continuously and has been sampled regularly since 1999, when TCE was detected at 6 μg/L. TCE concentrations have remained relatively stable at A1-PZ-19, exceeding 7 μg/L on three occasions, but never exceeding 10 μg/L. TCE has been below the 5 μg/L MCL since June 2008. DCE has exceeded the 7 μg/L MCL on four occasions, with one of those occasions occurring since March 2004 (7.7 μg/L in June 2006). The geology at A1-PZ-19 consists of silty sands interlayered with clay lenses in the 230-250 ft bgs screened interval (*Technical Memorandum, Permanent Discontinuation of the Vertical Circulation Treatment System at the Leading Edge Plume Area*, Battelle, 2005). This screened interval may be at the lower end of the upper fine-grained zone, which is reported to extend to more than 200 ft bgs.
Evaluation of Response to SC 8:			The response partially addresses the comment. The response clarifies the comment; however, it should be included in the Five-Year Review. Because OU-1 includes areas of contaminated soil and	The following will be added to the text of Section 3.6.2, which provides background information for OU-2: "The COCs of the remaining Areas of OU-2 are PAHs and PCBs and do not represent a source of contamination for OU-1 areas."

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			groundwater underlying MCAS Yuma at depths greater than 10 ft bgs, and OU-2 consists of contaminated soils from the ground surface to a depth of 10 feet bgs, if contaminated soils remain in place in OU-2 then there is the potential for these chemicals to leach/diffuse into OU-1. Please revise the Five-Year Review to discuss the relationship between contaminants in OU-1 and OU-2, and whether the OU-2 sites were potential localized source areas for OU-1 in the past, or may be source areas in the future.	
Evaluation of Response to SC 10:			The response partially addresses the comment. The revised Five-Year Review now has individual figures for Historical Concentrations of 1,1-DCE, TCE, and PCE in the OU-1 Area 1 Hot Spot, Historical Concentrations of 1,1-DCE, TCE and PCE in the OU-1 Area 1 LEPA, and Current Concentrations of 1,1-DCE, TCE and PCE in OU-1 Area 1, which now include PCE values; however, wells such as A1-MW-21 (where concentrations were below MCL values prior to June 2002 and increased in August 2002) that previously showed data up to 2002 are no longer displayed. The absence of wells from the figures should be explained, particularly those with past increasing concentrations. Please revise the Five-Year Review to provide past and recent data for wells with increasing	The groundwater monitoring schedule has been revised through time, with an example being the most recent LTM schedule revision Tech Memo, included in Appendix B11. Wells removed from the sampling schedule per approved revisions to the LTM schedule are not shown, particularly if the wells have not been sampled since 2002. Some wells have been removed from the LTM schedule with regulatory agency approval over time, and thus the most recent data available for presentation may be several years old. The most recent data have been provided wherever available. It is anticipated that the Navy and its contractors will continue the iterative review of the LTM schedule, and formally suggest revisions and updates as appropriate per ongoing review of the data. As has been the case throughout the RAO/LTM process at MCAS Yuma, the LTM schedule will only be revised after regulatory review and approval of the request to revise the schedule.

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			concentrations, or if recent data is not available then provide discussion of a need for additional monitoring (while still presenting the past data).	
Evaluation of Response to SC 12:			The response does not address the comment. See evaluation of response to GC 2.	Please see the response to Evaluation of Response to GC 2.
Evaluation of Response to SC 16:			The response does not address the comment. See evaluation of response to GC 2.	Please see the response to Evaluation of Response to GC 2.
Evaluation of Response to SC 17:			The response partially addresses the comment. Remedial Action Completion Reports (RACRs) were not prepared for Areas 2, 3, and 6 because technical memoranda were appropriate at the time of closure, but references to those memoranda are not provided. Please include a discussion of the technical memoranda, and provide their references.	RACRs were not prepared for these sites. The Technical Memorandum for OU-1, Area 2 is discussed in Section 4.1.3.5, and a copy of the Technical Memorandum and concurrence letter are included in Appendix B8. The Technical Memorandum for OU-1, Area 3 is discussed in Section 4.1.3.6, and a copy of the Technical Memorandum and concurrence letter are included in Appendix B9. The Technical Memorandum for OU-1, Area 6 is discussed in Section 4.1.3.7, and a copy of the Technical Memorandum and concurrence letter are included in Appendix B10.
MINOR COMMENT				
Evaluation of Response to GC 5:			The response to comment lists Section 3.4 "Basis for Taking Action" and Section 5.0 "Progress Since the Last Five-Year Review" to be included in the Final version of the document. Section 5.0 "Progress Since Previous Five-Year Review" covers the material requested in the comment. In the Five-Year Review, Section 3.6 is titled "Basis for Taking Action," however it is unclear how this section addresses the comment regarding actions as follow-up from the previous Five Year Review.	Section 5.0, "Progress Since the Last Five-Year Review", includes the information noted in the Guidance Document for inclusion in Section 5.0. Section 3.6 includes the basis for taking action following the remedial investigation, not as a response to the previous Five-Year Review. Section 3.6 falls within Section 3.0, "Background."

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			Please clarify the response to provide further information about how Section 3.6 pertains to the original comment.	
NEW SPECIFIC COMMENT				
Section 6.3, Document Review, Pages 6-2 and 6-3:			This section indicates that 'compliance reports' were reviewed, but does not specifically list what documents were reviewed. Please list the documents that demonstrate compliance requirements were met at MCAS Yuma.	The text will be revised to indicate that groundwater monitoring reports, including discharge reports and monitoring well inspections required by the LUCIP, were reviewed. Inspection requirements for OU-1 are described in Table 6-1 of the LUCIP, which describes the frequency and specific inspection items for the remediation systems and monitoring wells. Inspection forms are provided as Figures 6-1 and 6-2 of the LUCIP. Neither Table 6-1 nor Figures 6-1 or 6-2 calls for inspection of any new wells or construction. A recommendation will be added to evaluate the LUCIP and ensure that the plan is up-to-date, continues to provide effective processes for LUC implementation (including annual documentation describing LUCIP implementation), and continues to provide long-term protectiveness.
Section 7.1.1.4, Monitored Natural Attenuation, Page 7-2:			The basis for the statement that, "There was no significant plume migration," appears to be contradicted by information presented in Figures 4-6 and 4-7. These figures have been revised from the November 2009 draft figures to include historical data from 2003, 2005, and 2007, and comparisons of the annual isoconcentration contours show a northwestern migration of contaminants of about several hundred feet from 2007 to 2009. Please discuss migration of the plume in the context of meeting the plume stability requirements of Monitored Natural Attenuation and the statement that there has	OU-1 Area 1 plume maps include an error that will be corrected in the next version that will indicate a smaller plume footprint. The text of Section 7.1.1.4 will be amended to clarify that the Area 1 plume is a single plume undergoing MNA. Figures 4-6 and 4-7 will be redrawn and will indicate a smaller plume footprint. Further, a discussion will be added to the document to describe the effect of the shutdown of the Hot Spot AS/SVE system on the groundwater flow direction at the northeast edge of the Hot Spot. The DCE contour at A1-MW-27 will no longer be shown on the figure, as the actual DCE concentration at this point in June 2009 is below the MCL. As the change to MNA has recently been adopted for OU-1 Area 1, a recommendation to evaluate the MNA remedy in the fourth Five-Year

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			been no significant plume migration. Please also revise the Protectiveness Statements section (10.0) as appropriate	Review will be added to Sections 8 and 9.
Section 7.2.1.2, Implementation of Institutional Controls, Page 7-6:			While Institutional Controls (ICs) are contained in the MCAS Yuma Master Plan and require at least annual reporting that ICs are in force, the statement that no compliance reports have been submitted by MCAS tenants indicates that the administration of the ICs is incomplete; DEURs should also be completed and submitted to the ADEQ. As discussed in an above comment, the physical implementation of the ICs should also be described. If these issues cannot be corrected for this Five Year Review, they should be included in Section 8.0 (Issues) and Section 9.0 (Recommendations and Follow-Up Actions.) Please also revise the Protectiveness Statements section (10.0) as appropriate.	Section 8 will be revised to discuss the issues concerning the annual reporting of ICs and recordation of DEURs. Section 9 will be revised to recommend evaluation of the LUCIP to ensure that the plan is up-to-date, continues to provide effective processes for LUC implementation, and continues to provide long-term protectiveness. A recommendation will also be added to initiate discussion between ADEQ, EPA, and Navy legal counsel to determine how to best address and resolve the DEUR issue. MCAS Yuma tenants do not have access to groundwater water resources and the only mechanism for exposure to groundwater is through extraction via groundwater wells. The MCAS Yuma dig permit approval process (which must proceed through the MCAS Yuma Environmental Department) successfully maintains control over the installation of any groundwater wells. No groundwater extraction wells, with the exception of the wells used for environmental remediation, have been installed in the areas within OU-1. MCAS Yuma Environmental Department personnel routinely visit the secured areas in the course of their regular duties. Construction activities must proceed through the planning and NEPA process, which requires evaluation by the MCAS Yuma Environmental Department. Therefore, the Navy believes the remedy to be currently protective.

Table 12–8

Comparison of Maximum Soil Concentrations to Risk – Based Criteria

CAOC 8, Residential Housing Area

Chemical Class/Analyte	Maximum Soil Concentration (mg/kg) 0 to 10'	Residential			
		Risk–Based Criteria [1]		Ratio	
		Cancer (mg/kg)	Noncancer (mg/kg)	Cancer	Noncancer
Semivolatiles					
DI–N–BUTYL PHTHALATE	1.738		3.90E+03		<0.01
Subtotal					<0.01
Pesticides & PCBs					
4,4'–DDD	0.00087	9.35E–01		<0.01	
4,4'–DDE	0.00207	6.60E–01		<0.01	
4,4'–DDT	0.00792	6.60E–01	1.56E+01	0.01	<0.01
DIELDRIN	0.00506	1.40E–02	1.56E+00	0.36	<0.01
HEPTACHLOR EPOXIDE	0.01161	2.47E–02	4.06E–01	0.47	0.03
alpha–CHLORDANE	0.0869	1.73E–01	1.87E+00	0.50	0.05
delta–BHC	0.00145	1.58E–01		<0.01	
gamma–CHLORDANE	0.10152	1.73E–01	1.87E+00	0.59	0.05
Subtotal				1.94	0.13
Metals					
ALUMINUM	5900		7.11E+04		0.08
ARSENIC	3.7	3.02E–01	2.13E+01	12.25	0.17
BARIUM	137		1.52E+03		0.09
CHROMIUM	12.5		7.11E+04		<0.01
COBALT	3.2		4.54E+03		<0.01
COPPER	50.8		2.63E+03		0.02
LEAD [2]	22.2				
MANGANESE	150		1.36E+02		1.11
NICKEL	8		1.42E+03		0.01
VANADIUM	22.1		4.98E+02		0.04
ZINC	52.5		2.13E+04		<0.01
Subtotal				12.25	1.52
Total Petroleum Hydrocarbons [3]					
DIESEL	22				
Total				14.19	1.65

[1] Risk–based criteria are based on U.S. EPA toxicological data, a residential exposure scenario, a target carcinogenic risk of 10^{-6}, and a target noncarcinogenic hazard index of 1.0. The exposure routes considered include soil ingestion, dermal contact, inhalation of volatiles from soil, and inhalation of particulate–bound substances.

[2] Maximum reported concentration of lead is less than the EPA Region IX residential soil screening value, 400 mg/kg; consequently, lead does not represent a potential health threat for future–use residents.

[3] Total petroleum hydrocarbons have not been included in the RBC index calculations because the individual components of greatest concern (e.g., benzene, ethylbenzene, xylene, and PAHs) are addressed.

NOTE: The summary of maximum contaminant concentrations is presented in Appendix Z.

Appendix A

Documents Reviewed

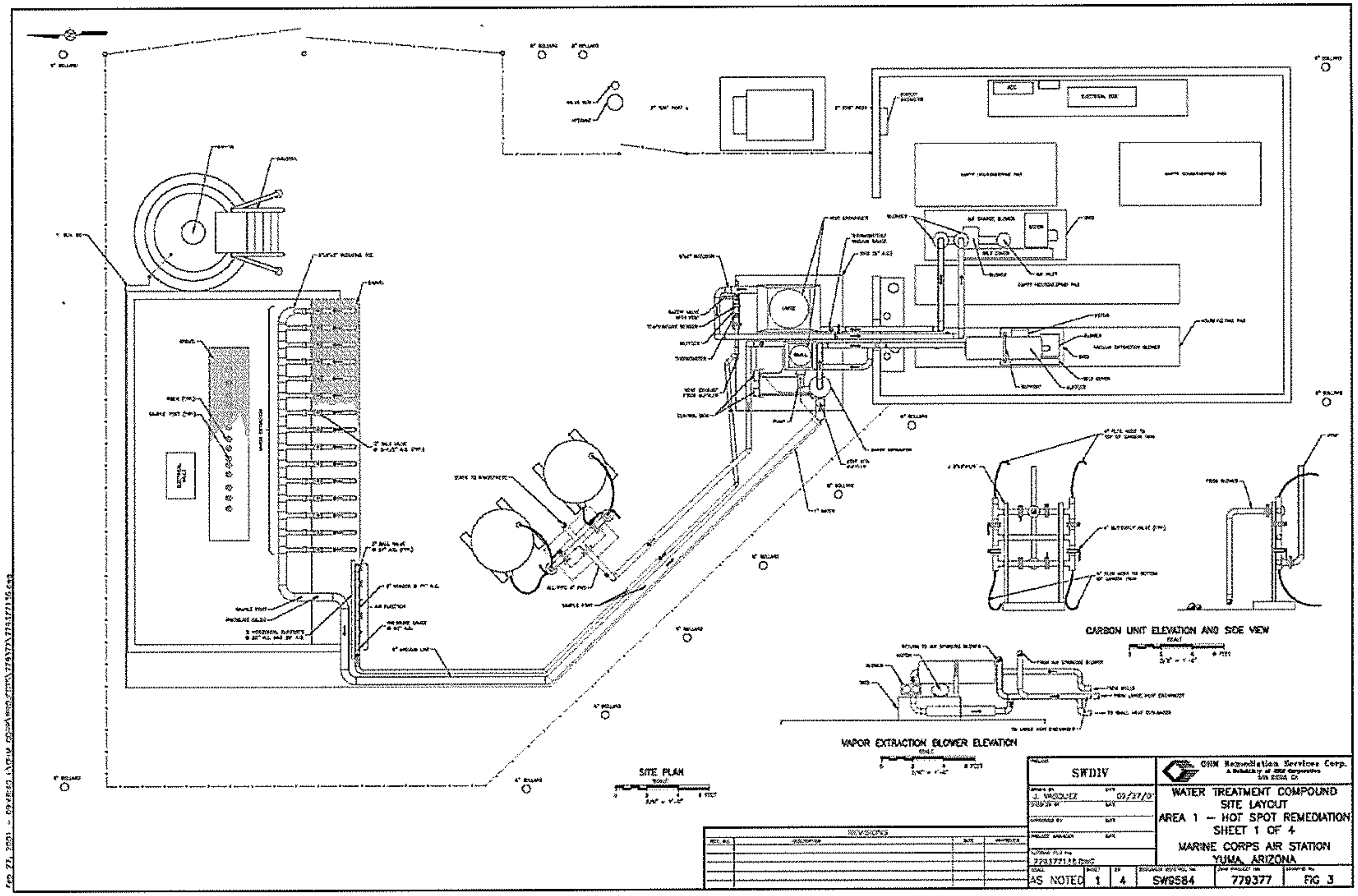
Document	Date	Author
Final Record of Decision for Operable Unit 2	29-Aug-97	Uribe
Final Record of Decision Operable Unit-1	05-Oct-00	SWDIV
MCAS Yuma Masterplan	Sep-01	KTUA
Final Land-Use Control Implementation Plan	23-Sep-02	SWDIV
Final Work Plan For Long-Term Groundwater Monitoring Operable Unit-1 (Areas 1, 2, 3, 6, and Sub-Area 5A)	19-Sep-02	Bechtel
Technical Memorandum, Temporary Discontinuation of the Vertical Circulation Treatment System at the Leading Edge Plume Area	24-Feb-03	Battelle
Technical Memorandum, Operable Unit 1 Area 6 Site Closure	03-Sep-03	Battelle
Quarterly (October to December 2003) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	23-Feb-04	Battelle
Quarterly (January to March 2004) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	1-Jun-04	Battelle
Quarterly (April to June 2004) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	6-Aug-04	Battelle
Quarterly (July to September 2004) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	01-Nov-04	Battelle
Quarterly (October to December 2004) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	18-Feb-05	Battelle
Quarterly (January to March 2005) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	19-Apr-05	Battelle
Quarterly (April to June 2005) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	22-Jul-05	Battelle
Technical Memorandum, Permanent Discontinuation of the Vertical Circulation Treatment System at the Leading Edge Plume Area	16-Aug-05	Battelle
Quarterly (July to September 2005) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	11-Nov-05	Battelle
Technical Memorandum, Operable Unit 1 Area 3 Site Closure	08-Dec-05	Battelle
Quarterly (October to December 2005) Progress and Annual Groundwater Monitoring Report for RAO and LTM for OU-1	17-Feb-06	Battelle
Technical Memorandum, Operable Unit 1 Area 2 Site Closure	06-Mar-06	Battelle
Quarterly (January to March 2006) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	03-May-06	Battelle
Quarterly (April to June 2006) Progress and Semi-Annual Groundwater Monitoring Report for RAO and LTM for OU-1	22-Jul-06	Battelle
Technical Memorandum, Groundwater Monitoring Schedule Revision	25-Jul-06	Battelle
Technical Memorandum, Temporary Shutdown of the Air Sparging/Soil Vapor Extraction System at the Hot Spot	16-Aug-06	Battelle
Quarterly (July to September 2006) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	31-Oct-06	Battelle
Quarterly (October to December 2006) Progress and Annual Groundwater Monitoring Report for RAO and LTM for OU-1	29-Jan-07	Battelle
Quarterly (January to March 2007) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	16-Apr-07	Battelle
Quarterly (April to June 2007) Progress and Semi-Annual Groundwater Monitoring Report for RAO and LTM for OU-1	18-Jul-07	Battelle
MCAS Yuma Masterplan	Sep-07	KTUA
Quarterly (July to December 2007) Progress and Annual Groundwater Monitoring Report for RAO and LTM for OU-1	Jan-08	Battelle
Quarterly (March to June 2008) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	Jul-08	Battelle
Quarterly (July to September 2008) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	Dec-08	Battelle
Quarterly (October to December 2008) Progress and Annual Groundwater Monitoring Report for RAO and LTM for OU-1	Feb-09	Battelle
Quarterly (January to March 2009) Progress and Groundwater Monitoring Report for RAO and LTM for OU-1	May-09	Battelle
Public Notice, CERCLA Five-Year Review for Operable Unit 1 and Operable Unit 2 at MCAS Yuma	10-May-09	Battelle
Quarterly (April to June 2009) Progress and Semi-Annual Groundwater Monitoring Report for RAO and LTM for OU-1	Aug-09	Battelle

Appendix B

Documentation Regarding Remedy Performance

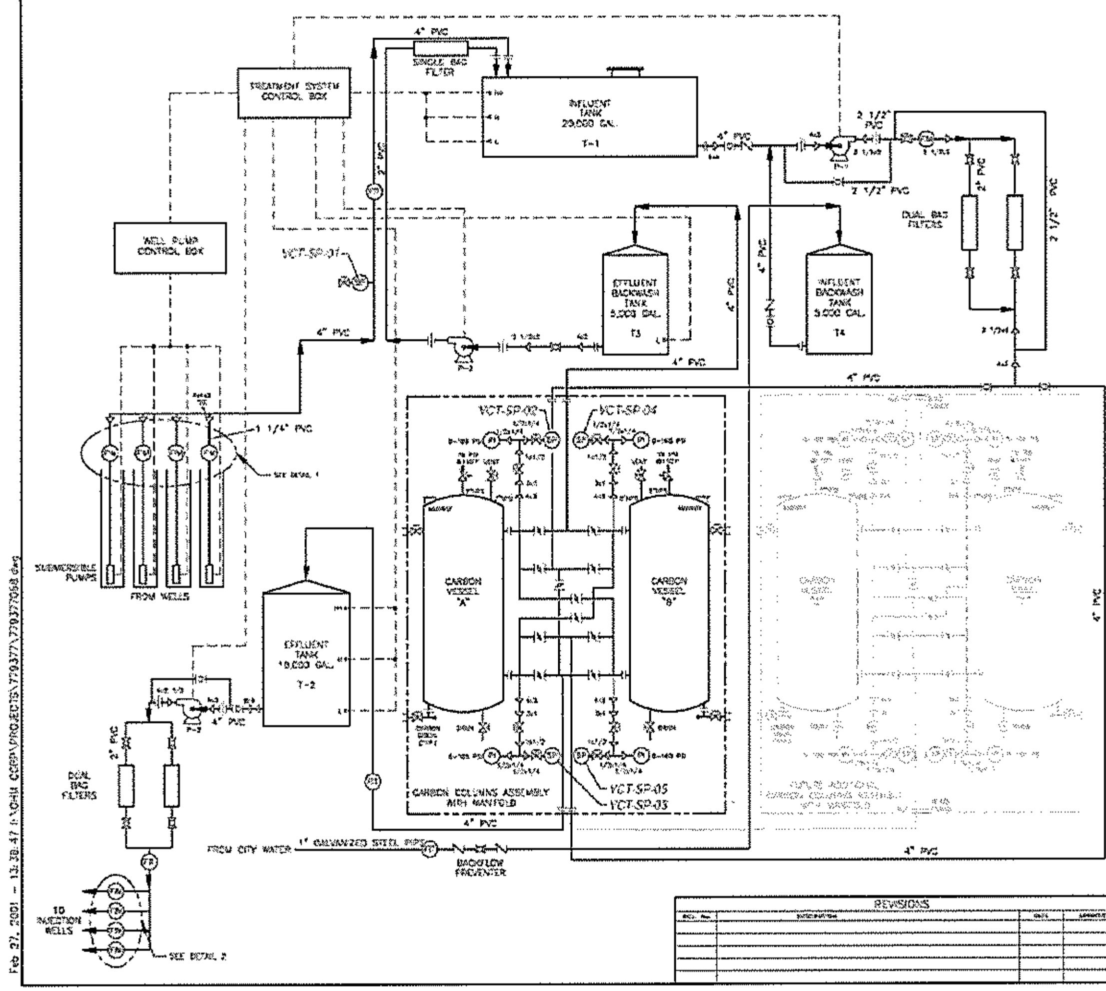
Appendix B1

AS/SVE Schematic Diagram


SITE PLAN
VAPOR EXTRACTION BLOWER ELEVATION
CARBON UNIT ELEVATION AND SIDE VIEW
REVISIONS
SWDIV
J. VASQUEZ
OHM Remediation Services Corp.
WATER TREATMENT COMPOUND
SITE LAYOUT
AREA 1 – HOT SPOT REMEDIATION
SHEET 1 OF 4
MARINE CORPS AIR STATION
YUMA, ARIZONA
AS NOTED
1
4
SW9584
779377
FIG 3

Appendix B2

VCT Schematic Diagram



LEGEND

FIT	FLOW TOTALIZER
FIV	FLOWMETER
PI	PRESSURE GAGE
SP	SAMPLING PORT
	BALL VALVE
	GLOBE VALVE
	BUTTERFLY VALVE
	UNION
	FLANGE
	REDUCER
	CHECK VALVE

REVISIONS

SWDIV	OHM Remediation Services Corp. A Subsidiary of OHM Corporation
DRAWN BY: J. VASQUEZ	DATE: 02/27/01
AUTOCAD FILE No. 77037706B.DWG	
SCALE: NONE	SHEET 2 OF 2
SW9583	779377
FIG 3	

PIPING AND INSTRUMENTATION DIAGRAM
VCT WELL SYSTEM
SHEET 2 OF 2
MARIN CORPS AIR STATION
YUMA, ARIZONA

Appendix B3

MCAS Yuma Land Use Control Implementation Plan (Selected Sections)

Final

Land-Use Control Implementation Plan
Marine Corps Air Station
Yuma, Arizona

SEPTEMBER 2002

Operable Unit-1 (Areas 1, 2, 3, and 6)
Operable Unit-2 (Areas 1, 8A, and 10)
FFAAP Area of Concern A, and
Conditional Closure of Former
Underground Storage Tanks at the
Former Exchange Gas Station

Section 3
LAND-USE CONTROLS

LUCs are necessary to limit human exposure to contaminants and maintain the integrity of the remedial measures. Monitoring and inspections will be conducted to assure that the LUCs are being followed. Objectives for OU-1 LUCs include the following.

- Prevent unauthorized installation of groundwater wells or potential use of untreated groundwater as a drinking water source while the selected remedies are in place.
- Prevent future land use that presents unacceptable risks to human health or the environment because of residual contamination.
- Prevent future land use that accelerates the movement of contaminated groundwater.
- Protect the air sparging and soil vapor extraction system, groundwater containment system, and monitoring wells.

3.1 Operable unit-1 Land-Use Controls

LUCs will also be used to assure that the DON and regulatory agencies can properly monitor and maintain the final remedy. It is anticipated that LUCs may be required for 30 to 40 years.

As stated in the final ROD for OU-1 (SWDIV 2000), LUCs will be applied as follows.

- LUCs will be implemented throughout the duration of the remedial actions to restrict the use of contaminated groundwater.
- LUCs are not required for soil excavation for utility trenches or building construction.
- MCAS Yuma tenants and assigned organizations will comply with all of the LUCs in force at MCAS Yuma.
- MCAS Yuma tenants and assigned organizations will not use contaminated groundwater underlying the designated plume areas for any purpose including but not limited to: drinking water, irrigation, fire control, dust control, or any other activity.
- MCAS Yuma tenants and assigned organizations will not damage or interfere in any way with groundwater monitoring wells, remedial treatment systems, and/or sampling efforts. Access to monitoring wells, remedial treatment systems, and sampling efforts will be permitted to regulatory agency personnel and individuals specifically contracted by the DON and the MCAS Yuma Environmental Department to perform activities related specifically to the use and maintenance of such wells, systems, and sampling efforts. Access to monitoring wells, remedial treatment systems, and sampling efforts will not be permitted to other MCAS personnel unless specifically authorized by the MCAS Yuma Environmental Department. Access will be required for equipment,

including trucks, small loaders, and drill rigs. Alteration or destruction of monitoring wells or remedial treatment systems will require approval from the MCAS Yuma Environmental Department, U.S. EPA, and ADEQ.

- Within 5 working days of discovery, MCAS Yuma tenants and assigned organizations will provide the MCAS Yuma Environmental Department with written notice of failure to comply with the LUCs.
- No later than 31 December of each year, MCAS Yuma tenant and assigned organizations will provide a written report to the MCAS Yuma Environmental Department describing compliance with prohibition of the use of groundwater underlying designated plume areas. A Station Order has been developed to assure tenant commands comply with LUCs and the Station Order will define requirements for reporting to the MCAS Yuma Environmental Department. In addition, the Station Order will establish authority to enforce by the MCAS Yuma Commanding Officer.

The Naval Facilities Engineering Command Southwest Division (NAVFAC SW Division) Real Estate Department shall notify regulatory agencies (U.S. EPA and ADEQ) of any plan to transfer or lease MCAS Yuma real property that has LUCs to any nonfederal entity. MCAS Yuma shall notify the transferee or lessee of the LUCs described in this section, and NAVFAC SW Division shall include the restrictions, as shown in Figure 2-1 of this Land-Use Control Implementation Plan, in the transfer or lease. Such notification will be provided at least 45 days in advance of the property transfer or lease conveyance. MCAS Yuma shall comply with Section 120(h)(3) of CERCLA in any such transfers (Appendix C). Transfer or lease of real property out of federal control will follow guidance included in the Department of Defense memorandum, Interim Policy on Land Use Controls Associated With Environmental Restoration Activities (DoD 2000, as amended) (Appendix D).

In the event that contaminated groundwater migration extends beyond the property controlled by the Yuma County Airport Authority and Yuma County, the NAVFAC SW Division will provide information to appropriate county agencies and private landowners, identifying the areas impacted by groundwater contamination exceeding MCLs. Such notification will be made in writing within 5 working days of the determination that contaminated groundwater migration is extending beyond the property. If applicable, the nature of the information provided should include the type of contaminant, its concentration, the vertical and horizontal extent of the plume, the hydraulic gradient and estimated rate of movement or attenuation. Any risk to human health or the environment should also be reported to the adjacent landowners and the county agencies.

The MCAS Yuma Master Plan was updated in September 2001. It included the above-mentioned restrictions and a map showing areas requiring LUCs (Figure 2-1) as per the OU-1 ROD. The Master Plan amendments included language that 1) prohibits unauthorized installation of groundwater wells or potential use of untreated groundwater as a drinking water source while the selected remedies are in place at MCAS Yuma, 2) described the risk to human health and the environment of contaminated groundwater use, and 3) referenced the final OU-1 ROD (SWDIV 2000). U.S. EPA and ADEQ have been provided copies of the pertinent sections of the Base Master Plan that incorporated the OU-1 ROD.

Section 6
OU-1 LAND-USE CONTROL MONITORING AND REPORTING

LUCs are put into place to assure the integrity of the containment system, prevent exposure to contaminants at the site, and maintain the structural integrity of the monitoring equipment. Remediation system components and engineering controls that will be inspected and/or monitored at OU-1 include the following:

- groundwater monitoring wells
- air sparging and soil vapor extraction wells
- vertical circulation treatment wells
- site security measures such as fences around remediation equipment and locks to restrict access to groundwater wells

To assure that the LUCs are in place and effective, this plan summarizes the required monitoring and reporting of LUCs.

6.1 responsible parties

The owner of the property has the most direct effect on the viability of the LUCs; therefore, MCAS Yuma is responsible for LUC maintenance, inspection, and reporting. If corrective measures are necessary or in case of an emergency, the MCAS Yuma Duty Officer and the MCAS Yuma Environmental Department should be contacted.

6.2 frequency of monitoring and inspections

OU-1 remediation system and engineering controls will be inspected by NAVFAC SW Division during each groundwater sampling event or during routine maintenance and operation of remediation systems. The frequency of groundwater sampling events will be determined as part of the OU-1 Long-Term Monitoring Plan for groundwater (BNI 2001). Sampling events will initially be performed two to four times a year. After 1 year, the data will be evaluated, and the frequency of sampling may be revised. Remediation system equipment will be inspected weekly.

The inspection schedule for the remediation system is presented in Table 6-1. Inspections of remediation systems will be documented on the form presented in Figure 6-1. Inspections of monitoring wells will be documented on the form presented in Figure 6-2.

6.3 reporting requirements

Until CHC groundwater contamination is reduced to concentrations equal to or below MCLs, the MCAS Yuma Environmental Department will be responsible for preparing an annual groundwater monitoring report for OU-1. The report will be submitted to U.S. EPA and ADEQ 60 days after the end of each calendar year.

Forms (Figures 6-1 and 6-2) documenting inspections of the remediation systems and monitoring wells will be included in the OU-1 LUC report. If results from inspections

Table 6-1
Operable Unit-1 Remediation System Inspection Schedule

Structure/Equipment	Inspection Frequency	Inspection
Security and remediation systems	During (at least weekly) routine operation and maintenance visits to verify system operation	Verify that access to remedial systems is restricted by fencing and locked entry Verify that remedial systems are operating at the desired frequency
Monitoring wells	During each monitoring event (one to four times a year)	Inspect well pads for cracks in the pavement Inspect the well vault for integrity Verify the presence of a lock to restrict access to the interior of the monitoring well Verify the presence of a well cap and the seal created by the well cap to prevent infiltration of surface water into the well casing Inspect whether surface water has accumulated in the well vault Inspect for damaged casing Inspect for potential obstructions in the well Inspect for other adverse conditions

and monitoring events indicate that the remedy is ineffective (i.e., groundwater CHC concentrations are increasing, or plume size is increasing), then NAVFAC SW Division will notify U.S. EPA and ADEQ both verbally and in writing within 5 days of receipt of the data and perform corrective measures until the remedy is shown to be effective.

6.4 Records Management

LUC records must be retained by MCAS Yuma to determine whether land-use changes can be made in the future. These records will be maintained in the Installation Restoration Program Administrative Records File at the MCAS Yuma Environmental Department. The records include the ROD, Feasibility Study Report, and MCAS Yuma Master Plan.

Appendix B4

MCAS Yuma Station Order 5090

UNITED STATES MARINE CORPS
MARINE CORPS AIR STATION
BOX 99100
YUMA, ARIZONA 85369-9100

StaO 5090
ENVO
10 JAN 2002

RECEIVED
2002 JAN 16 P 2:28

STATION ORDER 5090

From: Commanding Officer, Marine Corps Air Station Yuma, AZ
To: Distribution List

Subj: LAND USE CONTROLS

Ref: (a) MCO P5090.2A
(b) Land Use Control Implementation Plan

Encl: (1) Operable Unit-1 LUC Map
(2) Operable Unit-2 LUC Map
(3) Tenant List

1. Situation. The Navy and Marine Corps conduct several environmental cleanups on MCAS Yuma. To protect these cleanups and those who may come in contact with these cleanups, implementing land use controls, (LUCs), is sometimes necessary. LUCs include any type of physical, legal, or administrative mechanism restricting the use of, or limiting access to, environmental cleanup areas.

2. Mission. To implement land use controls necessary to protect human health and the environment as per the references.

3. Execution

a. Commander's Intent and Concept of Operations

(1) Commander's Intent

(a) Prevent unauthorized groundwater use.

(b) Prevent unauthorized land use.

(c) Protect environmental cleanup areas.

(d) Protect environmental cleanup facilities and equipment.

(2) Concept of Operations

(a) MCAS Yuma shall incorporate, as applicable, all cleanup area LUCs into its existing land-use planning and management systems. The system includes the site approval process for reviewing and approving all new construction and land-use changes.

(b) All groundwater use from the designated contaminated groundwater plume is prohibited.

(c) Before the end of each calendar year, each of the tenants listed in Enclosure (3) will give the MCAS Yuma Environmental Department a written description of their compliance with the groundwater use prohibition described above.

(d) MCAS Yuma and the tenants listed in Enclosure (3) will not damage or interfere with groundwater monitoring wells, remedial treatment systems, and/or sampling. Reasonable access to monitoring wells, remedial treatment systems, and sampling efforts will be permitted only for authorized MCAS Yuma personnel and contractors for sampling, operating, inspecting and maintaining monitoring wells and remediation systems. Reasonable access includes the use and/or transportation of equipment, including trucks, small loaders, and drill rigs.

(e) The tenants listed in Enclosure (3) will, within 5 working days of discovery, give the MCAS Yuma Environmental Department a written notice of failures to comply with the LUCs described in the preceding paragraphs.

b. <u>Subordinate Element Missions</u>

(1) MCAS Yuma Environmental Director is responsible for the implementation of this Order.

(2) MCAS Yuma Environmental Department is the point-of-contact for LUC matters to include compliance with this Order.

(3) MCAS Yuma tenants, the tenants in Enclosure (3), and future contractors conducting business, will comply with cleanup area LUCs.

c. <u>Coordinating Instructions</u>

(1) MCAS Yuma and the tenants in Enclosure (3) are responsible for compliance with this Order. (Note: This Order does not establish LUCs.)

(2) Enclosures (1) and (2) depict MCAS Yuma cleanup areas, and MCAS Yuma's Land Use Control Implementation Plan (LUCIP) . Reference (b) identifies and describes cleanup area LUCs.

4. <u>Administration and Logistics.</u> This order is new and should be reviewed in its entirety.

5. <u>Command and Signal</u>

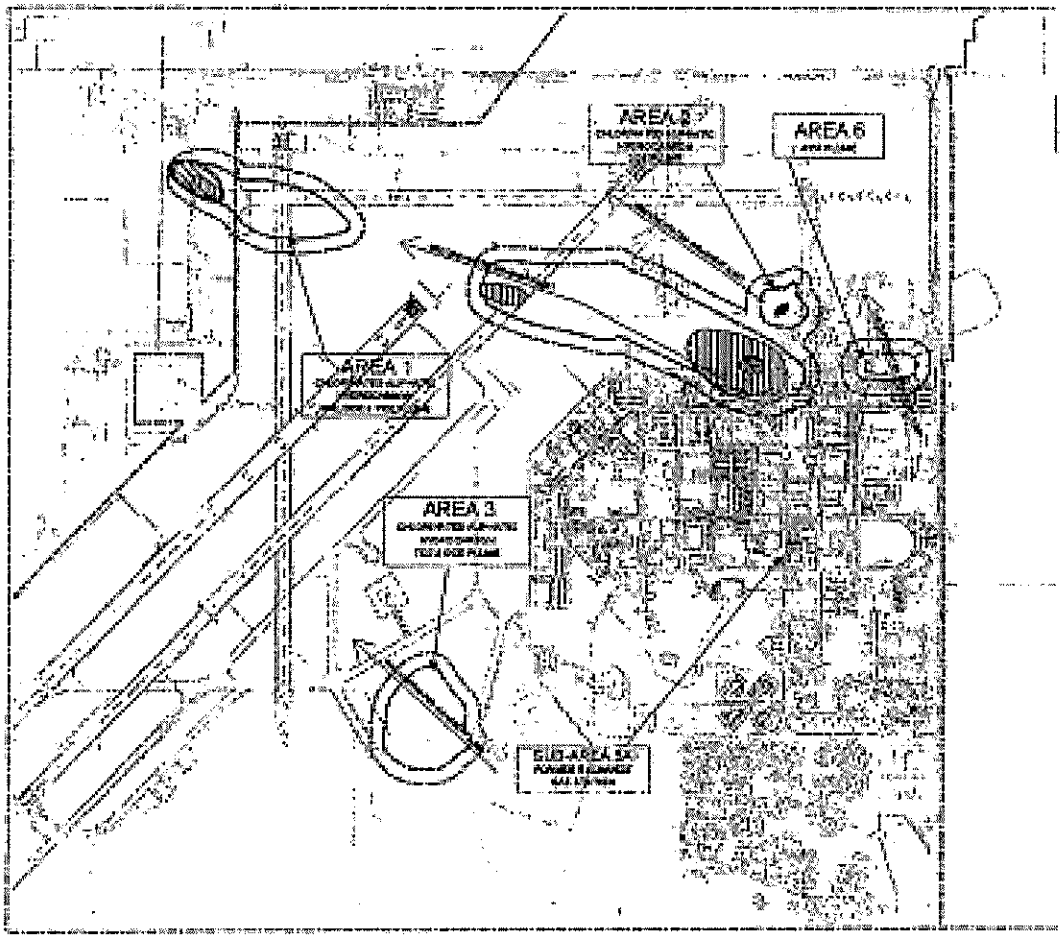
a. <u>Signal.</u> This Order is effective the date signed

b. Command. This order is applicable to MCAS Yuma and the tenants listed in Enclosure (3).

MARK E. CONDRA

DISTRIBUTION: A

1-0 JAN 2002



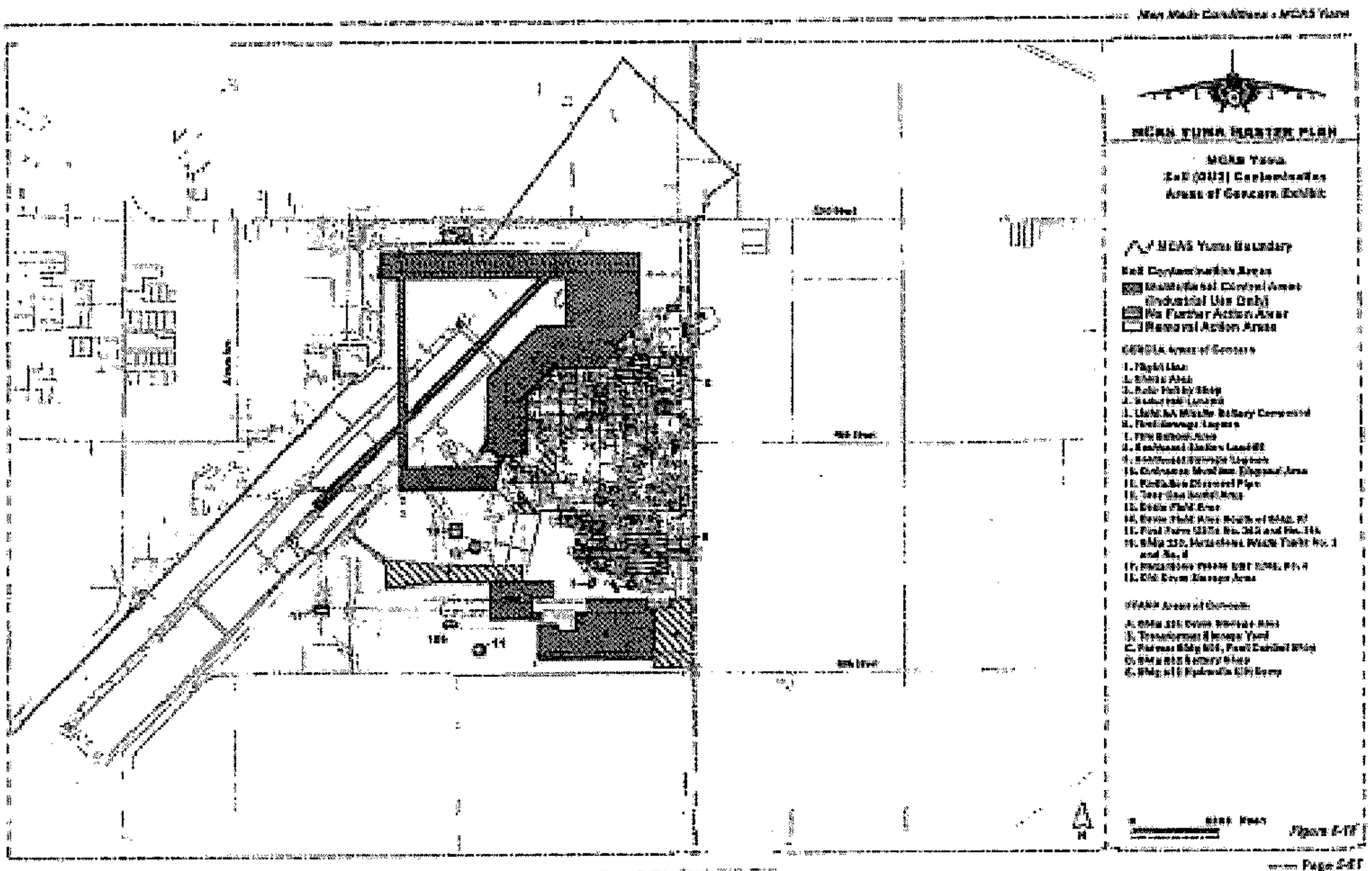
MCAS YUMA MASTER PLAN

MCAS Yuma Groundwater (GW) Areas of Concern

Figure 5-17

ENCLOSURE (1)

ENVO
10 JAN 2002



ENCLOSURE (2)

StaO 5090
ENVO
10 JAN [illegible]

TENANT COMMANDS

H&HS
MAWTS-1
MAG-13
MALS-13
VMA-211
VMA-214
VMA-311
VMA-513
MWSS-371
MACS-1
VMFT-401
CSSD-16

OTHER

MCCS (Marine Corps Community Services)
FMD (Facilities Management Department)
ROICC (Resident Officer in Charge of Construction)
BMC (Branch Medical/Dental Clinic)
YCAA (Yuma county Airport Authority)

CURRENT CONTRACTORS

RAYTHEON AEROSPACE
TERRA VAC
SIKORSKY SUPPORT SYSTEMS INC
BOEING
MAYTAG SERVICE
MAYBERRY
SUBURBAN SANITATION

Appendix B5

AS/SVE Temporary Shutdown Technical Memorandum with U.S. EPA Concurrence

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

11000
Ser OPCE.JDB/028
24 Jan 07

Ms. Cathy O'Connell
Arizona Department of Environmental Quality (ADEQ)
Federal Projects Unit, Superfund Programs Section, Waste Program Division
1110 West Washington Street
Phoenix, AZ 85007

SUBJECT: TECHNICAL MEMOS FOR THE REVISED LTM SCHEDULE AND THE SHUTDOWN OF THE HOT SPOT AS/SVE SYSTEM LOCATED AT THE MARINE CORPS AIR STATION (MCAS), YUMA ARIZONA

Dear Ms O'Connell:

The Department of the Navy proposed to diminish the sampling frequency of wells, reduce the number of wells being sampled, and temporarily shut down the Air Sparge/Soil Vapor Extraction System at Area 1, Operable Unit One (OU-1), MCAS Yuma, Arizona, in two separate technical memos sent to both ADEQ and U.S. Environmental Protection Agency (EPA) on 27 July and 16 August, 2006, respectively. These letters requested a response to the LTM schedule revision memo by 25 September, 2006, and a response to the Hot Spot temporary shutdown memo by 17 October, 2006, no response from ADEQ has been received. However, per enclosure (1), U.S. Environmental Protection Agency Region IX sent a concurrence letter.

This letter is to notify you that the Department of the Navy plans to proceed with the diminished sampling frequency of wells, reduced number of wells being sampled, and the temporary shut down of the Air Sparge/Soil Vapor Extraction System at Area 1 unless we receive a non-concurrence response from ADEQ within the next 10 days of receiving this correspondence. The Department of the Navy will assume ADEQ concurs with the recommendations in the memos otherwise.

If you have any questions please call me at (619) 532-1735.

Sincerely,

Juan Diez de Bonilla

JUAN DIEZ DE BONILLA
Remedial Project Manager
By Direction

Enclosure:
1. U.S. EPA Region IX Concurrence Letter dated November 28, 2006

Copy to:
U.S. EPA Region IX (Mr. Martin Hausladen)
Environmental Department, MCAS Yuma AZ (Mr. Dan Nail)
Arizona Department of Environmental Quality (ADEQ) (Bob Peeples)
Battelle, Environmental Restoration Department (Chris Coonfare)

OPCE.JAB
JC
OPES.FO

(619) 556-9160

November 28, 2006

NAVFAC Southwest
Central Area Focus Team
1220 Pacific Highway (Building 1)
San Diego, CA 92132

Attention: Juan Diez de Bonilla
Remedial Project Manager

Subject: Technical Memos for the revised LTM schedule and the shutdown of the Hot Spot AS/SVE system located at the MCAS, Yuma, Arizona.

Mr. Diez de Bonilla

The Environmental Protection Agency (EPA) has completed its review of the above mentioned Technical Memos regarding Operational Unit (OU) 1 located at the Marine Corps Air Station (MCAS), Yuma, Arizona. One memo discusses the reduction of the number of wells sampled in addition to the reduced frequency of sampling events, except for the "hot spot" area. The second memo discusses the temporary shut down of the Air Sparge/ Soil Vapor Extraction System. The EPA concurs with the recommendations presented in the Technical Memos.

If you should have any further questions, pleases call me at (415) 972-3007.

Sincerely,

Martin Hausladen
Environmental Protection Agency

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser ROPDE.AL/6240
August 16, 2006

Mr. Martin Hausladen
U.S. Environmental Protection Agency
Region 9 - Federal Facilities/Superfund Division
75 Hawthorne Street
San Francisco, CA 94105

Ms. Cathy O'Connell
Arizona Department of Environmental Quality
Federal Projects Unit, Superfund Program Section,
Waste Program Division
1110 West Washington Street
Phoenix, AZ 85007

Dear Environmental Project Managers:

SUBJECT: PROPOSED TEMPORARY SHUTDOWN OF THE AIR SPARGE/SOIL VAPOR EXTRACTION (AS/SVE) SYSTEM AT MARINE CORPS AIR STATION (MCAS) YUMA, ARIZONA

The Department of the Navy is proposing a temporary shutdown of the AS/SVE system at MCAS Yuma pursuant to the Record of Decision (ROD) for Operable Unit 1 (OU-1) dated July 2000. According to this ROD, the Department of the Navy can propose a temporary shutdown of the AS/SVE system when the system no longer removes mass (i.e., asymptotic condition is reached) or further removal of Chlorinated Hydrocarbons (CHC) is technically and economically unfeasible or Maximum Contaminant Levels (MCLs) are reached.

The enclosed Technical Memorandum demonstrates the AS/SVE system is no longer removing sufficient mass to justify continued operation of the system. Furthermore, only three of the numerous monitoring wells in the treatment zone have CHC concentrations that exceed (MCLs). In fact, one of the three monitoring wells barely exceeds MCLs. The highest concentration of CHCs in the other two wells is 33 µg/L. The Department of the Navy believes that these three wells will naturally attenuate to MCLs without continued operation of the AS/SVE system.

The Department of the Navy will continue to monitor the groundwater per the Long Term Monitoring Plan. If there is a significant rebound in CHC concentrations, the AS/SVE system will be restarted. However, the Department of the Navy will propose permanent shutdown of the AS/SVE system if no significant rebound occurs within two years.

The Department of the Navy is requesting your concurrence to the above-mentioned proposed temporary shutdown of the AS/SVE system in writing by October 17, 2006.

If you have any questions regarding this letter, please contact me at (619) 532-4228.

Sincerely,

ANGIE LIND
Remedial Project Manager
By direction of the Commanding Officer

Encl: (1) Technical Memorandum Groundwater Monitoring Schedule dated July 25, 2006

Copy to:
Mr. Ken Yargus, MCAS Yuma Environmental
Mr. Dan Nail, MCAS Yuma Installation Restoration Program Manager
Ms. Diane Silva, Admin Record

TECHNICAL MEMORANDUM

Temporary Shutdown of the Air Sparging/Soil Vapor Extraction System at the Hot Spot, Marine Corps Air Station Yuma, Arizona

Contract No. N68711-01-D-6009
Task Order No. 008
August 16, 2006

Introduction

This Technical Memorandum has been prepared to support the temporary shutdown of the Air Sparging/Soil Vapor Extraction (AS/SVE) system at the Area 1 Hot Spot, Operable Unit (OU) 1 at Marine Corps Air Station (MCAS) Yuma, Arizona. The rationale supporting the temporary shutdown of the AS/SVE system has been reviewed and approved previously by the United States Environmental Protection Agency (U.S. EPA) and the Arizona Department of Environmental Quality (ADEQ) with regard to the Vertical Circulation Treatment (VCT) system at the Leading Edge Plume Area (LEPA) of OU-1. Temporary shutdown of the AS/SVE system was discussed at a project review meeting attended by U.S. EPA, ADEQ, Naval Facilities Engineering Command (NAVFAC) Southwest, and Battelle on June 20, 2006.

Site Description

MCAS Yuma is an active facility located immediately southeast of the city of Yuma, Arizona. Previous activities at MCAS Yuma resulted in the release of volatile organic compounds (VOCs) to the groundwater in the vicinity of the flight line, near Building 230. This area is currently referred to as the Hot Spot. The plume of contaminated groundwater extends to the northwest from the Hot Spot. The Hot Spot is designated as a portion of Area 1 of OU-1. A final Record of Decision (ROD) for OU-1 was signed by the U.S. EPA and the ADEQ in September and October 2000, respectively. The remedial action objectives established for this effort are the Maximum Contaminant Levels (MCLs) based on the Safe Drinking Water Act (SDWA). The contaminants of concern (COCs) at the Hot Spot area are 1,1-Dichloroethylene (1,1-DCE), Perchloroethylene (PCE), and Trichloroethylene (TCE), with MCLs of 7 µg/L, 5 µg/L, and 5 µg/L, respectively.

System Description

An AS/SVE system was installed at the Hot Spot area to treat the contaminated groundwater in the subsurface northwest of Building 230. The AS system injects air into the saturated zone to strip VOCs from groundwater. The SVE system creates a vacuum in the vadose zone, capturing the sparge air and soil vapors and removing the stripped contaminants from the subsurface. The contaminated vapor stream is treated aboveground prior to discharge to the atmosphere. The injection of air into the subsurface also supports the reduction of COC concentrations via biodegradation.

The AS system consists of 43 sparge wells, operating in five banks (i.e., Rows 29, 39, 49, 59, and 70). A blower (rated at 400 cfm) is used to deliver the air to the wells. The SVE system uses a separate blower, rated at 500 cfm, to extract sparge air and soil vapors from 15 extraction wells. The extracted vapors are treated with granular activated carbon (GAC). The AS and SVE wells and injection/extraction manifolds are completed below the asphalt and concrete surface. The injection and extraction blowers, the vapor treatment system, and associated equipment are contained in the treatment compound located to the west of Building 230. The layout of the AS/SVE system is included as Figure 1, a piping and instrumentation diagram is included as Figure 2, and a map showing the locations of the sparge well rows and the Hot Spot area monitoring wells is included as Figure 3.

System Operation

The operation of the AS/SVE system is described in detail in the revised O&M manual (TerraVac, 2003b). The AS/SVE system was modified and reconfigured in December 2002 (see Addendum to the revised O&M manual [TerraVac, 2003b]). The AS/SVE system began operation on November 16, 1999. Battelle took over operation on September 30, 2002.

From November 2002 through early January 2004, air injection focused on the eastern portion of the site where elevated contaminant concentrations were persistent; air injection through Rows 29, 39, and 49 continued as an attempt to enhance VOC removal in this area. Such focused operations resulted in significant reductions of TCE and DCE concentrations in Hot Spot area groundwater. On November 24 and 25, 2003, Rows 59 and 70 were opened and Rows 29, 39, and 49 were closed for two days to test the wells for injection during the upcoming quarter. The injection pattern was revised in January 2005 to focus on the eastern part of the site while still addressing the western section (i.e., rows 59 and 70 operating for one week of each month, and rows 29, 39, and 49 operating for three weeks of each month). The injection strategy at the Area 1 Hot Spot was further modified in early October 2005 to incorporate a daily pulsed injection pattern, with injection manually switched between rows 29, 39, and 49 and rows 59 and 70 three times each day. The purpose of this modification was to optimize the removal of VOCs from the groundwater by disrupting established flow paths of injected air in the saturated zone.

Data Review

Vapor samples have been collected at the SVE vapor treatment unit on a monthly basis throughout the operation of the Hot Spot AS/SVE system. These samples are analyzed for volatile organic compounds (VOCs) at a laboratory, using the TO-14 Method. The VOC concentrations and the system vapor discharge rate are used to calculate a mass removal rate. Cumulative vapor-phase mass removal (Figure 4) has remained stable for approximately four years.

Groundwater samples have been collected on a quarterly, semiannual, or annual basis at the Hot Spot since April 2000, in accordance with the Long-Term Monitoring Plan and subsequent revisions. The most recent samples were collected in June, 2006. Nine groundwater monitoring wells in the Area 1 Hot Spot were scheduled to be sampled. TCE was detected at concentrations exceeding the 5 µg/L MCL in three of the 9 monitoring wells sampled during this event: 16-MW-06 (5.9 µg/L), 16-MW-18 (15 µg/L), and 16-MW-09 (33 µg/L). 1,1-DCE was detected at concentrations exceeding the 7 µg/L MCL in two monitoring wells: 16-MW-18 (14 µg/L) and 16-MW-09 (7.2 µg/L).

Significant reductions of TCE and DCE concentrations have occurred at the Hot Spot following system optimization actions undertaken by the Navy since December, 2002, including repairs to the injection wells and modifications to the injection strategy. For example, TCE and DCE concentrations in well 16-MW-18 decreased from 73 and 18 µg/L in March 2003 to 15 and 14 µg/L, respectively, in June 2006. TCE and DCE concentrations in 16-MW-09 decreased from 230 and 55 µg/L in August 2002 to 33.0 and 7.2 µg/L, respectively, in June 2006. The current DCE and TCE concentrations are contoured on Figures 5 and 6, respectively. The DCE and TCE concentrations appear to have stabilized over recent quarters. Historical and recent DCE and TCE concentrations at the Hot Spot are shown on Figure 3.

Conclusions and Recommendations

Figure 7 provides the decision flow diagram for operation and shutdown of the VCT and AS/SVE remediation systems in Area 1. This decision flow diagram was developed in the ROD in 2000. As shown on Figure 7, when the AS/SVE system no longer removes mass (i.e., asymptotic condition is reached), and further removal is technically and economically unfeasible or MCLs are reached, the Navy can propose a temporary shutdown of the system operation with continued groundwater monitoring for up to two years. If rebound of the COC concentrations does not occur, the Navy will propose permanent shutdown of the AS/SVE system. If rebound to above the MCLs does occur in wells at the Hot Spot, the system will be restarted and operated until the MCLs are reached again. Once asymptotic conditions are permanently reached, AS/SVE operation will be discontinued.

Recent TO-14 analyses indicate low and stable concentrations of VOCs in the SVE off-gas. Groundwater results show that the operation of the AS/SVE system has resulted in significant reductions of TCE and DCE concentrations in Hot Spot groundwater, and that concentrations have stabilized. Furthermore, groundwater modeling has been performed to evaluate the potential for COCs to reach the MCAS Yuma facility boundary at concentrations equal to or exceeding the MCLs. The simulations discussed in the "Final Groundwater Modeling Report for OU-1 at MCAS Yuma, AZ" (Battelle, 2004) indicate that COCs will not reach the facility boundary at such levels. The simulations discussed in the modeling report were based upon COC concentrations significantly higher than the current levels, providing an additional level of conservatism given the current reduced concentrations. Therefore, because the requirements for temporary shutdown of the AS/SVE system as set forth in the decision flow diagram have been met, Battelle recommends temporary shutdown of the AS/SVE system.

Quarterly groundwater monitoring in the Hot Spot area is recommended during the temporary shutdown period. The Navy has submitted a Technical Memorandum proposing a revised LTM schedule that incorporates continued quarterly sampling at the Hot Spot. The groundwater monitoring data will be used to evaluate the amount of rebound in the COC concentrations. Monthly start-up testing should be conducted to ensure that the AS/SVE system remains in working order should continued operation be required.

FIGURES

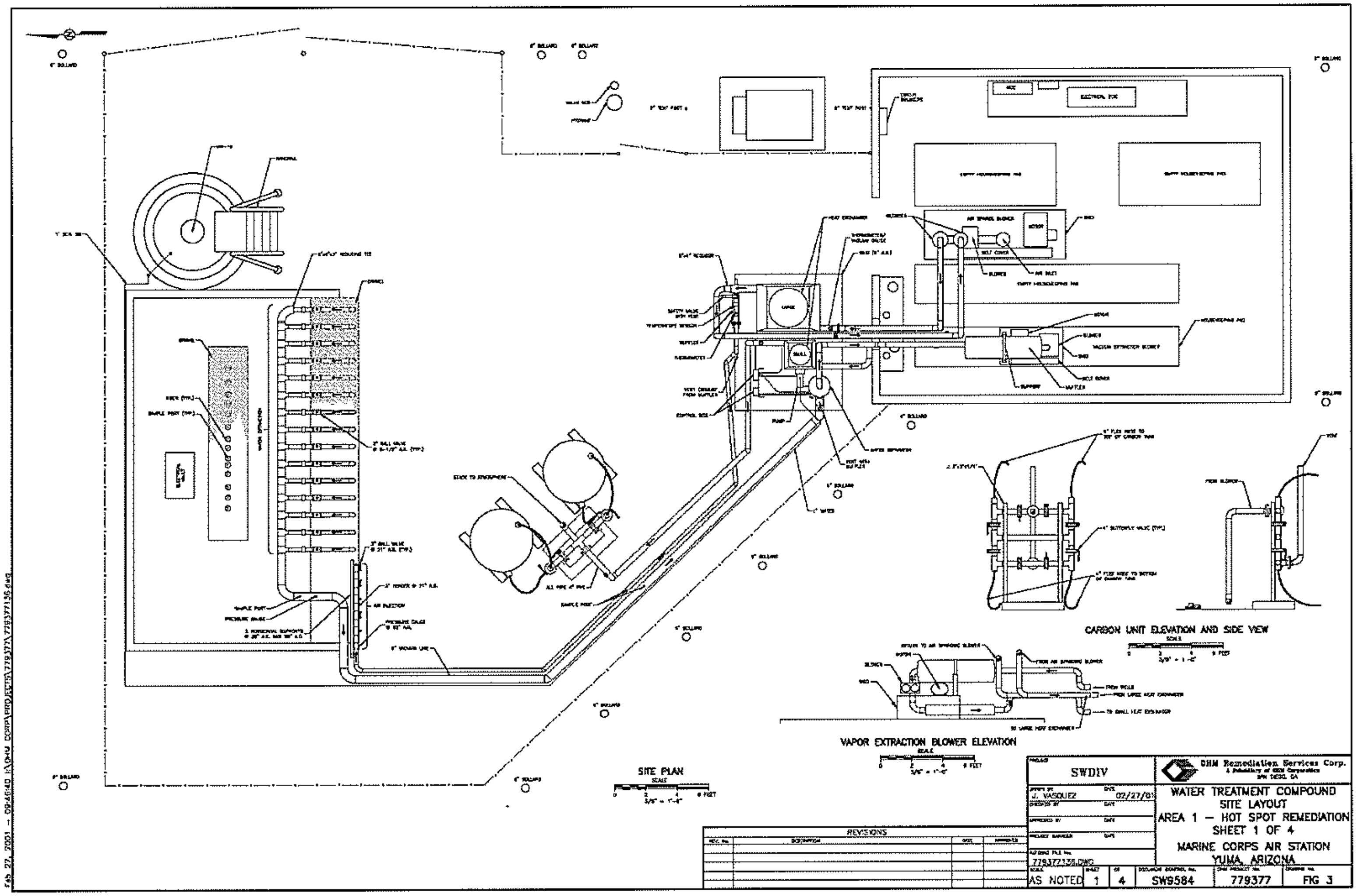


Figure 1. AS/SVE System Layout

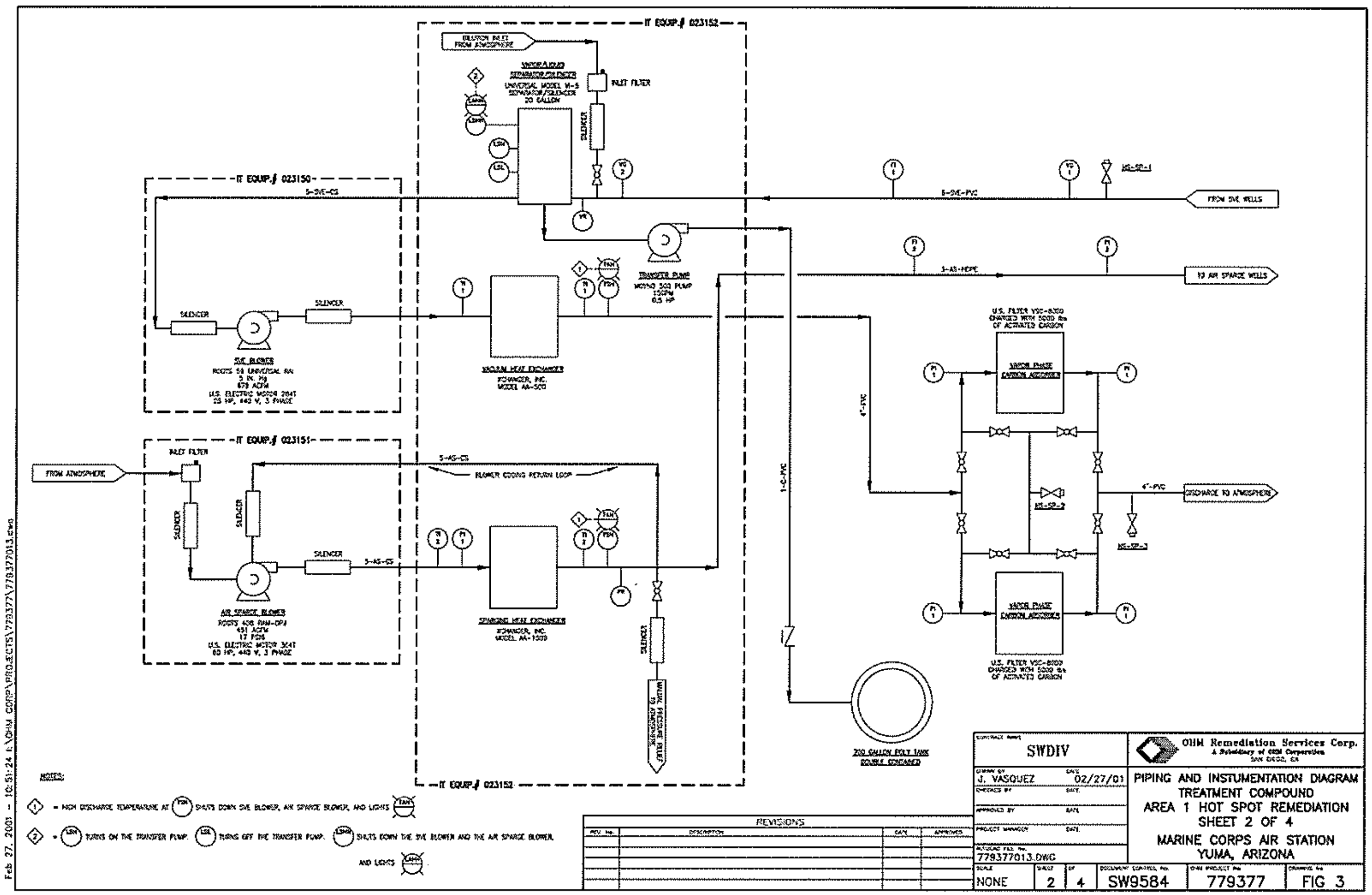


Figure 2. AS/SVE Piping and Instrumentation Diagram

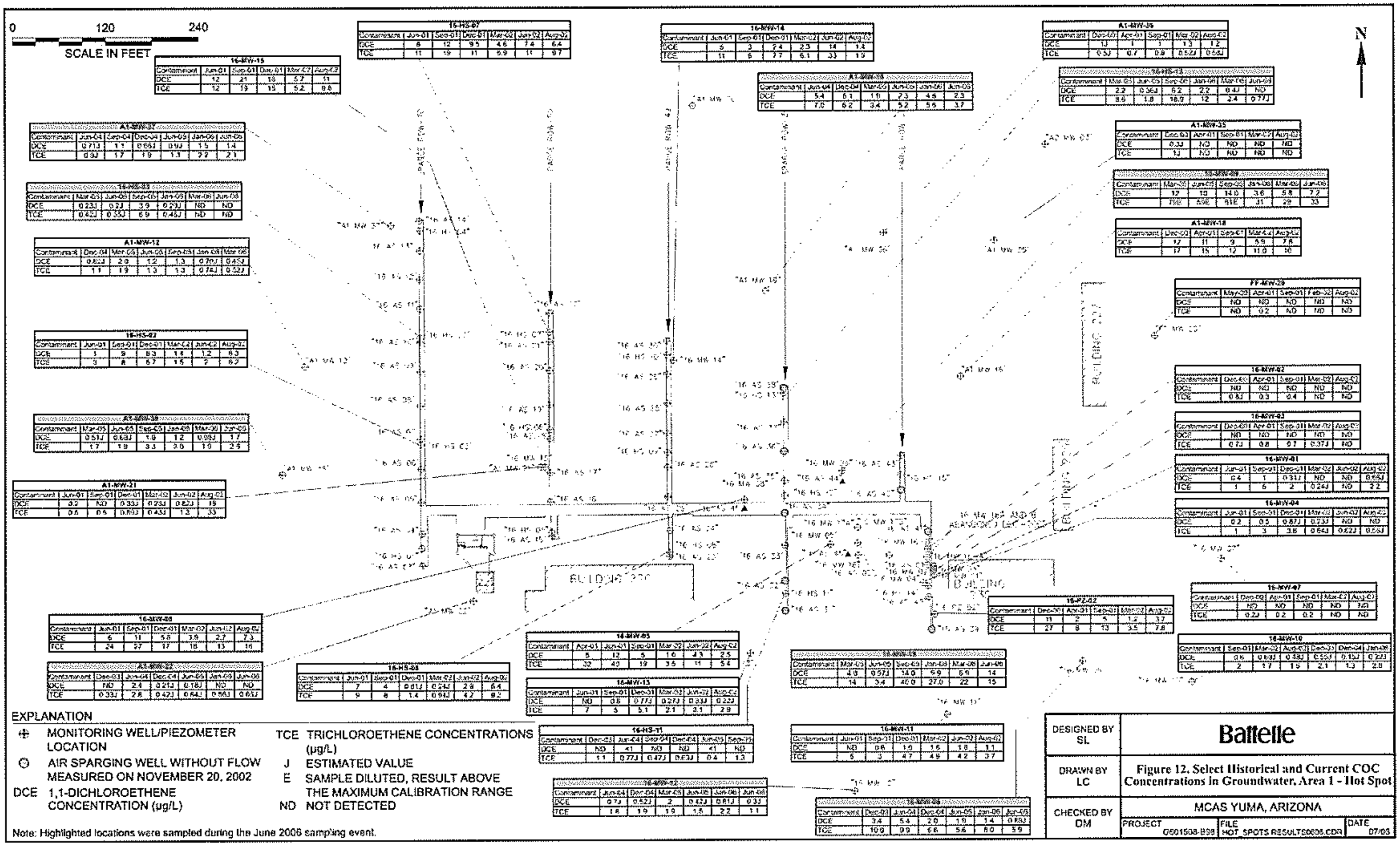


Figure 3. Locations of Hot Spot AS and Monitoring Wells, with Historical and Current DCE and TCE Concentrations

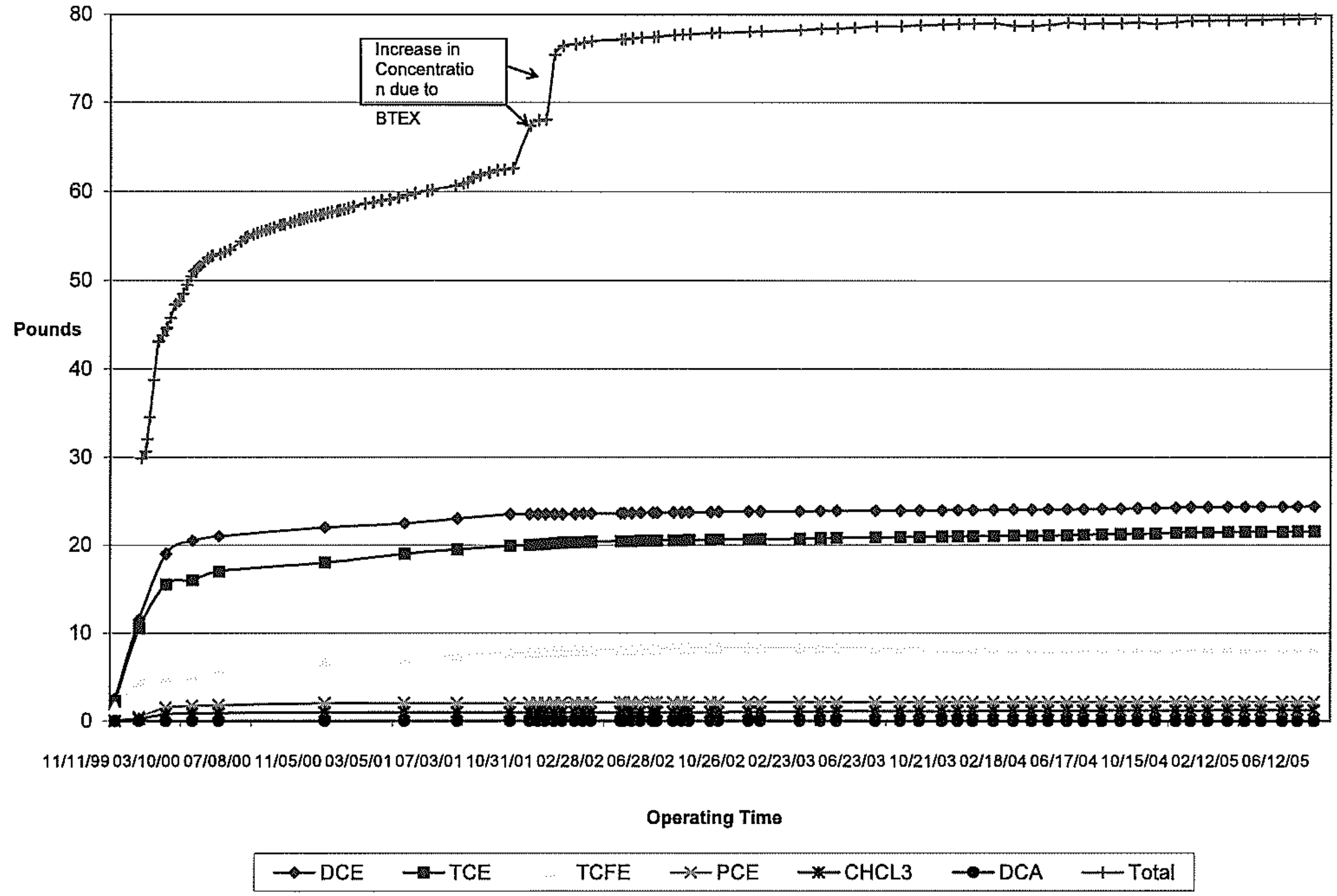


Figure 4. Cumulative Mass Removal by the SVE System

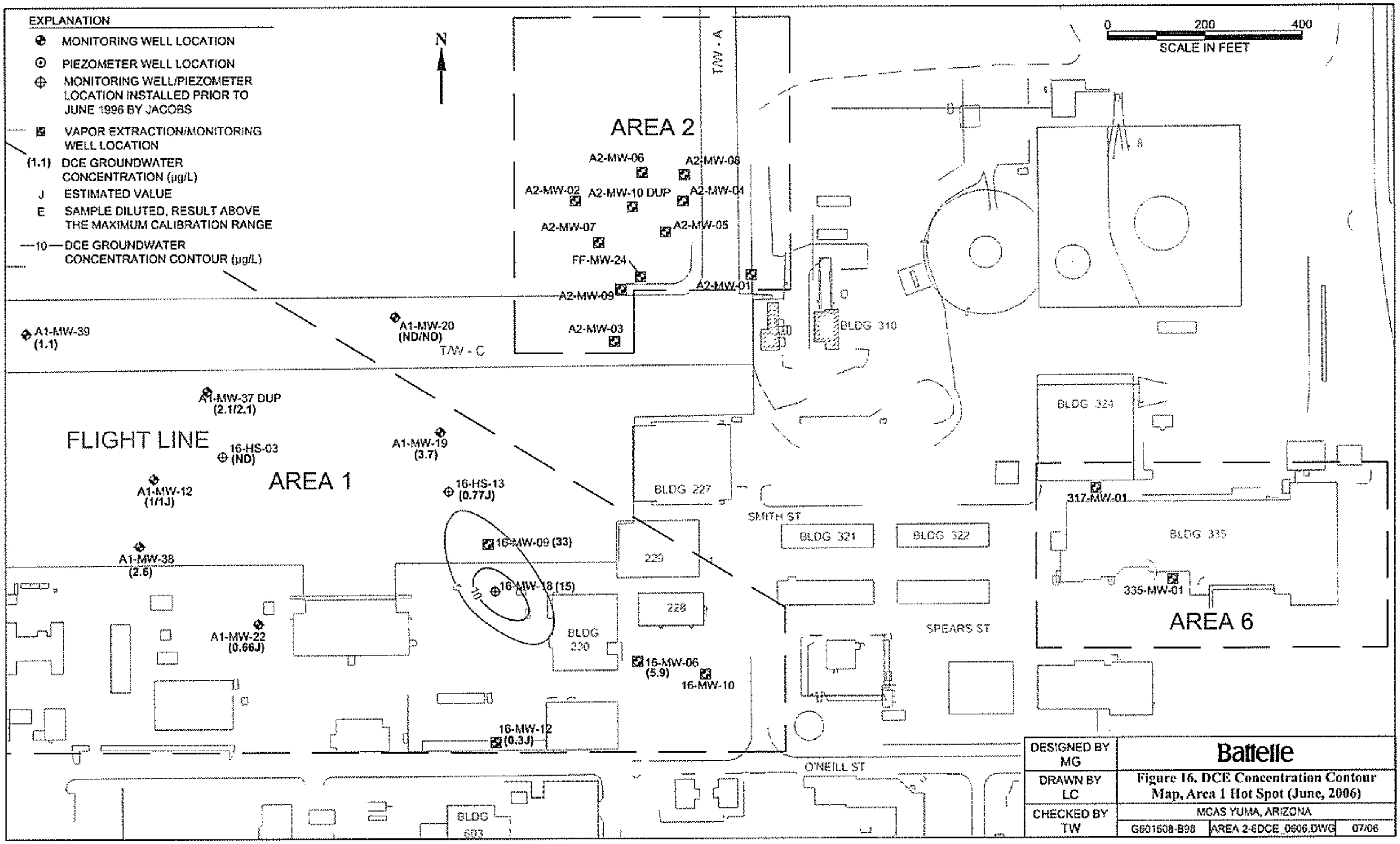


Figure 5. DCE Concentration Contour Map, June 2006

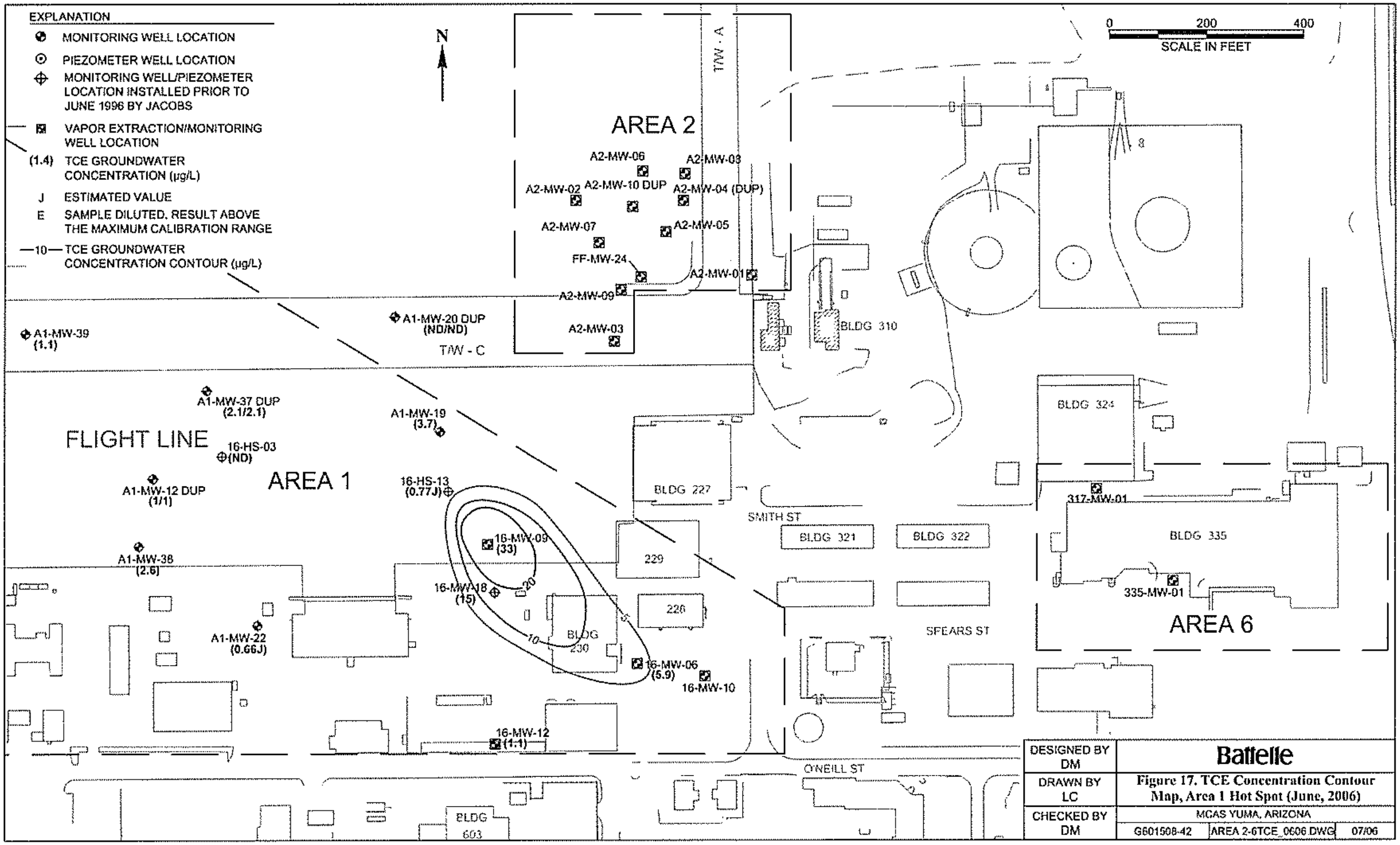


Figure 6. TCE Concentration Contour Map, June 2006

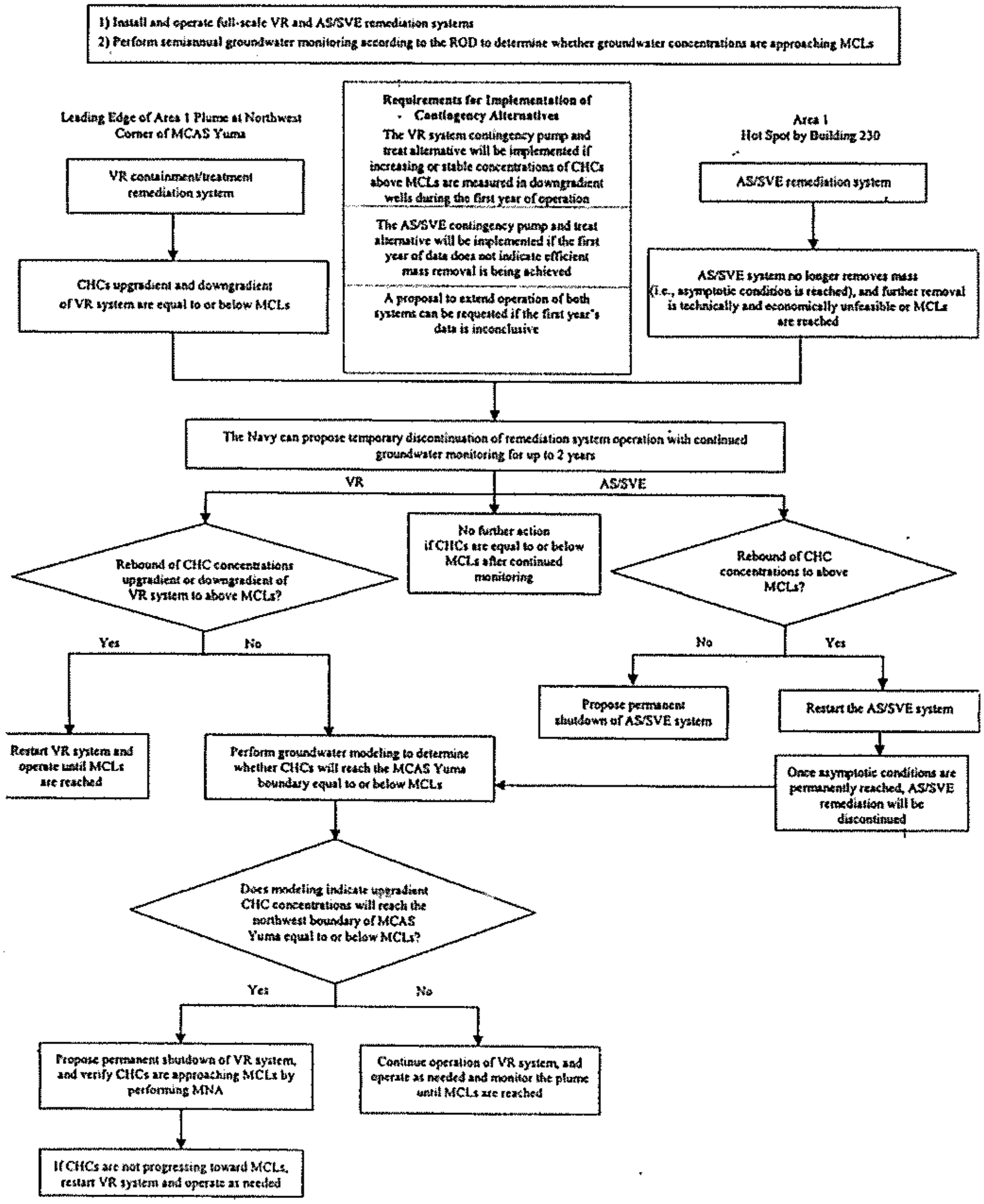


Figure 7. Decision Flow Diagram for Operation at Shutdown of VCT and AS/SVE Remediation Systems, Area 1

Appendix B6

VCT Temporary Shutdown Technical Memorandum with U.S EPA and ADEQ Concurrence

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser 5DEN.AL/3047
May 8, 2003

Mr. Frank Smaila, Project Manager
Arizona Department of Environmental Quality
Federal Projects Unit, Superfund Program Section
Waste Program Division
1110 West Washington Street
Phoenix, AZ 85012

Dear Mr. Smaila:

SUBJECT: TEMPORARY SHUTDOWN OF VERTICAL RECIRCULATION (VR) TREATMENT/CONTAINMENT SYSTEM AT LEADING EDGE OF PLUME AREA 1 (LEPA)

In response to your concurrence letter dated April 25, 2003 and the United States Environmental Protection Agency's (U.S. EPA) concurrence memorandum dated April 24, 2003, the Department of the Navy (DON) has temporarily shut down the VR system at the LEPA at Marine Corps Air Station (MCAS) Yuma on May 6, 2003.

The Department of the Navy did not specify a date for the VR system shut down in our original letter dated February 24, 2003, since we did not know when we would obtain your concurrence. However, our intent was to shut down the system immediately following your concurrence. The September 2003 date, mentioned in your concurrence letter, was used in the Draft Groundwater Flow and Transport Modeling Report for simulation only and the results of the simulation were not used as the basis for proposing the temporary shutdown.

The Department of the Navy will do the following now that the VR system is temporarily shut down:

- Inspect and turn on the VR system for a few hours during the first week of each month to ensure that the system is fully functional. The results and findings will be documented in quarterly, semi-annual, and annual progress and groundwater monitoring reports.

- Groundwater monitoring will continue as prescribed in the Long Term Monitoring (LTM) plan for a minimum of two years to determine if a rebound in contaminant concentrations occurs. As suggested by your letter, monitoring wells A1-PZ-19, A1-PZ-28, A1-PZ-15, A1-PZ-17, A1-PZ-22, A1-MW-01, A1-MW-06, and A1-PZ-26 will be monitored. The LTM plan will be amended to include all of the above-mentioned monitoring wells in the groundwater monitoring schedule. The results will be discussed in the quarterly, semi-annual, and annual progress and groundwater monitoring reports.

- The VR system will be restarted if there is a rebound in chlorinated hydrocarbons concentrations above Maximum Contaminant Levels (MCL) in VR monitoring wells.

If additional information is needed, please call me at (619) 532-4228. Thank you for your attention to this matter.

Sincerely,

Angie Lind
Remedial Project Manager
By direction of the Commander

Copy to:
Mr. Martin Hausladen, EPA Region 9, San Francisco, CA
Mr. Herbert "Gil" Guillory, MCAS Yuma, AZ
Ms. Carol Lewis, MCAS Yuma, AZ
Diane Silva, Southwest Division Admin Record (2 copies)

April 24, 2003

MEMORANDUM FOR THE RECORD

From: Mr. Martin Hausladen, U.S. Environmental Protection Agency
Region 9 – Federal Facilities/Superfund Division
75 Hawthorne Street, San Francisco, CA 94105

To: Angie Lind, RPM, Southwestdiv Naval Facilities Engineering Command

SUBJECT: PROPOSED TEMPORARY SHUT DOWN OF VERTICAL RECIRCULATION TREATMENT/CONTAINMENT (VR) SYSTEM AT THE LEADING EDGE OF THE AREA 1 PLUME (LEPA)

Ref (a): Southwestdiv Naval Facilities Engineering Command ltr 5090
Ser 5DEN.AL/3018 of 24 Feb 03

Reference (a) requested EPA concurrence to temporarily shut down the VR system for a period of two years with the following conditions:

- The Navy will continue to monitor the groundwater per the LTM plan
- The VR system will be restarted if there is rebound in CHC concentrations above MCLs in VR monitoring wells

After reviewing reference (a), EPA concurs with the recommendation to temporarily shutdown the VR system.

Sincerely,

MARTIN HAUSLADEN

Copy to: Frank Smaila, ADEQ, Phoenix, AZ (w/o enclosure)
Carol Lewis, MCAS Yuma, AZ
Herbert “Gil” Guillory, MCAS Yuma, AZ
Diane Silva, Southwest Division Admin Record

TECHNICAL MEMORANDUM
Temporary Discontinuation of the Vertical Circulation Treatment System
at the Leading Edge Plume Area
Marine Corps Air Station, Yuma, Arizona
Contract No. N68711-01-D-6009
Task Order No. 001

Introduction

Battelle has been contracted by the Naval Facilities Engineering Command (NAVFAC), Southwest Division (SWDIV) under Task Order 001, Remedial Action Operations (RAO)/Long Term Monitoring (LTM) for Operable Unit (OU) 1 at Marine Corps Air Station (MCAS), Yuma, Arizona. This task order includes the operation and maintenance (O&M) of the Vertical Circulation Treatment (VCT) system at the Area 1 Leading Edge Plume Area (LEPA), the O&M of the Air Sparging/Soil Vapor Extraction (AS/SVE) system at Area 1 Hot Spot, and the collection of groundwater samples in accordance with the Long Term Monitoring (LTM) Plan. The groundwater samples collected under the LTM portion of this task order are used to evaluate the VCT and AS/SVE systems. A data review of LEPA system wells is being addressed in this Technical Memorandum.

Site Description

MCAS Yuma is an active facility located immediately southeast of the city of Yuma, Arizona. Previous activities at MCAS Yuma resulted in the release of volatile organic compounds (VOCs) to the groundwater in the vicinity of the flight line, near Building 230. This area is currently referred to as the Hot Spot. The plume of contaminated groundwater extends to the northwest from the Hot Spot. The Leading Edge Plume Area (LEPA) is located downgradient from the Hot Spot, adjacent to the Yuma Airport. The Hot Spot and LEPA are designated as Area 1 of OU-1. A final Record of Decision (ROD) for OU-1 was signed by the United States Environmental Protection Agency (U.S. EPA) and the Arizona Department of Environmental Quality (ADEQ) in September and October 2000, respectively. The remedial action objectives established for this effort are the Maximum Contaminant Levels (MCLs) based on the Safe Drinking Water Act (SDWA). The contaminants of concern (COCs) in the LEPA area are 1,1-Dichloroethylene (1,1-DCE), Perchloroethylene (PCE), and Trichloroethylene (TCE), and the MCLs are 7 μg/L, 5 μg/L, and 5 μg/L, respectively.

System Description

The full-scale VCT system was installed in June 2000 to provide containment and treatment of relatively low concentrations of chlorinated hydrocarbons in the groundwater at the Northwest Station boundary. The VCT system uses submersible pumps to extract groundwater from four extraction wells. The extracted groundwater enters the aboveground treatment compound, where it is pumped through various holding tanks and bag filters before being treated with granular activated carbon (GAC). After the water has passed through the GAC units, the treated water is pumped back into the aquifer through four injection wells. Figure 1 provides a schematic of the VCT system. The following paragraphs provide a detailed description of the process flow and control logic for the VCT system located in the LEPA.

Contaminated groundwater is extracted from the four VCT wells simultaneously using four 40-gallon-per-minute (gpm) electric submersible pumps. The pumps transfer the untreated groundwater at a maximum rate of 160 gpm through high-density polyethylene (HDPE) piping to the water treatment compound. The water treatment compound processes the contaminated groundwater at a maximum rate of 200 gpm. The GAC-treated groundwater is then transferred through HDPE piping and discharged into four injection wells. The process and instrumentation diagram and details of the system are presented in Figure 2.

The remediation well field consists of four extraction wells (VCT-02, VCT-04, VCT-06 and VCT-08) and four injection wells (VCT-01, VCT-03, VCT-05, and VCT-07). Figure 3 presents the locations of the extraction and injection wells at LEPA.

VCT-02 and VCT-04 are 6-inch production wells installed to 145 feet below ground surface with two different screen intervals. The lower screen extends from 130 to 140 feet below ground surface; the upper screen extends from 40 to 70 feet below ground surface. A 40-gpm Grundfos submersible pump with a 2-horsepower (hp), 230-volt, 3-phase Grundfos electric motor is installed in the lower screened section of VCT-02. A 60-gpm Grundfos submersible pump with a 5-hp, 460-volt, 3-phase Franklin electric motor is installed in the lower screened section of VCT-04. The 60-gpm pump is normally operated at 40 gpm. The 2-hp pump is controlled by a variable speed Grundfos Red-Flo VFD controller. The 5-hp pump is controlled by a variable speed Baldor adjustable speed drive controller. All the pump controllers are located in enclosures at the treatment compound. TAM inflatable packers are installed above the pumps to limit the extraction to the lower screened interval.

VCT-06 and VCT-08 are 6-inch production wells installed to 145 feet below ground surface. The screened interval extends from 130 to 140 feet below ground surface. One each 5-hp, 60-gpm Grundfos electric submersible pump is installed in the screened section of VCT-06 and VCT-08. The 60-gpm pump is normally operated at 40-gpm. A variable speed Baldor adjustable speed drive controller controls the pumps which are located in enclosures at the treatment compound.

VCT-01 and VCT-03 are 6-inch production wells installed to 105 feet below ground surface, with two screen intervals. The lower screen extends from 90 to 100 feet below ground surface, the upper screen extends from 40 to 70 feet below ground surface. The wells are currently used for injection. VCT-01 is located close to VCT-02 and VCT-03 is located close to VCT-04 to produce groundwater circulation.

VCT-05 and VCT-07 are 6-inch production wells installed to 115 feet below ground surface. The screened interval extends from 100 to 110 feet below ground surface, with a 10-foot stainless steel prepack with 0.020-inch slots and No. 2/12 Monterey sand. Each well has a 5-foot stainless steel silt trap. VCT-05 is located close to VCT-06 and VCT-07 is located close to VCT-08 to produce groundwater circulation.

Five 3-inch extraction pipes (one spare) are manifolded on the east side of the treatment compound. Once aboveground, each pipe transitions to Schedule 80 PVC piping. Each pipe has a separate Signet 5090 analog flowmeter used to adjust the extraction rate from each extraction well. The readouts for all the system flowmeters are installed in panels at the treatment compound. All panels (including pump controllers, flowmeter readouts, and interface control panel) are located on the east side of the treatment compound. After the manifold, the total influent flow from the extraction wells is routed through a totalizing Signet 5500 analog digital flowmeter. This flowmeter is used to track the total gallons of groundwater extracted by the system. The contaminated influent groundwater then enters Tank 1 (T-1). This tank holds the untreated influent groundwater to allow settlement of any sediment and provides system surge capacity so that system maintenance, carbon backwashing, and carbon changeouts can be performed without shutting down the well extraction pumps

The untreated groundwater is pumped from T-1 via Pump 1 (P-1) (see Figure 2). P-1 is a 200-gpm, 65-pound-per-square-inch-gauge (psig) Aurora Model 341A transfer pump. The water is pumped from T-1 through a Signet 5100 digital flowmeter. This flowmeter is used to adjust the P-1 pump rate. The water then flows through a dual-bag filter system, followed by the liquid-phase GAC adsorbers, and then into Tank 2 (T-2).

The GAC treatment system consists of two Waterlink/Barneby Sutcliff LD-180 adsorbers, holding 5000 pounds of GAC each. T-2 contains treated groundwater and provides surge capacity. The clean treated water is pumped from T-2 using Pump 2 (P-2). The water is pumped through a dual-bag filter system with 100-micron filter elements, through a flowmeter, and enters the injection manifold.

The purpose of the backwash system is to maximize GAC efficiency by removing any sediment or precipitates that accumulate on the GAC bed. In addition, the backwash fluffs the GAC beds, thus ensuring that all GAC particles are exposed to groundwater contaminants. The GAC is currently being backwashed on a biweekly basis.

Data Review

The LEPA VCT system is currently operating at a total influent and effluent rate of approximately 120 gpm. The system is operating with 3-extraction and 3-injection wells on-line. Extraction well VCT-06 and injection well VCT-01 are not operational. Inspection of well VCT-01 during October 2001 VCT well redevelopment indicated a collapsed well casing and a stuck down-hole packer assembly and drop pipe. The motor at VCT -06, currently not operational, was previously replaced under warranty by Franklin Motor and, therefore, further repairs are no longer warranted. Franklin motor further stated that the damage to the pump is caused by the water at the site, possibly due to the activities of sulfate-reducing bacteria. The cost to repair the pump would be greater than the cost to replace it. Given a review of the data presented during the October 23, 2002 project review meeting, there is no current plan to replace VCT-01 or the damaged pump and motor. Extraction well VCT-04 was temporarily not operable (October 7, 2002). The pump and motor were replaced on October 15, 2002 and the well was placed back in service. VCT-08 also was temporarily out of service (December 30, 2002); the pump and motor were replaced on January 6, 2003.

Groundwater samples have been collected on a quarterly, semiannual, or annual basis at the site since April 2000. A total of 48 groundwater monitoring wells were used in this document to evaluate the contaminants of concern (COC) concentrations in LEPA and the area downgradient (northwest) of the intersection of Runways 17 and 8-26 (see Figure 4 for well locations). Table 1 provides the historical and current analytical results. A graphical representation of these concentrations in each monitoring well is provided in Figure 5 (Figure 5-A presents graphs of wells which have never exceeded MCLs, and Figure 5-B represents graphs of wells which have exceeded MCLs).

Data from the historical and most recent monitoring events, conducted in December 2002, show that concentrations of 1,1-DCE, TCE, and PCE have never exceeded MCLs in the following 35 of the 48 monitoring wells:

➢ A1-MW-44	A1-MW-45	A1-MW-46	A1-MW-47	A1-MW-48
➢ A1-PZ-01	A1-PZ-02	A1-PZ-04	A1-PZ-07	A1-PZ-08
➢ A1-PZ-11	A1-PZ-12	A1-PZ-13	A1-PZ-14	A1-PZ-16
➢ A1-PZ-18	A1-PZ-20	A1-PZ-24	A1-PZ-25A	A1-PZ-26
➢ A1-PZ-27	A1-PZ-28	A1-MW-02	A1-MW-03	A1-MW-04
➢ A1-MW-05	A1-MW-06	A1-MW-28	A1-MW-29A	A1-MW-30
➢ A1-MW-33	A1-MW-43	NW-MW-01	NW-MW-02	NW-MW-04

Further, PCE has never exceeded its MCL in any of the 48 monitoring wells during any monitoring events. 1,1-DCE and TCE concentrations have exceeded their respective MCLs in 11 of the 48 wells historically but have been below their MCLs during the last four to ten monitoring events. In 2 of the 48 monitoring wells, A1-PZ-19 and A1-MW-01, TCE concentrations have been measured slightly above the MCL (i.e., 5.1 to 5.3 µg/L) during the last three sampling events. Detections of 1,1-DCE and TCE with regard to their MCLs and trends in these 13 monitoring wells are discussed below:

A1-PZ-09 (Screened from 130 to 140 ft bgs)

In April 2000, the 1,1-DCE concentration at this well was reported at 8.0 µg/L, exceeding the MCL of 7 µg/L. This is the only measured concentration exceeding the MCL for 1,1-DCE at this well in a total of 10 monitoring events. The TCE concentration also was reported above its MCL in this well in April 2000 (6 µg/L) and at its MCL in December 2000 (5.0 µg/L), The 1,1-DCE and TCE concentrations have been well below their MCLs in the six subsequent sampling events. All COCs have been below detection since March 2002. This well is scheduled to be sampled on a semiannual basis and, therefore, was not sampled during the quarterly monitoring event in December 2002.

A1-PZ-17 (Screened from 100 to 110 ft bgs)

The MCLs for 1,1-DCE and TCE were exceeded in only one (December 2000) of the ten monitoring events. Concentrations have been decreasing in this well since December 2000 and are currently at 0.41 µg/L and 0.23 µg/L, respectively.

A1-PZ-21 (Screened from130 to 140 ft bgs)

The 1,1-DCE concentration was measured at its MCL of 7 µg/L during the August 2000 monitoring event. This level has decreased since and this COC was not detected during the last two monitoring events (June and August 2002). TCE was exceeded only in August 2000 (6.0 µg/L) and its concentration has decreased since then. TCE was not detected during the June 2002 or August 2002 monitoring events. This well is scheduled to be sampled on a semiannual basis and, therefore, was not sampled during the quarterly monitoring event in December 2002.

A1-PZ-22 (Screened from 100 to 110 ft bgs)

The 1,1-DCE concentration exceeded the MCL during the August 2000 (15 µg/L), September 2000 (8 µg/L), and December 2000 (8.0 µg/L) monitoring events. This COC has been below the MCL, ranging from less than detection to 4 µg/L, since April 2001. TCE also exceeded the MCL during August 2000 (12.0 µg/L), September 2000 (6.0 µg/L), and December 2000 (7.0 µg/L), however, it has not been detected since September 2001. This well is scheduled to be sampled on a semiannual basis and, therefore, was not sampled during the quarterly monitoring event in December 2002.

A1-PZ-23 (Screened from130 to 140 ft bgs)

1,1-DCE exceeded its MCL during the August 2000 monitoring event (9.0 µg/L). The concentration has been steadily decreasing since September 2000 and was measured at 0.25 µg/L in August 2002. The TCE MCL was exceeded in the first four of the ten monitoring events at concentrations of 6.0 µg/L (April 2000), 9.0 µg/L (August 2000), 7.0 µg/L (September 2000), and 6.0 µg/L (December 2000). However, the TCE concentration has been decreasing since August 2000 and was measured at 0.26 µg/L in August 2002. This well is scheduled to be sampled on a semiannual basis and, therefore, was not sampled during the quarterly monitoring event in December 2002.

A1-MW-31 (Screened from 50 to 80 ft bgs)

TCE exceeded the MCL in this monitoring well only during the April 2000 monitoring event. In all subsequent monitoring events, TCE concentrations have been less than 5 μg/L with six of those monitoring events at levels less than the detection limit. This well is scheduled to be sampled on a semiannual basis and, therefore, was not sampled during the quarterly monitoring event in December 2002.

A1-MW-32 (Screened from 100 to 110 ft bgs)

Only TCE exceeded the MCL in April 2000 and December 2000 at concentrations of 6.0 μg/L; and the concentration in March 2001 was at the 5.0 μg/L MCL. However, concentrations have been below MCL in the subsequent seven monitoring events. In August 2002, the TCE concentration was 3.3 μg/L. This well is scheduled to be sampled on a semiannual basis and, therefore, was not sampled during the quarterly monitoring event in December 2002.

A1-MW-42 (Screened from 48.5 to 78.5 ft bgs)

The TCE MCL was exceeded once in this well, with a concentration of 6.0 μg/L reported in December 2000. During the other seven monitoring events in which this well was sampled (August 2000 to August 2002) no MCLs were exceeded. This well is scheduled to be sampled on a semiannual basis and, therefore, was not sampled during the quarterly monitoring event in December 2002.

A1-PZ-15 (Screened from 130 to 140 ft bgs)

The 1,1-DCE MCL was exceeded in April 2001 (9.0 μg/L), September 2001 (10 μg/L), and February 2002 (12 μg/L). The TCE concentration was at its MCL in December 2000 (5.0 μg/L), and exceeded its MCL in April 2001 (7.0 μg/L) and September 2001 (9.0 μg/L). Concentrations have been declining since the February 2002 and are currently at 0.30 μg/L (1,1-DCE) and 0.9 μg/L (TCE).

A1-MW-34 (Screened from 130 to 140 ft bgs)

The MCL for TCE was exceeded in this well during the August and December 2000 and June 2001 sampling events (7.0, 8.0, and 7.0 μg/L, respectively). The 1,1-DCE MCL has not been exceeded. The MCL for TCE has been less than the MCL since September 2001. This well is scheduled to be sampled on a semiannual basis and, therefore, was not sampled during the quarterly monitoring event in December 2002.

A1-MW-41 (Screened from 49 to 79 ft bgs)

The TCE concentration exceeded its MCL in January 2000 (6.0 μg/L) and during the September 2001 sampling event, TCE was measured at 5.0 μg/L. In all other quarterly monitoring events since January 2000, concentrations were less than 5.0 μg/L. Results from the most recent monitoring event reported a TCE concentration of 3.9 μg/L (August 2002). This well is scheduled to be sampled on a semiannual basis and, therefore, was not sampled during the quarterly monitoring event in December 2002.

A1-PZ-19 (Screened from 230 to 250 ft bgs)

The MCL for 1,1-DCE has not been exceeded in this well. TCE concentrations of 5.1 μg/L (June and August 2002) and 5.3 μg/L (December 2002) were reported for the last three monitoring events.

A1-MW-01 (Screened from 53 to 78 ft bgs)

The MCLs for 1,1-DCE and TCE were exceeded in this well from April 2000 to March 2002. However, results from 2002 monitoring events show concentrations below the MCL for 1,1-DCE and TCE concentrations at or near the MCL. The average TCE concentration (a duplicate sample was collected) for the December 2002 monitoring event was 5.2 μg/L (reported concentrations of 5.4 and 5.0 μg/L).

Conclusions and Recommendations

Figure 6 provides the decision flow diagram for operation and shutdown of VCT and AS/SVE remediation systems in Area 1. This decision flow diagram was developed in the ROD in 2000. As shown on Figure 6, when the concentrations of the COCs (or chlorinated hydrocarbons [CHCs] as noted on the diagram) upgradient and downgradient of the VCT system have reached the levels equal to or below the respective MCLs, the Navy can propose a temporary shutdown of the system operation with continued groundwater monitoring for up to two years. If rebound to above the MCLs occurs in wells located either upgradient or downgradient of the system, the system will be restarted and operated until the MCLs are reached again. If rebound of the COC concentrations does not occur, groundwater modeling will be performed to determine whether COCs will reach the MCAS Yuma boundary at levels equal to or below the MCLs.

The review of the COC concentrations in 48 upgradient or downgradient monitoring wells indicates that, except in two wells (i.e., A1-MW-01 screened from 53 to 78 bgs and A1-PZ-19 screened from 230 to 250 bgs), the COC concentrations have reached the levels equal to or below the MCLs. In A1-MW-01 and A1-PZ-19, TCE has been detected at 5.1 to 5.3 μg/L, slightly above its MCL, since June 2002. Historically, A1-MW-01 has experienced significant DCE and TCE reductions, i.e., from as high as 37 μg/L of DCE and 15 μg/L of TCE, to levels below the respective MCLs. The slightly above- and below-the-MCL-concentrations of TCE detected in June, August, and December 2002 may indicate that the system has reached an asymptotic state.

In A1-PZ-19, TCE concentrations were 6.0 μg/L in July 1999, reduced to below its MCL till June 2002, and increased to 5.1−5.3 μg/L afterwards. The exact reasons for these minor concentration variations are not known. The cross sections A-A' and B-B' at the Northwest Station (see Figure 7) revealed that the geology at A1-PZ-19 consists of silty sands interlayered with clay lenses at the depths from 230 to 250 bgs. This natural heterogeneity could be one of the factors causing the concentration variations observed in A1-PZ-19.

By design, the VCT system treats contaminated groundwater in the "shallower" aquifer where most of the contamination was present. The VCT system extracts groundwater from 130 to 140 ft bgs and reinjects the treated water to 40-70 ft bgs. As such, the treatment system was not designed to treat the localized area at A1-PZ-19 at depths from 230 to 250 bgs. Therefore, even if it continues to operate, the system may not reduce TCE concentrations in A1-PZ-19. Because of the low permeability of the geologic materials in this area, the TCE plume is moving very slowly and the principal mechanisms for the TCE reduction would be such naturally attenuating processes as dispersion, sorption, and biological degradation. As such, the most effective approach to deal with the TCE in A1-PZ-19 would be continually monitoring its concentrations and evaluating the effects of the natural attenuating processes.

Because the requirements for temporary discontinuation of remediation system operation, as set in the decision flow diagram, have been met, Battelle recommends that the VCT system be temporarily shutdown with continued groundwater monitoring.

TABLE

Table 1. 1,1-DCE, PCE, and TCE Concentrations

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL) 1,1-DCE (7 μg/L)		PCE (5 μg/L)		TCE (5 μg/L)	
A1-MW-44	LEPA	04/00	1.0	J	0.2	J	2.0	J
A1-MW-44	LEPA	08/00	1.0	J	ND		1.0	J
A1-MW-44	LEPA	12/00	1.0	J	0.2	J	2.0	J
A1-MW-44	LEPA	09/01	0.9	J	ND		1.0	J
A1-MW-44	LEPA	03/28/02	0.27	J	ND		0.33	J
A1-MW-44	LEPA	08/09/02	1.1		0.21	J	1.0	
A1-MW-45	LEPA	04/00	0.8	J	ND		1.0	J
A1-MW-45	LEPA	08/00	0.9	J	ND		1.0	J
A1-MW-45	LEPA	12/00	0.9	J	0.1	J	1.0	J
A1-MW-45	LEPA	09/01	0.4	J	ND		0.3	J
A1-MW-45	LEPA	03/27/02	ND		ND		0.65	J
A1-MW-45	LEPA	08/07/02	ND		ND		ND	
A1-MW-46	LEPA	04/00	2.0	J	ND		2.0	
A1-MW-46	LEPA	08/00	1.0	J	ND		2.0	J
A1-MW-46	LEPA	12/00	0.6	J	ND		0.9	J
A1-MW-46	LEPA	09/01	ND		ND		ND	
A1-MW-46	LEPA	03/26/02	ND		ND		0.5	J
A1-MW-46	LEPA	08/07/02	ND		ND		ND	
A1-MW-47	LEPA	12/00	2.0		0.9	J	3.0	
A1-MW-47	LEPA	03/01	2.0	J	ND		2.0	J
A1-MW-47	LEPA	06/01	0.6	J	0.2	J	0.8	J
A1-MW-47	LEPA	09/01	ND		ND		ND	
A1-MW-47	LEPA	03/16/02	ND		ND		ND	
A1-MW-47	LEPA	08/07/02	ND		ND		ND	
A1-MW-47 DUP	LEPA	03/16/02	ND		ND		ND	
A1-MW-48	LEPA	08/00	1.0	J	0.5	J	2.0	J
A1-MW-48	LEPA	12/00	3.0		2.0	J	3.0	
A1-MW-48	LEPA	06/01	0.4	J	0.2	J	0.7	J
A1-MW-48	LEPA	09/01	0.5	J	ND		0.6	J
A1-MW-48	LEPA	03/27/02	ND		ND		0.21	J
A1-MW-48	LEPA	08/08/02	0.25	J	ND		ND	
A1-PZ-01	LEPA	01/00	ND		ND		ND	
A1-PZ-01	LEPA	04/00	ND		ND		ND	
A1-PZ-01	LEPA	08/00	ND		ND		ND	
A1-PZ-01	LEPA	12/00	ND		ND		0.2	J
A1-PZ-01	LEPA	03/01	ND		ND		ND	
A1-PZ-01	LEPA	09/01	ND		ND		ND	
A1-PZ-01	LEPA	03/11/02	ND		ND		ND	
A1-PZ-01	LEPA	08/06/02	ND		ND		ND	
A1-PZ-01 DUP	LEPA	03/12/02	ND		ND		ND	
A1-PZ-02	LEPA	02/00	0.3	J	ND		0.7	J
A1-PZ-02	LEPA	04/00	0.2	J	ND		0.3	J
A1-PZ-02	LEPA	08/00	2.0		ND		3.0	
A1-PZ-04	LEPA	01/00	ND		ND		0.5	J
A1-PZ-04	LEPA	04/00	ND		ND		0.5	J
A1-PZ-04	LEPA	08/00	ND		ND		ND	
A1-PZ-04	LEPA	12/00	ND		ND		0.2	J
A1-PZ-04	LEPA	03/01	ND		ND		ND	

Table 1. 1,1-DCE, PCE, and TCE Concentrations (Continued)

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL) 1,1-DCE (7 µg/L)	PCE (5 µg/L)	TCE (5 µg/L)
A1-PZ-04	LEPA	09/01	ND	ND	ND
A1-PZ-04	LEPA	04/02/02	ND	ND	ND
A1-PZ-04	LEPA	08/07/02	ND	ND	ND
A1-PZ-07	LEPA	01/00	ND	ND	0.3 J
A1-PZ-07	LEPA	09/00	ND	ND	ND
A1-PZ-08	LEPA	01/00	ND	ND	ND
A1-PZ-08	LEPA	12/00	ND	ND	0.4 J
A1-PZ-09	LEPA	01/00	ND	ND	ND
A1-PZ-09	LEPA	04/00	**8.0**	0.6 J	**6.0**
A1-PZ-09	LEPA	08/00	2.0 J	ND	2.0 J
A1-PZ-09	LEPA	12/00	6.0	0.4 J	**5.0**
A1-PZ-09	LEPA	04/01	0.5 J	ND	ND
A1-PZ-09	LEPA	09/01	0.5 J	ND	0.7 J
A1-PZ-09	LEPA	12/18/01	0.46 J	ND	0.56 J
A1-PZ-09	LEPA	03/28/02	ND	ND	ND
A1-PZ-09	LEPA	06/10/02	ND	ND	ND
A1-PZ-09	LEPA	08/08/02	ND	ND	ND
A1-PZ-11	LEPA	01/00	2.0 J	ND	2.0 J
A1-PZ-11	LEPA	04/00	4.0	0.3 J	4.0
A1-PZ-11	LEPA	08/00	ND	ND	ND
A1-PZ-11	LEPA	12/00	2.0 J	0.1 J	2.0
A1-PZ-11	LEPA	03/01	1.0 J	ND	2.0 J
A1-PZ-11	LEPA	06/01	1.0 J	ND	2.0 J
A1-PZ-11	LEPA	09/01	1.0 J	ND	ND
A1-PZ-11	LEPA	12/18/01	1.5	ND	1.6
A1-PZ-11	LEPA	06/11/02	1.1	ND	1.4
A1-PZ-11	LEPA	08/08/02	0.66 J	ND	1.0
A1-PZ-12	LEPA	01/00	ND	ND	0.5 J
A1-PZ-12	LEPA	04/00	0.7 J	ND	0.8 J
A1-PZ-12	LEPA	08/00	0.8 J	ND	0.8 J
A1-PZ-12	LEPA	12/00	2.0 J	0.2 J	2.0
A1-PZ-12	LEPA	04/01	2.0 J	ND	2.0 J
A1-PZ-12	LEPA	09/01	0.6 J	ND	0.7 J
A1-PZ-12	LEPA	03/28/02	0.4 J	ND	0.49 J
A1-PZ-12	LEPA	08/08/02	ND	ND	0.27 J
A1-PZ-13	LEPA	01/00	ND	ND	ND
A1-PZ-13	LEPA	04/00	0.9 J	ND	0.8 J
A1-PZ-13	LEPA	08/00	ND	ND	ND
A1-PZ-13	LEPA	12/00	1.0 J	0.1 J	1.0 J
A1-PZ-13	LEPA	03/01	0.8 J	ND	1.0 J
A1-PZ-13	LEPA	09/01	3.0	0.2 J	3.0
A1-PZ-13	LEPA	08/08/02	2.1	0.21 J	2.2
A1-PZ-14	LEPA	01/00	0.3 J	ND	0.7 J
A1-PZ-14	LEPA	04/00	0.3 J	ND	0.4 J
A1-PZ-14	LEPA	08/00	ND	ND	ND
A1-PZ-14	LEPA	12/00	ND	ND	ND
A1-PZ-14	LEPA	03/01	ND	ND	ND
A1-PZ-14	LEPA	09/01	ND	ND	ND
A1-PZ-14	LEPA	08/07/02	1.2	ND	0.88 J
A1-PZ-15	LEPA	04/00	3.0	0.2 J	2.0

Table 1. 1,1-DCE, PCE, and TCE Concentrations (Continued)

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL) 1,1-DCE (7 µg/L)		PCE (5 µg/L)		TCE (5 µg/L)	
A1-PZ-15	LEPA	08/00	4.0		ND		4.0	
A1-PZ-15	LEPA	12/00	6.0		0.4	J	**5.0**	
A1-PZ-15	LEPA	04/01	**9.0**		0.7	J	**7.0**	
A1-PZ-15	LEPA	06/01	3.0		0.3	J	3.0	
A1-PZ-15	LEPA	09/01	**10**		0.6	J	**9.0**	
A1-PZ-15	LEPA	02/06/02	**12**		0.4	J	4.7	
A1-PZ-15	LEPA	02/11/02	**12**		0.4		4.7	
A1-PZ-15	LEPA	04/02/02	3.4		ND		3.3	
A1-PZ-15	LEPA	06/11/02	1.4		0.23	J	2.4	
A1-PZ-15	LEPA	06/11/02	1.4		0.24	J	2.5	
A1-PZ-15	LEPA	08/09/02	0.76	J	0.21	J	1.5	
A1-PZ-15	LEPA	12/07/02	0.30	J	ND		0.9	J
A1-PZ-16	LEPA	04/00	ND		ND		ND	
A1-PZ-16	LEPA	08/00	ND		ND		ND	
A1-PZ-16	LEPA	12/00	ND		ND		ND	
A1-PZ-16	LEPA	03/01	ND		ND		ND	
A1-PZ-16	LEPA	06/01	ND		ND		ND	
A1-PZ-16	LEPA	09/01	ND		ND		ND	
A1-PZ-16	LEPA	12/19/01	ND		ND		0.22	J
A1-PZ-16	LEPA	04/02/02	ND		ND		ND	
A1-PZ-16	LEPA	06/10/02	ND		ND		ND	
A1-PZ-16	LEPA	08/07/02	ND		ND		ND	
A1-PZ-16	LEPA	12/07/02	ND		ND		ND	
A1-PZ-17	LEPA	04/00	0.3	J	ND		0.7	J
A1-PZ-17	LEPA	08/00	4.0		ND		3.0	
A1-PZ-17	LEPA	12/00	**8.0**		0.3	J	**6.0**	
A1-PZ-17	LEPA	04/01	5.0		0.2	J	4.0	
A1-PZ-17	LEPA	06/01	3.0		0.2	J	2.0	
A1-PZ-17	LEPA	09/01	1.0	J	ND		1.0	J
A1-PZ-17	LEPA	12/20/01	0.5	J	ND		0.42	J
A1-PZ-17	LEPA	03/28/02	0.69	J	ND		0.43	J
A1-PZ-17	LEPA	06/11/02	0.48	J	ND		0.35	J
A1-PZ-17	LEPA	08/08/02	0.42	J	ND		0.36	J
A1-PZ-17	LEPA	12/07/02	0.41	J	ND		0.23	J
A1-PZ-18	LEPA	01/00	3.0		ND		3.0	
A1-PZ-18	LEPA	08/00	1.0	J	ND		1.0	J
A1-PZ-18	LEPA	12/00	4.0		0.3	J	3.0	
A1-PZ-18	LEPA	04/01	2.0	J	ND		2.0	J
A1-PZ-18	LEPA	06/01	3.0		0.3	J	2.0	
A1-PZ-18	LEPA	09/01	1.0	J	1.0	J	ND	
A1-PZ-18	LEPA	12/19/01	1.8		0.25	J	1.8	
A1-PZ-18	LEPA	03/28/02	2.3		0.23	J	1.9	
A1-PZ-18	LEPA	06/11/02	2.5		0.31	J	2.6	
A1-PZ-18	LEPA	08/08/02	4.4		0.52	J	4.5	
A1-PZ-18	LEPA	12/07/02	3.5		0.36	J	3.6	
A1-PZ-19	LEPA	04/00	ND		ND		ND	
A1-PZ-19	LEPA	08/00	3.0		ND		3.0	J
A1-PZ-19	LEPA	12/00	3.0		ND		3.0	
A1-PZ-19	LEPA	03/01	3.0		ND		3.0	
A1-PZ-19	LEPA	06/01	2.0		ND		3.0	

Table 1. 1,1-DCE, PCE, and TCE Concentrations (Continued)

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL)		
			1,1-DCE (7 µg/L)	PCE (5 µg/L)	TCE (5 µg/L)
A1-PZ-19	LEPA	09/01	1.0 J	ND	1.0 J
A1-PZ-19	LEPA	12/20/01	4.1	ND	4.6
A1-PZ-19	LEPA	06/11/02	5.1	ND	**5.1**
A1-PZ-19	LEPA	08/08/02	5.5	ND	**5.1**
A1-PZ-19	LEPA	12/05/02	5.1	ND	**5.3**
A1-PZ-20	LEPA	02/00	ND	ND	0.3 J
A1-PZ-20	LEPA	04/00	0.9 J	ND	0.7 J
A1-PZ-20	LEPA	08/00	0.7 J	ND	0.8 J
A1-PZ-20	LEPA	12/00	1.0 J	ND	1.0 J
A1-PZ-20	LEPA	03/01	0.5 J	ND	0.6 J
A1-PZ-20	LEPA	09/01	0.2 J	0.4 J	ND
A1-PZ-20	LEPA	03/27/02	0.3 J	ND	0.4 J
A1-PZ-20	LEPA	08/07/02	0.32 J	ND	ND
A1-PZ-21	LEPA	04/00	2.0	ND	3.0
A1-PZ-21	LEPA	08/00	**7.0**	ND	**6.0**
A1-PZ-21	LEPA	09/00	4.0	0.2 J	4.0
A1-PZ-21	LEPA	12/00	5.0	0.3 J	**5.0**
A1-PZ-21	LEPA	03/01	3.0	ND	3.0
A1-PZ-21	LEPA	06/01	2.0	0.2 J	3.0
A1-PZ-21	LEPA	09/01	1.0 J	ND	2.0 J
A1-PZ-21	LEPA	12/19/01	0.6 J	ND	0.76 J
A1-PZ-21	LEPA	03/29/02	0.32 J	ND	0.21 J
A1-PZ-21	LEPA	06/11/02	ND	ND	ND
A1-PZ-21	LEPA	08/08/02	ND	ND	ND
A1-PZ-22	LEPA	02/00	2.0 J	ND	1.0 J
A1-PZ-22	LEPA	04/00	3.0	ND	3.0
A1-PZ-22	LEPA	08/00	**15**	1.0 J	**12**
A1-PZ-22	LEPA	09/00	**8.0**	0.5 J	**6.0**
A1-PZ-22	LEPA	12/00	**8.0**	0.8 J	**7.0**
A1-PZ-22	LEPA	04/01	4.0	ND	3.0
A1-PZ-22	LEPA	09/01	ND	ND	ND
A1-PZ-22	LEPA	12/18/01	0.38 J	ND	ND
A1-PZ-22	LEPA	03/09/02	0.59 J	ND	ND
A1-PZ-22	LEPA	06/10/02	0.48 J	ND	ND
A1-PZ-22	LEPA	08/06/02	0.97 J	ND	ND
A1-PZ-22 DUP	LEPA	12/18/01	0.36 J	ND	ND
A1-PZ-23	LEPA	04/00	6.0	0.5 J	**6.0**
A1-PZ-23	LEPA	08/00	**9.0**	0.8 J	**9.0**
A1-PZ-23	LEPA	09/00	**7.0**	0.7 J	**7.0**
A1-PZ-23	LEPA	12/00	6.0	0.8 J	**6.0**
A1-PZ-23	LEPA	04/01	4.0	0.4 J	4.0
A1-PZ-23	LEPA	06/01	3.0	0.3 J	3.0
A1-PZ-23	LEPA	09/01	1.0 J	ND	2.0 J
A1-PZ-23	LEPA	12/20/01	1.1	ND	1.7
A1-PZ-23	LEPA	06/11/02	0.32 J	ND	0.28 J
A1-PZ-23	LEPA	06/11/02	0.41 J	ND	0.33 J
A1-PZ-23	LEPA	08/09/02	0.24 J	ND	0.28 J
A1-PZ-23 -DUP	LEPA	08/09/02	0.25 J	ND	0.26 J
A1-PZ-25A	LEPA	08/00	2.0 J	ND	2.0 J
A1-PZ-25A	LEPA	12/00	5.0	0.5 J	4.0

Table 1. 1,1-DCE, PCE, and TCE Concentrations (Continued)

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL)		
			1,1-DCE (7 µg/L)	PCE (5 µg/L)	TCE (5 µg/L)
A1-PZ-25A	LEPA	04/01	ND	ND	ND
A1-PZ-25A	LEPA	06/01	4.0	0.4 J	3.0
A1-PZ-25A	LEPA	09/01	3.0	0.3 J	2.0
A1-PZ-25A	LEPA	12/21/01	2.1	ND	2.3
A1-PZ-25A	LEPA	04/02/02	2.5	ND	1.7
A1-PZ-25A	LEPA	06/11/02	1.7	ND	1.5
A1-PZ-25A	LEPA	08/08/02	5.9	0.37 J	4.4
A1-PZ-27	LEPA	01/00	ND	ND	ND
A1-PZ-27	LEPA	08/00	ND	ND	ND
A1-PZ-27	LEPA	12/00	ND	ND	ND
A1-PZ-27	LEPA	03/01	ND	ND	ND
A1-PZ-27	LEPA	09/01	ND	ND	ND
A1-PZ-27	LEPA	03/09/02	ND	ND	ND
A1-PZ-27	LEPA	08/06/02	ND	ND	ND
A1-PZ-28	LEPA	01/00	1.0 J	ND	ND
A1-PZ-28	LEPA	08/00	0.6 J	ND	0.7 J
A1-PZ-28	LEPA	12/00	1.0 J	ND	1.0 J
A1-PZ-28	LEPA	03/01	0.9 J	ND	0.9 J
A1-PZ-28	LEPA	09/01	0.7 J	ND	0.7 J
A1-PZ-28	LEPA	03/11/02	1.1	ND	0.69 J
A1-PZ-28	LEPA	06/10/02	0.67 J	ND	0.47 J
A1-PZ-28	LEPA	08/07/02	0.86 J	ND	0.71 J
A1-MW-01	Area 1	04/00	**16**	ND	**12**
A1-MW-01	Area 1	08/00	**17**	0.8 J	**15**
A1-MW-01	Area 1	09/00	**13**	0.4 J	**10**
A1-MW-01	Area 1	12/00	**16**	0.7 J	**14**
A1-MW-01	Area 1	04/01	**20**	0.9 J	**15**
A1-MW-01	Area 1	06/01	**16**	1.0 J	**13**
A1-MW-01	Area 1	09/01	**17**	0.9 J	**13**
A1-MW-01	Area 1	02/06/02	**37**	1.0	**11**
A1-MW-01	Area 1	02/11/02	**37**	1.0	**11**
A1-MW-01	Area 1	03/09/02	**16**	0.92 J	**13**
A1-MW-01	Area 1	06/10/02	3.90	0.45 J	3.20
A1-MW-01	Area 1	08/05/02	5.1	0.50 J	**5.0**
A1-MW-01	Area 1	12/06/02	5.9	0.47 J	**5.4**
A1-MW-01 DUP	Area 1	12/06/02	5.4	0.43 J	**5**
A1-MW-02	Area 1	01/00	0.6 J	ND	0.2 J
A1-MW-02	Area 1	08/00	ND	ND	ND
A1-MW-02	Area 1	12/00	0.3 J	ND	ND
A1-MW-02	Area 1	03/01	0.8 J	ND	ND
A1-MW-02	Area 1	09/01	0.6 J	ND	ND
A1-MW-02	Area 1	03/12/02	0.47 J	ND	ND
A1-MW-02	Area 1	08/05/02	0.33 J	ND	ND
A1-MW-03	Area 1	01/00	ND	ND	ND
A1-MW-03	Area 1	04/00	3.0	ND	3.0
A1-MW-03	Area 1	08/00	ND	ND	ND
A1-MW-03	Area 1	12/00	5.0	ND	4.0
A1-MW-03	Area 1	03/01	0.7 J	ND	ND
A1-MW-03	Area 1	09/01	0.8 J	ND	0.2 J
A1-MW-03	Area 1	03/12/02	0.26 J	ND	ND

Table 1. 1,1-DCE, PCE, and TCE Concentrations (Continued)

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL) 1,1-DCE (7 µg/L)	PCE (5 µg/L)	TCE (5 µg/L)
A1-MW-03	Area 1	08/05/02	0.40 J	ND	ND
A1-MW-04	Area 1	01/00	ND	ND	0.2 J
A1-MW-04	Area 1	08/00	ND	ND	ND
A1-MW-04	Area 1	12/00	ND	ND	ND
A1-MW-04	Area 1	03/01	ND	ND	ND
A1-MW-04	Area 1	09/01	ND	ND	ND
A1-MW-04	Area 1	03/11/02	ND	ND	ND
A1-MW-04	Area 1	08/05/02	ND	ND	ND
A1-MW-04	Area 1	12/05/02	ND	ND	ND
A1-MW-05	Area 1	01/00	ND	ND	0.4 J
A1-MW-05	Area 1	04/00	ND	ND	0.3 J
A1-MW-05	Area 1	08/00	ND	ND	ND
A1-MW-05	Area 1	12/00	ND	ND	ND
A1-MW-05	Area 1	04/01	ND	ND	ND
A1-MW-05	Area 1	09/01	0.4 J	ND	ND
A1-MW-05	Area 1	03/09/02	0.44 J	ND	ND
A1-MW-05	Area 1	08/05/02	0.37 J	ND	ND
A1-MW-05	Area 1	12/05/02	0.25 J	ND	ND
A1-MW-06	Area 1	01/00	ND	ND	ND
A1-MW-06	Area 1	08/00	ND	ND	ND
A1-MW-06	Area 1	12/00	ND	ND	ND
A1-MW-06	Area 1	03/01	ND	ND	ND
A1-MW-06	Area 1	09/01	ND	ND	ND
A1-MW-06	Area 1	03/12/02	ND	ND	ND
A1-MW-06	Area 1	08/05/02	ND	ND	ND
A1-MW-24	Area 1	03/11/02	0.62 J	ND	1.1
A1-MW-24	Area 1	08/13/02	0.29 J	ND	0.67 J
A1-MW-24 DUP	Area 1	03/11/02	0.44 J	ND	0.96 J
A1-MW-26	Area 1	03/12/02	ND	ND	0.38 J
A1-MW-26	Area 1	08/13/02	ND	ND	0.21 J
A1-MW-28	Area 1	03/12/02	ND	ND	0.31 J
A1-MW-28	Area 1	08/13/02	0.38 J	ND	0.45 J
A1-MW-29A	Area 1	03/16/02	0.84 J	ND	0.78 J
A1-MW-29A	Area 1	08/14/02	1.8	ND	1.9
A1-MW-29A DUP	Area 1	08/14/02	2.2	ND	2.2
A1-MW-30	Area 1	03/12/02	ND	ND	ND
A1-MW-30	Area 1	08/14/02	ND	ND	ND
A1-MW-31	Area 1	04/00	6.0	0.5 J	**6.0**
A1-MW-31	Area 1	08/00	3.0	ND	**5.0**
A1-MW-31	Area 1	12/00	1.0 J	ND	0.2 J
A1-MW-31	Area 1	03/01	0.9 J	ND	ND
A1-MW-31	Area 1	06/01	ND	ND	ND
A1-MW-31	Area 1	09/01	ND	ND	ND
A1-MW-31	Area 1	12/17/01	0.41 J	ND	ND
A1-MW-31	Area 1	03/11/02	1.1	ND	ND
A1-MW-31	Area 1	06/07/02	0.54 J	ND	ND
A1-MW-31	Area 1	08/06/02	1.0	ND	0.21 J
A1-MW-32	Area 1	04/00	5.0	0.6 J	**6.0**
A1-MW-32	Area 1	08/00	1.0 J	ND	2.0 J
A1-MW-32	Area 1	12/00	5.0	0.5 J	**6.0**

Table 1. 1,1-DCE, PCE, and TCE Concentrations (Continued)

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL) 1,1-DCE (7 µg/L)		PCE (5 µg/L)		TCE (5 µg/L)	
A1-MW-32	Area 1	03/01	4.0		0.4	J	5.0	
A1-MW-32	Area 1	06/01	2.0		0.3	J	3.0	
A1-MW-32	Area 1	09/01	2.0		0.3	J	3.0	
A1-MW-32	Area 1	12/18/01	2.0		0.21	J	2.1	
A1-MW-32	Area 1	03/09/02	3.0		0.24	J	3.3	
A1-MW-32	Area 1	06/07/02	2.7		0.25	J	3.0	
A1-MW-32	Area 1	06/13/02	1.6		0.25	J	2.5	
A1-MW-32	Area 1	08/07/02	2.4		0.24	J	3.3	
A1-MW-32 DUP	Area 1	08/07/02	2.4		0.27	J	2.9	
A1-MW-33	Area 1	03/11/02	1.4		ND		1.5	
A1-MW-33	Area 1	08/14/02	0.70	J	ND		0.89	J
A1-MW-33 DUP	Area 1	03/11/02	1.4		ND		1.5	
A1-MW-34	Area 1	03/00	3.0		ND		4.0	
A1-MW-34	Area 1	08/00	5.0		0.5	J	**7.0**	
A1-MW-34	Area 1	12/00	6.0		0.6	J	**8.0**	
A1-MW-34	Area 1	06/01	5.0		0.6	J	**7.0**	
A1-MW-34	Area 1	09/01	0.9	J	ND		1.0	J
A1-MW-34	Area 1	12/17/01	2.7		0.33	J	2.8	
A1-MW-34	Area 1	03/09/02	3.1		0.28	J	2.8	
A1-MW-34	Area 1	06/07/02	4.0		0.45	J	3.7	
A1-MW-34	Area 1	08/09/02	4.5		0.54	J	4.0	
A1-MW-41	Area 1	01/00	5.0		0.6	J	**6.0**	
A1-MW-41	Area 1	04/00	4.0	J	0.3	J	4.0	J
A1-MW-41	Area 1	08/00	2.0	J	ND		2.0	
A1-MW-41	Area 1	12/00	2.0		0.2	J	2.0	
A1-MW-41	Area 1	06/01	3.0		0.4	J	3.0	
A1-MW-41	Area 1	09/01	3.0		0.4	J	**5.0**	
A1-MW-41	Area 1	12/16/01	2.8		0.32	J	3.9	
A1-MW-41	Area 1	03/09/02	2.8		0.27	J	4.1	
A1-MW-41	Area 1	06/07/02	1.9		0.29	J	3.5	
A1-MW-41	Area 1	06/07/02	2.3		0.33	J	3.8	
A1-MW-41	Area 1	08/09/02	3.2		0.38	J	3.9	
A1-MW-42	Area 1	08/00	3.0		ND		3.0	
A1-MW-42	Area 1	12/00	6.0		0.8	J	**6.0**	
A1-MW-42	Area 1	06/01	3.0		0.4	J	4.0	
A1-MW-42	Area 1	09/01	2.0	J	0.2	J	2.0	
A1-MW-42	Area 1	12/18/01	2.3		0.41	J	2.9	
A1-MW-42	Area 1	03/09/02	2.6		0.37	J	3.2	
A1-MW-42	Area 1	06/07/02	2.0		0.37	J	2.6	
A1-MW-42	Area 1	08/07/02	2.2		0.32	J	3.3	
A1-MW-43	Area 1	04/00	1.0	J	ND		1.0	J
A1-MW-43	Area 1	08/00	ND		ND		0.8	J
A1-MW-43	Area 1	12/00	0.7	J	ND		1.0	J
A1-MW-43	Area 1	09/01	0.3	J	ND		0.6	J
A1-MW-43	Area 1	03/09/02	0.91	J	ND		1.1	
A1-MW-43	Area 1	08/07/02	0.49	J	ND		0.94	J
NW1-MW-01	Area 1	01/00	ND		ND		ND	
NW1-MW-01	Area 1	03/00	ND		ND		ND	
NW1-MW-01	Area 1	12/00	ND		ND		ND	
NW1-MW-01	Area 1	09/01	ND		ND		ND	

Table 1. 1,1-DCE, PCE, and TCE Concentrations (Continued)

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL) 1,1-DCE (7 µg/L)	PCE (5 µg/L)	TCE (5 µg/L)
NW1-MW-01	Area 1	03/07/02	ND	ND	ND
NW1-MW-01	Area 1	08/06/02	ND	ND	ND
NW1-MW-01	Area 1	12/07/02	ND	ND	ND
NW1-MW-02	Area 1	01/00	ND	ND	ND
NW1-MW-02	Area 1	03/00	ND	ND	ND
NW1-MW-02	Area 1	12/00	ND	ND	ND
NW1-MW-02	Area 1	09/01	ND	ND	ND
NW1-MW-02	Area 1	03/08/02	ND	ND	ND
NW1-MW-02	Area 1	08/06/02	ND	ND	ND
NW1-MW-04	Area 1	01/00	ND	1.0 J	ND
NW1-MW-04	Area 1	03/00	ND	ND	ND
NW1-MW-04	Area 1	12/00	ND	ND	ND
NW1-MW-04	Area 1	09/01	ND	ND	ND
NW1-MW-04	Area 1	03/08/02	ND	ND	ND
NW1-MW-04	Area 1	08/06/02	ND	ND	ND

J: estimated value, below detection limit.
ND: not detected.
MCL: maximum contaminant level.
Shaded cells: concentration above MCL.

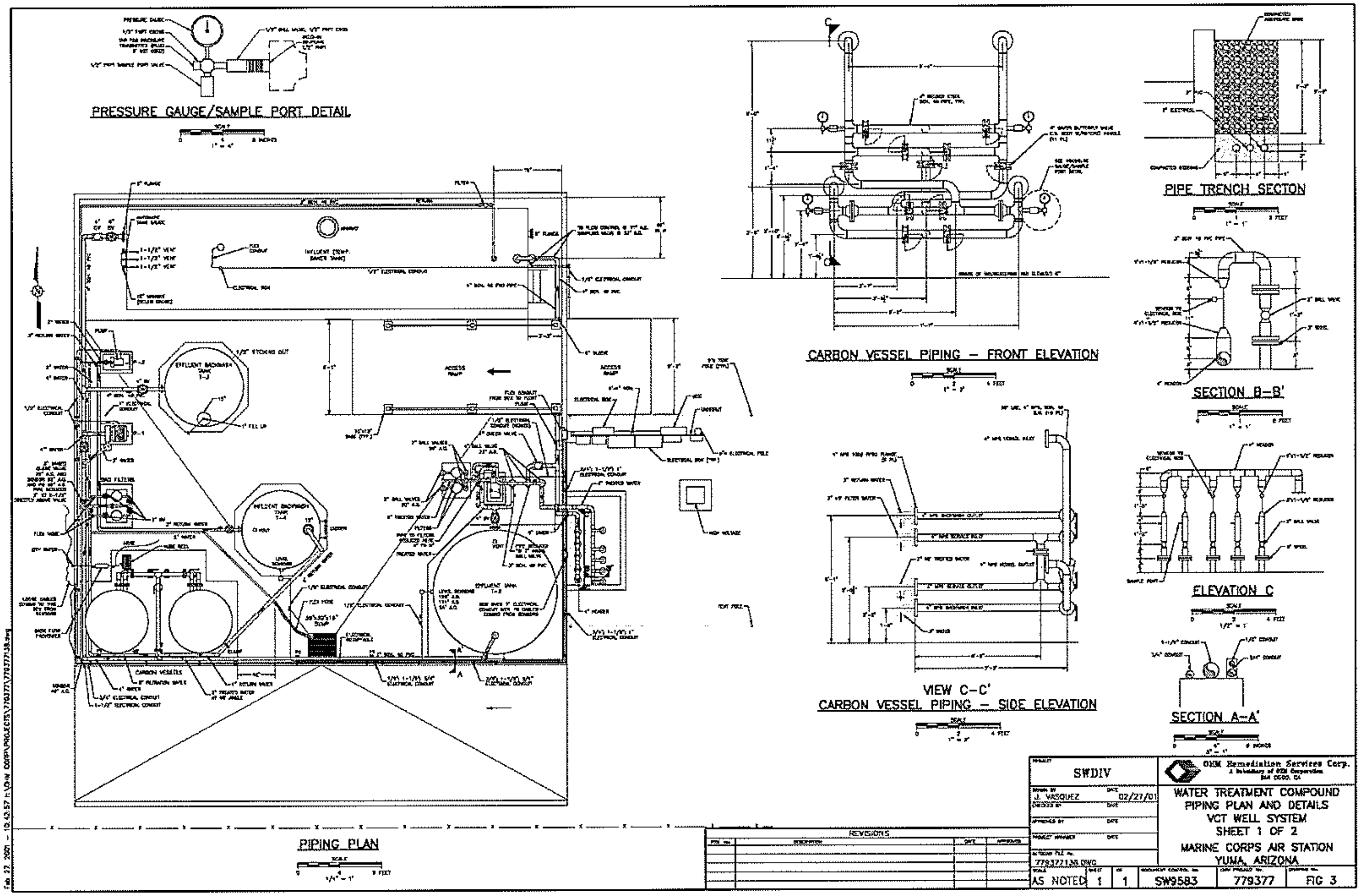


Figure 1. VCT System Schematic

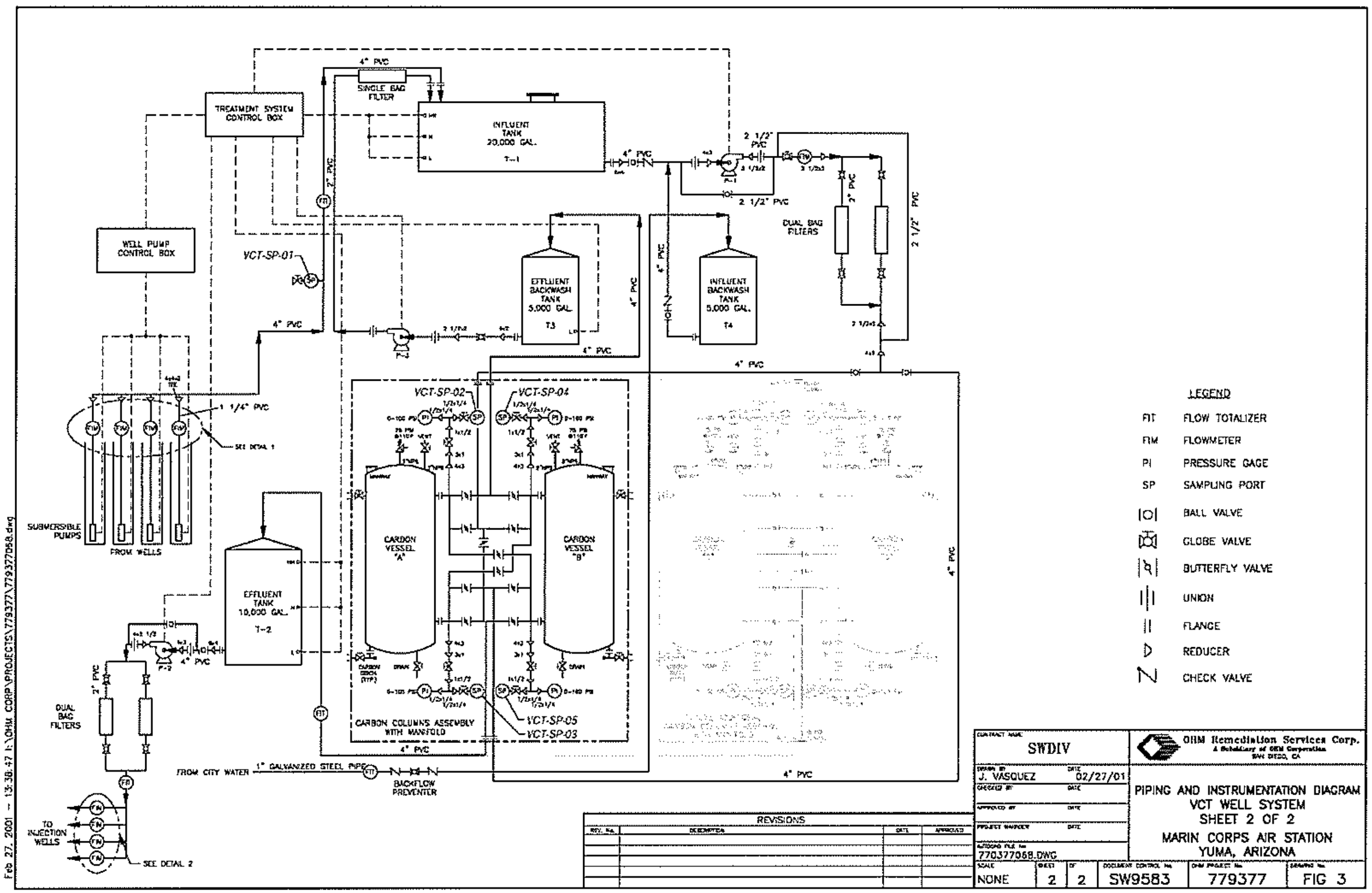


Figure 2. VCT System Piping and Instrumentation Diagram

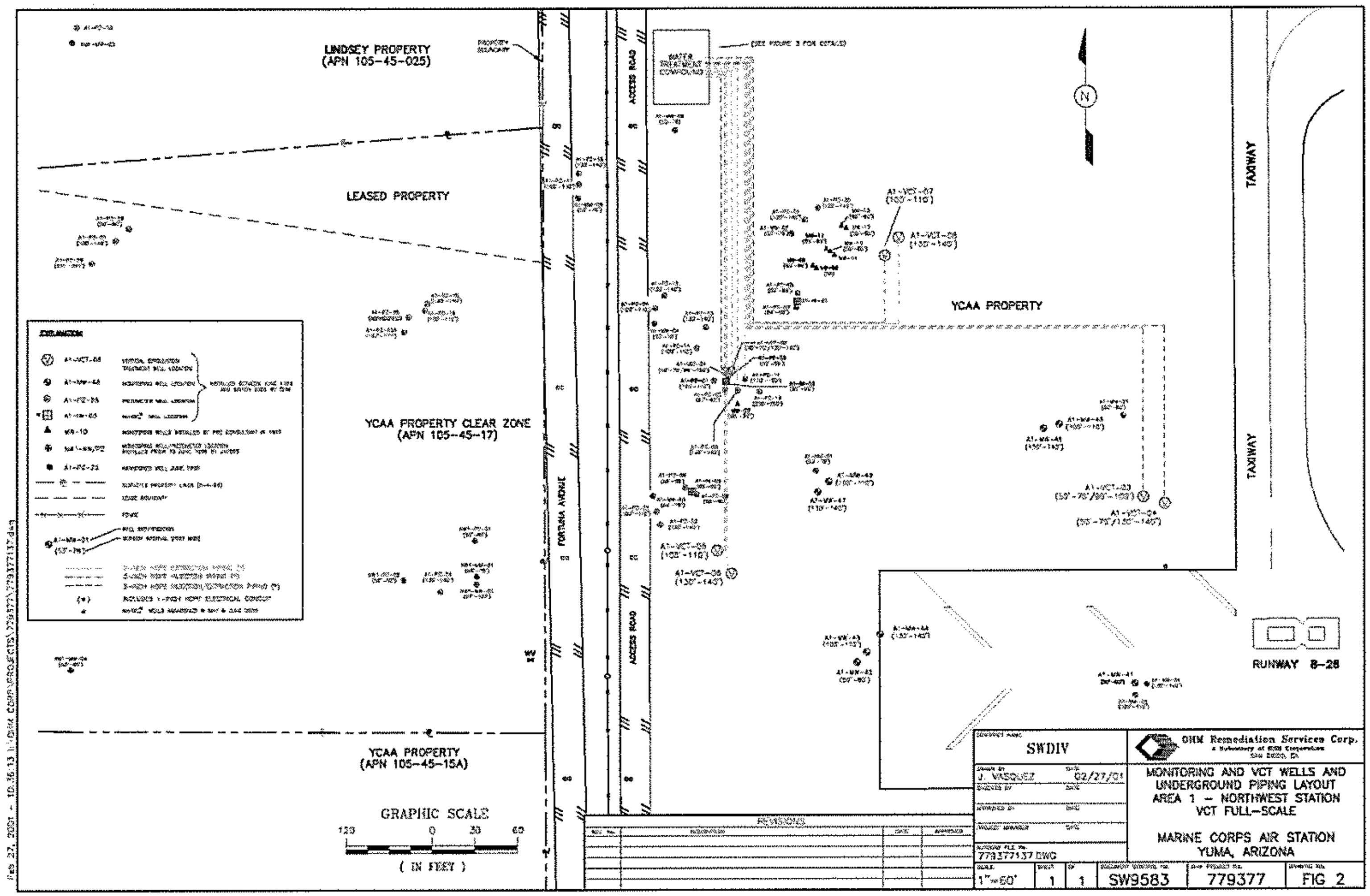


Figure 3. VCT Injection and Extraction Well Locations

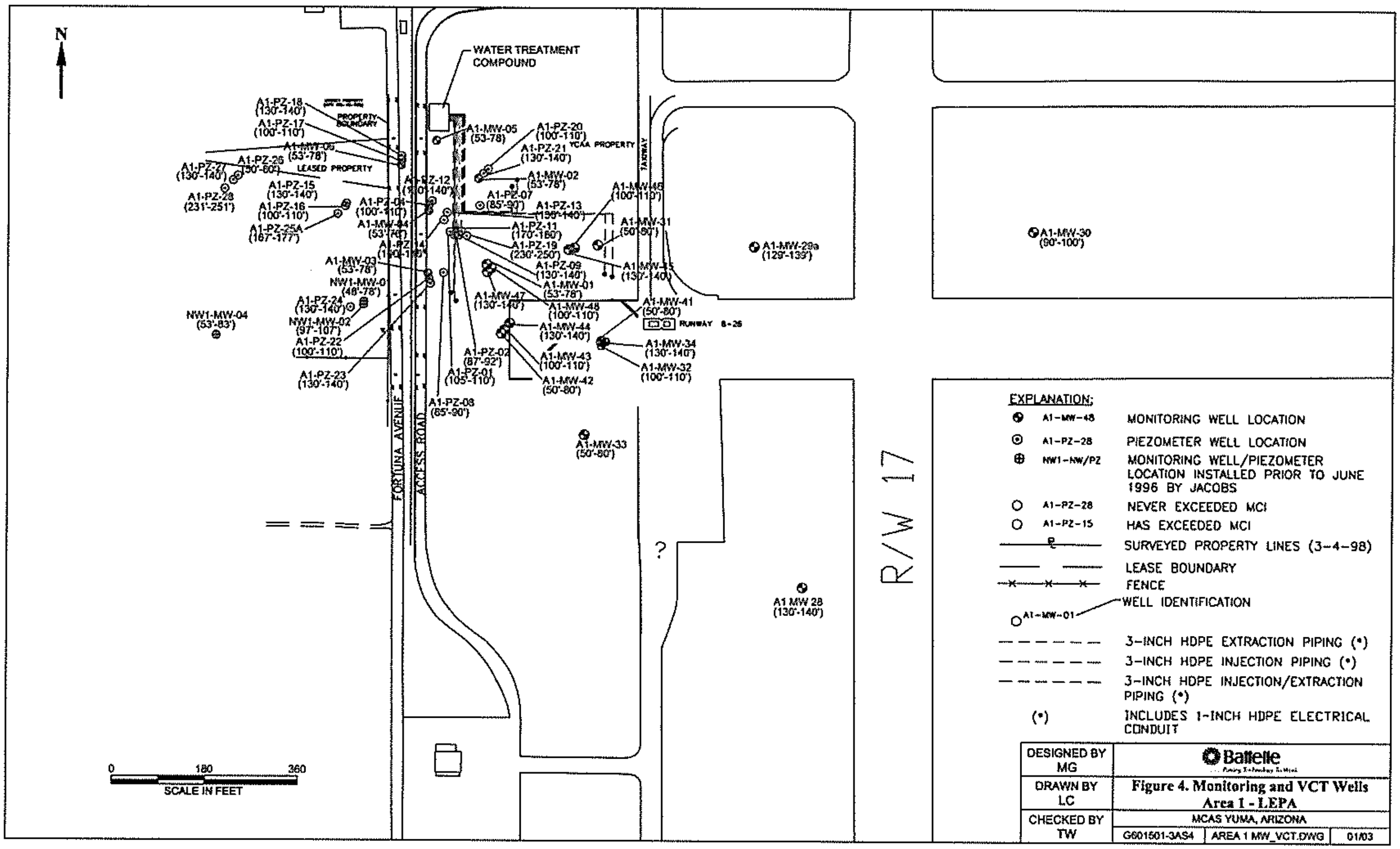
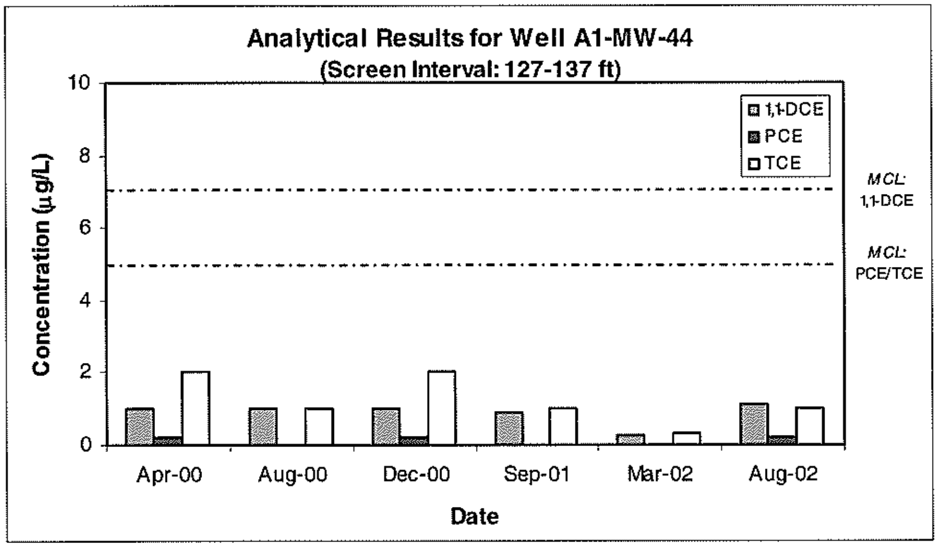
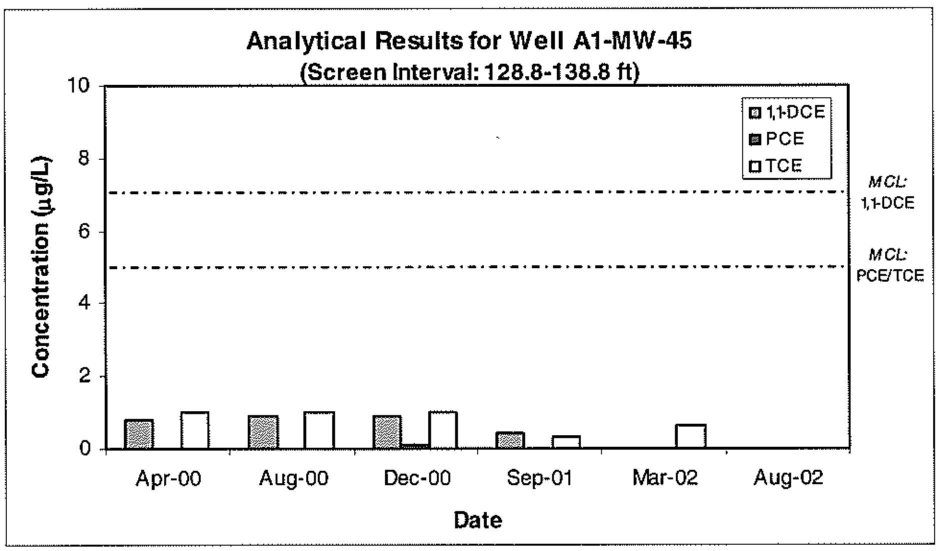


Figure 4. Monitoring Well Locations (LEPA)

Figure 5A. Concentration vs. Time
(Wells That Have Not Exceeded MCLs)





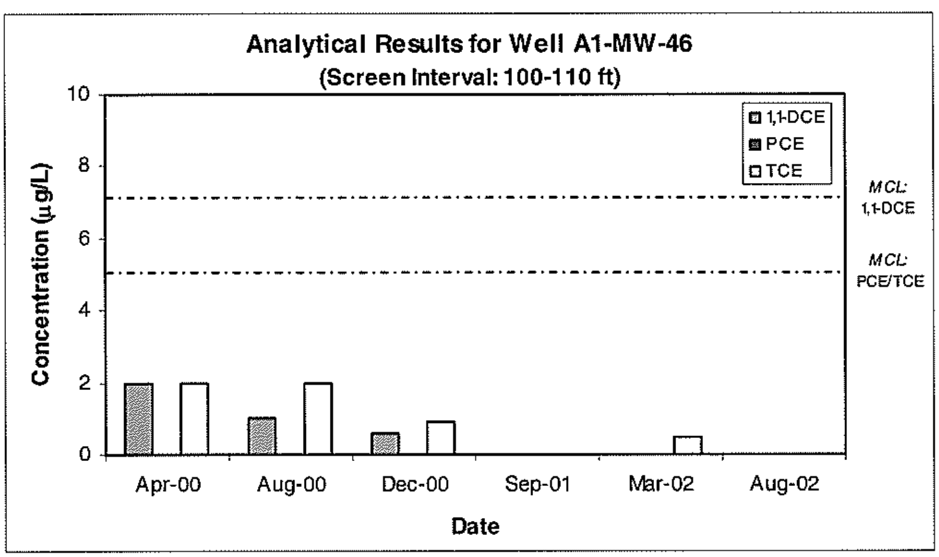
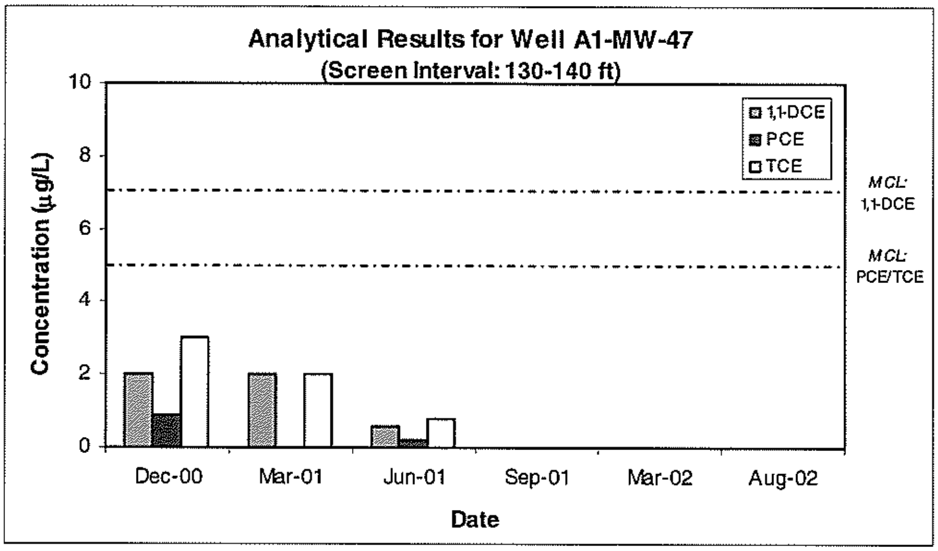
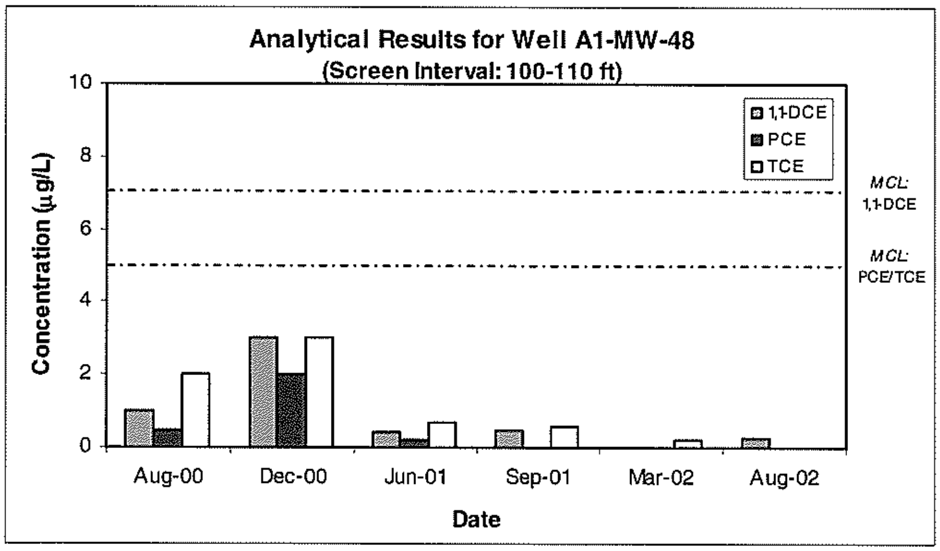


Figure 5A. Concentration vs. Time
(Wells That Have Not Exceeded MCLs)





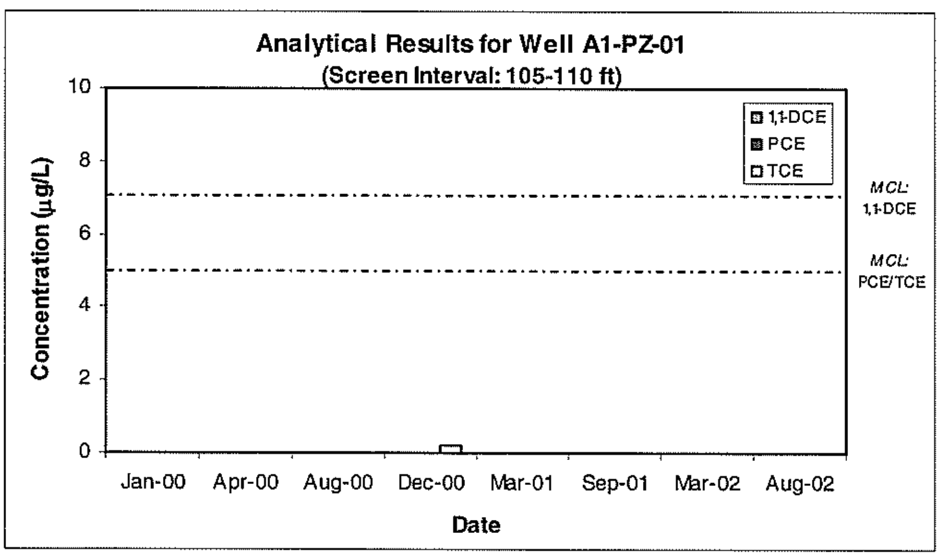
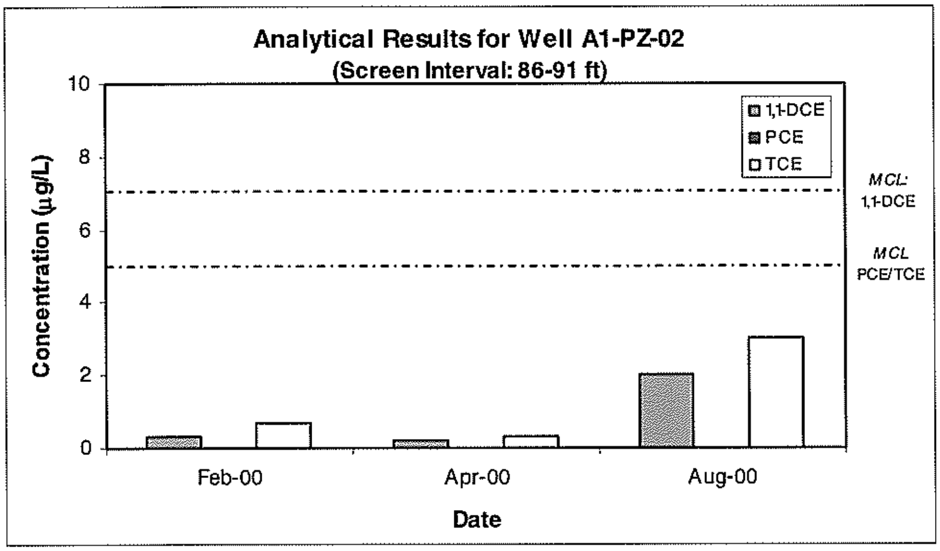
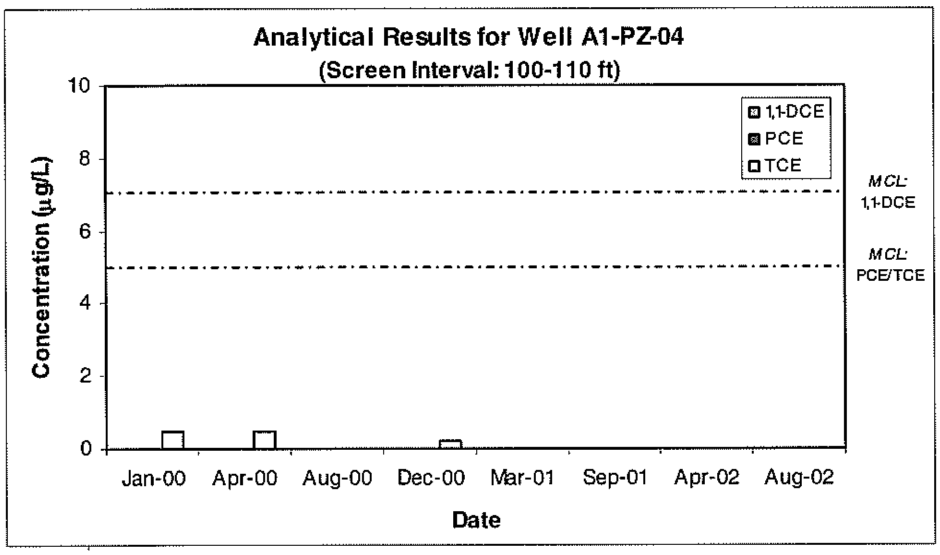


Figure 5A. Concentration vs. Time
(Wells That Have Not Exceeded MCLs)





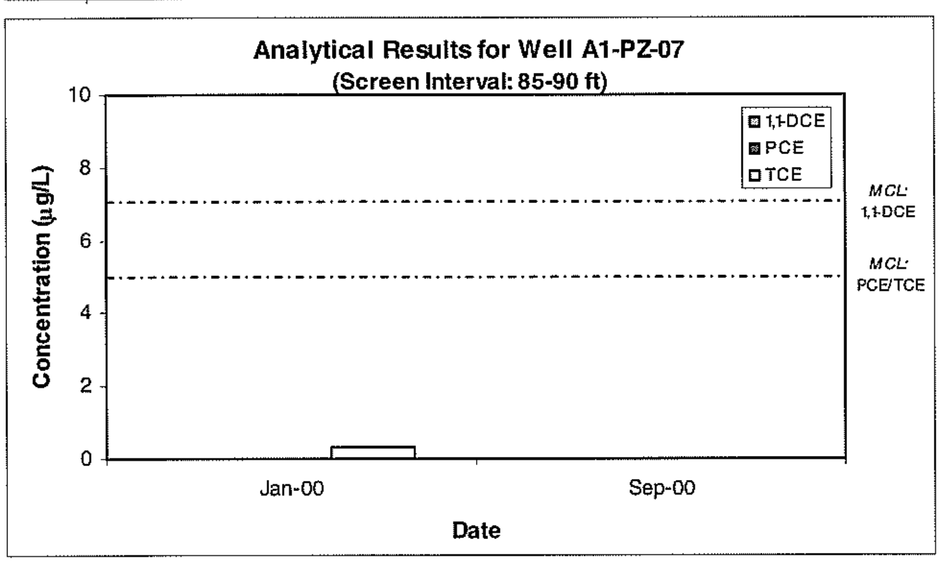
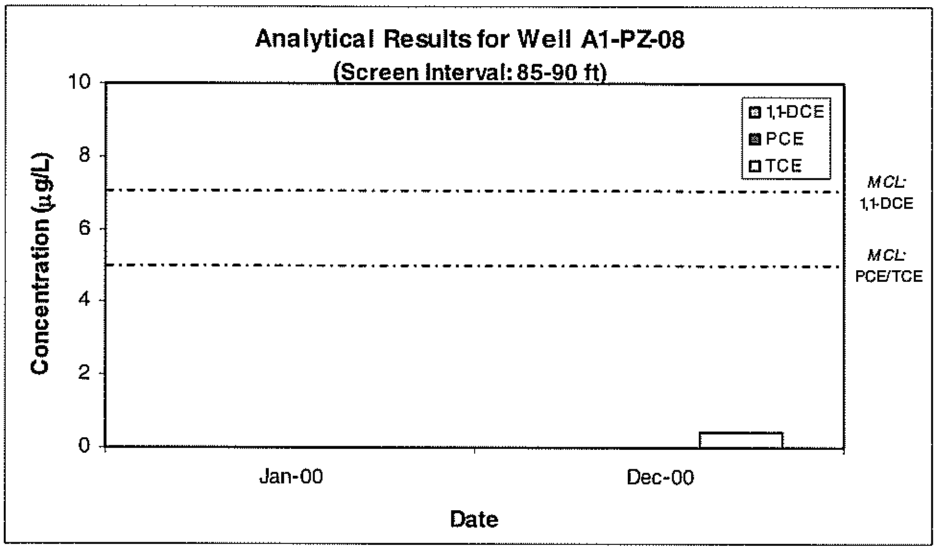
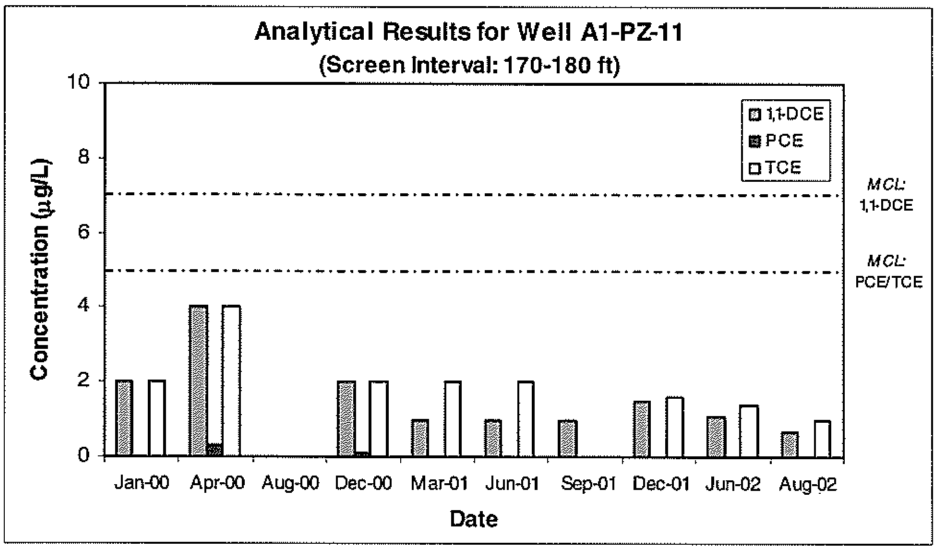


Figure 5A. Concentration vs. Time
(Wells That Have Not Exceeded MCLs)





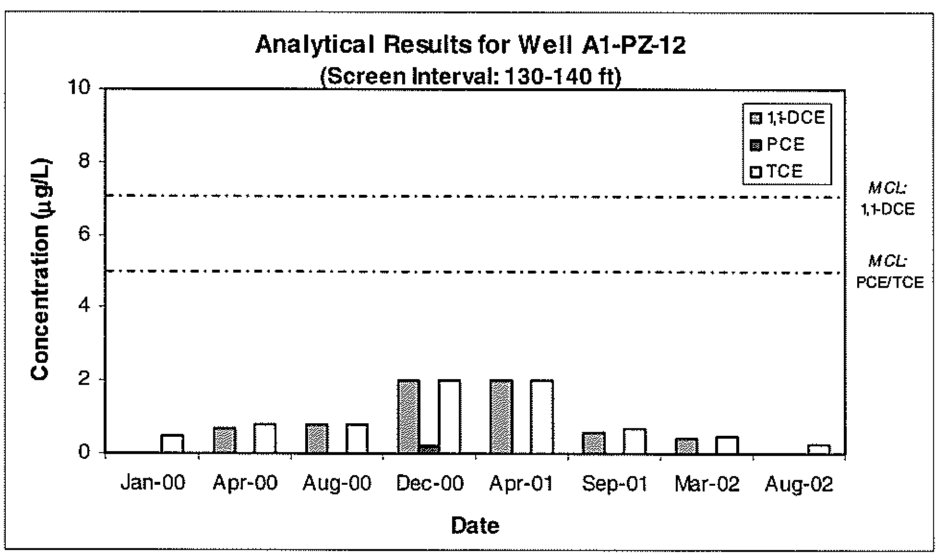
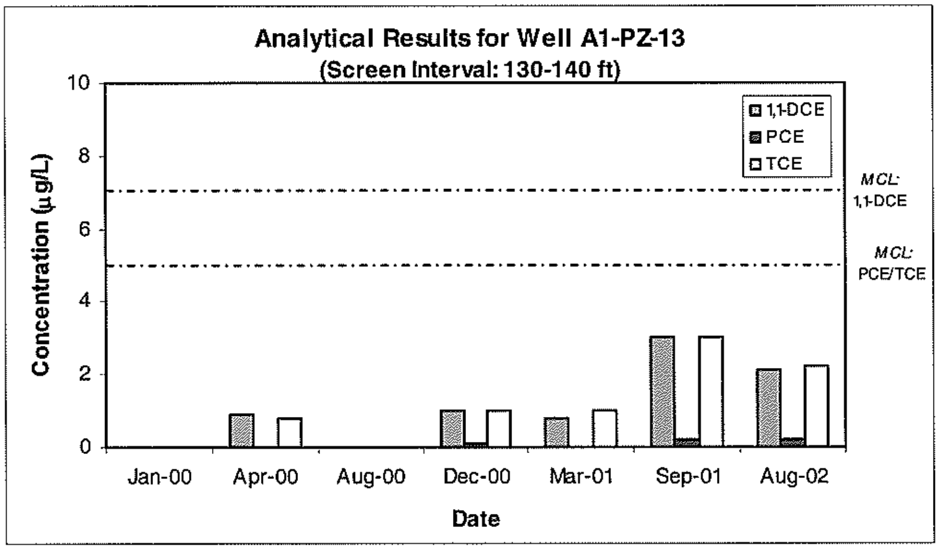
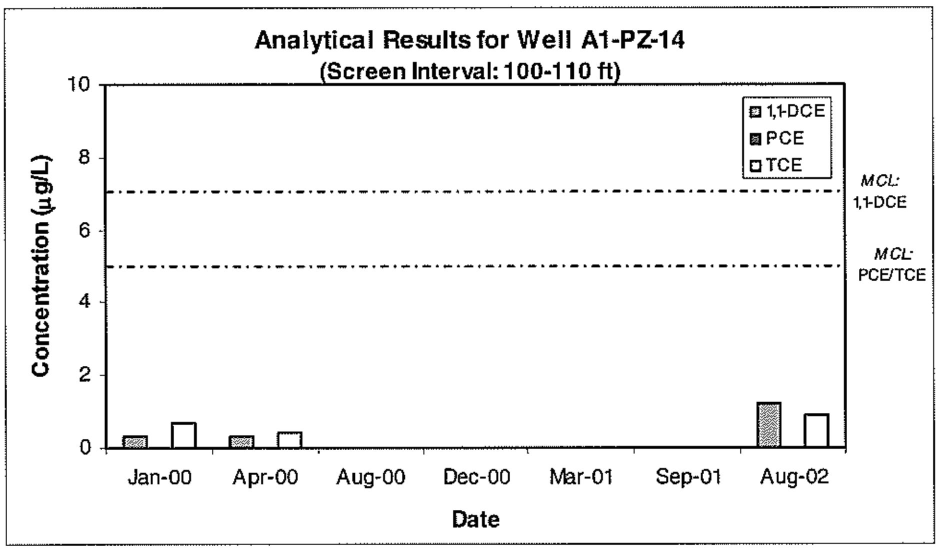


Figure 5A. Concentration vs. Time
(Wells That Have Not Exceeded MCLs)





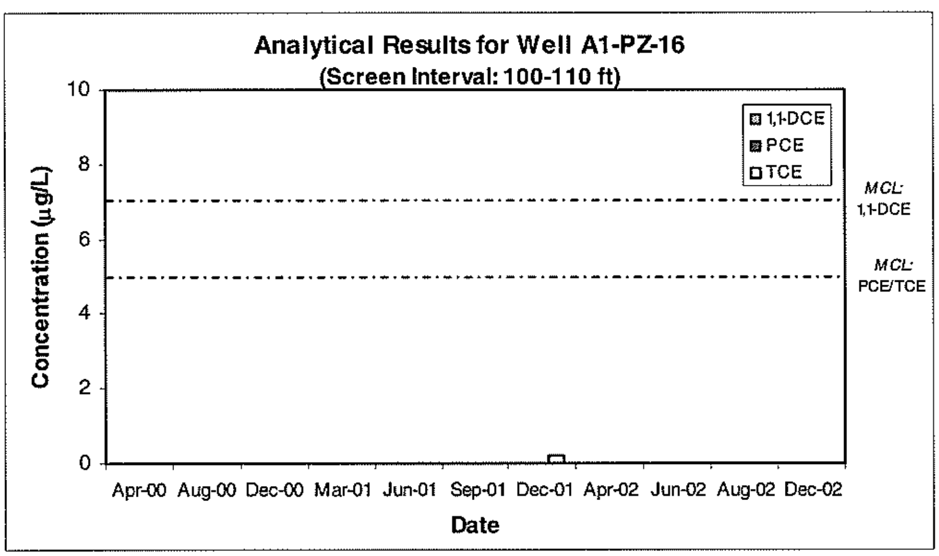
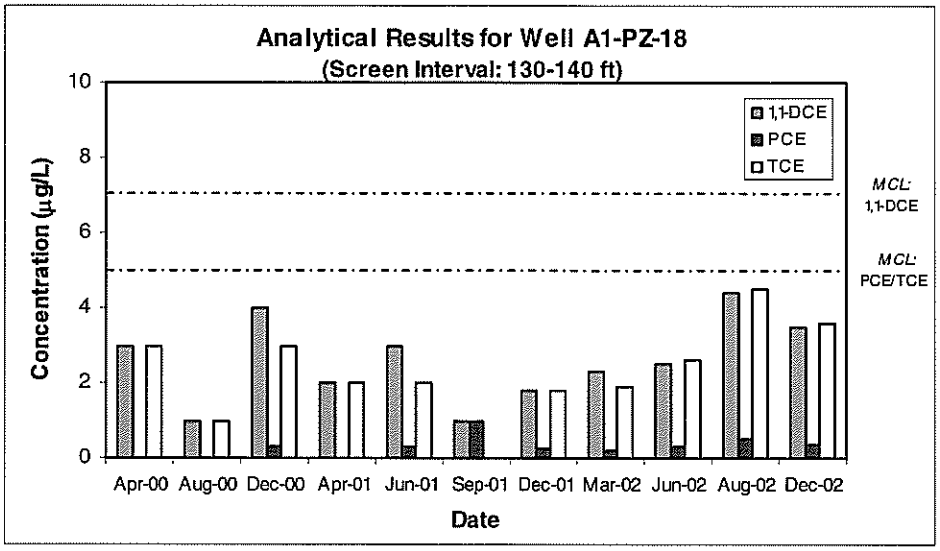
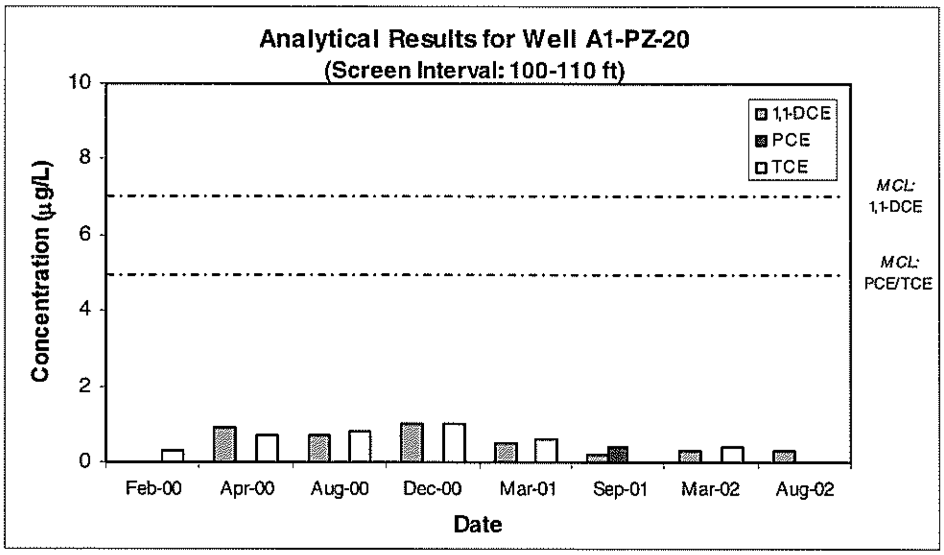


Figure 5A. Concentration vs. Time (Wells That Have Not Exceeded MCLs)





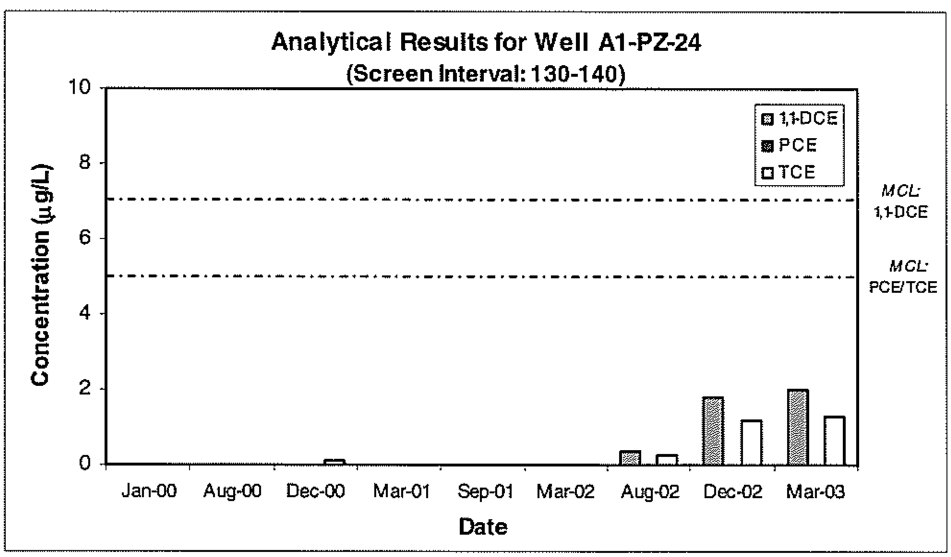
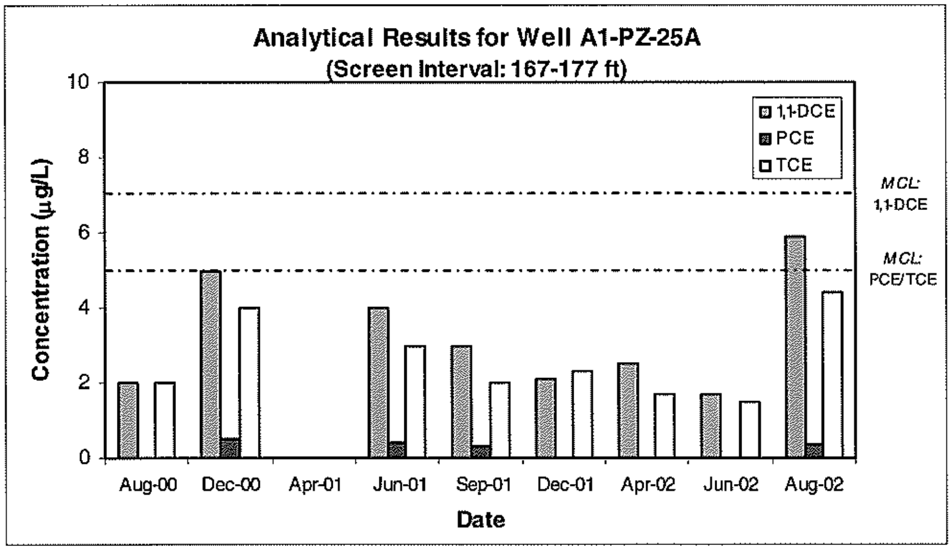
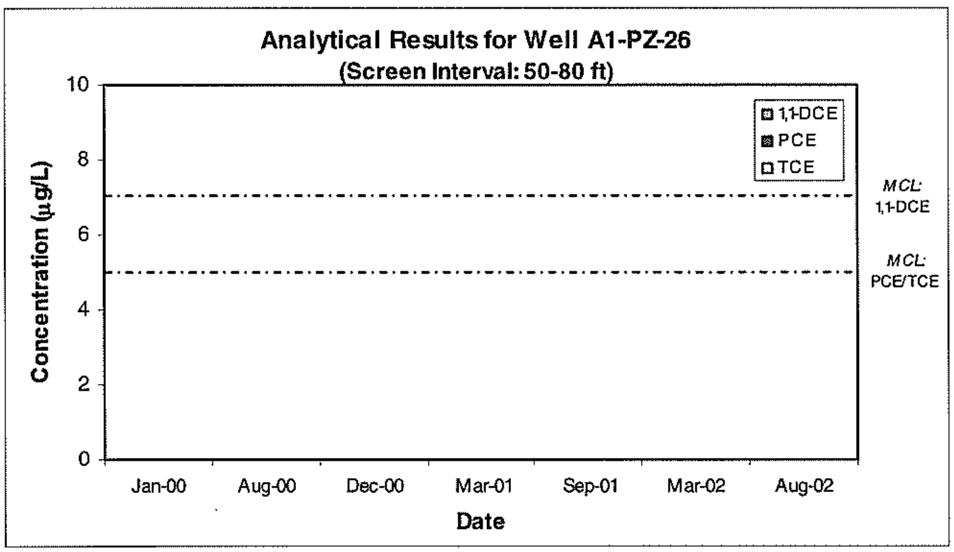


Figure 5A. Concentration vs. Time (Wells That Have Not Exceeded MCLs)





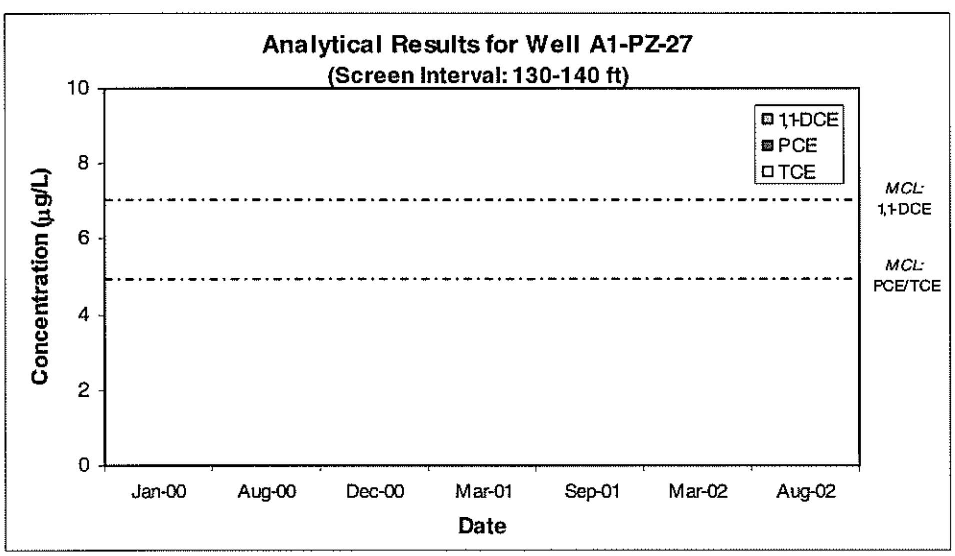
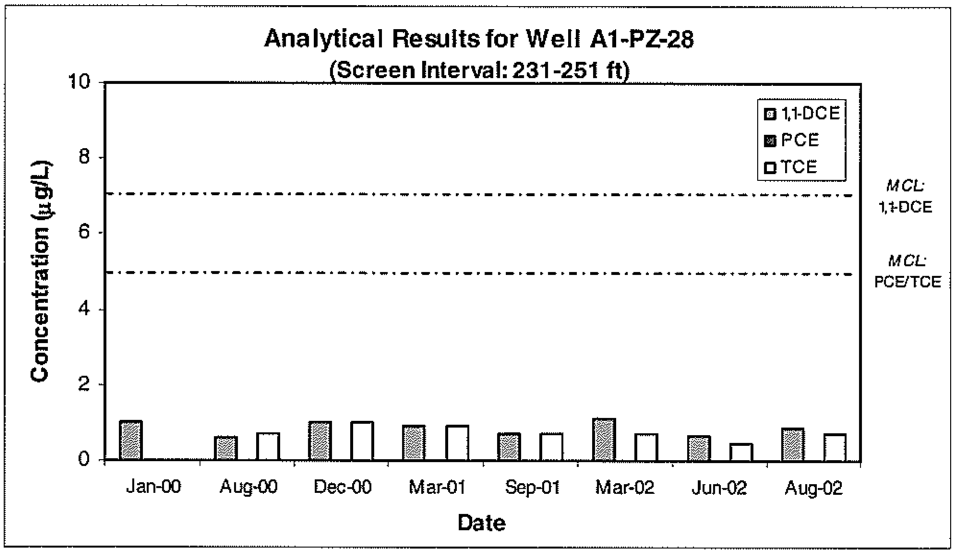
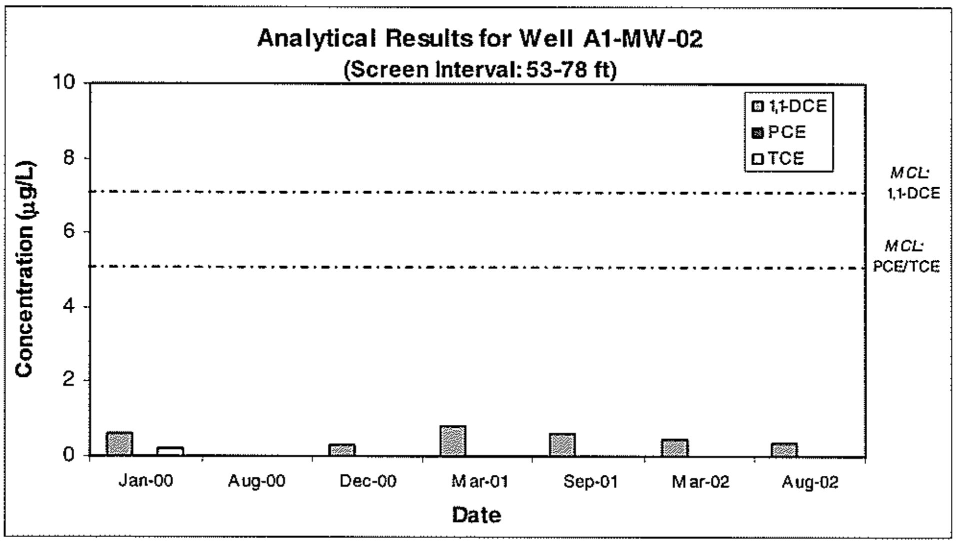


Figure 5A. Concentration vs. Time
(Wells That Have Not Exceeded MCLs)





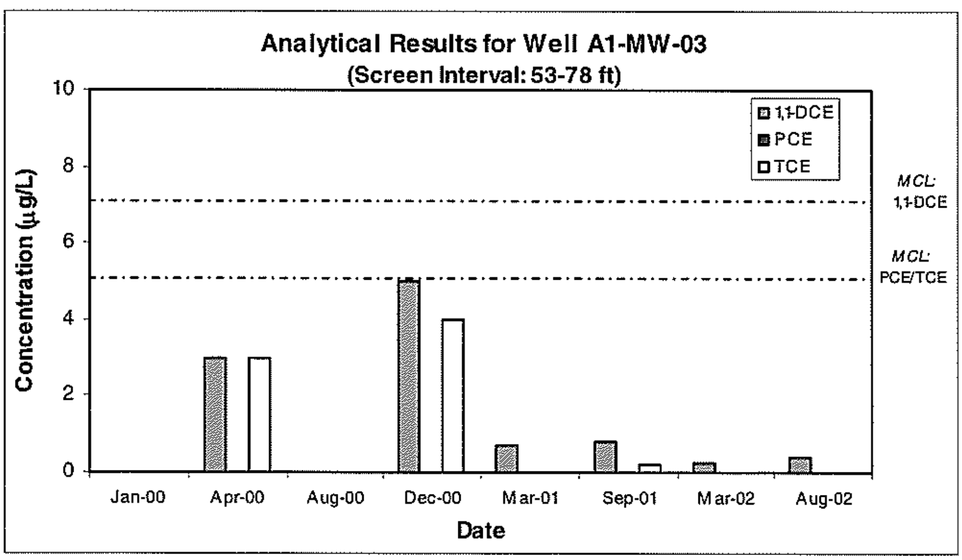
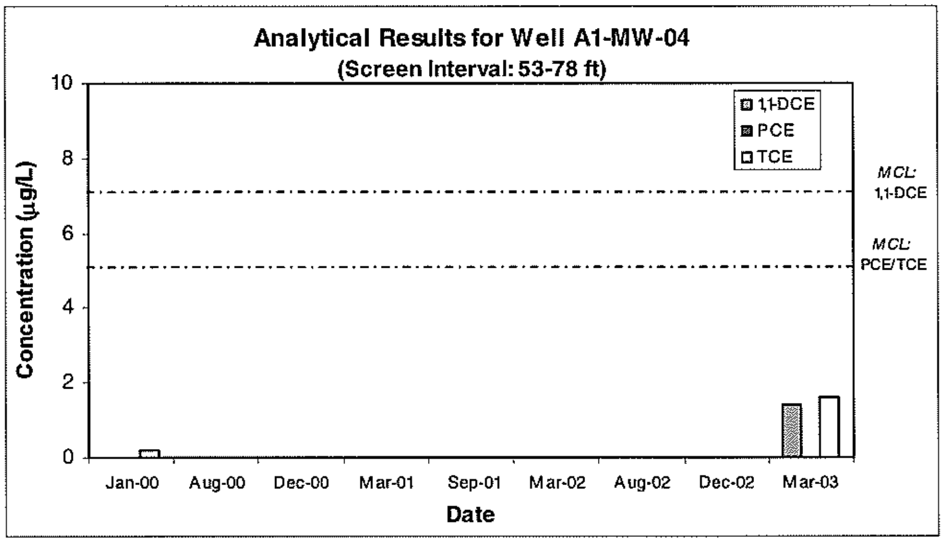
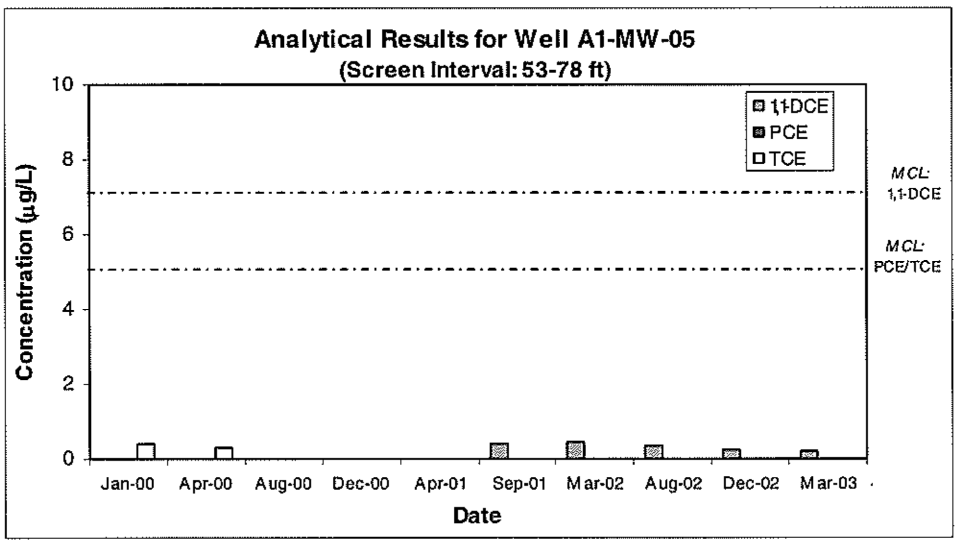


Figure 5A. Concentration vs. Time
(Wells That Have Not Exceeded MCLs)





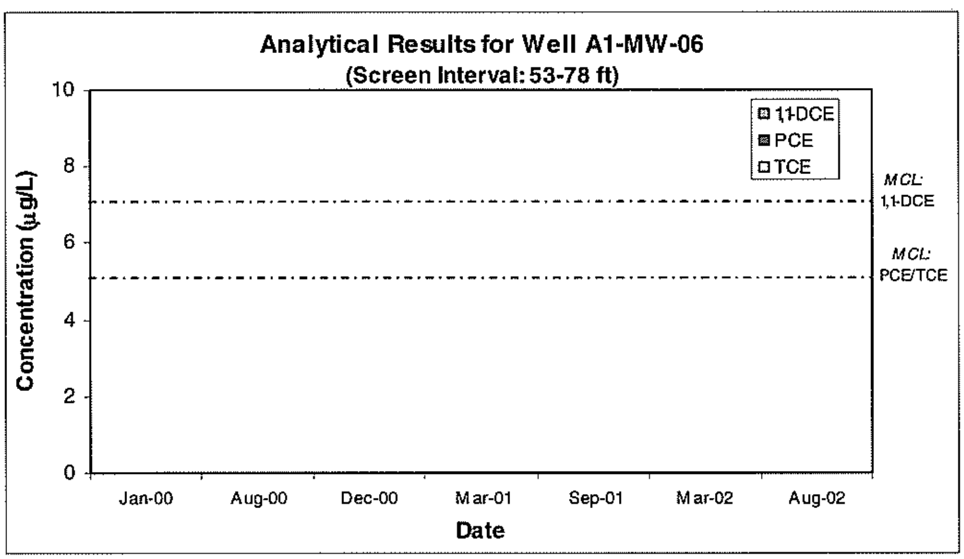
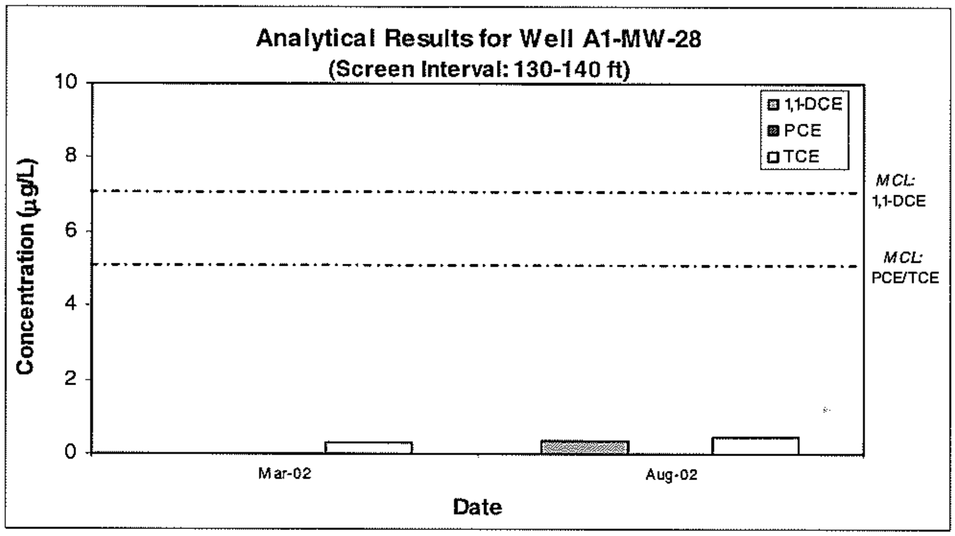
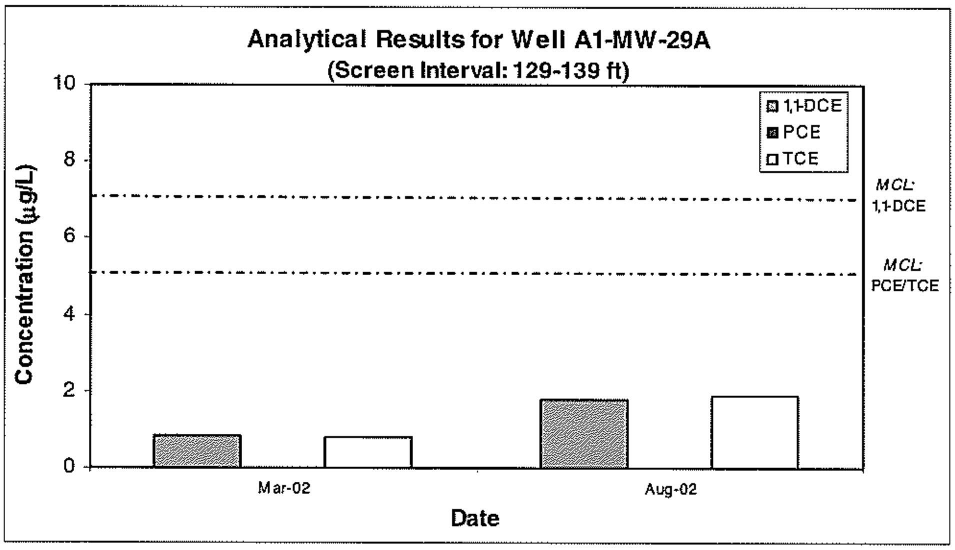


Figure 5A. Concentration vs. Time
(Wells That Have Not Exceeded MCLs)





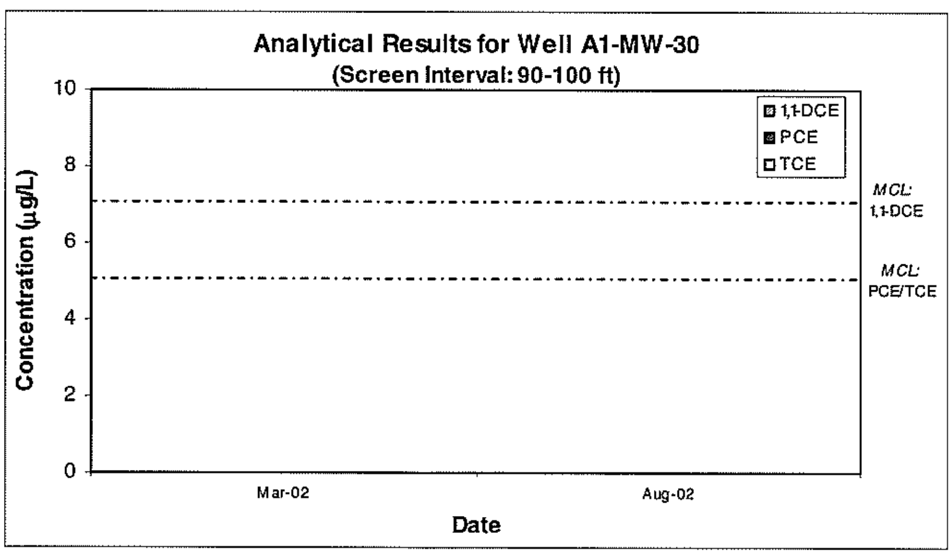
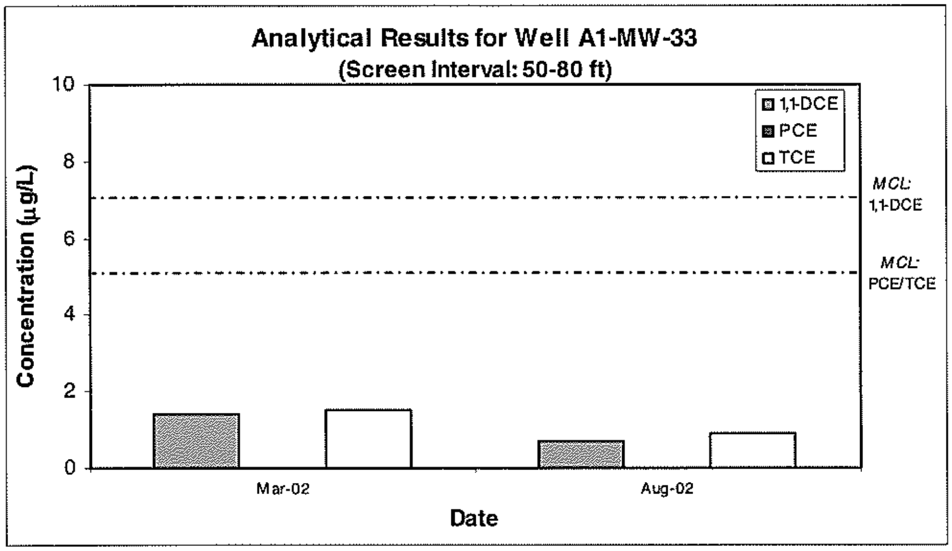
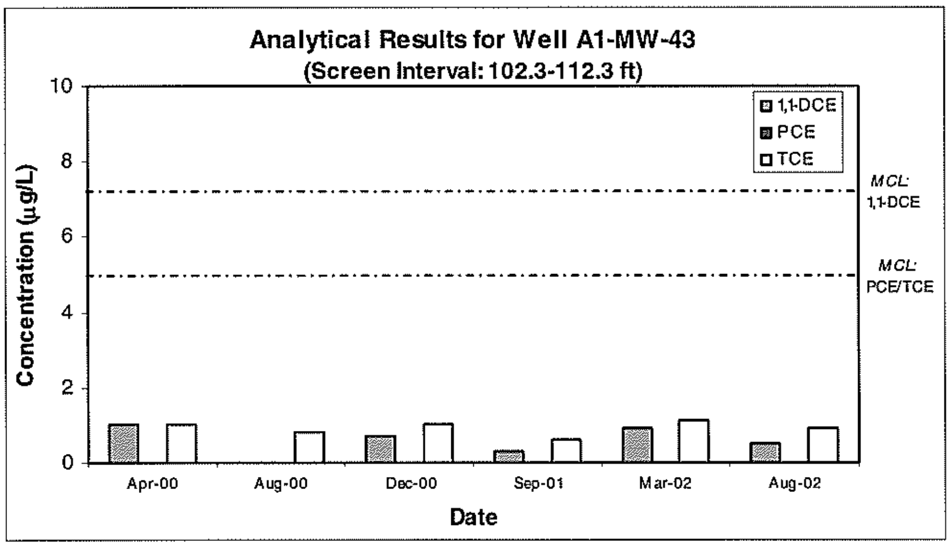


Figure 5A. Concentration vs. Time
(Wells That Have Not Exceeded MCLs)





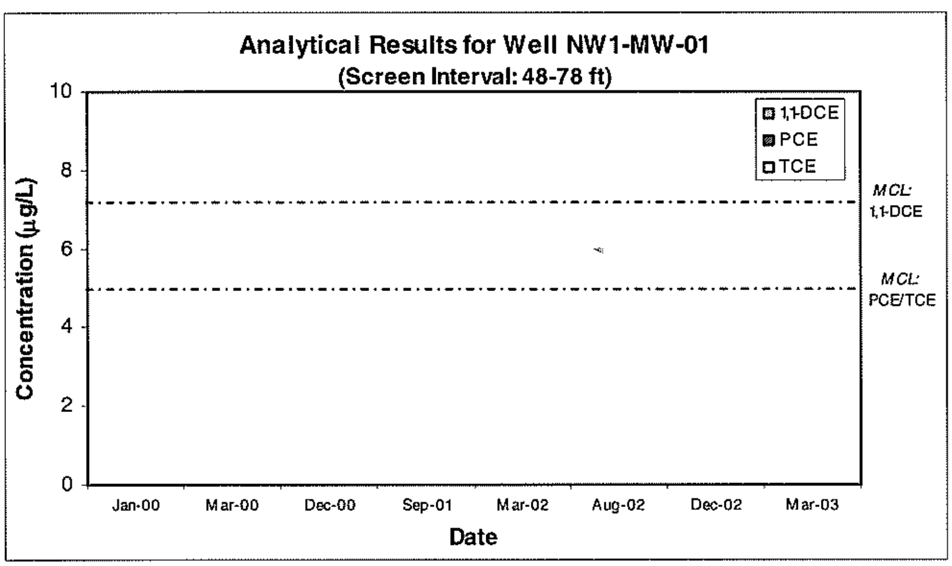
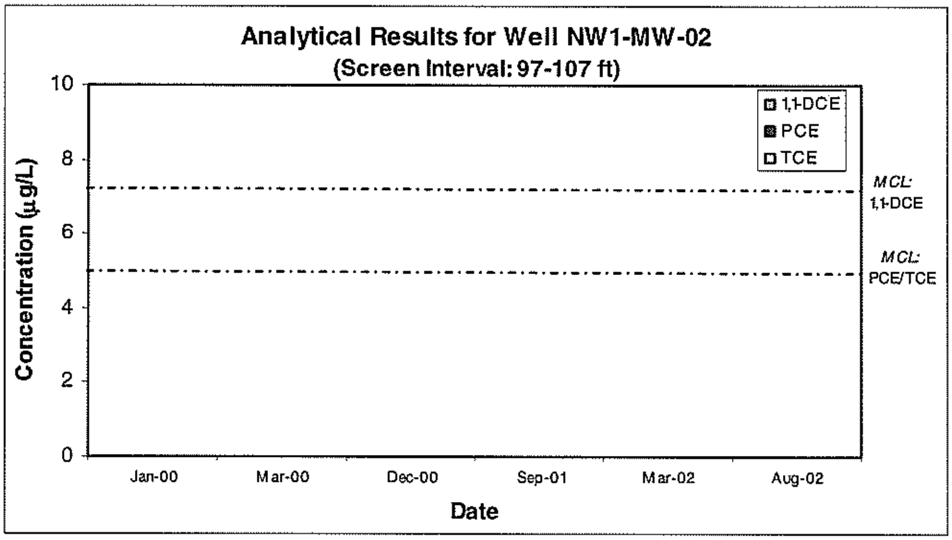


Figure 5A. Concentration vs. Time
(Wells That Have Not Exceeded MCLs)



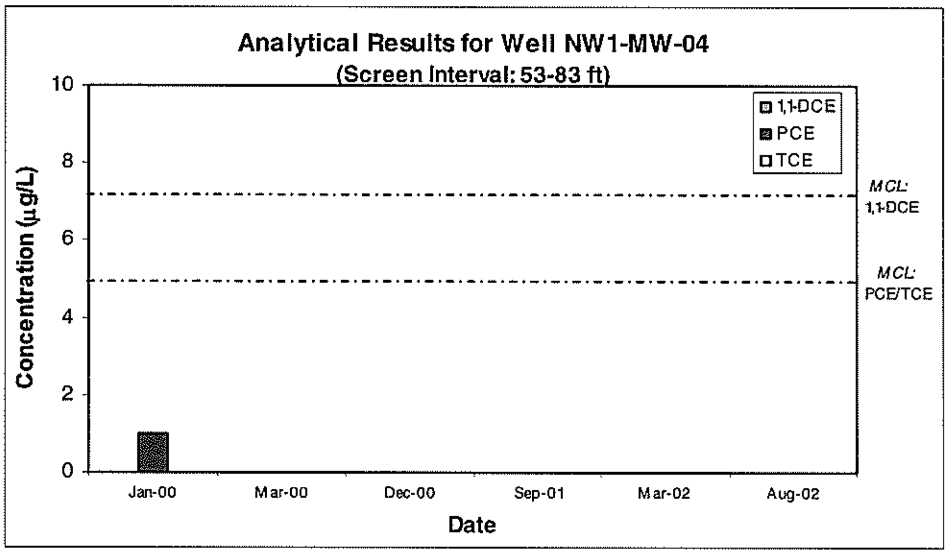
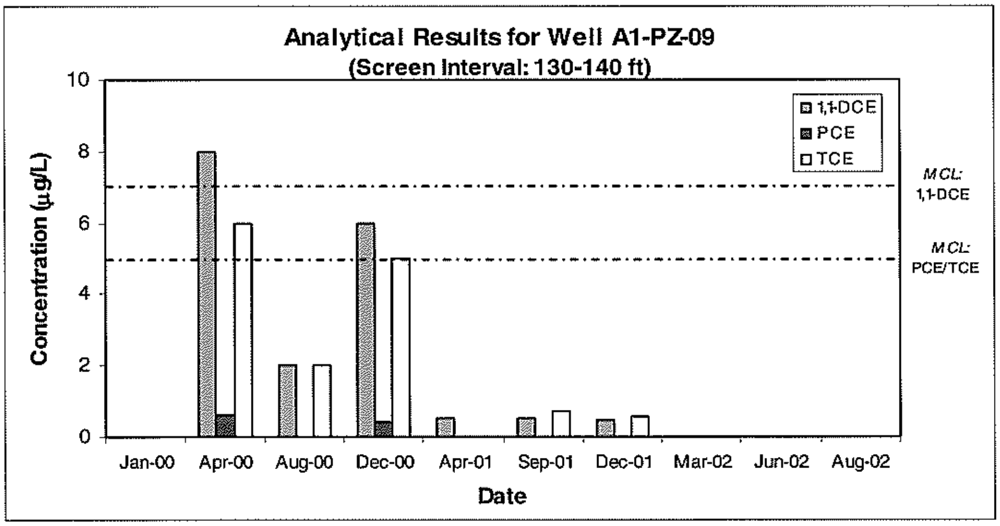
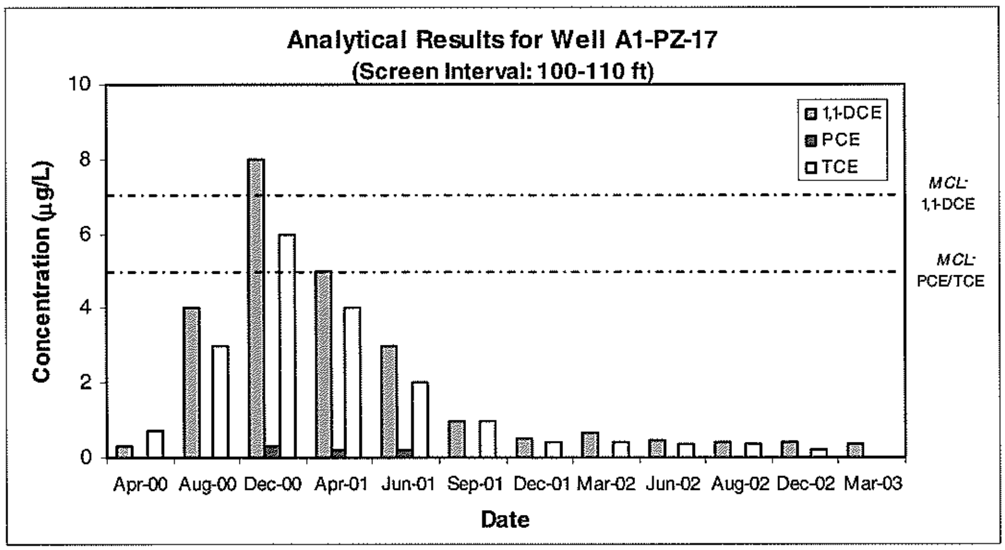


Figure 5B. Concentration vs. Time
(Wells That Have Exceeded MCLs)





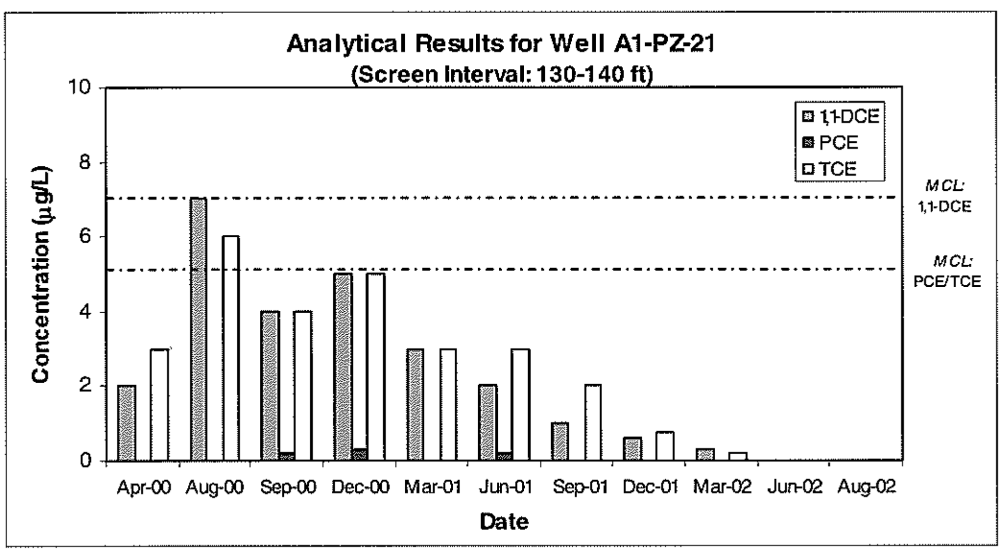
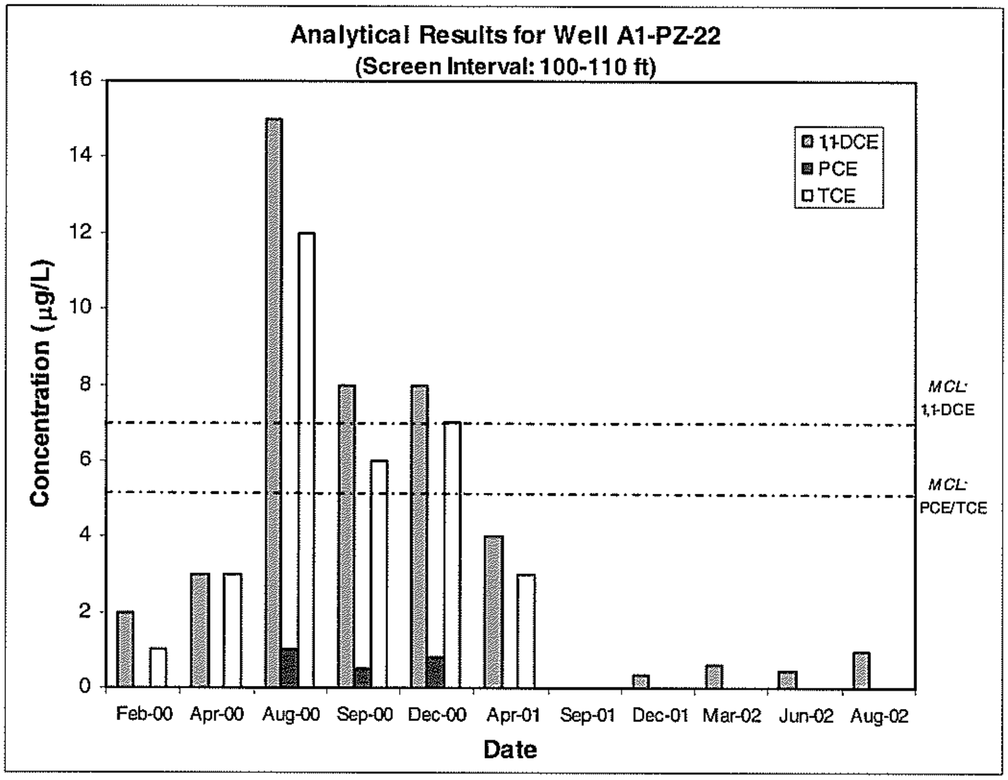


Figure 5B. Concentration vs. Time
(Wells That Have Exceeded MCLs)



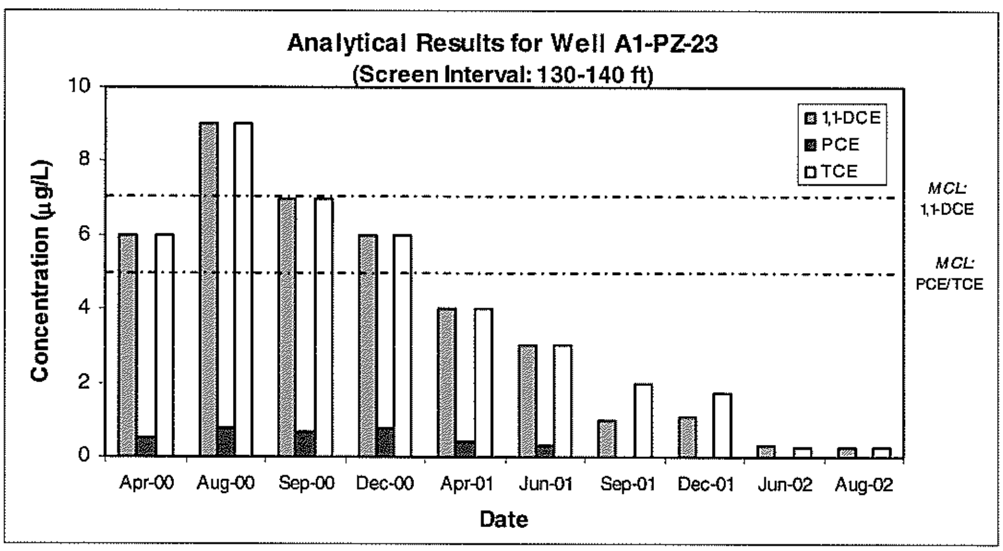
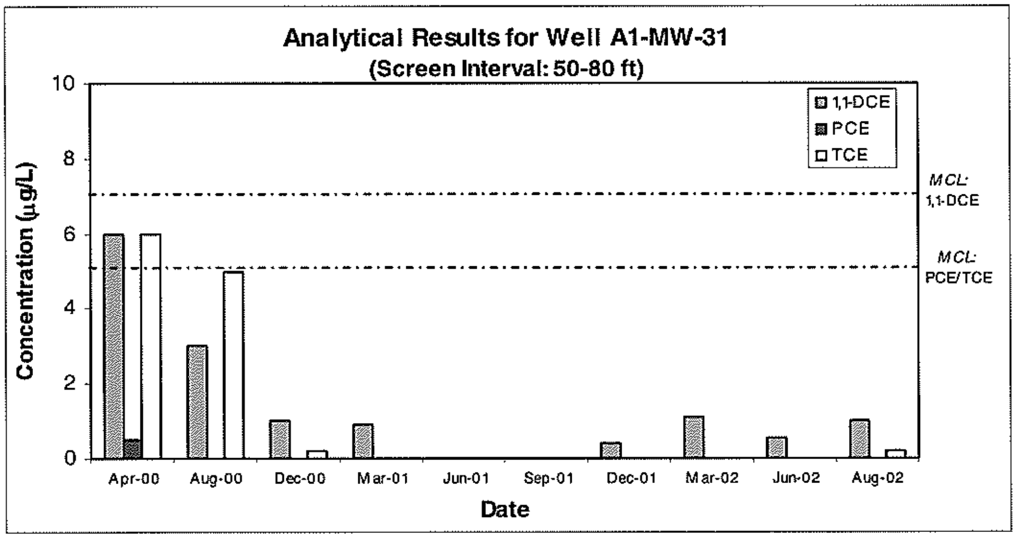
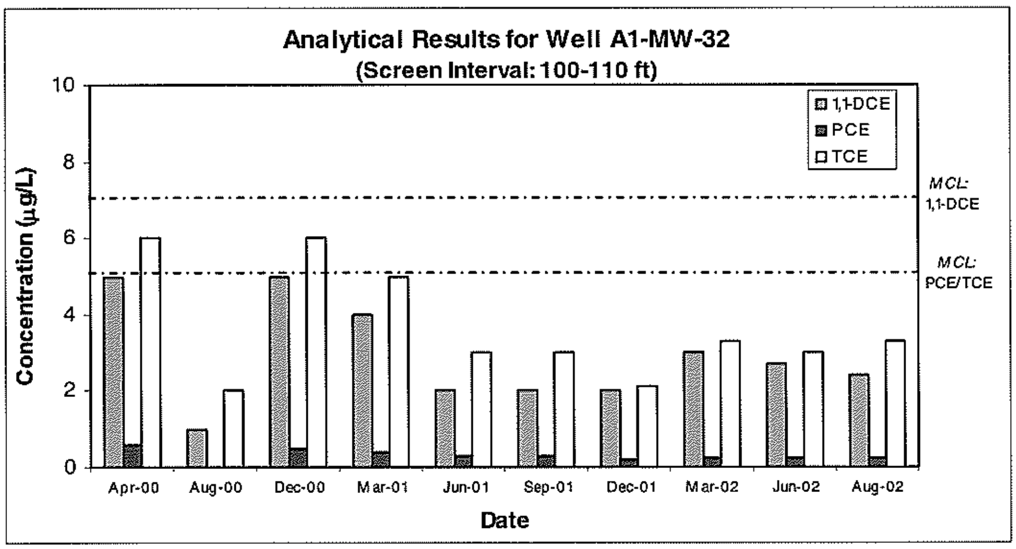


Figure 5B. Concentration vs. Time (Wells That Have Exceeded MCLs)





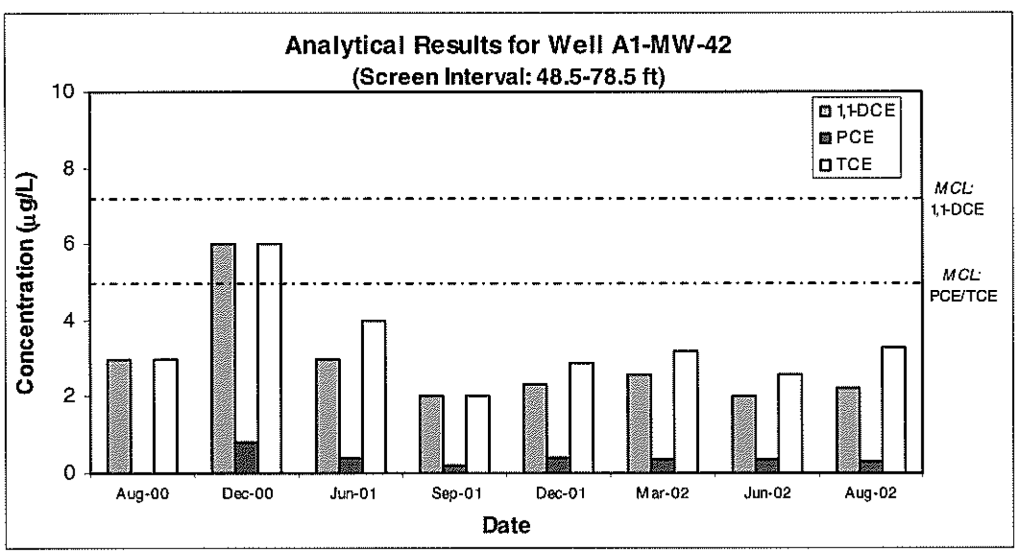
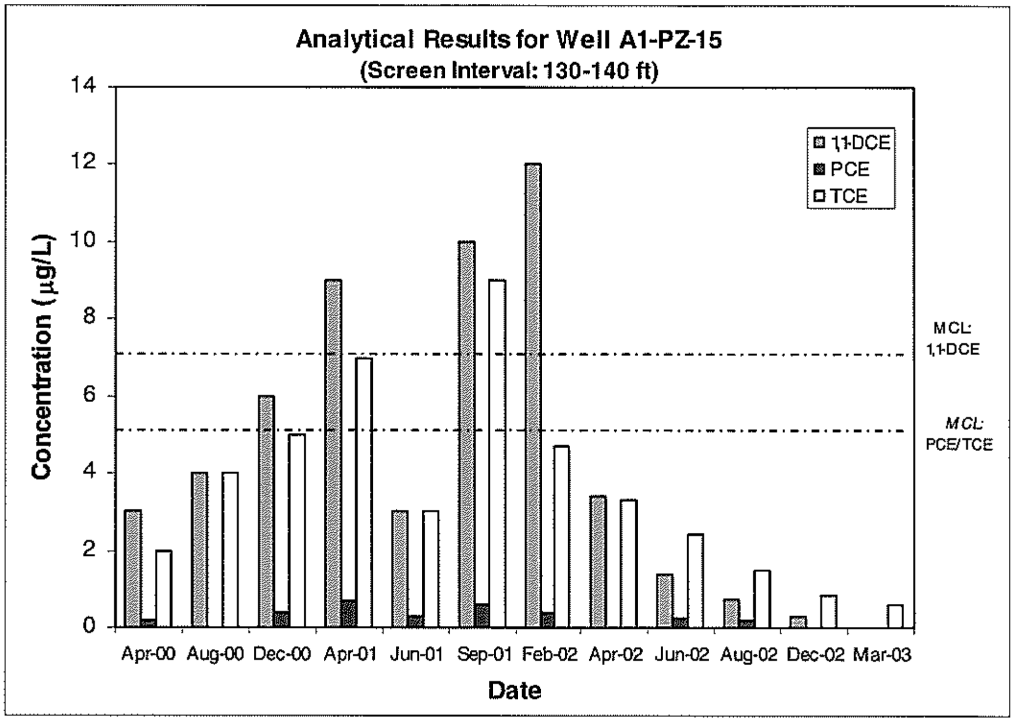


Figure 5B. Concentration vs. Time (Wells That Have Exceeded MCLs)



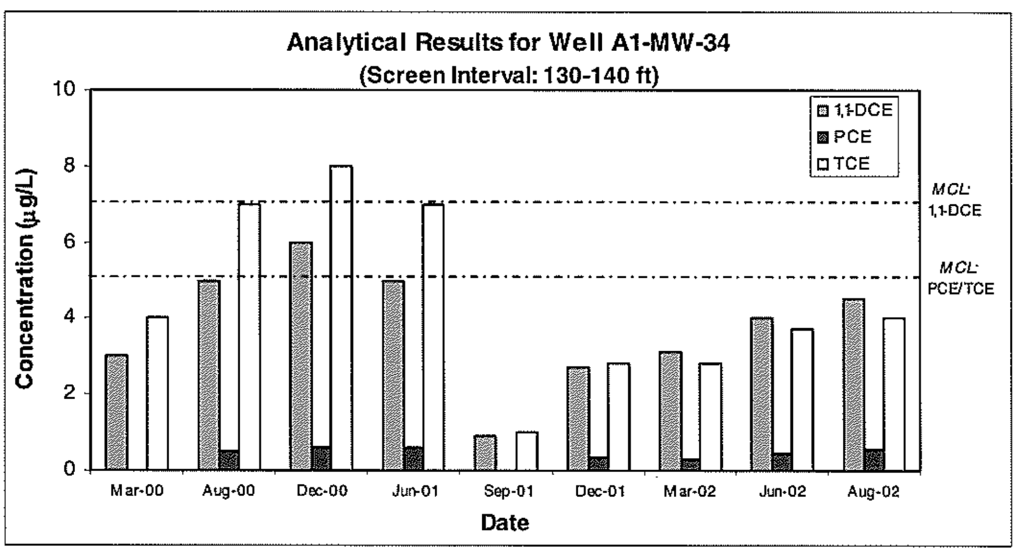
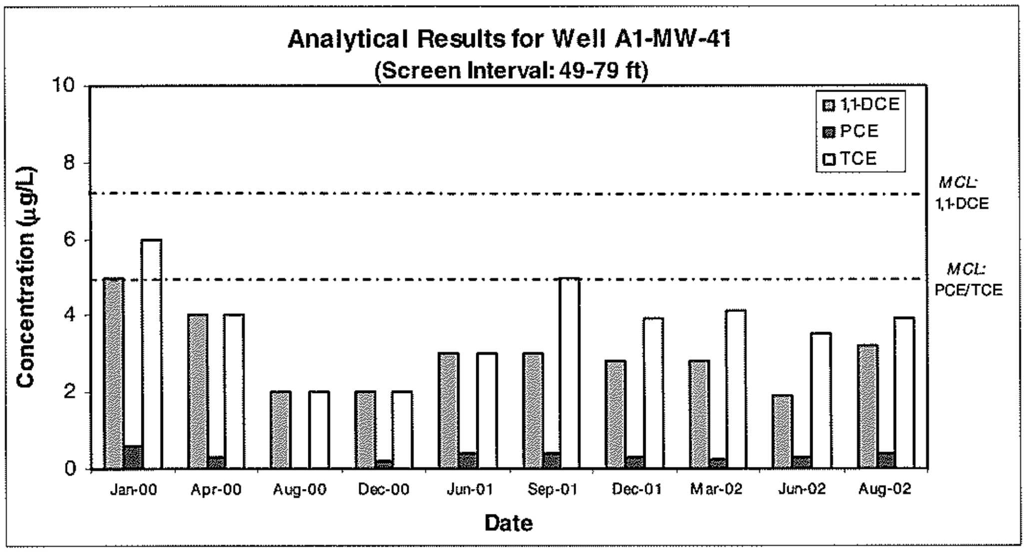


Figure 5B. Concentration vs. Time
(Wells That Have Exceeded MCLs)



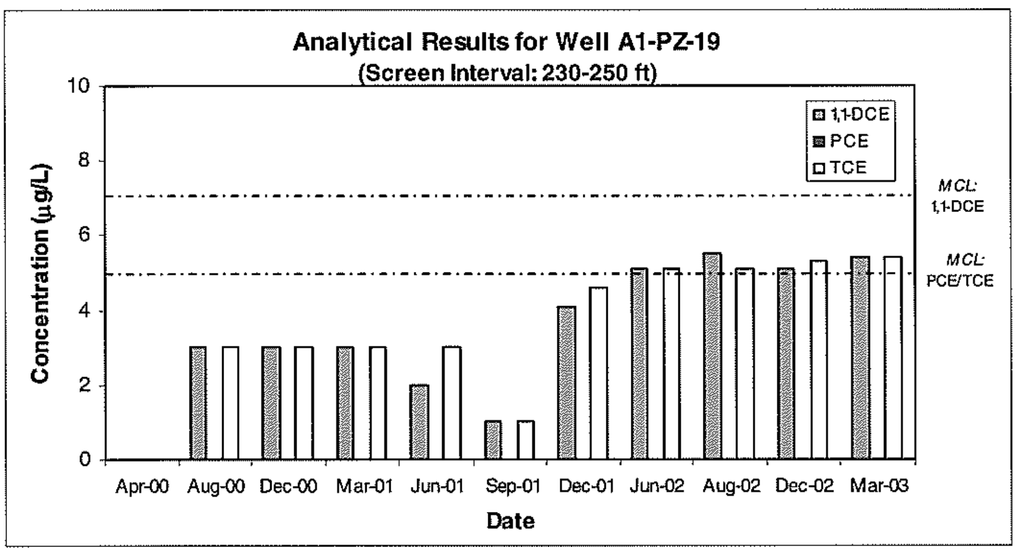
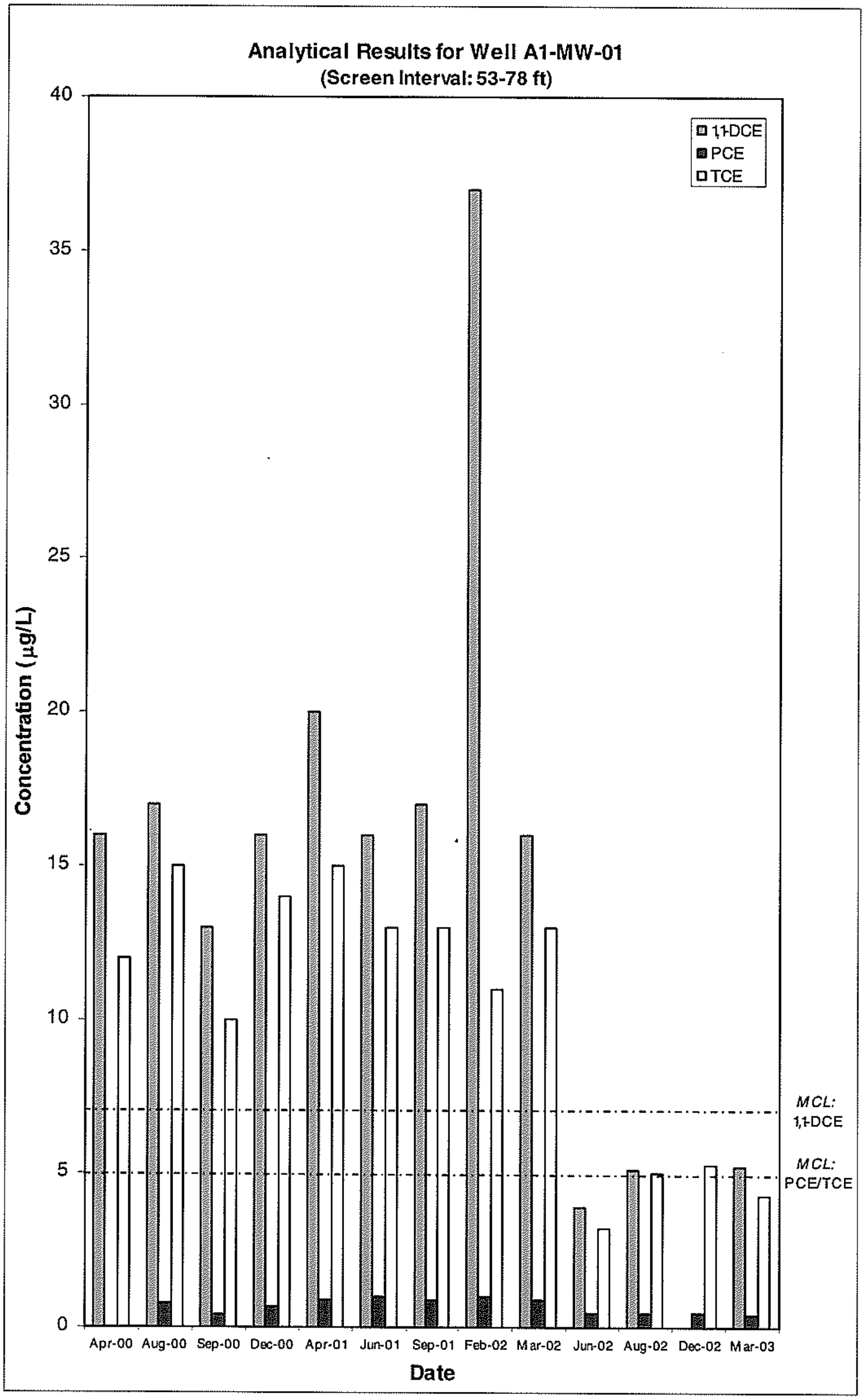


Figure 5B. Concentration vs. Time
(Wells That Have Exceeded MCLs)



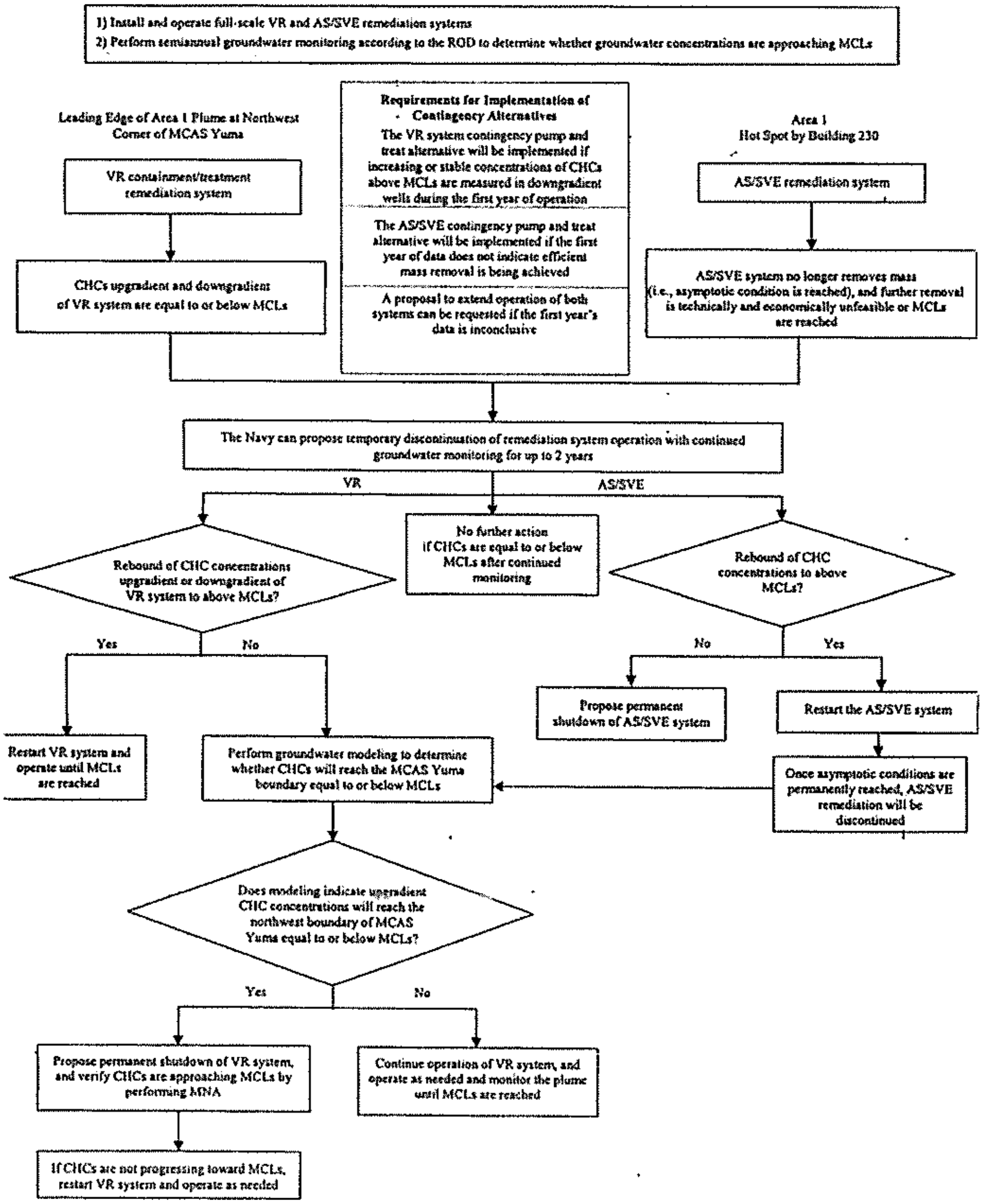


Figure 6. Decision Flow Diagram for Operation at Shutdown of VCT and AS/SVE Remediation Systems, Area 1

Figure 7. Cross Sections A-A' and B-B', Area 1 – Northwest Station

(Figure unavailable)

Appendix B7

VCT Permanent Shutdown Technical Memorandum with U.S EPA and ADEQ Concurrence

From: Lind, Angela Y CIV NAVFAC SW [angela.lind@navy.mil]
Sent: Monday, December 05, 2005 6:53 AM
To: Magnificentmoose@aol.com
Cc: Coonfare, Christopher T; Cathy O'Connell (E-mail); Dan Nail (E-mail)
Subject: RE: FW: permanent shutdown of vCT
Signed By: There are problems with the signature. Click the signature button for details.
Martin,

Thanks for the quick response. I will forward the attached to my contractor Battelle, so that they can work up some drawings showing the current plume configuration and so that they can revisit our proposed LTM optimization plan.

I'll be on leave during Christmas. Let's get together after the 1st of the year. By then, my contract and hopefully ADEQ, will have enough time to look into our original request and your below suggestions.

Angie Lind
angela.lind@navy.mil
Remedial Project Mgr (MCAS Yuma/NAF El Centro)
Southwest Division, NAVFACENGCOM Code ROPDE.AL
1220 Pacific Highway
San Diego, CA 92132-5190
tel: (619) 532-4228
Mobile: (619) 726-5668
fax: (619) 532-1195

-----Original Message-----
From: Magnificentmoose@aol.com [mailto:Magnificentmoose@aol.com]
Sent: Thursday, December 01, 2005 10:53
To: Lind, Angela Y CIV NAVFAC SW
Subject: Re: FW: permanent shutdown of vCT

Hi Angie:

As we have discussed, I have reviewed the two letters you provided regarding the permanent shut-down of the VCT and the abandonment of the wells at the site. In general I have no problems with the shutdown of the system. Your modeling seems to indicate that the plume has been captured or remediated up gradient of the system and the monitoring shows little or no contamination. However, since the plan is to go to MNA I do have issues with the plugging of the monitoring wells. Since the system was to be in operation for many years it is prudent to plan on a long-term monitoring program to demonstrate effectiveness since waste is still in place in some wells, though at low levels. Due to the requirement of the 5-Year Review, the Marines/Navy will need to provide evidence that the remedy is effective and leaving the monitoring wells, or a subset of the wells, in place will be more cost effective than having to reinstall monitoring wells or provide hydro-punch data when requested. I would suggest you provide a map of the current plume configuration to help understand changes in geometry of the plume. Additionally, please consider providing a list of wells which can remain open and monitored to prove that the remedy is working. It is acceptable to me to plug wells that no longer provide critical data.

I would like to schedule a review meeting in San Diego to review the current state of Yuma, perhaps the week before Christmas of right after the first of the year. Additionally, please be advised that I would like a response from the State prior to any action at the site.

I you have questions regarding the EPA position, please feel free to contact me At (415) 972-3007 at any time.

Martin

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser OPDE.AL/5293
September 6, 2005

Mr. Martin Hausladen
Federal Facilities and Site Cleanup Branch
Environmental Protection Agency Region IX
75 Hawthorne Street
San Francisco, CA 94105-3901

Dear Mr. Hausladen:

SUBJECT: PROPOSED PERMANENT SHUTDOWN OF THE VERTICAL RECIRCULATION (VR) TREATMENT/CONTAINMENT SYSTEM AT THE LEADING EDGE OF THE PLUME AREA (LEPA) 1

The Department of the Navy is proposing permanent shutdown of the VR system at the Leading Edge of the Plume Area 1 at Marine Corps Air Station (MCAS) Yuma pursuant to the Record of Decision (ROD) for Operable Unit 1 (OU-1) dated July 2000. According to the ROD, the Department of the Navy can propose permanent shutdown of the VR system if the following conditions have been met:

- Continued monitoring after temporary shutdown of the VR system demonstrates that concentrations of Chlorinated Hydrocarbons (CHCs) continue to meet groundwater cleanup standards for a period of up to two years after temporary shutdown of the VR system.

- Groundwater modeling has demonstrated that remaining CHC concentrations will not migrate off MCAS Yuma's base boundary above groundwater cleanup standards.

Both the review of CHCs concentrations per the attached technical memorandum dated August 2005 and the Revised Final Groundwater Modeling Report for OU-1 at MCAS Yuma dated February 2004 demonstrate that the Department of the Navy has met the above permanent closure criteria. Therefore, the Department of the Navy is requesting your concurrence to permanently shutdown the VR system.

If you have any questions please call me at (619) 532-4228.

Sincerely,

ANGELA LIND
Remedial Project Manager
By direction of the Commanding Officer

Enclosure: 1. Permanent Discontinuation of the VCT System Tech Memo dtd Aug 05

Copy to:
Ms. Cathy O'Connell, ADEQ, Phoenix, AZ
Mr. Dan Nail, Environmental Department, MCAS Yuma AZ

TECHNICAL MEMORANDUM
Permanent Discontinuation of the Vertical Circulation Treatment System
at the Leading Edge Plume Area
Marine Corps Air Station, Yuma, Arizona
Contract No. N68711-01-D-6009
Task Order No. 008
August 16, 2005

Introduction

Battelle has been contracted by the Naval Facilities Engineering Command (NAVFAC), Southwest Division (SWDIV) under Task Orders 001 and 008, Remedial Action Operations (RAO)/Long Term Monitoring (LTM) for Operable Unit (OU) 1 at Marine Corps Air Station (MCAS), Yuma, Arizona. These task orders include the operation and maintenance (O&M) of the Vertical Circulation Treatment (VCT) system at the Area 1 Leading Edge Plume Area (LEPA), the O&M of the Air Sparging/Soil Vapor Extraction (AS/SVE) system at Area 1 Hot Spot, and the collection of groundwater samples in accordance with the Long Term Monitoring (LTM) Plan.

The VCT system began operation on June 16, 2000. Battelle took over the system operation on September 30, 2002. A technical memorandum proposing a temporary shutdown of the VCT system was submitted to the U.S. EPA and the ADEQ on February 24, 2003. A review of the analytical results from LTM showed that, after two and a half years of system operations, the chlorinated hydrocarbon concentrations in all but two monitoring wells (A1-PZ-19 and A1-MW-01) had reached MCLs. TCE concentrations detected in those monitoring wells were only slightly above MCLs (5.1 to 5.3 μg/L, respectively). Based on concurrence from the U.S. EPA and ADEQ received on April 24 and 25, 2003, respectively, the VCT system was temporarily shut down on May 6, 2003.

In accordance with the temporary shutdown notification letter to ADEQ submitted May 8, 2003, the Navy has performed a monthly system inspection to ensure that the VCT system is fully functional. The Navy has continued to perform LTM in the vicinity of the LEPA to monitor for rebound of dissolved COCs in groundwater. In the two years since the shutdown of the VCT system, rebound of COC concentrations has not occurred. This Technical Memorandum presents a data review of LTM results in the LEPA area to support permanent shutdown of the VCT system.

Site Description

MCAS Yuma is an active facility located immediately southeast of the city of Yuma, Arizona. Previous activities at MCAS Yuma resulted in the release of volatile organic compounds (VOCs) to the groundwater in the vicinity of the flight line, near Building 230. This area is currently referred to as the Hot Spot. The plume of contaminated groundwater extends to the northwest from the Hot Spot. The Leading Edge Plume Area (LEPA) is located downgradient from the Hot Spot, adjacent to the Yuma Airport. The Hot Spot and LEPA are designated as Area 1 of OU-1. A final Record of Decision (ROD) for OU-1 was signed by the United States Environmental Protection Agency (U.S. EPA) and the Arizona Department of Environmental Quality (ADEQ) in September and October 2000, respectively. The remedial action objectives established for this effort are the Maximum Contaminant Levels (MCLs) based on the Safe Drinking Water Act (SDWA). The contaminants of concern (COCs) in the LEPA area are 1,1-Dichloroethylene (1,1-DCE), Perchloroethylene (PCE), and Trichloroethylene (TCE), and the MCLs are 7 μg/L, 5 μg/L, and 5 μg/L, respectively.

System Description

The full-scale VCT system was installed in June 2000 to provide containment and treatment of relatively low concentrations of chlorinated hydrocarbons in the groundwater at the Northwest Station boundary. The VCT system uses submersible pumps to extract groundwater from four extraction wells. The extracted groundwater enters the aboveground treatment compound, where it is pumped through various holding tanks and bag filters before being treated with granular activated carbon (GAC). After the water has passed through the GAC units, the treated water is pumped back into the aquifer through four injection wells. Figure 1 provides a schematic of the VCT system. The following paragraphs provide a detailed description of the process flow and control logic for the VCT system located in the LEPA.

Contaminated groundwater is extracted from the four VCT wells simultaneously using four 40-gallon-per-minute (gpm) electric submersible pumps. The pumps transfer the untreated groundwater at a maximum rate of 160 gpm through high-density polyethylene (HDPE) piping to the water treatment compound. The water treatment compound processes the contaminated groundwater at a maximum rate of 200 gpm. The GAC-treated groundwater is then transferred through HDPE piping and discharged into four injection wells. The process and instrumentation diagram and details of the system are presented in Figure 2.

The remediation well field consists of four extraction wells (VCT-02, VCT-04, VCT-06 and VCT-08) and four injection wells (VCT-01, VCT-03, VCT-05, and VCT-07). Figure 3 presents the locations of the extraction and injection wells at LEPA.

VCT-02 and VCT-04 are 6-inch production wells installed to 145 feet below ground surface with two different screen intervals. The lower screen extends from 130 to 140 feet below ground surface; the upper screen extends from 40 to 70 feet below ground surface. A 40-gpm Grundfos submersible pump with a 2-horsepower (hp), 230-volt, 3-phase Grundfos electric motor is installed in the lower screened section of VCT-02. A 60-gpm Grundfos submersible pump with a 5-hp, 460-volt, 3-phase Franklin electric motor is installed in the lower screened section of VCT-04. The 60-gpm pump is normally operated at 40 gpm. The 2-hp pump is controlled by a variable speed Grundfos Red-Flo VFD controller. The 5-hp pump is controlled by a variable speed Baldor adjustable speed drive controller. All the pump controllers are located in enclosures at the treatment compound. TAM inflatable packers are installed above the pumps to limit the extraction to the lower screened interval.

VCT-06 and VCT-08 are 6-inch production wells installed to 145 feet below ground surface. The screened interval extends from 130 to 140 feet below ground surface. One each 5-hp, 60-gpm Grundfos electric submersible pump is installed in the screened section of VCT-06 and VCT-08. The 60-gpm pump is normally operated at 40-gpm. A variable speed Baldor adjustable speed drive controller controls the pumps which are located in enclosures at the treatment compound.

VCT-01 and VCT-03 are 6-inch production wells installed to 105 feet below ground surface, with two screen intervals. The lower screen extends from 90 to 100 feet below ground surface, the upper screen extends from 40 to 70 feet below ground surface. The wells are currently used for injection. VCT-01 is located close to VCT-02 and VCT-03 is located close to VCT-04 to produce groundwater circulation.

VCT-05 and VCT-07 are 6-inch production wells installed to 115 feet below ground surface. The screened interval extends from 100 to 110 feet below ground surface, with a 10-foot stainless steel prepack with 0.020-inch slots and No. 2/12 Monterey sand. Each well has a 5-foot stainless steel silt trap. VCT-05 is located close to VCT-06 and VCT-07 is located close to VCT-08 to produce groundwater circulation.

Five 3-inch extraction pipes (one spare) are manifolded on the east side of the treatment compound. Once aboveground, each pipe transitions to Schedule 80 PVC piping. Each pipe has a separate Signet 5090 analog flowmeter used to adjust the extraction rate from each extraction well. The readouts for all the system flowmeters are installed in panels at the treatment compound. All panels (including pump controllers, flowmeter readouts, and interface control panel) are located on the east side of the treatment compound. After the manifold, the total influent flow from the extraction wells is routed through a totalizing Signet 5500 analog digital flowmeter. This flowmeter is used to track the total gallons of groundwater extracted by the system. The contaminated influent groundwater then enters Tank 1 (T-1). This tank holds the untreated influent groundwater to allow settlement of any sediment and provides system surge capacity so that system maintenance, carbon backwashing, and carbon changeouts can be performed without shutting down the well extraction pumps

The untreated groundwater is pumped from T-1 via Pump 1 (P-1) (see Figure 2). P-1 is a 200-gpm, 65-pound-per-square-inch-gauge (psig) Aurora Model 341A transfer pump. The water is pumped from T-1 through a Signet 5100 digital flowmeter. This flowmeter is used to adjust the P-1 pump rate. The water then flows through a dual-bag filter system, followed by the liquid-phase GAC adsorbers, and then into Tank 2 (T-2).

The GAC treatment system consists of two Waterlink/Barneby Sutcliff LD-180 adsorbers, holding 5000 pounds of GAC each. T-2 contains treated groundwater and provides surge capacity. The clean treated water is pumped from T-2 using Pump 2 (P-2). The water is pumped through a dual-bag filter system with 100-micron filter elements, through a flowmeter, and enters the injection manifold.

The purpose of the backwash system is to maximize GAC efficiency by removing any sediment or precipitates that accumulate on the GAC bed. In addition, the backwash fluffs the GAC beds, thus ensuring that all GAC particles are exposed to groundwater contaminants.

The LEPA VCT system has been in temporary shutdown status since May 6, 2003. Since that time, the system has been turned on one day each month to test the components and make sure the system could be returned to service if necessary.

Data Review

Groundwater samples have been collected on a quarterly, semiannual, or annual basis at the site since April 2000. Samples collected since March 2003, two months prior to the shutdown of the VCT system in May 2003, will be used in this document to evaluate the contaminants of concern (COC) concentrations in the LEPA and the area downgradient (northwest) of the intersection of Runways 17 and 8-26 (see Figures 4 and 5 for well locations). Table 1 provides the historical and current analytical results. The LEPA wells monitored during these events correspond to the revised LTM plan, as per the Technical Memorandum dated December 1, 2003. Thirty monitoring wells are listed in Table 1.

Data from the June 2003 through June 2005 period show that concentrations of 1,1-DCE, TCE, and PCE did not exceed MCLs in the following 28 of the 30 monitoring wells:

A1-MW-04	A1-MW-05	NW1-MW-01	A1-PZ-15	A1-PZ-16
A1-PZ-17	A1-PZ-18	A1-PZ-24	A1-PZ-26	A1-MW-06
A1-PZ-28	A1-MW-31	A1-MW-33	A1-MW-42	A1-MW-43
A1-MW-44	A1-PZ-09	A1-PZ-20	A1-PZ-21	A1-PZ-22
A1-PZ-23	A1-MW-28	A1-MW-29A	A1-MW-30	A1-MW-32
A1-MW-34	A1-MW-41	A1-MW01		

Further, PCE has never exceeded its MCL in any of the 30 monitoring wells during any monitoring events throughout this period. 1,1-DCE and TCE concentrations have exceeded their respective MCLs in only 2 of the 30 wells. However, these 2 wells (A1-PZ-19 and A1-MW-27) are not within the treatment zone of the VCT system. Monitoring well A1-MW-27 is located 1,200 feet southeast of the VCT system (near the Central Plume Area) and monitoring well A1-PZ-19 is screened at 230 to 250 ft bgs which is below the treatment zone of the VCT system. Detections of 1,1-DCE and TCE with regard to their MCLs and trends in these 2 monitoring wells since June 2003 are discussed below:

A1-MW-27 (Screened from 80 to 90 ft bgs)

The MCL for 1,1-DCE was exceeded in each of the two annual sampling events conducted at this well since the VCT system was shut down (10, 9.1, and 7.7 μg/L in the January 2004, January 2004 duplicate, and December 2004 samples, respectively). The MCL for TCE also was exceeded in each of these sampling events (9.9, 8.9, and 9.3 μg/L in the January 2004, January 2004 duplicate, and December 2004 samples, respectively).

A1-PZ-19 (Screened from 230 to 250 ft bgs)

The MCL for 1,1-DCE was exceeded in this well in four out of twelve samples (including duplicates) collected during the period from June 2003 through June 2005, with concentrations averaging 6.6 μg/L during this period. TCE concentrations exceeding the MCL were detected in 10 out of 12 samples (including duplicates) collected during this period, with concentrations averaging 6.4 μg/L. When this well was first developed in July 1999, the concentrations of DCE and TCE were both at 6 μg/L. Thus the concentrations of DCE and TCE have remained relatively stable within this well with minor fluctuations both between 4 and 10 μg/L.

Conclusions and Recommendations

Figure 6 provides the decision flow diagram for operation and shutdown of VCT and AS/SVE remediation systems in Area 1. This decision flow diagram was developed in the ROD in 2000. As shown on Figure 6, when the concentrations of the COCs (or chlorinated hydrocarbons [CHCs] as noted on the diagram) upgradient and downgradient of the VCT system have reached the levels equal to or below the respective MCLs, the Navy can propose a temporary shutdown of the system operation with continued groundwater monitoring for up to two years. If rebound to above the MCLs occurs in wells located either upgradient or downgradient of the system, the system will be restarted and operated until the MCLs are reached again. If rebound of the COC concentrations does not occur, groundwater modeling will be performed to determine whether COCs will reach the MCAS Yuma boundary at levels equal to or below the MCLs.

The review of the COC concentrations in 30 LEPA monitoring wells indicates that, except in two wells (i.e., A1-MW-27 screened from 80 to 90 ft bgs and A1-PZ-19 screened from 230 to 250 bgs), the COC concentrations have reached and remained at levels equal to or below the MCLs during this period.

In A1-MW-27, concentrations of 1,1-DCE and TCE exceeded their respective MCLs in each of the two annual sampling events conducted at this well since the VCT system was shut down. However, this well is actually located adjacent to the Central Plume Area (Figure 5), which is 1,200 feet southeast of the VCT system. Hence, this well is located outside the treatment zone of the VCT system. Furthermore, the *Final Groundwater Modeling Report for OU-1* demonstrates that DCE or TCE will not migrate beyond MCAS Yuma boundary above MCLs (Battelle, 2004). In view of these two factors, this well should have no influence on the decision to permanently shut down the VCT system.

In A1-PZ-19, 1,1-DCE and TCE concentrations fluctuated between 4 and 10 μg/L during this period. The exact reasons for these minor concentration variations are not known. The geology at A1-PZ-19 consists of silty sands interlayered with clay lenses at the depths from 230 to 250 bgs. This natural heterogeneity could be one of the factors causing the concentration variations observed in A1-PZ-19. By design, the VCT system treats contaminated groundwater in the "shallower" aquifer where most of the contamination was present. The VCT system extracts groundwater from 130 to 140 ft bgs and reinjects the treated water to 40-70 ft bgs. As such, the treatment system was not designed to treat the localized area at A1-PZ-19 at depths from 230 to 250 bgs. Therefore, even if the VCT system continues to operate, the system may not reduce TCE concentrations in A1-PZ-19. Because of the low permeability of the geologic materials in this area, the TCE plume is moving very slowly and the principal mechanisms for the TCE reduction would be such naturally attenuating processes as dispersion, sorption, and biological degradation. As such, the most effective approach to deal with the TCE in A1-PZ-19 is continued monitoring and evaluation of the contaminant concentrations and natural attenuation processes.

Throughout the two-year temporary shutdown period, the LTM effort has demonstrated that COC concentrations in the target treatment zone at the LEPA have remained below MCLs, and rebound has not occurred. According to the decision flow diagram, no further action is required if the COC concentrations are at or below the MCLs after continued monitoring. Furthermore, groundwater modeling has been performed to evaluate the potential for COCs to reach the MCAS Yuma facility boundary at concentrations equal to or exceeding the MCLs. The simulations discussed in the "Final Groundwater Modeling Report for OU-1 at MCAS Yuma, AZ" (Battelle, 2004) indicate that COCs will not reach the facility boundary at such levels. Therefore, because the requirements for permanent shutdown of the VCT system as set forth in the decision flow diagram have been met, Battelle recommends that the VCT system be turned off permanently.

Table 1. 1,1-DCE, PCE, and TCE Concentrations

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL) 1,1-DCE (7 µg/L)		PCE (5 µg/L)		TCE (5 µg/L)	
A1-MW-04	LEPA	Mar-03	1.4		< 1		1.6	
A1-MW-04	LEPA	Jun-03	2.5		< 1		2	
A1-MW-04	LEPA	Sep-03	1.9		< 1		1.4	
A1-MW-04	LEPA	Dec-03	1.9		< 1		1.5	
A1-MW-04	LEPA	Mar-04	0.83	J	< 1		0.76	J
A1-MW-04	LEPA	Jun-04	0.67	J	< 1		0.39	J
A1-MW-04	LEPA	Sep-04	0.79	J	< 1		0.69	J
A1-MW-04	LEPA	Dec-04	0.35	J	< 1		0.19	J
A1-MW-04	LEPA	Mar-05	0.47	J	< 1		0.2	J
A1-MW-04	LEPA	Jun-05	0.35	J	< 1		< 1	
A1-MW-05	LEPA	Mar-03	0.22	J	< 1		< 1	
A1-MW-05	LEPA	Jun-03	0.21	J	< 1		< 1	
A1-MW-05	LEPA	Sep-03	< 1		< 1		< 1	
A1-MW-05	LEPA	Jan-04	0.22	J	< 1		< 1	
A1-MW-05	LEPA	Mar-04	0.23	J	< 1		< 1	
A1-MW-05	LEPA	Jun-04	0.34	J	< 1		< 1	
A1-MW-05	LEPA	Sep-04	0.61	J	< 1		0.43	J
A1-MW-05	LEPA	Dec-04	0.17	J	< 1		< 1	
A1-MW-05	LEPA	Mar-05	0.25	J	< 1		< 1	
A1-MW-05	LEPA	Jun-05	0.22	J	< 1		< 1	
A1-MW-01	LEPA	Mar-03	5.2		0.41	J	[illegible]	
A1-MW-01	LEPA	Jun-03	1.6		< 1		[illegible]	
A1-MW-01	LEPA	Sep-03	3		0.32 J		2.4	
A1-MW-01	LEPA	Dec-03	3.2		0.57	J	3.3	
A1-MW-01	LEPA	Mar-04	2.5		0.31	J	2	
A1-MW-01	LEPA	Jun-04	3.9		0.38	J	3.2	
A1-MW-01	LEPA	Sep-04	3.2		0.20	J	2.9	
A1-MW-01	LEPA	Jan-05	1.9		0.24	J	2.2	
A1-MW-01	LEPA	Mar-05	2.8		0.25	J	2.6	
A1-MW-01	LEPA	Jun-05	4.5		0.41	J	4.3	
NW1-MW-01	LEPA	Mar-03	< 1		< 1		< 1	
NW1-MW-01	LEPA	Jun-03	< 1		< 1		< 1	
NW1-MW-01	LEPA	Sep-03	< 1		< 1		< 1	
NW1-MW-01	LEPA	Jan-04	< 1		< 1		< 1	
NW1-MW-01	LEPA	Mar-04	< 1		< 1		< 1	
NW1-MW-01	LEPA	Jun-04	< 1		< 1		< 1	
NW1-MW-01	LEPA	Sep-04	< 1		< 1		< 1	
NW1-MW-01	LEPA	Dec-04	< 1		< 1		< 1	
NW1-MW-01	LEPA	Mar-05	< 1		< 1		< 1	
NW1-MW-01	LEPA	Jun-05	< 1		< 1		< 1	
A1-PZ-19	LEPA	Mar-03	5.4		< 1		[illegible]	
A1-PZ-19 DUP	LEPA	Mar-03	5.7		< 1		[illegible]	
A1-PZ-19	LEPA	Jun-03	5.2		< 1		4.8	
A1-PZ-19 DUP	LEPA	Jun-03	5.2		< 1		[illegible]	
A1-PZ-19	LEPA	Sep-03	[illegible]		< 1		[illegible]	
A1-PZ-19	LEPA	Dec-03	[illegible]		< 1		[illegible]	
A1-PZ-19 DUP	LEPA	Dec-03	10		< 1		10	
A1-PZ-19	LEPA	Mar-04	[illegible]		< 1		[illegible]	

Table 1. 1,1-DCE, PCE, and TCE Concentrations (Continued)

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL) 1,1-DCE (7 µg/L)	PCE (5 µg/L)	TCE (5 µg/L)
A1-PZ-19 DUP	LEPA	Mar-04	6.4	< 1	5.3
A1-PZ-19	LEPA	Jun-04	6.3	< 1	5
A1-PZ-19	LEPA	Sep-04	4.1	< 1	4.2
A1-PZ-19	LEPA	Jan-05	4	< 1	5.3
A1-PZ-19	LEPA	Mar-05	6.8	< 1	6.6
A1-PZ-19	LEPA	Jun-05	5.7	< 1	6.7
A1-PZ-15	LEPA	Mar-03	< 1	< 1	0.59 J
A1-PZ-15	LEPA	Jun-03	0.28 J	< 1	0.57 J
A1-PZ-15	LEPA	Sep-03	< 1	< 1	0.43 J
A1-PZ-15	LEPA	Jan-04	< 1	< 1	0.5 J
A1-PZ-15	LEPA	Mar-04	< 1	< 1	0.46 J
A1-PZ-15	LEPA	Jun-04	< 1	< 1	0.42 J
A1-PZ-15	LEPA	Sep-04	< 1	< 1	0.39 J
A1-PZ-15	LEPA	Dec-04	< 1	< 1	0.31 J
A1-PZ-15	LEPA	Mar-05	< 1	< 1	0.27 J
A1-PZ-15	LEPA	Jun-05	0.15 J	< 1	0.42 J
A1-PZ-16	LEPA	Mar-03	< 1	< 1	< 1
A1-PZ-16	LEPA	Jun-03	< 1	< 1	< 1
A1-PZ-16	LEPA	Sep-03	< 1	< 1	< 1
A1-PZ-16	LEPA	Jan-04	< 1	< 1	< 1
A1-PZ-16	LEPA	Mar-04	< 1	< 1	< 1
A1-PZ-16	LEPA	Jun-04	< 1	< 1	< 1
A1-PZ-16	LEPA	Sep-04	< 1	< 1	< 1
A1-PZ-16	LEPA	Dec-04	< 1	< 1	< 1
A1-PZ-16	LEPA	Mar-05	< 1	< 1	< 1
A1-PZ-16	LEPA	Jun-05	< 1	< 1	< 1
A1-PZ-17	LEPA	Mar-03	0.38 J	< 1	ND
A1-PZ-17	LEPA	Jun-03	0.43 J	< 1	0.23 J
A1-PZ-17	LEPA	Sep-03	0.43 J	< 1	0.31 J
A1-PZ-17	LEPA	Jan-04	0.36 J	< 1	0.35 J
A1-PZ-17	LEPA	Mar-04	0.22 J	< 1	0.18 J
A1-PZ-17	LEPA	Jun-04	0.37 J	< 1	0.28 J
A1-PZ-17	LEPA	Sep-04	1.3	< 1	1
A1-PZ-17	LEPA	Jan-05	0.75 J	< 1	0.88 J
A1-PZ-17	LEPA	Mar-05	0.93 J	< 1	0.76 J
A1-PZ-17	LEPA	Jun-05	0.62 J	< 1	0.73
A1-PZ-18	LEPA	Mar-03	3.3	0.24 J	3.1
A1-PZ-18	LEPA	Jun-03	3.2	0.22 J	2.5
A1-PZ-18	LEPA	Sep-03	4.1	0.31 J	3.8
A1-PZ-18	LEPA	Jan-04	3.1	0.27 J	3.9
A1-PZ-18	LEPA	Mar-04	3.1	0.21 J	3.4
A1-PZ-18	LEPA	Jun-04	3.5	< 1	2.5
A1-PZ-18	LEPA	Sep-04	2.5	0.22 J	2.9
A1-PZ-18	LEPA	Jan-05	1.6	< 1	2.2
A1-PZ-18 DUP	LEPA	Jan-05	1.5	< 1	2.3
A1-PZ-18	LEPA	Mar-05	2.1	< 1	2.2
A1-PZ-18	LEPA	Jun-05	1.6	< 1	2.0
A1-PZ-24	LEPA	Mar-03	2	< 1	1.3
A1-PZ-24	LEPA	Jun-03	2	< 1	1.2
A1-PZ-24	LEPA	Jan-04	1.9	< 1	1.8

Table 1. 1,1-DCE, PCE, and TCE Concentrations (Continued)

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL)		
			1,1-DCE (7 µg/L)	PCE (5 µg/L)	TCE (5 µg/L)
A1-PZ-24	LEPA	Mar-04	1.8	0.18 J	1.7
A1-PZ-24	LEPA	Jun-04	1.7	0.20 J	1.3
A1-PZ-24	LEPA	Sep-04	0.79 J	< 1	0.75 J
A1-PZ-24	LEPA	Jan-05	0.64 J	< 1	0.79 J
A1-PZ-24	LEPA	Mar-05	0.99 J	< 1	0.88 J
A1-PZ-24	LEPA	Jun-05	0.92 J	< 1	1.0
A1-PZ-26	LEPA	Sep-03	< 1	< 1	< 1
A1-PZ-26	LEPA	Dec-03	< 1	< 1	< 1
A1-PZ-26	LEPA	Jun-04	< 1	< 1	< 1
A1-PZ-26	LEPA	Sep-04	< 1	< 1	< 1
A1-PZ-26	LEPA	Jan-05	< 1	< 1	< 1
A1-PZ-26	LEPA	Mar-05	< 1	< 1	< 1
A1-PZ-26	LEPA	Jun-05	< 1	< 1	< 1
A1-MW-06	LEPA	Sep-03	0.44 J	< 1	< 1
A1-MW-06	LEPA	Jan-04	0.37 J	< 1	< 1
A1-MW-06	LEPA	Mar-04	0.42 J	< 1	< 1
A1-MW-06	LEPA	Jun-04	0.47 J	< 1	< 1
A1-MW-06	LEPA	Sep-04	0.23 J	< 1	< 1
A1-MW-06	LEPA	Jan-05	< 1	< 1	< 1
A1-MW-06	LEPA	Mar-05	< 1	< 1	< 1
A1-MW-06	LEPA	Jun-05	< 1	< 1	< 1
A1-PZ-28	LEPA	Jun-03	0.88 J	< 1	0.75 J
A1-PZ-28	LEPA	Sep-03	1.5 J	< 1	0.9 J
A1-PZ-28	LEPA	Dec-03	1.4 J	< 1	1.3
A1-PZ-28	LEPA	Jun-04	1.6	< 1	0.74 J
A1-PZ-28	LEPA	Sep-04	1.2	< 1	0.8 J
A1-PZ-28	LEPA	Dec-04	1.6	< 1	0.95 J
A1-PZ-28	LEPA	Mar-05	1.6	< 1	0.83 J
A1-PZ-28	LEPA	Jun-05	1.9	< 1	1.4
A1-MW-31	Area 1	Jun-03	1.8	< 1	1
A1-MW-31	Area 1	Dec-03	2.8	< 1	2
A1-MW-31	Area 1	Jun-04	2.5	< 1	1.5
A1-MW-31	Area 1	Dec-04	1.2	< 1	0.98 J
A1-MW-31	Area 1	Jun-04	1.3	< 1	1.6
A1-MW-33	Area 1	Jun-03	0.77 J	< 1	0.93 J
A1-MW-33	Area 1	Jan-04	0.95 J	< 1	1.2
A1-MW-33	Area 1	Jun-04	1.3	< 1	1.1
A1-MW-33	Area 1	Dec-04	0.49 J	< 1	0.79 J
A1-MW-33	Area 1	Jun-05	0.52 J	< 1	0.43 J
A1-MW-42	Area 1	Jun-03	2.9	0.37 J	3
A1-MW-42	Area 1	Dec-03	1	0.21 J	1.6
A1-MW-42	Area 1	Jun-04	1.5	0.19 J	1.9
A1-MW-42	Area 1	Dec-04	1.1	0.19 J	1.5
A1-MW-42	Area 1	Jun-05	1.4	0.2 J	1.7
A1-MW-43	Area 1	Jun-03	2.3	0.27 J	3.2
A1-MW-43	Area 1	Dec-03	0.77 J	< 1	1.1
A1-MW-43	Area 1	Jun-04	2.4	< 1	2.2
A1-MW-43	Area 1	Dec-04	1.5	0.24 J	2
A1-MW-43	Area 1	Jun-05	1.0	0.22 J	1.4

Table 1. 1,1-DCE, PCE, and TCE Concentrations (Continued)

Well ID Number	Well Location	Date Sampled	Contaminants of Concern (MCL)		
			1,1-DCE (7 µg/L)	PCE (5 µg/L)	TCE (5 µg/L)
A1-MW-44	LEPA	Jun-03	2.5	0.36 J	2.5
A1-MW-44	LEPA	Dec-03	2	0.38 J	2.2
A1-MW-44	LEPA	Jun-04	4	0.50 J	2.8
A1-MW-44	LEPA	Dec-04	2.1	0.33 J	2.2
A1-MW-44 DUP	LEPA	Dec-04	2.0	0.31 J	2.0
A1-MW-44	LEPA	Jun-05	1.8	0.33 J	2.1
A1-PZ-09	LEPA	Jun-03	1.8	< 1	0.73 J
A1-PZ-09 DUP	LEPA	Jun-03	1.7	< 1	0.65 J
A1-PZ-09	LEPA	Jan-04	1.2	< 1	0.67 J
A1-PZ-09	LEPA	Jun-04	1.3	< 1	0.56 J
A1-PZ-09	LEPA	Jan-05	0.55 J	< 1	0.42 J
A1-PZ-09	LEPA	Jun-05	2.3	< 1	2.5
A1-PZ-09 DUP	LEPA	Jun-05	2.4	< 1	2.6
A1-PZ-20	LEPA	Jun-03	1.9	< 1	0.76 J
A1-PZ-20	LEPA	Jan-04	1.6	< 1	1
A1-PZ-20	LEPA	Jun-04	1.6	< 1	0.91 J
A1-PZ-20	LEPA	Jan-05	0.53 J	< 1	0.63 J
A1-PZ-20	LEPA	Jun-05	0.8 J	< 1	0.85 J
A1-PZ-21	LEPA	Jun-03	1.3	< 1	0.49 J
A1-PZ-21	LEPA	Sep-03	1.1	< 1	0.73 J
A1-PZ-21	LEPA	Jan-04	0.2 J	< 1	0.23 J
A1-PZ-21	LEPA	Jun-04	0.38 J	< 1	0.35 J
A1-PZ-21	LEPA	Jan-05	< 1	< 1	0.24 J
A1-PZ-21	LEPA	Jun-05	0.19 J	< 1	0.37 J
A1-PZ-22	LEPA	Jun-03	2.2	< 1	1 J
A1-PZ-22	LEPA	Jan-04	2.4	< 1	1.4
A1-PZ-22 DUP	LEPA	Jan-04	2.1	< 1	1.1
A1-PZ-22	LEPA	Jun-04	2.3	< 1	1.1
A1-PZ-22	LEPA	Jan-05	0.71 J	< 1	0.74 J
A1-PZ-22	LEPA	Jun-05	1.1	< 1	0.99 J
A1-PZ-23	LEPA	Jun-03	2.1	< 1	0.9 J
A1-PZ-23	LEPA	Jan-04	1.8	< 1	1
A1-PZ-23	LEPA	Jun-04	2.2	< 1	1
A1-PZ-23	LEPA	Dec-04	1.3	< 1	0.83 J
A1-PZ-23	LEPA	Jun-05	1.1	< 1	0.77 J
A1-PZ-23 DUP	LEPA	Jun-05	1.1	< 1	0.82 J
A1-MW-27	LEPA	Jan-04	[redacted]	0.80 J	[redacted]
A1-MW-27 DUP	LEPA	Jan-04	[redacted]	0.74 J	[redacted]
A1-MW-27	LEPA	Dec-04	[redacted]	0.61 J	[redacted]
A1-MW-28	LEPA	Jan-04	0.77 J	< 1	0.74 J
A1-MW-28	LEPA	Dec-04	0.57 J	< 1	0.52 J
A1-MW-29A	LEPA	Jan-04	1.7	< 1	1.7
A1-MW-29A	LEPA	Dec-04	2.1	< 1	2.6
A1-MW-30	LEPA	Jan-04	< 1	< 1	< 1
A1-MW-30	LEPA	Dec-04	< 1	< 1	< 1
A1-MW-32	LEPA	Jun-03	4	0.44 J	3.9
A1-MW-34	LEPA	Jun-03	4.8	0.51 J	4.1
A1-MW-41	LEPA	Jun-03	3	0.35 J	4.1

J: estimated value, below detection limit.

Table 1. 1,1-DCE, PCE, and TCE Concentrations (Continued)

ND: not detected.
MCL: maximum contaminant level.
Shaded cells: concentration above MCL.

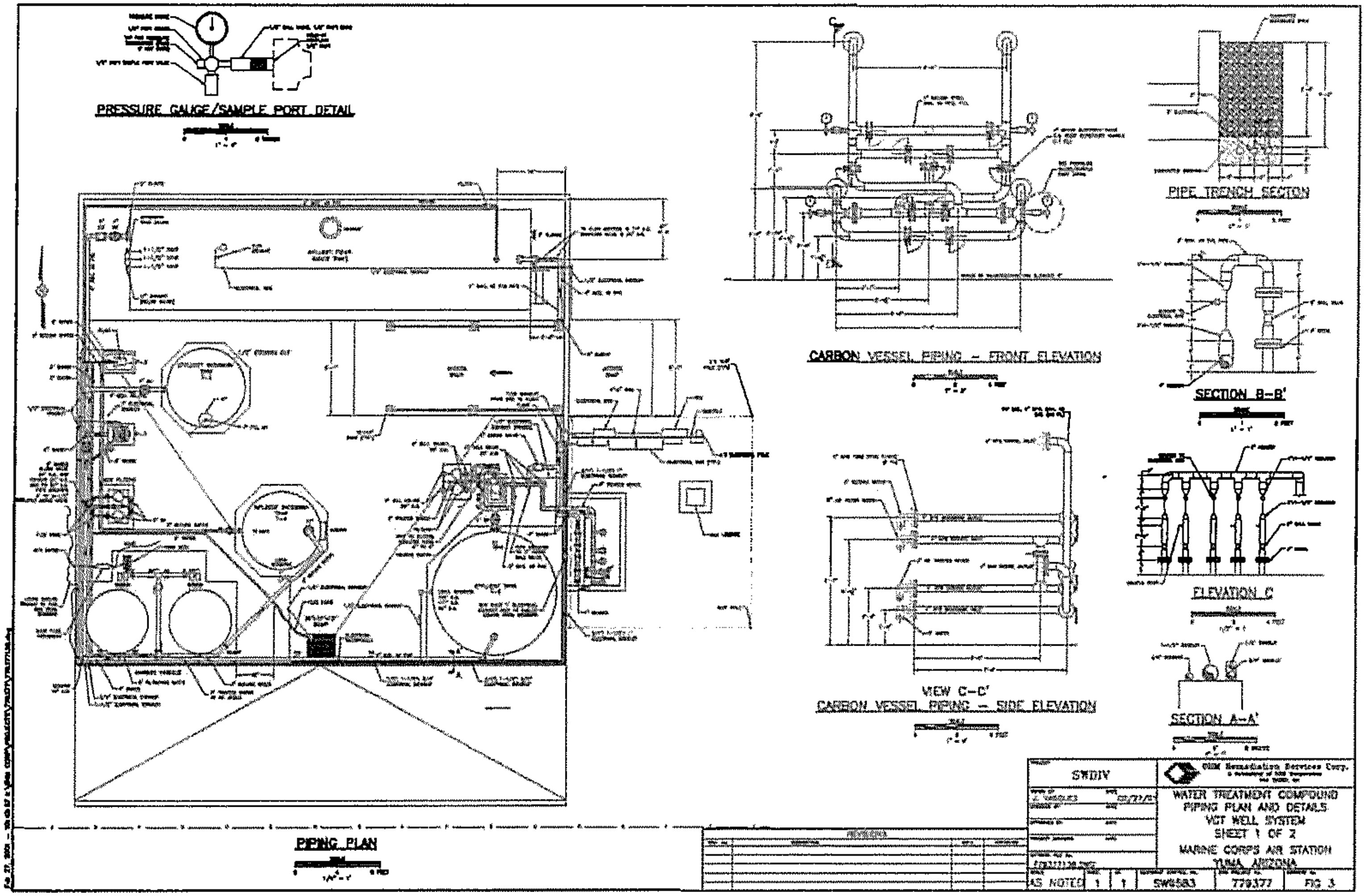


Figure 1. VCT System Schematic

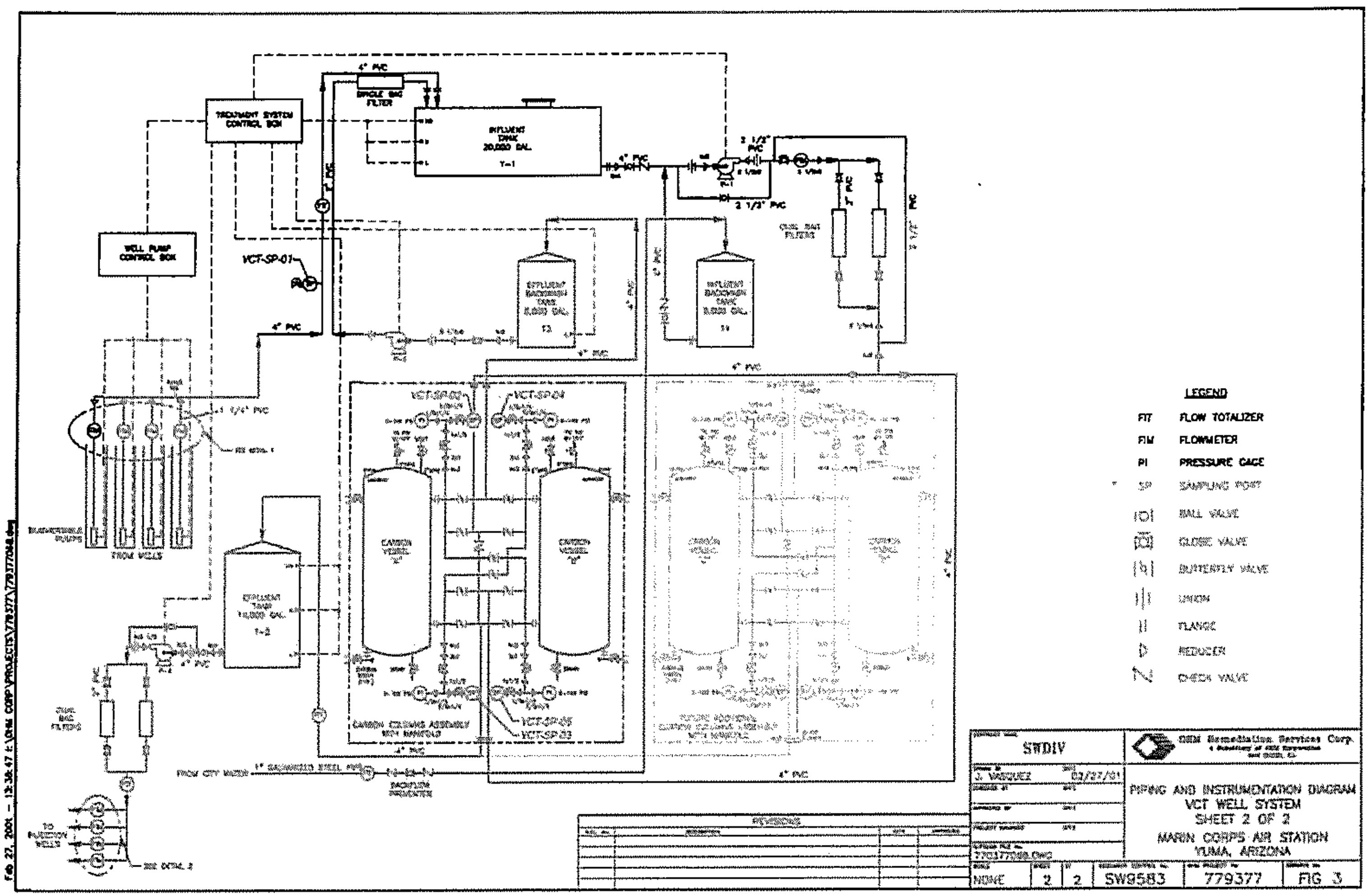


Figure 2. VCT System Piping and Instrumentation Diagram

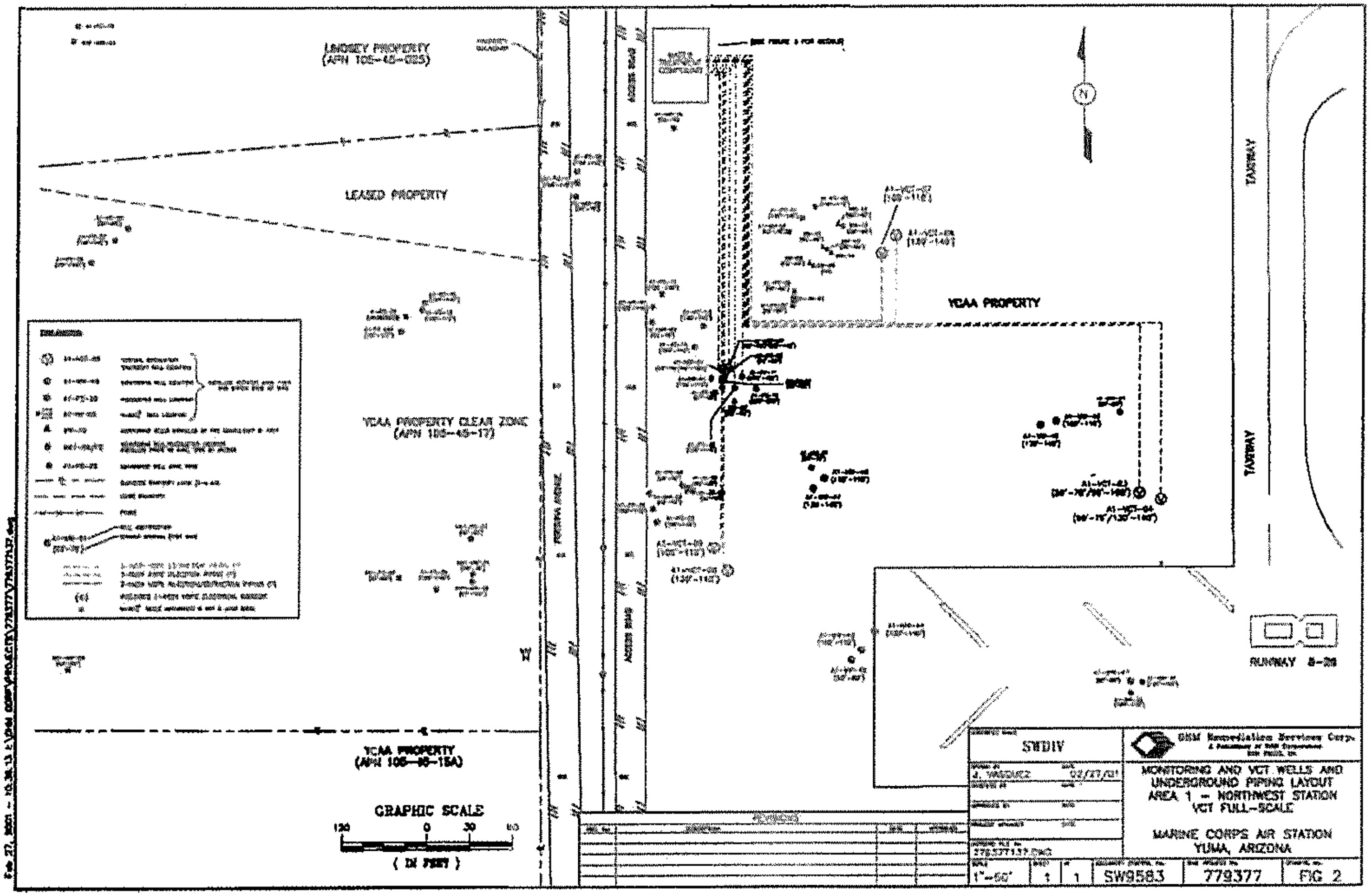


Figure 3. VCT Injection and Extraction Well Locations

Appendix B8

Area 2 Closure Technical Memorandum with U.S. EPA Concurrence

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser 5DEN.AL/6193
May 25, 2006

Ms. Cathy O'Connell
Arizona Department of Environmental Quality
Federal Projects Unit, Superfund Programs Section, Waste Program Division
1110 West Washington Street
Phoenix, AZ 85007

Dear Ms. O'Connell:

SUBJECT: NOTIFICATION TO CLOSE AREA 2, OPERABLE UNIT ONE, MARINE CORPS AIR STATION (MCAS), YUMA ARIZONA

The Department of the Navy proposed site closure and an end to long-term monitoring (LTM) at Area 2, Operable Unit One (OU-1), MCAS Yuma, Arizona in a letter dated March 12, 2006 that was sent to both Arizona Department of Environmental Quality (ADEQ) and U.S. Environmental Protection Agency (EPA). This letter requested a response by April 30, 2006. No response from ADEQ has been received. However, per enclosure (1), U.S. Environmental Protection Agency Region IX sent a concurrence letter.

This letter is to notify you that the Department of the Navy plans to proceed with site closure by conducting well abandonments at Area 2 unless we receive a non-concurrence response from ADEQ within the next 10 days.

If you have any questions please call me at (619) 532-4228.

Sincerely,

ANGELA LIND
Remedial Project Manager
By direction of the Commanding Officer

Enclosure: 1. U.S. EPA Region IX Closure Letter dated May 23, 2006

Copy to:
U.S. EPA Region IX (Mr. Martin Hausladen)
Environmental Department, MCAS Yuma AZ (Mr. Dan Nail)

May 23, 2006

MEMORANDUM FOR THE RECORD

From: Mr. Martin Hausladen, U.S. Environmental Protection Agency
Region 9 – Federal Facilities/Superfund Division
75 Hawthorne Street, San Francisco, CA 94105

To: Angie Lind, RPM, Naval Facilities Engineering Command, Southwest
1220 Pacific Highway, San Diego, CA 92132

SUBJ: PROPOSAL TO CLOSE AREA 2, OPERABLE UNIT ONE, MARINE CORPS AIR STATION, YUMA ARIZONA

Ref: (a) Naval Facilities Engineering Command, Southwest ltr 5090
Ser ROPDE.AL/6078 of 12 Mar 06

Reference (a) requested EPA's concurrence to site closure and an end to Long-Term Monitoring (LTM) at Area 2.

After reviewing reference (a), EPA concurs with the recommendation for Area 2 site closure and an end to LTM.

Sincerely,

Martin M. Hausladen

MARTIN HAUSLADEN

Copy to: Cathy O'Connell, ADEQ, Phoenix, AZ
Dan Nail, MCAS Yuma, AZ
Chris Coonfare, Battelle
Diane Silva, NAVFAC Southwest Admin Record

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser ROPDE.AL/6078
March 12, 2006

Mr. Martin Hausladen
U.S. Environmental Protection Agency
Region 9 - Federal Facilities/Superfund Division
75 Hawthorne Street
San Francisco, CA 94105

Ms. Cathy O'Connell
Arizona Department of Environmental Quality
Federal Projects Unit, Superfund Program Section,
Waste Program Division
1110 West Washington Street
Phoenix, AZ 85007

Dear Environmental Project Managers:

SUBJECT: PROPOSAL TO CLOSE AREA 2, OPERABLE UNIT ONE, MARINE CORPS AIR STATION, YUMA ARIZONA

The Department of the Navy is proposing site closure and an end to long-term monitoring (LTM) at Area 2, Operable Unit One (OU-1), Marine Corps Air Station Yuma, Arizona.

Section 2.13.2.2 of the Record of Decision states that when monitoring indicates that volatile organic compound (VOC) concentrations have decreased to Maximum Contaminant Levels (MCLs), the LTM program will continue for a minimum of 2 additional years. If there is no significant rebound in VOC concentrations above MCLs, the Navy can propose that the LTM program be terminated. The Navy has monitored groundwater at Area 2 for more than two years to demonstrate that the selected remedy has effectively and permanently reduced the VOC contamination to well within cleanup standards. Please refer to the enclosed Technical Memorandum.

Request your concurrence and/or comments in writing by April 30, 2006.

If you have any questions regarding this letter, please call (619) 532-4228.

Sincerely,

ANGIE LIND
Remedial Project Manager
By direction of the Commanding Officer

Enclosure: 1. Technical Memorandum Operable Unit 1 Area 2 Site Closure of March 6, 2006

Copy to:
Mr. Ken Yargus, MCAS Yuma Environmental
Mr. Dan Nail, MCAS Yuma Installation Restoration Program Manager
Ms. Diane Silva, Admin Record

TECHNICAL MEMORANDUM
Operable Unit 1 Area 2 Site Closure
Marine Corps Air Station, Yuma, Arizona
Contract No. N68711-01-D-6009
Task Order No. 008
March 6, 2006

Introduction

Battelle has been contracted to collect and analyze groundwater samples as specified in the Long Term Monitoring (LTM) Plan for Marine Corps Air Station (MCAS) Yuma, Area 2. These data were used to evaluate whether Area 2 can be closed in accordance with the Record of Decision (ROD) criteria. The data review of Area 2 groundwater monitoring results is addressed in this Technical Memorandum. A site location map is provided as Figure 1.

Site Description

MCAS Yuma is an active facility located immediately southeast of the city of Yuma, Arizona. Previous activities at MCAS Yuma resulted in the release of volatile organic compounds (VOCs) to groundwater. Four areas (i.e., Areas 1, 2, 3 and 6) were impacted by chlorinated hydrocarbons. The Operable Unit (OU)-1 chlorinated hydrocarbon plumes were investigated as part of the Department of Navy (DON) Installation Restoration (IR) Program established in 1980. A final ROD for OU-1 was signed by the United States Environmental Protection Agency (U.S. EPA) and the Arizona Department of Environmental Quality (ADEQ) in September and October 2000, respectively. The remedial action objectives established for this effort are the Maximum Contaminant Levels (MCLs) based on the Safe Drinking Water Act (SDWA). The contaminant of concern (COC) in Area 2 is 1,1-dichloroethene (1,1-DCE), with an MCL of 7 µg/L.

Area 2 is located in the northeastern portion of the airfield, near the intersection of Taxiways Alpha and Charlie.

Selected Remedy Description

The Area 2 plume was a relatively small and stable 1,1-DCE plume. The major components of the selected remedy (Alternative 2 – Institutional Controls and Monitored Natural Attenuation) are as follows:

- Implementing institutional controls on MCAS Yuma;
- Operating and maintaining an LTM plan that includes periodic monitoring of selected COCs in groundwater monitoring wells, to be specified in a post-ROD OU-1 groundwater remedial action LTM plan; and
- Closure criteria.

According to the ROD, the Navy will monitor the groundwater as specified in the LTM plan until it is demonstrated that the remedial action has effectively and permanently reduced the COC contamination to below cleanup standards (i.e., MCLs). When monitoring indicates that COC concentrations have decreased to at or below MCLs, the LTM program will continue for a minimum of two additional years. In accordance with Section 2.13.2.2 of the ROD, if there is no significant rebound in COC concentrations above MCLs, the Navy can propose that the LTM program be terminated.

Area 2 Data Review

Historically, eleven monitoring wells have been sampled at Area 2, including: A2-MW-01 through A2-MW-10, and FF-MW-24. Wells A2-MW-02, -06, and -07 are monitored quarterly, wells A2-MW-03, -04, -05, -08, -09, -10, and FF-MW-24 are monitored semi-annually, and well A2-MW-01 is monitored annually. The locations of the Area 2 monitoring wells are displayed on Figure 2.

A summary of the available data for Area 2 is presented in Figure 3 and Table 1. Results indicate that 1,1-DCE has exceeded its MCL of 7 μg/L in only four of the eleven monitoring wells historically (A2-MW-04, -07, -09, and FF-MW-24). TCE has not been detected above its 5 μg/L MCL in any of the monitoring events. A brief summary of each of these eleven monitoring wells is provided below.

- **A2-MW-01.** 1,1-DCE has not been detected at concentrations exceeding the 7 μg/L MCL at this monitoring well during the LTM program. Data from 3 sampling events from January 2004, December 2004, and January 2006 are available for this well. 1,1-DCE concentrations were 2.8 μg/L (for both field sample and duplicate) in January 2004, 1.6 μg/L a year later, and were below the 1 μg/L detection limit in January 2006.

- **A2-MW-02.** 1,1-DCE has not been detected at concentrations exceeding the 7 μg/L MCL at this monitoring well during the LTM program. Data from fifteen sampling events between March 2002 to December 2005 are available for this well. All DCE results from this well have been below the 1 μg/L detection limit. Values reported below that limit have ranged from 0.15 to 0.39 μg/L.

- **A2-MW-03**. 1,1-DCE has not been detected at concentrations exceeding the 7 μg/L MCL at this monitoring well during the LTM program. Data from ten sampling events between December 2001 to December 2005 are available for this well. DCE concentrations have ranged from 1.1 to 3.2 μg/L. The most recent result for this well is 1.2 μg/L in December 2005.

- **A2-MW-04.** 1,1-DCE has been detected at concentrations exceeding the 7 μg/L MCL at this monitoring well on one occasion (June 2004) during the LTM program. The overall trend observed at this well indicates concentrations of 1,1-DCE remaining at least 3 μg/L below the MCL, with the exception of the samples collected in June 2004 and June 2005. Data from ten sampling events from December 2001 to December 2005 are available for this well. DCE concentrations have ranged from 0.56 to 8.6 μg/L. The DCE concentration has exceeded the 7 μg/L MCL one time at this well: 8.6 μg/L in June 2004. All other results, including the most recent event in December 2005 (1.5 μg/L), have had DCE concentrations below 6.5 μg/L.

- **A2-MW-05.** 1,1-DCE has not been detected at concentrations exceeding the 7 μg/L MCL at this monitoring well during the LTM program. Data from ten sampling events from December 2001 to January 2006 are available for this well. Reported DCE concentrations have ranged from 0.38 to 2.9 μg/L. The most recent concentration in January 2006 was 0.67 μg/L.

- **A2-MW-06.** 1,1-DCE has not been detected at concentrations exceeding the 7 μg/L MCL at this monitoring well during the LTM program. Data from sixteen sampling events from December 2001 to December 2005 are available for this well. 1,1-DCE has not been detected in any of the samples collected from this well.

- **A2-MW-07.** 1,1-DCE has been detected at concentrations exceeding the 7 µg/L MCL on one occasion (March 2003) at this monitoring well during the LTM program, but has not been detected at concentrations exceeding the MCL for more than two years. Data from seventeen sampling events from December 2001 through December 2005 are available for this well. Concentrations of 1,1-DCE have ranged from 0.28 to 12 µg/L. The DCE concentration has exceeded the 7 µg/L MCL one time at this well (12 µg/L and 9.3 µg/L in duplicate samples collected March, 2003). The maximum concentration detected since March 2003 is 6.2 µg/L in the December 2005 sample. The elevated concentration observed in March 2003 appears to be an isolated event (see Figure 2).

- **A2-MW-08.** 1,1-DCE has not been detected at concentrations exceeding the 7 µg/L MCL at this monitoring well during the LTM program. Data from ten sampling events from December 2001 to January 2006 are available for this well. Concentrations of DCE have ranged from non-detect to 5.3 µg/L. The most recent sample in January 2006 was 4.2 µg/L.

- **A2-MW-09.** 1,1-DCE has been detected at concentrations exceeding the 7 µg/L MCL at this monitoring well on three occasions during the LTM program. The overall trend observed at this well indicates concentrations of 1,1-DCE remaining below the MCL, with the exception of the samples collected in June 2003, January 2004, and June 2004. A slight downward trend has been observed in the data in the eighteen months following the June 2004 sampling event, with no samples exceeding the 7 µg/L MCL during this period. Data from ten sampling events are available from January 2002 to January 2006 for this well. DCE concentrations have ranged from 2.2 to 13.0 µg/L. The DCE concentration has exceeded the 7 µg/L MCL on three occasions (10, 12, and 13 µg/L in June 2003, January 2004, and June 2004, respectively). The most recent result in January 2006 is 6.0 µg/L.

- **A2-MW-10.** 1,1-DCE has not been detected at concentrations exceeding the 7 µg/L MCL at this monitoring well during the LTM program. Data from ten sampling events from March 2002 to December 2005 are available for this well. DCE has been detected in two samples: 0.7 µg/L and 1.2 µg/L in June 2004 and June 2005 respectively. All other samples have been reported as "ND".

- **FF-MW-24.** 1,1-DCE has been detected at concentrations exceeding the 7 µg/L MCL on one occasion (January 2004) at this monitoring well during the LTM program, but has not been detected at concentrations exceeding the MCL within the last two years. Data from ten sampling events from January 2002 to January 2006 are available for this well. DCE concentrations have ranged from 2.9 to 10.0 µg/L. The DCE concentration has exceeded the 7 µg/L MCL on one occasion (10.0 µg/L in January 2004, with a duplicate result of 6.9 µg/L). All other reported concentrations have been at or below 4.9 µg/L, including the most recent event (3.4 µg/L, January 2006). The elevated concentration observed in January 2004 appears to be an isolated event (see Figure 2).

Conclusions and Recommendations

Results indicate that 1,1-DCE has exceeded its MCL of 7 µg/L in only four of the eleven monitoring wells historically (A2-MW-04, -07, -09, and FF-MW-24). Concentrations of 1,1-DCE have not exceeded the 7 µg/L MCL at seven of the eleven Area 2 wells (A2-MW-01, -02, -03, -05, -06, -08, and -10). There has been one spike above the MCL at each of three wells (A2-MW-04, A2-MW-07 and FF-MW-24), with neither of the spikes at A2-MW-07 nor FF-MW-24 occurring within the last two years. The 1,1-DCE concentration has exceeded the MCL on three occasions since January 2002 at well A2-MW-09 (June 2003, January and June 2004). However, these instances appear to be anomalies within the overall trend at this well; the trend at A2-MW-09 is indicating a decrease in concentrations.

All detections prior to June 2003 were below the MCL, as was the most recent event in December 2005 and January 2006. Overall, the concentrations of 1,1-DCE in the Area 2 monitoring wells have remained below the 7 μg/L MCL, with the minor exceptions noted above. The detections exceeding the MCL have been within only 1.1 to 6 μg/L above the MCL. The concentrations appear to be stable, and have remained so for over two years. Therefore, the Navy recommends site closure for OU-1, Area 2.

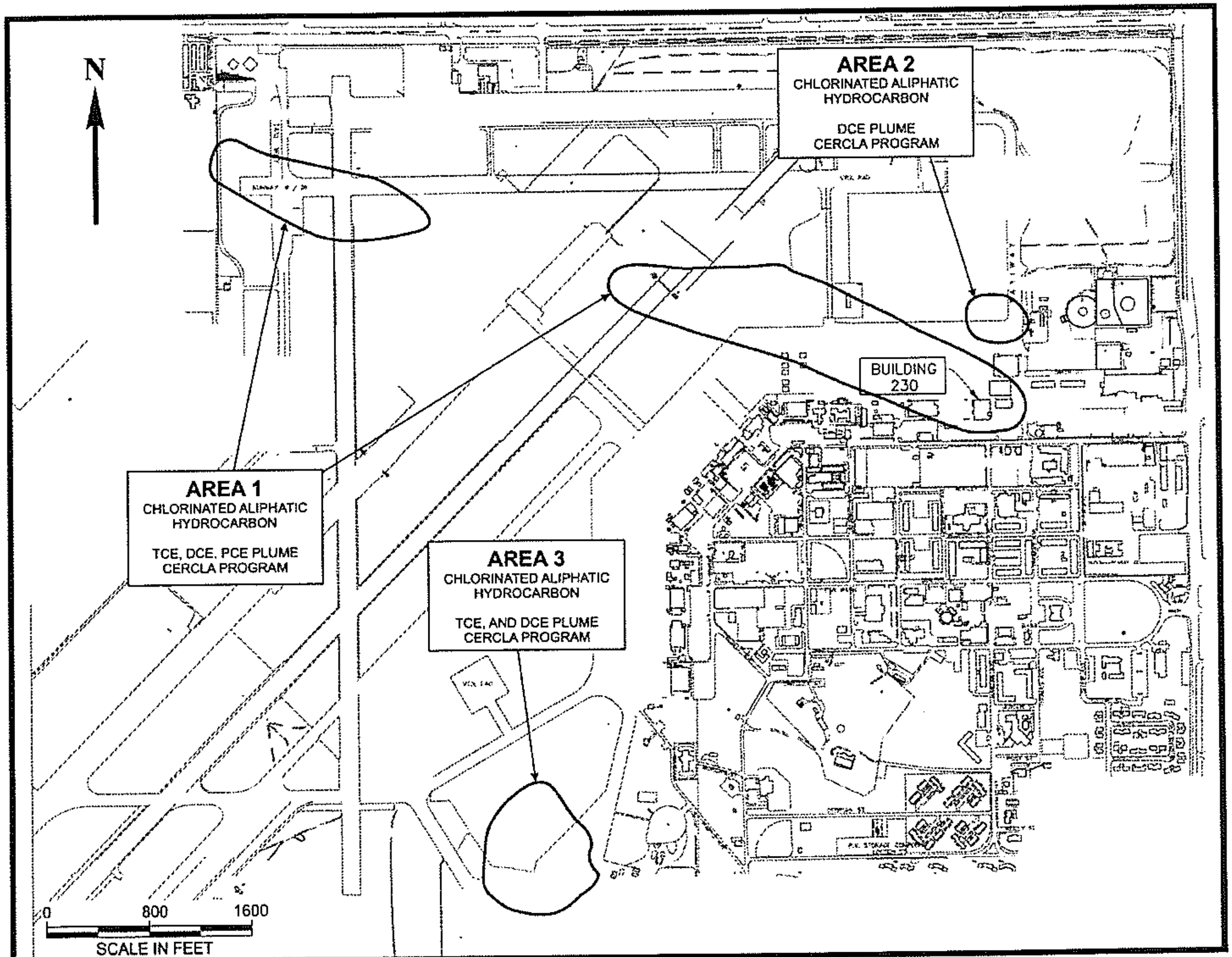


Figure 1. Site Location Map

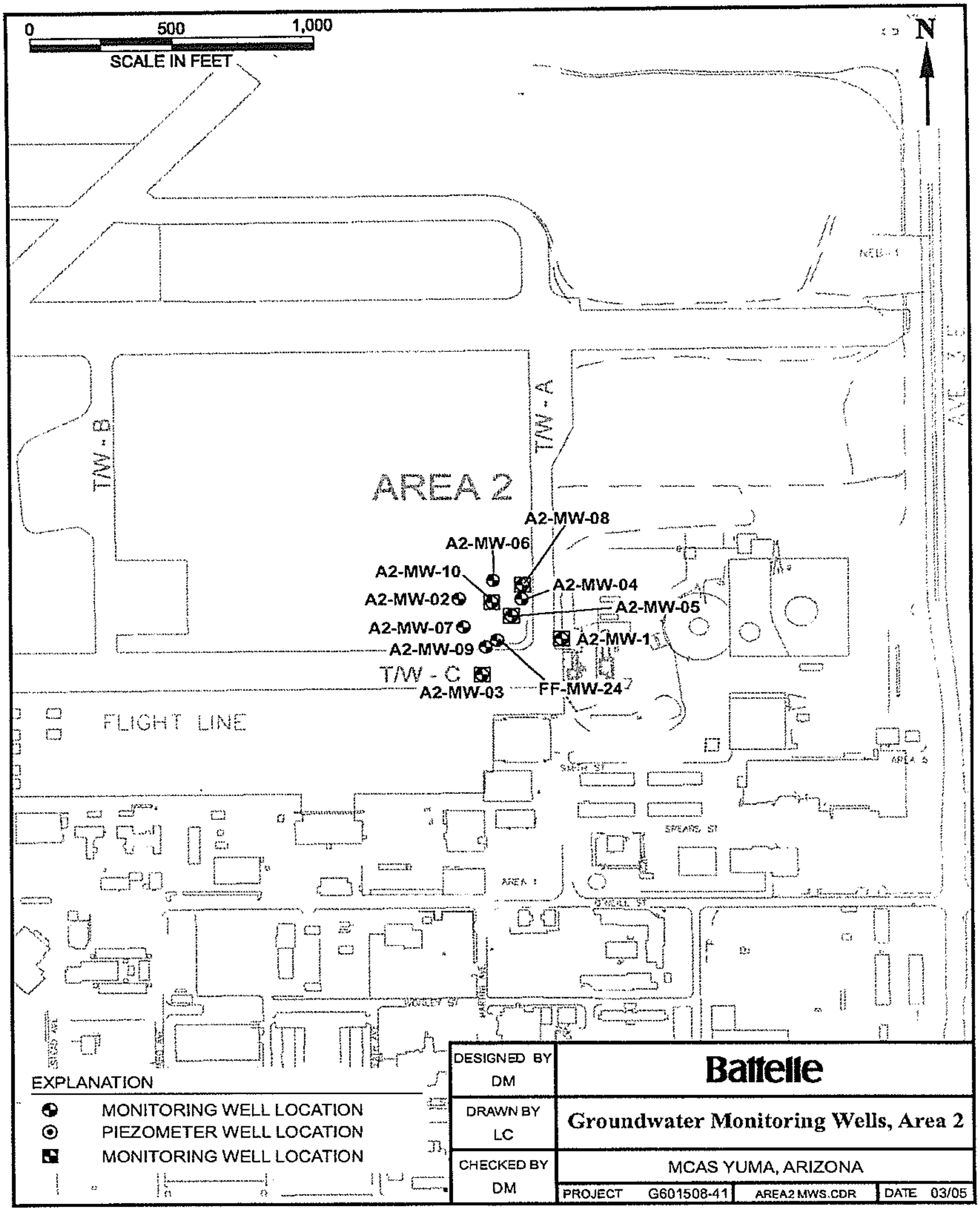
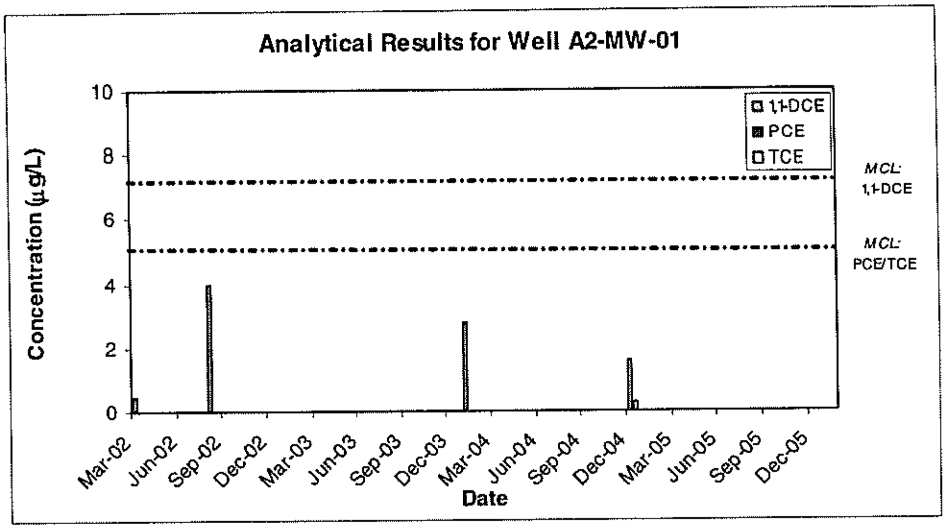
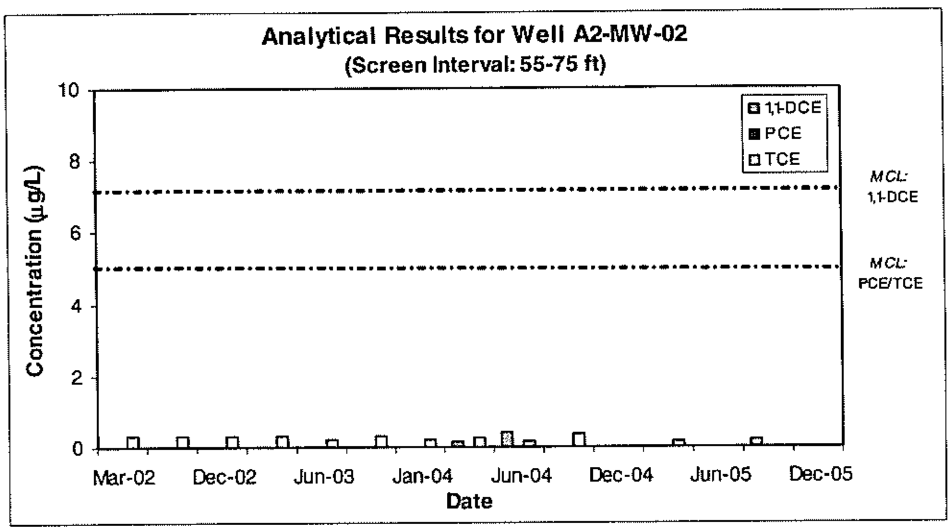
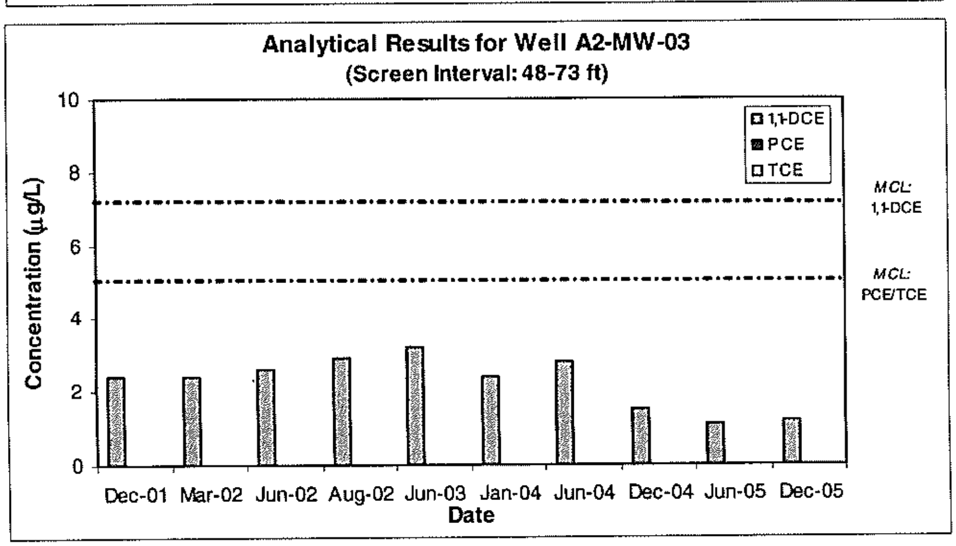


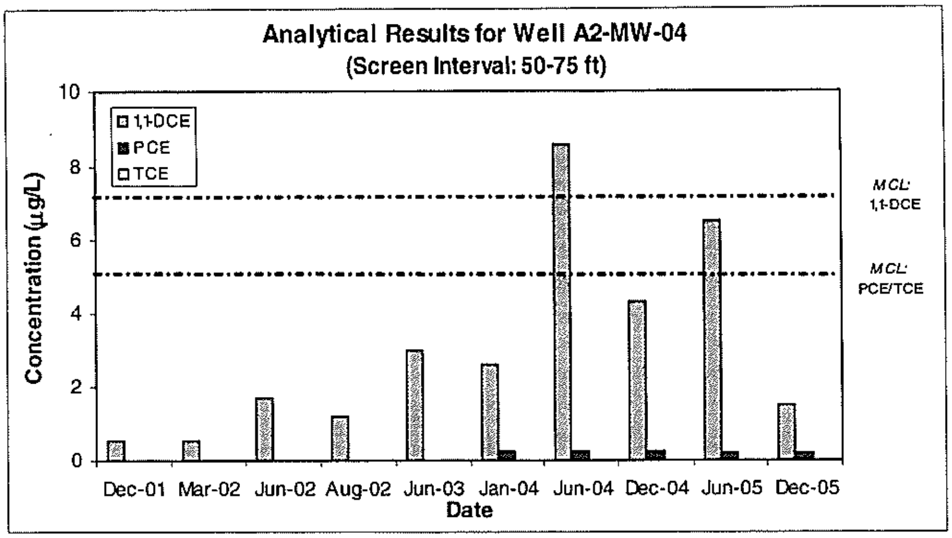
Figure 2. Groundwater Monitoring Wells, Area 2

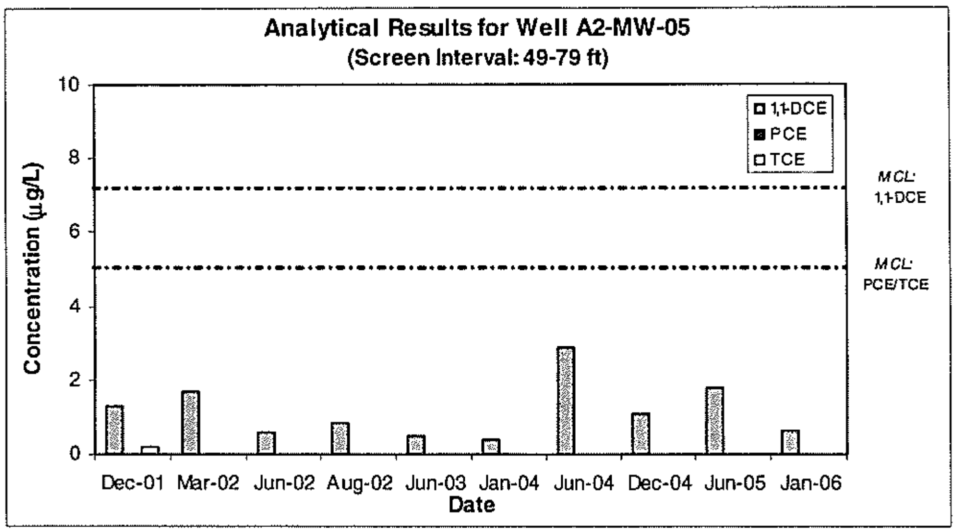
Figure 3. Historical and Current COC Concentrations at OU-1, Area 2

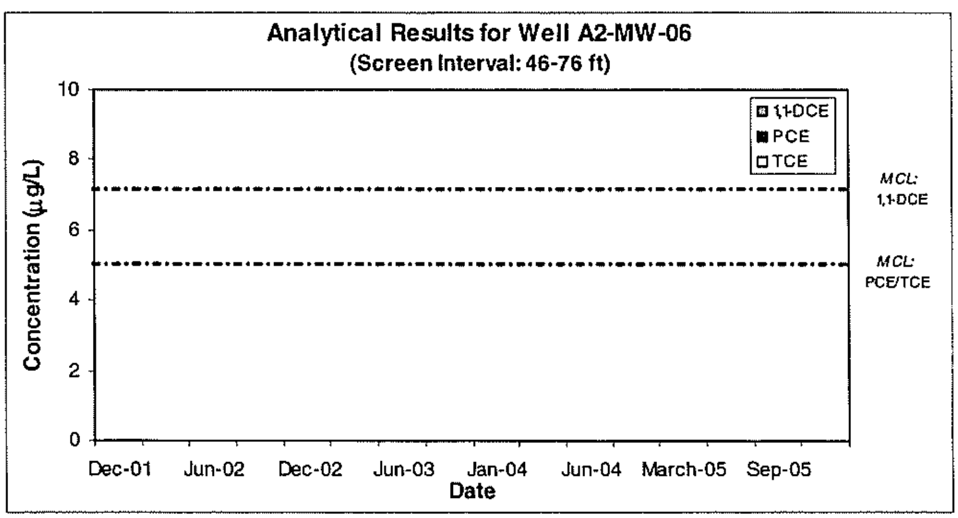


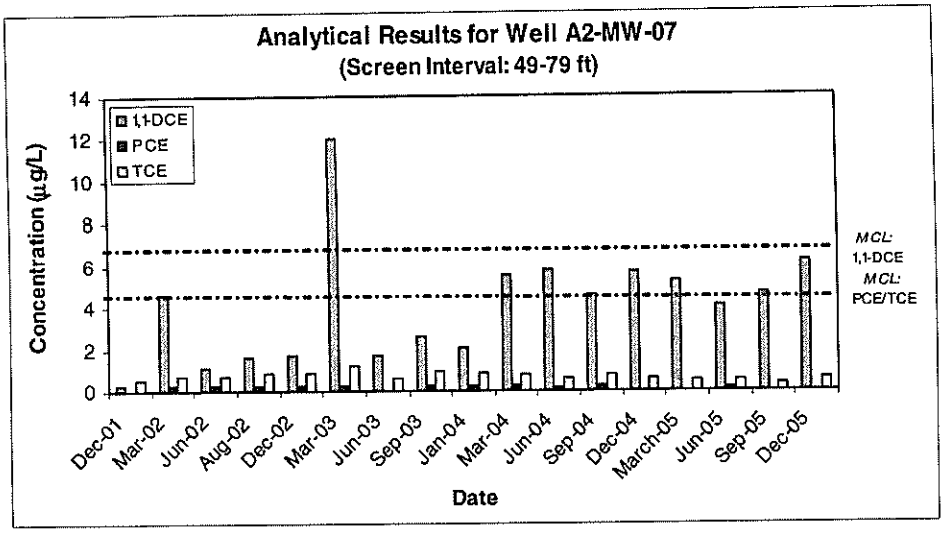





Analytical Results for Well A2-MW-04
(Screen Interval: 50-75 ft)
Concentration (µg/L)
10
8
6
4
2
0
1,1-DCE
PCE
TCE
MCL: 1,1-DCE
MCL: PCE/TCE
Dec-01 Mar-02 Jun-02 Aug-02 Jun-03 Jan-04 Jun-04 Dec-04 Jun-05 Dec-05
Date


Analytical Results for Well A2-MW-05
(Screen Interval: 49-79 ft)
Concentration (µg/L)
10
8
6
4
2
0
1,1-DCE
PCE
TCE
MCL: 1,1-DCE
MCL: PCE/TCE
Dec-01 Mar-02 Jun-02 Aug-02 Jun-03 Jan-04 Jun-04 Dec-04 Jun-05 Jan-06
Date


Analytical Results for Well A2-MW-06
(Screen Interval: 46-76 ft)
Concentration (µg/L)
10
8
6
4
2
0
1,1-DCE
PCE
TCE
MCL: 1,1-DCE
MCL: PCE/TCE
Dec-01 Jun-02 Dec-02 Jun-03 Jan-04 Jun-04 March-05 Sep-05
Date



Analytical Results for Well A2-MW-07
(Screen Interval: 49-79 ft)
1,1-DCE
PCE
TCE
Concentration (µg/L)
0
2
4
6
8
10
12
14
MCL: 1,1-DCE
MCL: PCE/TCE
Dec-01
Mar-02
Jun-02
Aug-02
Dec-02
Mar-03
Jun-03
Sep-03
Jan-04
Mar-04
Jun-04
Sep-04
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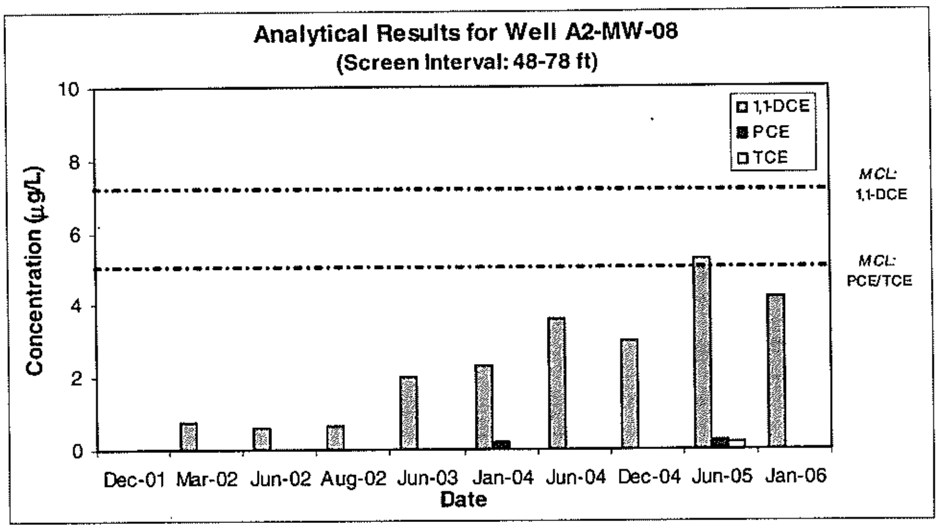
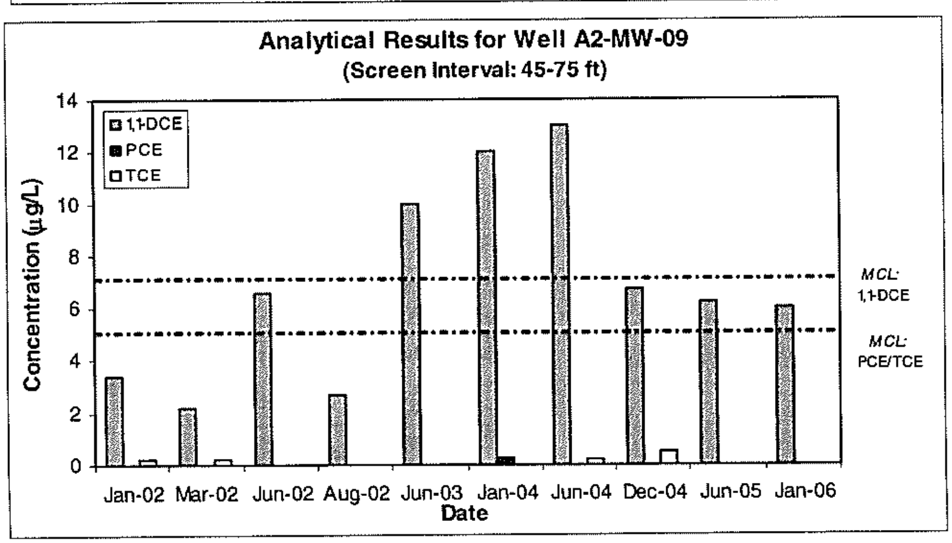
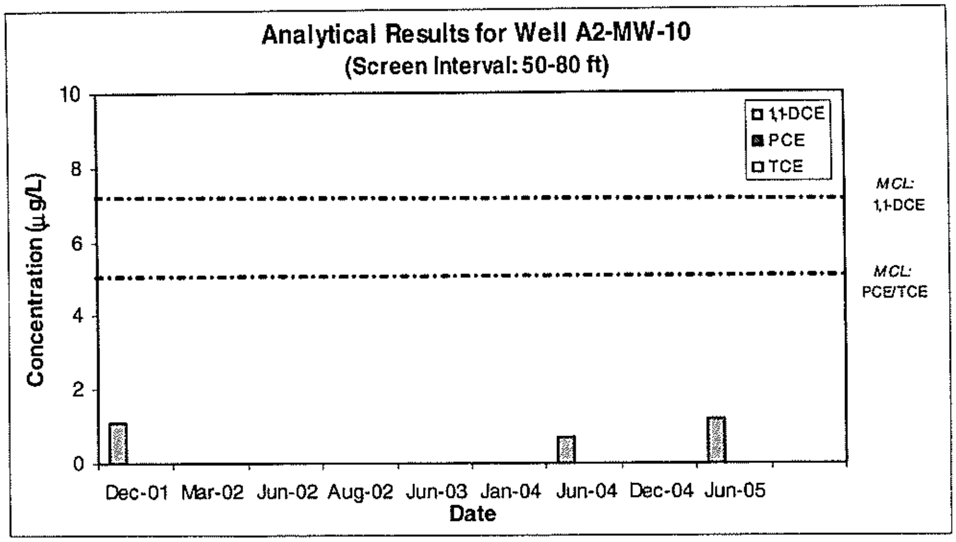
March-05
Jun-05
Sep-05
Dec-05
Date



Analytical Results for Well A2-MW-08
(Screen Interval: 48-78 ft)
1,1-DCE
PCE
TCE
Concentration (µg/L)
0
2
4
6
8
10
MCL: 1,1-DCE
MCL: PCE/TCE
Dec-01
Mar-02
Jun-02
Aug-02
Jun-03
Jan-04
Jun-04
Dec-04
Jun-05
Jan-06
Date



Analytical Results for Well A2-MW-09
(Screen Interval: 45-75 ft)
1,1-DCE
PCE
TCE
Concentration (µg/L)
0
2
4
6
8
10
12
14
MCL: 1,1-DCE
MCL: PCE/TCE
Jan-02
Mar-02
Jun-02
Aug-02
Jun-03
Jan-04
Jun-04
Dec-04
Jun-05
Jan-06
Date


Analytical Results for Well A2-MW-10
(Screen Interval: 50-80 ft)
Concentration (µg/L)
10
8
6
4
2
0
1,1-DCE
PCE
TCE
MCL:
1,1-DCE
MCL:
PCE/TCE
Dec-01 Mar-02 Jun-02 Aug-02 Jun-03 Jan-04 Jun-04 Dec-04 Jun-05
Date

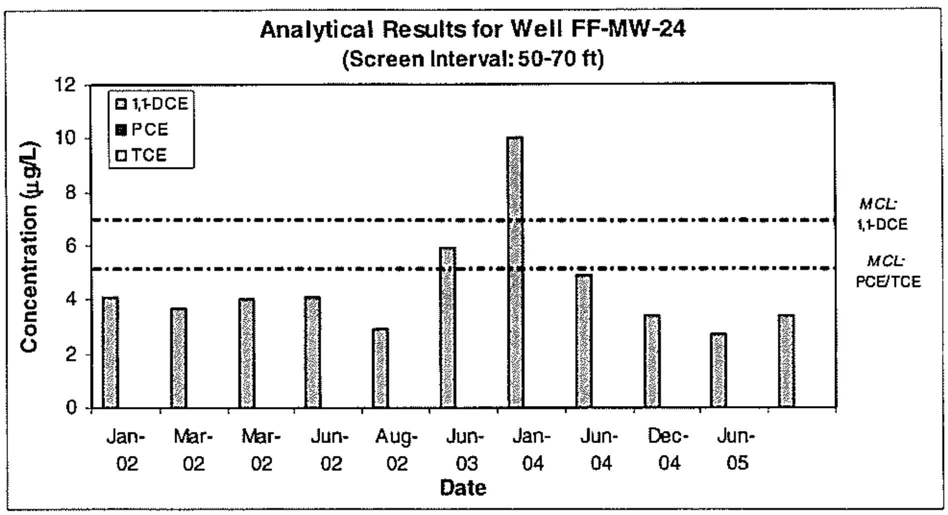

Analytical Results for Well FF-MW-24
(Screen Interval: 50-70 ft)
Concentration (µg/L)
12
10
8
6
4
2
0
1,1-DCE
PCE
TCE
MCL:
1,1-DCE
MCL:
PCE/TCE
Jan-02 Mar-02 Mar-02 Jun-02 Aug-02 Jun-03 Jan-04 Jun-04 Dec-04 Jun-05
Date

Table 1. Groundwater Monitoring Results at OU-1, Area 2

WELL ID NUMBER	WELL LOCATION	DATE SAMPLED	CONTAMINANTS OF CONCERN (MCL) 1,1-DCE (7 ug/L)		TCE (5 ug/L)	
A2-MW-01	Area 2	Mar-02	0.44	J	ND	
A2-MW-01	Area 2	Aug-02	4		ND	
A2-MW-01	Area 2	Jan-04	2.8		ND	
A2-MW-01 DUP	Area 2	Jan-04	2.8		ND	
A2-MW-01	Area 2	Dec-04	1.6		0.26	J
A2-MW-01	Area 2	Jan-06	ND		ND	
A2-MW-02	Area 2	Mar-02	ND		0.32	J
A2-MW-02	Area 2	Aug-02	ND		0.29	J
A2-MW-02	Area 2	Dec-02	ND		0.33	J
A2-MW-02	Area 2	Mar-03	ND		0.33	J
A2-MW-02	Area 2	Jun-03	ND		0.22	J
A2-MW-02	Area 2	Sep-03	ND		0.29	J
A2-MW-02	Area 2	Jan-04	ND		0.2	J
A2-MW-02	Area 2	Mar-04	0.16	J	0.28	J
A2-MW-02 DUP	Area 2	Mar-04	0.15	J	0.28	J
A2-MW-02	Area 2	Jun-04	0.39	J	0.17	J
A2-MW-02	Area 2	Sep-04	ND		0.37	J
A2-MW-02	Area 2	Dec-04	ND		ND	
A2-MW-02	Area 2	Mar-05	ND		0.17	J
A2-MW-02	Area 2	Jun-05	ND		ND	
A2-MW-02	Area 2	Sep-05	0.21	J	ND	
A2-MW-02	Area 2	Dec-05	ND	J	ND	
A2-MW-03	Area 2	Dec-01	2.4		ND	
A2-MW-03	Area 2	Mar-02	2.4		ND	
A2-MW-03	Area 2	Jun-02	2.6		ND	
A2-MW-03	Area 2	Aug-02	2.9		ND	
A2-MW-03	Area 2	Jun-03	3.2		ND	
A2-MW-03	Area 2	Jan-04	2.4		ND	
A2-MW-03	Area 2	Jun-04	2.8		ND	
A2-MW-03	Area 2	Dec-04	1.5		ND	
A2-MW-03	Area 2	Jun-05	1.1		ND	
A2-MW-03	Area 2	Dec-05	1.2		ND	
A2-MW-04	Area 2	Dec-01	0.56	J	ND	
A2-MW-04	Area 2	Mar-02	0.56	J	ND	
A2-MW-04	Area 2	Jun-02	1.7		ND	
A2-MW-04	Area 2	Aug-02	1.2		ND	
A2-MW-04	Area 2	Jun-03	3		ND	
A2-MW-04	Area 2	Jan-04	2.6		ND	
A2-MW-04	Area 2	Jun-04	8.6		ND	
A2-MW-04	Area 2	Dec-04	4.3		ND	
A2-MW-04 DUP	Area 2	Dec-04	3.9		ND	
A2-MW-04	Area 2	Jun-05	6.5		ND	
A2-MW-04 DUP	Area 2	Jun-05	8.1		ND	
A2-MW-04	Area 2	Dec-05	1.5		ND	
A2-MW-05	Area 2	Dec-01	1.3		0.21	J
A2-MW-05	Area 2	Mar-02	1.7		ND	

WELL ID NUMBER	WELL LOCATION	DATE SAMPLED	CONTAMINANTS OF CONCERN (MCL) 1,1-DCE *(7 ug/L)*		TCE *(5 ug/L)*	
A2-MW-05	Area 2	Jun-02	0.61	J	ND	
A2-MW-05	Area 2	Aug-02	0.85	J	ND	
A2-MW-05	Area 2	Jun-03	0.51	J	ND	
A2-MW-05	Area 2	Jan-04	0.38	J	ND	
A2-MW-05	Area 2	Jun-04	2.9		ND	
A2-MW-05	Area 2	Dec-04	1.1		ND	
A2-MW-05	Area 2	Jun-05	1.8		ND	
A2-MW-05	Area 2	Jan-06	0.67	J	ND	
A2-MW-06	Area 2	Dec-01	ND		ND	
A2-MW-06	Area 2	Mar-02	ND		ND	
A2-MW-06	Area 2	Jun-02	ND		ND	
A2-MW-06	Area 2	Aug-02	ND		ND	
A2-MW-06 DUP	Area 2	Aug-02	ND		ND	
A2-MW-06	Area 2	Dec-02	ND		ND	
A2-MW-06	Area 2	Mar-03	ND		ND	
A2-MW-06	Area 2	Jun-03	ND		ND	
A2-MW-06	Area 2	Sep-03	ND		ND	
A2-MW-06	Area 2	Jan-04	ND		ND	
A2-MW-06	Area 2	Mar-04	ND		ND	
A2-MW-06	Area 2	Jun-04	ND		ND	
A2-MW-06	Area 2	Dec-04	ND		ND	
A2-MW-06	Area 2	Mar-05	ND		ND	
A2-MW-06 DUP	Area 2	Mar-05	ND		ND	
A2-MW-06	Area 2	Jun-05	ND		ND	
A2-MW-06	Area 2	Sep-05	ND		ND	
A2-MW-06	Area 2	Dec-05	ND		ND	
A2-MW-07	Area 2	Dec-01	0.28	J	0.52	J
A2-MW-07	Area 2	Mar-02	4.6		0.65	J
A2-MW-07	Area 2	Jun-02	1.1		0.67	J
A2-MW-07	Area 2	Aug-02	1.6		0.85	J
A2-MW-07	Area 2	Dec-02	1.7		0.83	J
A2-MW-07	Area 2	Mar-03	12		1.2	
A2-MW-07 Dup	Area 2	Mar-03	9.3		0.85	J
A2-MW-07	Area 2	Jun-03	1.7		0.59	J
A2-MW-07	Area 2	Sep-03	2.6		0.98	J
A2-MW-07-DUP	Area 2	Sep-03	2.6		0.99	J
A2-MW-07	Area 2	Jan-04	2.1		0.85	J
A2-MW-07	Area 2	Mar-04	5.5		0.74	J
A2-MW-07	Area 2	Jun-04	5.8		0.63	J
A2-MW-07	Area 2	Sep-04	4.6		0.76	J
A2-MW-07	Area 2	Dec-04	5.7		0.61	J
A2-MW-07	Area 2	Mar-05	5.3		0.54	J
A2-MW-07	Area 2	Jun-05	4.1		0.52	J
A2-MW-07	Area 2	Sep-05	4.7		0.38	J
A2-MW-07	Area 2	Dec-05	6.2		0.57	J
A2-MW-08	Area 2	Dec-01	ND		ND	
A2-MW-08	Area 2	Mar-02	0.76	J	ND	
A2-MW-08	Area 2	Jun-02	0.58	J	ND	

WELL ID NUMBER	WELL LOCATION	DATE SAMPLED	CONTAMINANTS OF CONCERN (MCL) 1,1-DCE (7 ug/L)		TCE (5 ug/L)	
A2-MW-08	Area 2	Aug-02	0.64	J	ND	
A2-MW-08	Area 2	Jun-03	2		ND	
A2-MW-08	Area 2	Jan-04	2.3		ND	
A2-MW-08	Area 2	Jun-04	3.6		ND	
A2-MW-08	Area 2	Dec-04	3		ND	
A2-MW-08	Area 2	Jun-05	5.3		0.19	J
A2-MW-08	Area 2	Jan-06	4.2		ND	
A2-MW-09	Area 2	Jan-02	3.4		0.21	J
A2-MW-09	Area 2	Mar-02	2.2		0.2	J
A2-MW-09	Area 2	Jun-02	6.6		ND	
A2-MW-09	Area 2	Aug-02	2.7		ND	
A2-MW-09 DUP	Area 2	Aug-02	2.6		ND	
A2-MW-09	Area 2	Jun-03	10		ND	
A2-MW-09	Area 2	Jan-04	12		ND	
A2-MW-09	Area 2	Jun-04	13		0.2	J
A2-MW-09	Area 2	Dec-04	6.7		0.51	J
A2-MW-09	Area 2	Jun-05	6.2		ND	
A2-MW-09	Area 2	Jan-06	6		ND	
A2-MW-10	Area 2	Dec-01	1.1		ND	
A2-MW-10 DUP	Area 2	Dec-01	ND		ND	
A2-MW-10	Area 2	Mar-02	ND		ND	
A2-MW-10 DUP	Area 2	Mar-02	ND		ND	
A2-MW-10	Area 2	Jun-02	ND		ND	
A2-MW-10	Area 2	Aug-02	ND		ND	
A2-MW-10	Area 2	Jun-03	ND		ND	
A2-MW-10	Area 2	Jan-04	ND		ND	
A2-MW-10	Area 2	Jun-04	0.7	J	ND	
A2-MW-10	Area 2	Dec-04	ND		ND	
A2-MW-10	Area 2	Jun-05	1.2		ND	
A2-MW-10	Area 2	Dec-05	ND		ND	
A2-MW-10 DUP	Area 2	Dec-05	ND		ND	
FF-MW-24	Area 2	Jan-02	4.1		ND	
FF-MW-24	Area 2	Mar-02	3.7		ND	
FF-MW-24	Area 2	Mar-02	4		ND	
FF-MW-24	Area 2	Jun-02	4.1		ND	
FF-MW-24	Area 2	Aug-02	2.9		ND	
FF-MW-24	Area 2	Jun-03	5.9		ND	
FF-MW-24	Area 2	Jan-04	10		ND	
FF-MW-24 DUP	Area 2	Jan-04	6.9		ND	
FF-MW-24	Area 2	Jun-04	4.9		ND	
FF-MW-24 DUP	Area 2	Jun-04	4.7		ND	
FF-MW-24	Area 2	Dec-04	3.4		ND	
FF-MW-24	Area 2	Jun-05	2.7		ND	
FF-MW-24	Area 2	Jan-06	3.4		ND	

ND = not detected
J = detected below the 1 μg/L reporting limit.
Highlighted cells indicate detections above the MCL.

Appendix B9

Area 3 Closure Technical Memorandum with U.S. EPA Concurrence

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO CA 92132-5190

5090
Ser OPDE.AL/6055
February 15, 2006

Ms. Cathy O'Connell
Arizona Department of Environmental Quality
Federal Projects Unit, Superfund Programs Section, Waste Program Division
110 West Washington Street
Phoenix, AZ 85007

Dear Ms. O'Connell:

SUBJECT: NOTIFICATION TO CLOSE AREA 3, OPERABLE UNIT ONE, MARINE CORPS AIR STATION YUMA, ARIZONA

The Department of the Navy proposed site closure and an end to long-term monitoring (LTM) at Area 3, Operable Unit One (OU-1), Marine Corps Air Station Yuma, Arizona in a letter dated December 14, 2005 that was sent to both the Arizona Department of Environmental Quality (ADEQ) and the U.S. Environmental Protection Agency (EPA). This letter requested a response by January 30, 2006. No response from ADEQ has been received. However, per enclosure (1), the U.S. Environmental Protection Agency Region IX sent a concurrence letter.

This letter is to notify you that the Department of the Navy plans to proceed with site closure by conducting well abandonments at Area 3 unless we receive a non-concurrence response from ADEQ within the next ten days.

If you have any questions please call me at (619) 532-4228.

Sincerely,

ANGELA LIND
Remedial Project Manager
By direction of the Commanding Officer

Enclosure: 1. U.S. EPA Region IX Closure Letter dated February 9, 2006

Copy to:
Mr. Martin Hausladen, U.S. EPA Region IX
Mr. Dan Nail, Environmental Department, MCAS Yuma, AZ

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

February 9, 2006

Ms. Angela Lind
Project Manager
Southwest Division Naval Facilities
Engineering Command
1220 Pacific Highway
San Diego, CA 92132-5190

Dear Ms. Lind

SUBJECT: CLOSURE OF AREA 3, OPERABLE UNIT ONE, MARINE CORPS AIR STATION, YUMA, ARIZONA

The United States Environmental Protection Agency(EPA) has reviewed your request for closure of the afore mentioned site . After reviewing all pertinent data and a review of site history, the EPA concurs with the request and agrees with the closure request.

We appreciate the work completed at this site and are pleased to have been involved with the project. If you have questions regarding this letter please feel free to contact me at any time at (415) 972-3007.

Sincerely,

Martin Hausladen
Project Manager

TECHNICAL MEMORANDUM
Operable Unit 1 Area 3 Site Closure
Marine Corps Air Station, Yuma, Arizona
Contract No. N68711-01-D-6009
Task Order No. 008
December 8, 2005

Introduction

Battelle has been contracted to collect and analyze groundwater samples as specified in the Long Term Monitoring (LTM) Plan for Marine Corps Air Station (MCAS) Yuma, Area 3. These data were used to evaluate whether Area 3 can be closed in accordance with the Record of Decision (ROD) criteria. The data review of Area 3 groundwater monitoring results is addressed in this Technical Memorandum. A site location map is provided as Figure 1.

Site Description

MCAS Yuma is an active facility located immediately southeast of the city of Yuma, Arizona. Previous activities at MCAS Yuma resulted in the release of volatile organic compounds (VOCs) to groundwater. Four areas (i.e., Areas 1, 2, 3 and 6) were impacted by chlorinated hydrocarbons. The Operable Unit (OU)-1 chlorinated hydrocarbon plumes were investigated as part of the Department of Navy (DON) Installation Restoration (IR) Program established in 1980. A final ROD for OU-1 was signed by the United States Environmental Protection Agency (U.S. EPA) and the Arizona Department of Environmental Quality (ADEQ) in September and October 2000, respectively. The remedial action objectives established for this effort are the Maximum Contaminant Levels (MCLs) based on the Safe Drinking Water Act (SDWA). The contaminants of concern (COCs) in Area 3 are 1,1-dichloroethene (1,1-DCE), with an MCL of 7 μg/L, and trichloroethene (TCE), with an MCL of 5 μg/L.

Area 3 is located in the southeastern portion of the airfield, between Taxiways Oscar and November.

Selected Remedy Description

The Area 3 remediation strategy was the same as the other OU-1 sites. The major components of the selected remedy (Alternative 2 – Institutional Controls and Monitored Natural Attenuation) are as follows:

- Implementing institutional controls on MCAS Yuma;
- Operating and maintaining an LTM plan that includes periodic monitoring of selected COCs in groundwater monitoring wells, to be specified in a post-ROD OU-1 groundwater remedial action LTM plan; and
- Closure criteria.

According to the ROD, the Navy will monitor the groundwater as specified in the LTM plan until it is demonstrated that the remedial action has effectively and permanently reduced the COC contamination to below cleanup standards (i.e., MCLs). When monitoring indicates that COC concentrations have decreased to at or below MCLs, the LTM program will continue for a minimum of two additional years. In accordance with Section 2.13.2.2 of the ROD, if there is no significant rebound in COC concentrations above MCLs, the Navy can propose that the LTM program be terminated.

Area 3 Data Review

Historically, six monitoring wells have been sampled at Area 3, including: A3-MW-03, A3-MW-04, A3-MW-07, A3-MW-08, A3-MW-11, and W-5A. Wells A3-MW-03 and A3-MW-08 are monitored quarterly; wells A3-MW-04, -11, and W-5A are monitored semi-annually; and well A3-MW-07 is monitored annually. The locations of the Area 3 monitoring wells are displayed on Figure 2.

A summary of the available data for Area 3 is presented in Figure 3 and Table 1. Results indicate that neither COC has been detected in any of the six monitoring wells since sampling began in December 2001. A brief summary of each of these six monitoring wells is provided below.

- **A3-MW-03.** Data from 16 quarterly sampling events from December 2001 through September 2005 are available for this well. 1,1-DCE and TCE concentrations were below the 1 µg/L detection limit for all samples and reported as "ND", for "not detected".

- **A3-MW-04.** Data from 9 semiannual sampling events from December 2001 through June 2005 are available for this well. 1,1-DCE and TCE concentrations were below the 1 µg/L detection limit for all samples and reported as "ND", for "not detected".

- **A3-MW-07**. Data from 4 annual sampling events from December 2001 through December 2004 are available for this well. 1,1-DCE and TCE concentrations were below the 1 µg/L detection limit for all samples and reported as "ND", for "not detected".

- **A3-MW-08.** Data from 16 quarterly sampling events from December 2001 through September 2005 are available for this well. 1,1-DCE and TCE concentrations were below the 1 µg/L detection limit for all samples and reported as "ND", for "not detected.

- **A3-MW-11.** Data from 9 semiannual sampling events from December 2001 through June 2005 are available for this well. 1,1-DCE and TCE concentrations were below the 1 µg/L detection limit for all samples and reported as "ND", for "not detected".

- **W-5A.** Data from 9 semiannual sampling events from December 2001 through June 2005 are available for this well. 1,1-DCE and TCE concentrations were below the 1 µg/L detection limit for all samples and reported as "ND", for "not detected".

Conclusions and Recommendations

Concentrations of 1,1-DCE and TCE in Area 3 wells have been consistently reported as being below the 1 µg/L detection limit. As such, they have not exceeded the respective 7 and 5 µg/L MCLs at any of the six Area 3 wells (A3-MW-03, -04, 07, -08, -11, and W-5A). These low concentrations appear to be stable, and have remained so for over two years required by the ROD. Additionally, the Navy has completed an investigation of the presence of a small volume of free product at A3-MW-07. The conclusions of the investigation, performed in two phases according to a plan of action submitted by the Navy to the U.S. EPA and ADEQ in January 2004, support site closure. Therefore, based on the results of the free product investigation and the LTM data, the Navy recommends site closure and termination of long-term groundwater monitoring at OU-1, Area 3.

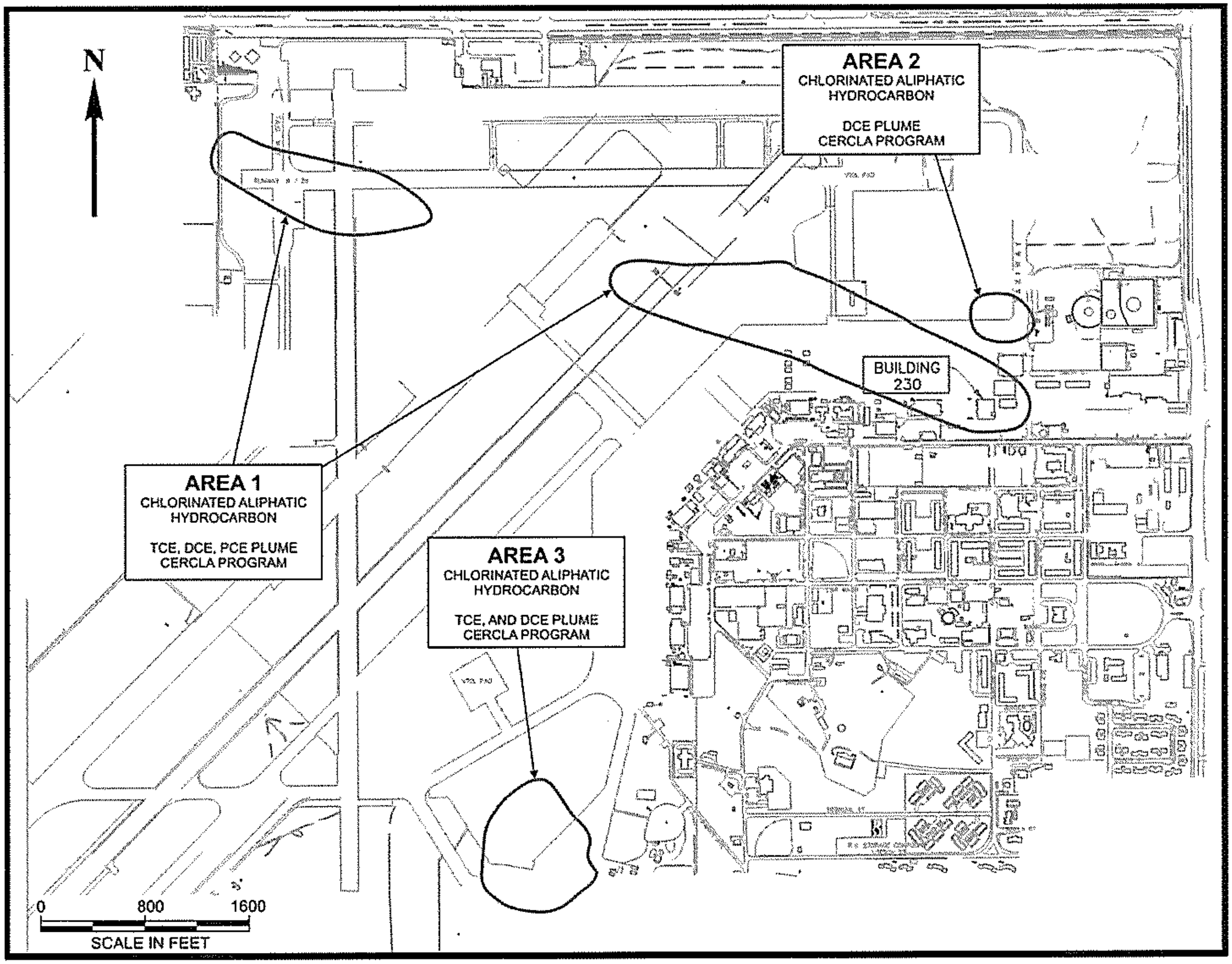


Figure 1. Site Location Map

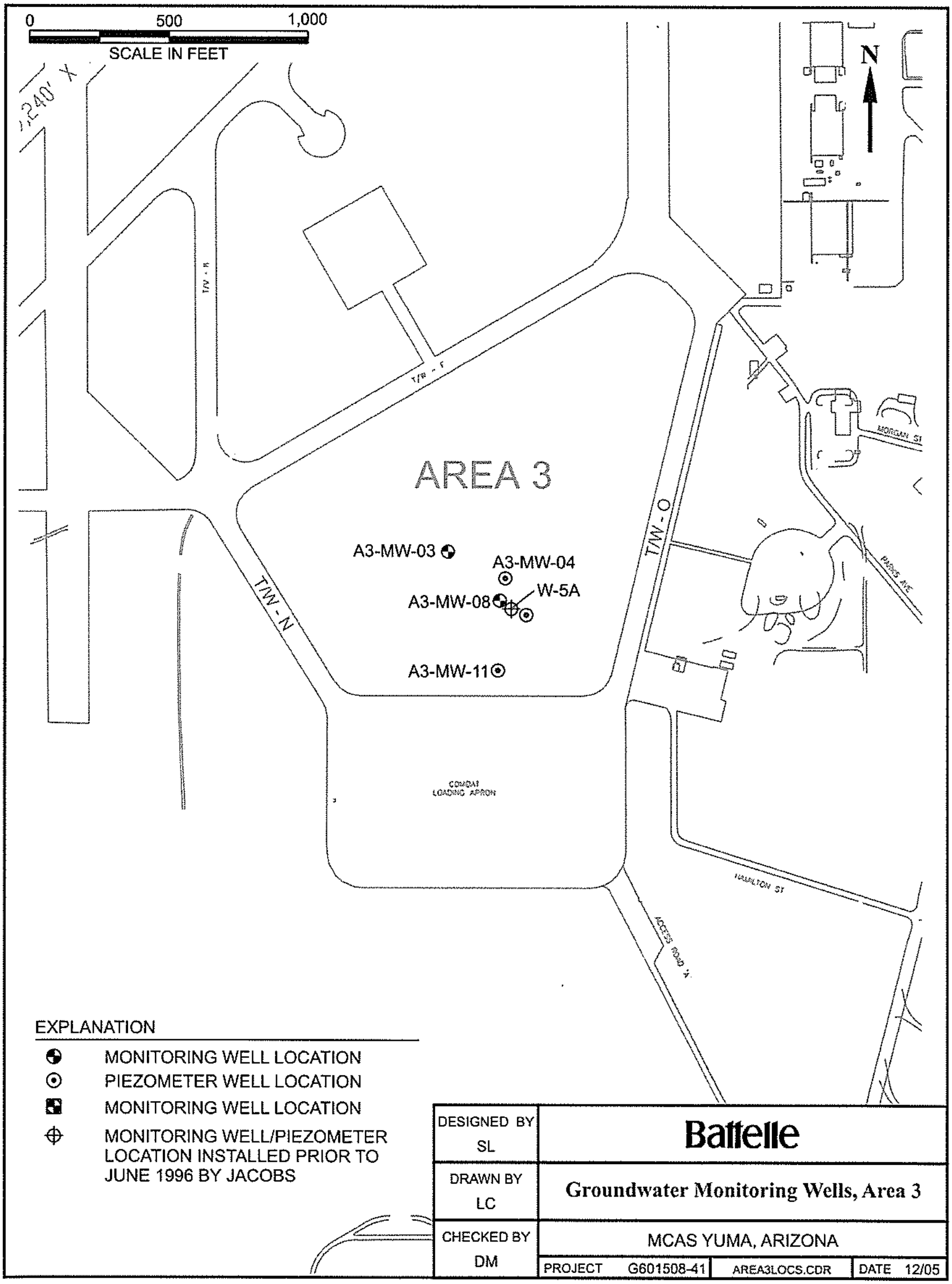
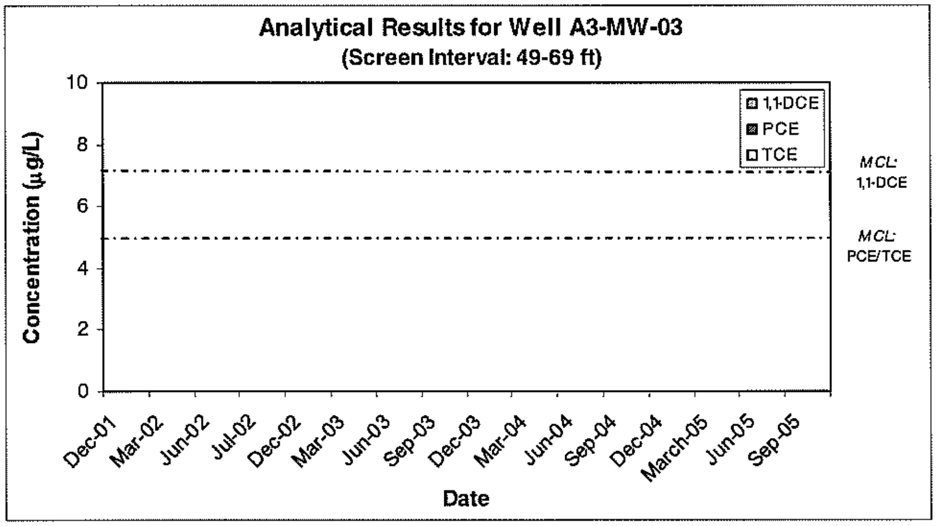
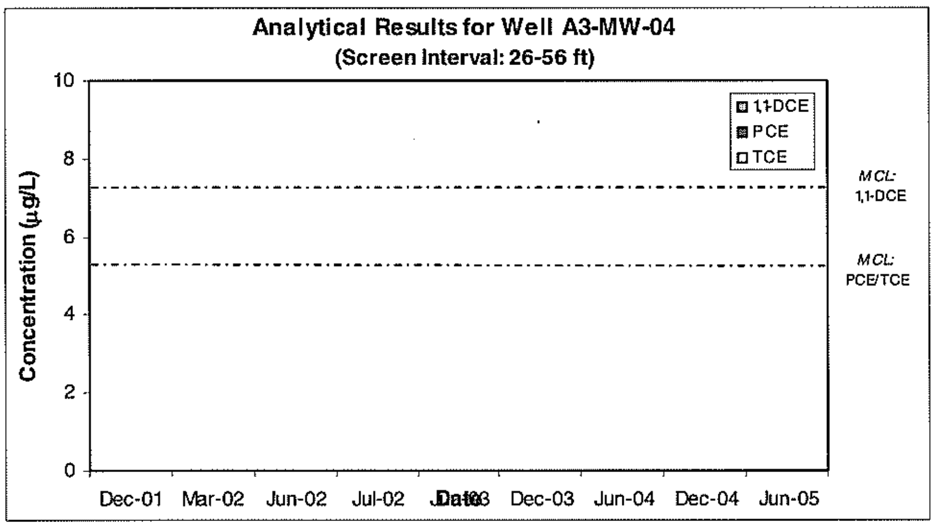
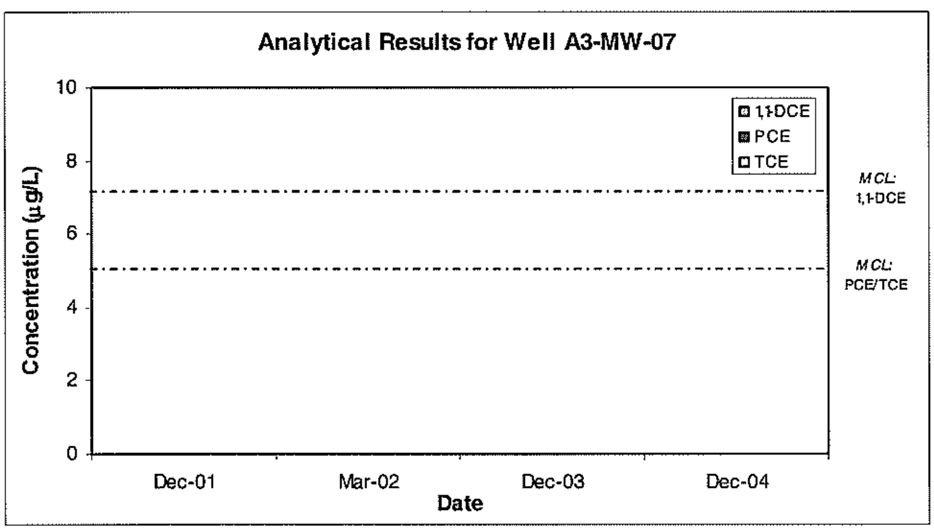


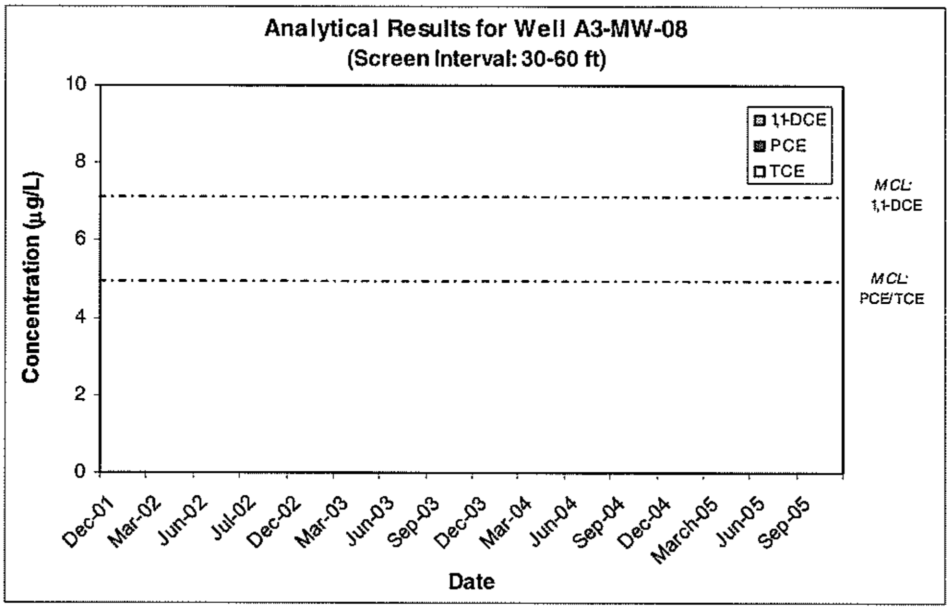
Figure 3. Groundwater Monitoring Wells, Area 3

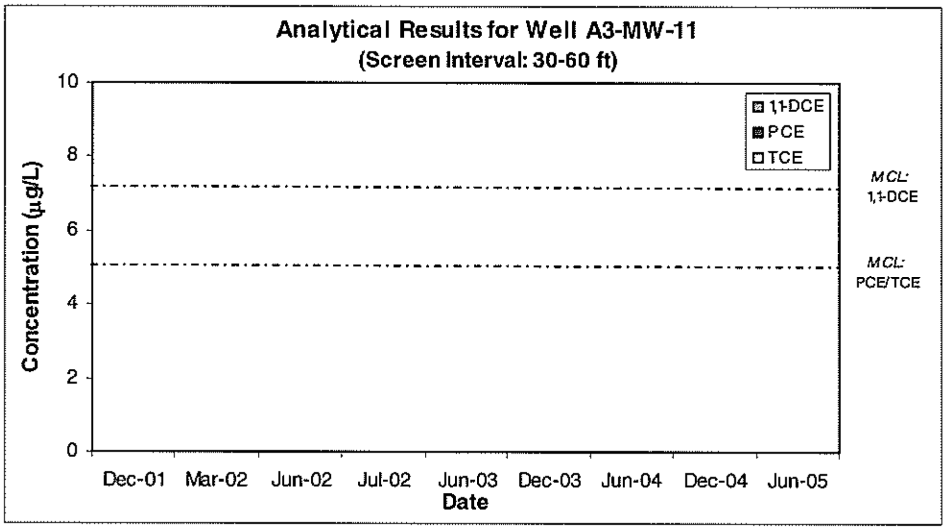
Figure 3. Historical and Current COC Concentrations at OU-1, Area 3








Analytical Results for Well A3-MW-08
(Screen Interval: 30-60 ft)
Concentration (µg/L)
10
8
6
4
2
0
1,1-DCE
PCE
TCE
MCL: 1,1-DCE
MCL: PCE/TCE
Dec-01
Mar-02
Jun-02
Jul-02
Dec-02
Mar-03
Jun-03
Sep-03
Dec-03
Mar-04
Jun-04
Sep-04
Dec-04
March-05
Jun-05
Sep-05
Date


Analytical Results for Well A3-MW-11
(Screen Interval: 30-60 ft)
Concentration (µg/L)
10
8
6
4
2
0
1,1-DCE
PCE
TCE
MCL: 1,1-DCE
MCL: PCE/TCE
Dec-01
Mar-02
Jun-02
Jul-02
Jun-03
Dec-03
Jun-04
Dec-04
Jun-05
Date

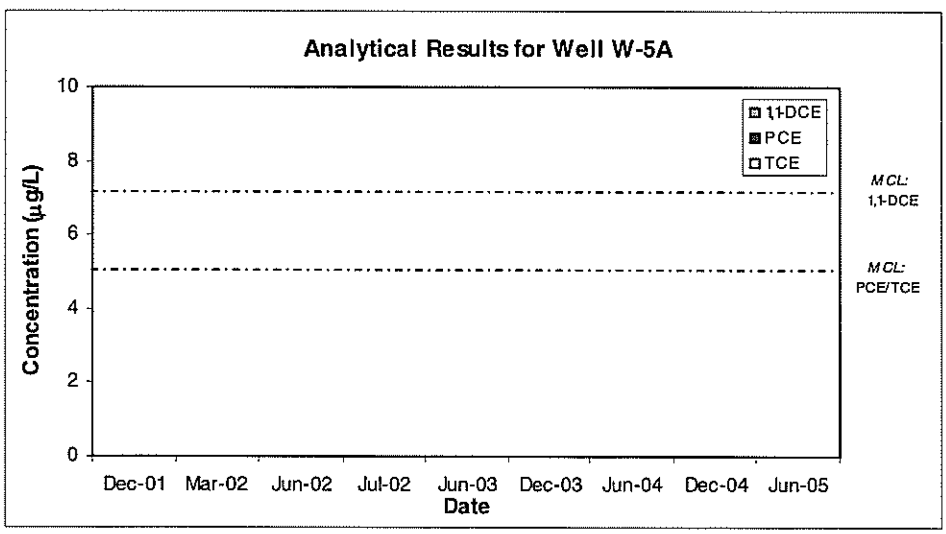

Analytical Results for Well W-5A
Concentration (µg/L)
10
8
6
4
2
0
1,1-DCE
PCE
TCE
MCL: 1,1-DCE
MCL: PCE/TCE
Dec-01
Mar-02
Jun-02
Jul-02
Jun-03
Dec-03
Jun-04
Dec-04
Jun-05
Date

Table 1. Groundwater Monitoring Results at OU-1, Area 3

WELL ID NUMBER	WELL LOCATION	DATE SAMPLED	CONTAMINANTS OF CONCERN (MCL) 1,1-DCE *(7 ug/L)*	TCE *(5 ug/L)*
A3-MW-03	Area 3	Dec-01	ND	ND
A3-MW-03	Area 3	Mar-02	ND	ND
A3-MW-03	Area 3	Jun-02	ND	ND
A3-MW-03	Area 3	Jul-02	ND	ND
A3-MW-03	Area 3	Dec-02	ND	ND
A3-MW-03	Area 3	Mar-03	ND	ND
A3-MW-03	Area 3	Jun-03	ND	ND
A3-MW-03	Area 3	Sep-03	ND	ND
A3-MW-03	Area 3	Dec-03	ND	ND
A3-MW-03	Area 3	Mar-04	ND	ND
A3-MW-03 DUP	Area 3	Mar-04	ND	ND
A3-MW-03	Area 3	Jun-04	ND	ND
A3-MW-03	Area 3	Sep-04	ND	ND
A3-MW-03	Area 3	Dec-04	ND	ND
A3-MW-03	Area 3	March-05	ND	ND
A3-MW-03	Area 3	Jun-05	ND	ND
A3-MW-03	Area 3	Sep-05	ND	ND
A3-MW-04	Area 3	Dec-01	ND	ND
A3-MW-04 DUP	Area 3	Dec-01	ND	ND
A3-MW-04	Area 3	Mar-02	ND	ND
A3-MW-04	Area 3	Jun-02	ND	ND
A3-MW-04	Area 3	Jul-02	ND	ND
A3-MW-04	Area 3	Jun-03	ND	ND
A3-MW-04	Area 3	Dec-03	ND	ND
A3-MW-04	Area 3	Jun-04	ND	ND
A3-MW-04	Area 3	Dec-04	ND	ND
A3-MW-04	Area 3	Jun-05	ND	ND
A3-MW-07	Area 3	Dec-01	ND	ND
A3-MW-07	Area 3	Mar-02	ND	ND
A3-MW-07	Area 3	Dec-03	ND	ND
A3-MW-07	Area 3	Dec-04	ND	ND
A3-MW-08	Area 3	Dec-01	ND	ND
A3-MW-08	Area 3	Mar-02	ND	ND
A3-MW-08 DUP	Area 3	Mar-02	ND	ND
A3-MW-08	Area 3	Jun-02	ND	ND
A3-MW-08	Area 3	Jul-02	ND	ND
A3-MW-08	Area 3	Dec-02	ND	ND
A3-MW-08	Area 3	Mar-03	ND	ND
A3-MW-08	Area 3	Jun-03	ND	ND
A3-MW-08	Area 3	Sep-03	ND	ND
A3-MW-08	Area 3	Dec-03	ND	ND
A3-MW-08	Area 3	Mar-04	ND	ND
A3-MW-08	Area 3	Jun-04	ND	ND
A3-MW-08	Area 3	Sep-04	ND	ND
A3-MW-08	Area 3	Dec-04	ND	ND

WELL ID NUMBER	WELL LOCATION	DATE SAMPLED	CONTAMINANTS OF CONCERN (MCL) 1,1-DCE *(7 ug/L)*	TCE *(5 ug/L)*
A3-MW-08	Area 3	March-05	ND	ND
A3-MW-08	Area 3	Jun-05	ND	ND
A3-MW-08	Area 3	Sep-05	ND	ND
A3-MW-08 DUP	Area 3	Sep-05	ND	ND
A3-MW-11	Area 3	Dec-01	ND	ND
A3-MW-11	Area 3	Mar-02	ND	ND
A3-MW-11	Area 3	Jun-02	ND	ND
A3-MW-11	Area 3	Jul-02	ND	ND
A3-MW-11	Area 3	Jun-03	ND	ND
A3-MW-11 DUP	Area 3	Jun-03	ND	ND
A3-MW-11	Area 3	Dec-03	ND	ND
A3-MW-11	Area 3	Jun-04	ND	ND
A3-MW-11	Area 3	Dec-04	ND	ND
A3-MW-11	Area 3	Jun-05	ND	ND
W-5A	Area 3	Dec-01	ND	ND
W-5A	Area 3	Mar-02	ND	ND
W-5A	Area 3	Jun-02	ND	ND
W-5A	Area 3	Jul-02	ND	ND
W-5A	Area 3	Jun-03	ND	ND
W-5A	Area 3	Dec-03	ND	ND
W-5A	Area 3	Jun-04	ND	ND
W-5A	Area 3	Dec-04	ND	ND
W-5A	Area 3	Jun-05	ND	ND

ND = not detected
Highlighted cells indicate detections above the MCL.

Appendix B10

Area 6 Closure Technical Memorandum with U.S. EPA and ADEQ Concurrence

M62974.001173
MCAS YUMA
SSIC NO. 5090.3

November 20, 2003

MEMORANDUM FOR THE RECORD

From: Mr. Martin Hausladen, U.S. Environmental Protection Agency
Region 9 – Federal Facilities/Superfund Division
75 Hawthorne Street, San Francisco, CA 94105

To: Angie Lind, Lead RPM, Southwestdiv Naval Facilities Engineering Command

SUBJECT: PROPOSAL TO CLOSE AREA 6, OPERABLE UNIT ONE, MARINE CORPS AIR STATION, YUMA ARIZONA

Ref (a): Southwestdiv Naval Facilities Engineering Command ltr 5090 Ser 5DEN.AL/3140 of 3 Sep 03

Reference (a) requested EPA's concurrence to site closure and an end to Long-Term Monitoring (LTM) at Area 6.

After reviewing reference (a), EPA concurs with the recommendation for Area 6 site closure and an end to LTM, since Volatile Organic Compound concentrations have been below the Maximum Contaminant Level for two years.

Sincerely,

Martin Hausladen

MARTIN HAUSLADEN

Copy to: Frank Smaila, ADEQ, Phoenix, AZ (w/o enclosure)
Carol Lewis, MCAS Yuma, AZ
Herbert "Gil" Guillory, MCAS Yuma, AZ
Diane Silva, Southwest Division Admin Record

(619) 532-1195

Janet Napolitano
Governor

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

1110 West Washington Street • Phoenix, Arizona 85007
(602) 771-2300 • www.adeq.state.az.us

Stephen A. Owens
Director

October 21, 2003
FPU-04-053

Ms. Angie Lind
Remedial Project Manager
Naval Facilities Engr'g Command SW Div.
1220 Pacific Highway
San Diego, CA. 92132-5190

Re: "Technical Memorandum Operable Unit 1 Area 6 Site Closure, Marine Corps Air Station Yuma Arizona", dated September 3, 2003, prepared by Battelle, received September 5, 2003

Dear Ms. Lind:

The Arizona Department of Environmental Quality (ADEQ) has completed a review of the above-referenced correspondence from the U.S. Navy and its contractor, Battelle. Based on historical and present data, ADEQ has concurred that the Operable Unit 1 Area 6 site does not require any further investigation or remediation, and meets the requirements for closure. The following summary forms the basis of our decision.

- Groundwater monitoring at Area 6 has not detected volatile organic compounds (VOCs) in excess of maximum contaminant levels (MCLs) since May 16, 2000. Only well 317-MW-01, with a maximum PCE concentration of 9µg/L in August 1999 and March 2000, is known to have ever exceeded MCLs. Further monitoring of Area 6 groundwater monitoring wells is not justified.

- It appears that the U.S. Navy has met the requirements for long term monitoring of Area 6 as outlined in the OU-1 Record of Decision (ROD), and upon receipt of U.S. EPA and ADEQ concurrence may discontinue Long-Term Monitoring (LTM) at Area 6.

In conclusion, ADEQ is closing the above site and not requiring additional work at this time. However, if in the future, evidence of previously undocumented contamination is discovered at, or emanating from, this facility, the ADEQ will require additional investigation including necessary remediation. This letter shall not be construed as a determination by the ADEQ of the referenced sites compliance with any other applicable laws and requirements. This letter does not affect the status of any other ADEQ Program for this facility. The ADEQ may revoke or amend this letter if any of the submitted information is determined to be inaccurate or if any condition was unknown to the ADEQ at the time this letter was issued.

If you have any questions or concerns with the attached comments, please contact me at 602-771-4237 or e-mail at smaila.frank@ev.state.az.us.

Sincerely,

Frank M. Smaila

Frank M. Smaila
Project Manager, Federal Projects Unit
Superfund Programs Section
Waste Program Division

cc: Mr. Moses Olade, ADEQ Manager, Federal Projects
Mr. Don Atkinson, ADEQ Hydrologist
Mr. Martin Hausladen, US EPA Project Manager
File: 4210.8.1.1.1 & 9.6

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132 - 5190

5090
Ser 5DEN.AL/3140
September 3, 2003

Mr. Martin Hausladen
U.S. Environmental Protection Agency
Region 9 - Federal Facilities/Superfund Division
75 Hawthorne Street
San Francisco, CA 94105

Mr. Frank M. Smaila
Arizona Department of Environmental Quality
Federal Projects Unit, Superfund Program Section,
Waste Program Division
1110 West Washington Street
Phoenix, AZ 85007

Gentlemen:

SUBJECT: PROPOSAL TO CLOSE AREA 6, OPERABLE UNIT ONE, MARINE CORPS AIR STATION, YUMA ARIZONA

As noted in the Response to Comments of our 18 July 2003 meeting (our letter 5090 Ser 5DEN.AL/3085 of 24 July 2003), the Department of the Navy is proposing site closure and an end to long-term monitoring (LTM) at Area 6, Operable Unit One (OU-1), Marine Corps Air Station Yuma, Arizona.

Section 2.13.2.2 of the Record of Decision states that when monitoring indicates that volatile organic compound (VOC) concentrations have decreased to Maximum Contaminant Levels (MCLs), the LTM program will continue for a minimum of 2 additional years. If there is no significant rebound in VOC concentrations above MCLs, the Navy can propose that the LTM program be terminated. The Navy has monitored groundwater at Area 6 for more than two years to demonstrate that the selected remedy has effectively and permanently reduced the VOC contamination to well within cleanup standards. Please refer to the enclosed Technical Memorandum, including a summary of monitoring data for Area 6 provided in Figure 2.

5090
Ser 5DEN.AL/3140
September 3, 2003

Request your concurrence and/or comments in writing by 30 September 2003.

If you have any questions regarding this letter, please contact me at (619) 532-4228 or Don Bosch at (619) 532-4046.

Sincerely,

ANGIE LIND
Remedial Project Manager
By direction of the Commander

Encl: 1. Technical Memorandum, Area 6, Operable Unit 1 Site Closure

Copy to:
Mr. Herbert "Gil" Guillory, MCAS Yuma Environmental
Ms. Carol Lewis, MCAS Yuma Installation Restoration Program Manager
Ms. Diane Silva, Admin Record

TECHNICAL MEMORANDUM
Operable Unit 1 Area 6 Site Closure
Marine Corps Air Station, Yuma, Arizona
Contract No. N68711-01-D-6009
Task Order No. 001

Introduction

Battelle has been contracted to collect and analyze groundwater samples for the LTM Plan at MCAS Yuma for Area 6. This data was used to evaluate whether Area 6 can be closed in accordance with the Record of Decision (ROD) criteria. The data review of Area 6 groundwater monitoring wells is being addressed in this Technical Memorandum. A site location map is provided as Figure 1.

Site Description

MCAS Yuma is an active facility located immediately southeast of the city of Yuma, Arizona. Previous activities at MCAS Yuma resulted in the release of volatile organic compounds (VOCs) to groundwater. Four areas (i.e., Areas 1, 2, 3 and 6) were impacted by chlorinated hydrocarbons. The OU-1 chlorinated hydrocarbon plumes were investigated as part of the Department of Navy (DON) Installation Restoration Program established in 1980. A final ROD for OU-1 was signed by the United States Environmental Protection Agency (U.S.EPA) and the Arizona Department of Environmental Quality (ADEQ) in September and October 2000, respectively. The remedial action objectives established for this effort are the Maximum Contaminant Levels (MCLs) based on the Safe Drinking Water Act (SDWA). The contaminant of concern (COC) in Area 6 is perchloroethlyene (PCE), with an MCL of 5 μg/L.

The Area 6 plume is located south of the Central Receiving Warehouse (Building 328), where a small plume of primarily PCE was detected in the vicinity of three former concrete tanks that stored fuel. PCE concentrations have steadily decreased in this area.

Selected Remedy Description

The Area 6 plume was a relatively small, stable PCE plume. The major components of the selected remedy (Alternative 2 - Institutional Controls and Monitored Natural Attenuation) are as follows:

- Implementing institutional controls on MCAS Yuma
- Operating and maintaining an LTM plan that includes periodic monitoring of selected COCs in groundwater monitoring wells, to be specified in a post-ROD OU-1 groundwater remedial action LTM plan; and
- Closure criteria.

According to the ROD, the Navy will monitor the groundwater as specified in the LTM plan until it is demonstrated that the remedial action has effectively and permanently reduced the VOC contamination to cleanup standards (i.e., MCLs). When monitoring indicates that VOC concentrations have decreased to at or below MCLs, the LTM program will continue for a minimum of two additional years. In accordance with Section 2.13.2.2 of the ROD, if there is no significant rebound in VOC concentrations above MCLs, the Navy can propose that the LTM program be terminated.

Area 6 Data Review

Historically, five wells have been monitored in Area 6 for chlorinated hydrocarbons, including PCE, trichloroethylene (TCE), and 1,1-dichloroethylene (1,1-DCE). These wells are identified as Wells 317-MW-01, 335-MW-01, 335-MW-02, 335-MW-03, and 335-MW-05. Wells 317-MW-01 is currently monitored on a quarterly basis and 335-MW-01 on a semi-annual basis as specified in the LTM Plan.

A summary of the available data for Area 6 is presented in Figure 2. Results indicate that only PCE exceeded its MCL in one well (317-MW-01) during two sampling events (March 7 and May 16, 2000). The following 16 sampling events have resulted in PCE levels below MCL in Well 317-MW-01. Results from the other monitoring wells indicate no MCL exceedance during any monitoring event.

A brief summary of each monitoring well is provided below. Please note that the detection limit is 2.0 μg/L for samples taken prior to December 2001 and 1.0 μg/L for samples taken December 2001 to present:

- **317-MW-01.** Data from 18 sampling events from March 2000 to June 2003 are available for this well. 1,1-DCE and TCE data were all below the respective MCL, ranging from a maximum concentration of 4.0 μg/L in October 2000 to non-detect (below detection limits). Except for two exceedances (i.e., 9.0 μg/L on March 7, 2000 and 6.0 μg/L on May 16, 2000), PCE concentrations were all below the MCL, ranging from a maximum concentration of 4.0 μg/L in June 2000 to below detection limits in March 2003.

- **335-MW-01.** Data from 13 sampling events from March 2000 to June 2003 are available for this well. 1,1-DCE and TCE data were not detected (except for June 2000 with 1,1-DCE at 0.3J μg/L). PCE concentrations were all below the MCL, ranging from a maximum concentration of 0.80J μg/L in March 2000 and June 2001 to below detection limits in June 2003.

- **335-MW-02**. Data from 12 sampling events from March 2000 to July 2002 are available for this well. 1,1-DCE and TCE data were not detected (except for June 2000 with TCE concentration at 0.70J μg/L). PCE concentrations were all below the MCL, ranging from a maximum concentration of 0.60 μg/L in June 2001 to below detection limits in September 2000.

- **335-MW-03**. Data from 12 sampling events from March 2000 to July 2002 are available for this well. 1,1-DCE and TCE data were not detected (except for June 2000 with TCE concentration at 0.70J μg/L). PCE concentrations were all below the MCL, ranging from a maximum concentration of 0.50 μg/L in June and September 2001 to below detection limits in September 2000 and June 2002.

- **335-MW-05.** Data from 10 sampling events from March 2000 to March 2002 are available for this well. 1,1-DCE and TCE data were not detected (except for March 2000 with TCE concentration at 0.30J μg/L). PCE concentrations were all below the MCL, ranging from a maximum concentration of 0.93J μg/L in March 2002 to 0.40 μg/L in September 2001.

Conclusions and Recommendations

Because the requirements for site closure under the ROD have been met (i.e., no exceedance of the MCL for 2 years), we recommend site closure for Area 6, and that LTM in this area be terminated.

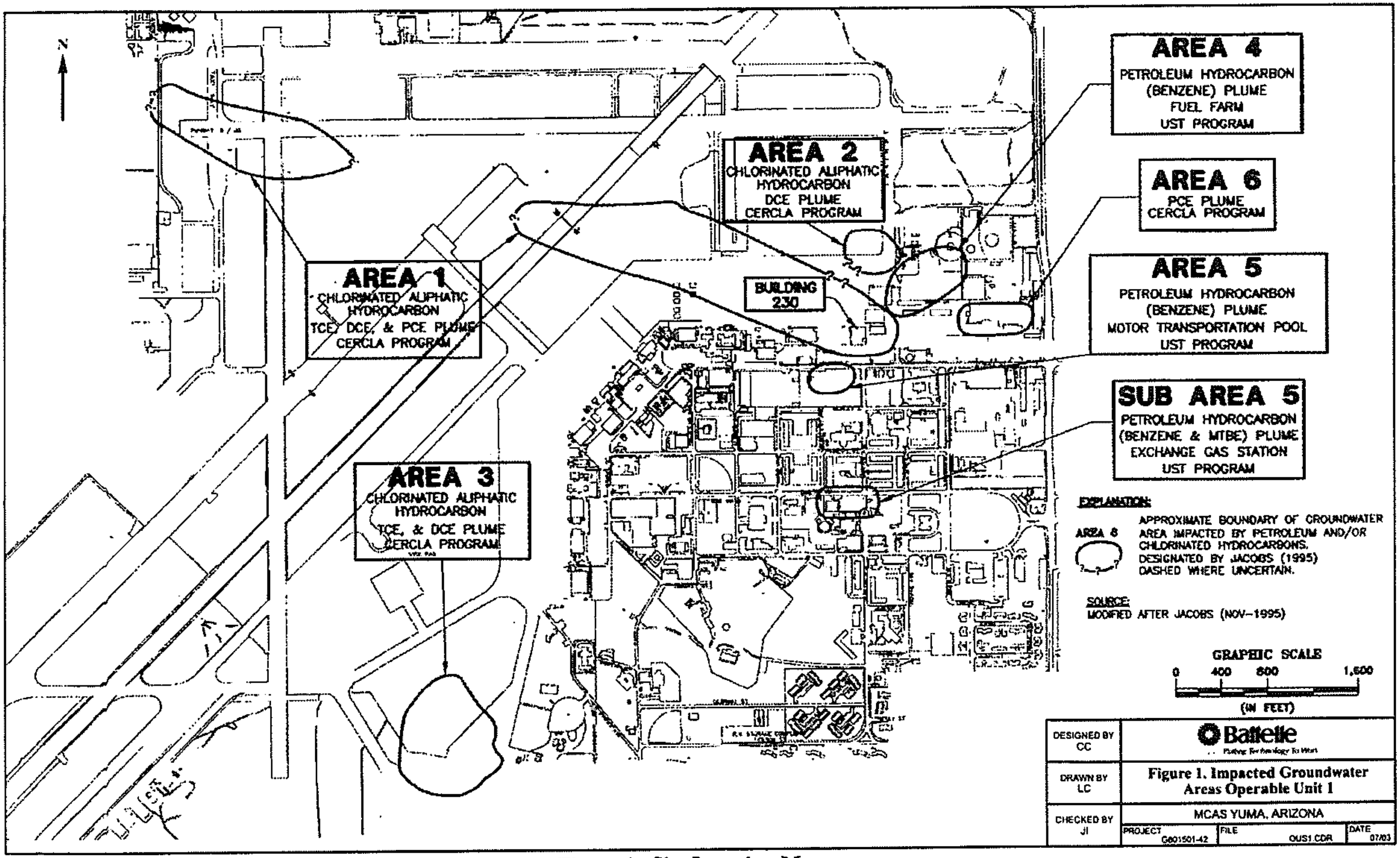
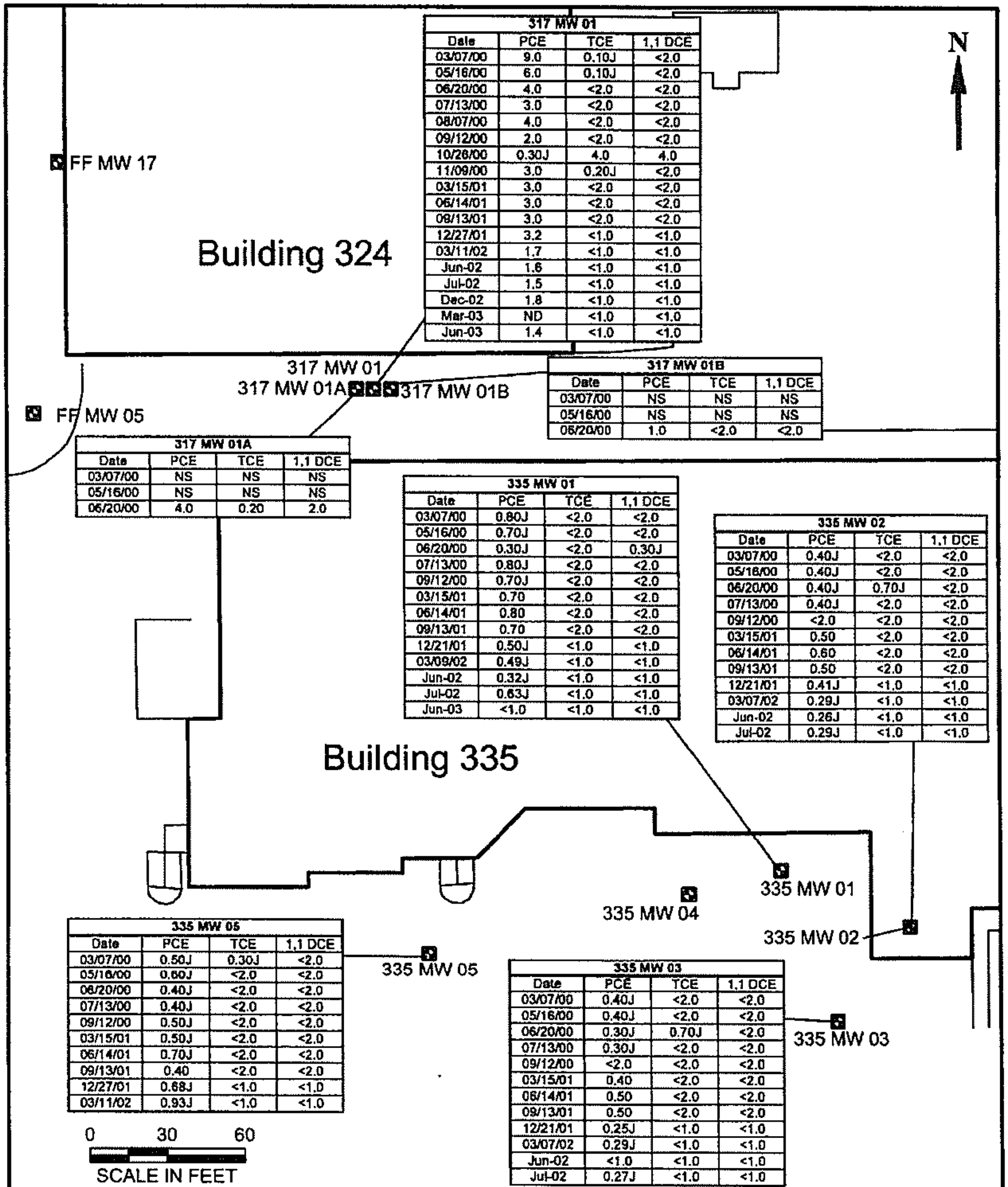


Figure 1. Site Location Map



317 MW 01			
Date	PCE	TCE	1,1 DCE
03/07/00	9.0	0.10J	<2.0
05/16/00	6.0	0.10J	<2.0
06/20/00	4.0	<2.0	<2.0
07/13/00	3.0	<2.0	<2.0
08/07/00	4.0	<2.0	<2.0
09/12/00	2.0	<2.0	<2.0
10/26/00	0.30J	4.0	4.0
11/09/00	3.0	0.20J	<2.0
03/15/01	3.0	<2.0	<2.0
06/14/01	3.0	<2.0	<2.0
09/13/01	3.0	<2.0	<2.0
12/27/01	3.2	<1.0	<1.0
03/11/02	1.7	<1.0	<1.0
Jun-02	1.6	<1.0	<1.0
Jul-02	1.5	<1.0	<1.0
Dec-02	1.8	<1.0	<1.0
Mar-03	ND	<1.0	<1.0
Jun-03	1.4	<1.0	<1.0

317 MW 01B			
Date	PCE	TCE	1,1 DCE
03/07/00	NS	NS	NS
05/16/00	NS	NS	NS
06/20/00	1.0	<2.0	<2.0

317 MW 01A			
Date	PCE	TCE	1,1 DCE
03/07/00	NS	NS	NS
05/16/00	NS	NS	NS
06/20/00	4.0	0.20	2.0

335 MW 01			
Date	PCE	TCE	1,1 DCE
03/07/00	0.80J	<2.0	<2.0
05/16/00	0.70J	<2.0	<2.0
06/20/00	0.30J	<2.0	0.30J
07/13/00	0.80J	<2.0	<2.0
09/12/00	0.70J	<2.0	<2.0
03/15/01	0.70	<2.0	<2.0
06/14/01	0.80	<2.0	<2.0
09/13/01	0.70	<2.0	<2.0
12/21/01	0.50J	<1.0	<1.0
03/09/02	0.49J	<1.0	<1.0
Jun-02	0.32J	<1.0	<1.0
Jul-02	0.63J	<1.0	<1.0
Jun-03	<1.0	<1.0	<1.0

335 MW 02			
Date	PCE	TCE	1,1 DCE
03/07/00	0.40J	<2.0	<2.0
05/16/00	0.40J	<2.0	<2.0
06/20/00	0.40J	0.70J	<2.0
07/13/00	0.40J	<2.0	<2.0
09/12/00	<2.0	<2.0	<2.0
03/15/01	0.50	<2.0	<2.0
06/14/01	0.60	<2.0	<2.0
09/13/01	0.50	<2.0	<2.0
12/21/01	0.41J	<1.0	<1.0
03/07/02	0.29J	<1.0	<1.0
Jun-02	0.26J	<1.0	<1.0
Jul-02	0.29J	<1.0	<1.0

335 MW 05			
Date	PCE	TCE	1,1 DCE
03/07/00	0.50J	0.30J	<2.0
05/16/00	0.60J	<2.0	<2.0
06/20/00	0.40J	<2.0	<2.0
07/13/00	0.40J	<2.0	<2.0
09/12/00	0.50J	<2.0	<2.0
03/15/01	0.50J	<2.0	<2.0
06/14/01	0.70J	<2.0	<2.0
09/13/01	0.40	<2.0	<2.0
12/27/01	0.68J	<1.0	<1.0
03/11/02	0.93J	<1.0	<1.0

335 MW 03			
Date	PCE	TCE	1,1 DCE
03/07/00	0.40J	<2.0	<2.0
05/16/00	0.40J	<2.0	<2.0
06/20/00	0.30J	0.70J	<2.0
07/13/00	0.30J	<2.0	<2.0
09/12/00	<2.0	<2.0	<2.0
03/15/01	0.40	<2.0	<2.0
06/14/01	0.50	<2.0	<2.0
09/13/01	0.50	<2.0	<2.0
12/21/01	0.25J	<1.0	<1.0
03/07/02	0.29J	<1.0	<1.0
Jun-02	<1.0	<1.0	<1.0
Jul-02	0.27J	<1.0	<1.0

EXPLANATION

■	MONITORING WELL LOCATION
ND	NOT DETECTED
NS	NOT SAMPLED
J	ESTIMATED VALUE

Note: Concentration units= µg/L

DESIGNED BY MG	Battelle ... Putting Technology To Work		
DRAWN BY LC	Distribution of DCE, TCE and PCE in Groundwater Monitoring Wells, Area 6		
CHECKED BY TW	MCAS YUMA, ARIZONA		
	G601501-14	AREA6_TABLES.DWG	07/03

Figure 2. Distribution of DCE, TCE, and PCE in Groundwater Monitoring Wells, Area 6, OU1

Appendix B11

OU-1 Revised LTM Plan Technical Memorandum with U.S. EPA Concurrence

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

11000
Ser OPCE.JDB/028
24 Jan 07

Ms. Cathy O'Connell
Arizona Department of Environmental Quality (ADEQ)
Federal Projects Unit, Superfund Programs Section, Waste Program Division
1110 West Washington Street
Phoenix, AZ 85007

SUBJECT: TECHNICAL MEMOS FOR THE REVISED LTM SCHEDULE AND THE SHUTDOWN OF THE HOT SPOT AS/SVE SYSTEM LOCATED AT THE MARINE CORPS AIR STATION (MCAS), YUMA ARIZONA

Dear Ms O'Connell:

The Department of the Navy proposed to diminish the sampling frequency of wells, reduce the number of wells being sampled, and temporarily shut down the Air Sparge/Soil Vapor Extraction System at Area 1, Operable Unit One (OU-1), MCAS Yuma, Arizona, in two separate technical memos sent to both ADEQ and U.S. Environmental Protection Agency (EPA) on 27 July and 16 August, 2006, respectively. These letters requested a response to the LTM schedule revision memo by 25 September, 2006, and a response to the Hot Spot temporary shutdown memo by 17 October, 2006, no response from ADEQ has been received. However, per enclosure (1), U.S. Environmental Protection Agency Region IX sent a concurrence letter.

This letter is to notify you that the Department of the Navy plans to proceed with the diminished sampling frequency of wells, reduced number of wells being sampled, and the temporary shut down of the Air Sparge/Soil Vapor Extraction System at Area 1 unless we receive a non-concurrence response from ADEQ within the next 10 days of receiving this correspondence. The Department of the Navy will assume ADEQ concurs with the recommendations in the memos otherwise.

If you have any questions please call me at (619) 532-1735.

Sincerely,

Juan Diez de Bonilla

JUAN DIEZ DE BONILLA
Remedial Project Manager
By Direction

Enclosure:
1. U.S. EPA Region IX Concurrence Letter dated November 28, 2006

Copy to:
U.S. EPA Region IX (Mr. Martin Hausladen)
Environmental Department, MCAS Yuma AZ (Mr. Dan Nail)
Arizona Department of Environmental Quality (ADEQ) (Bob Peeples)
Battelle, Environmental Restoration Department (Chris Coonfare)

OPCE.JAB
JC
OPES.FO

November 28, 2006

NAVFAC Southwest
Central Area Focus Team
1220 Pacific Highway (Building 1)
San Diego, CA 92132

Attention: Juan Diez de Bonilla
Remedial Project Manager

Subject: Technical Memos for the revised LTM schedule and the shutdown of the Hot Spot AS/SVE system located at the MCAS, Yuma, Arizona.

Mr. Diez de Bonilla

The Environmental Protection Agency (EPA) has completed its review of the above mentioned Technical Memos regarding Operational Unit (OU) 1 located at the Marine Corps Air Station (MCAS), Yuma, Arizona. One memo discusses the reduction of the number of wells sampled in addition to the reduced frequency of sampling events, except for the "hot spot" area. The second memo discusses the temporary shut down of the Air Sparge/ Soil Vapor Extraction System. The EPA concurs with the recommendations presented in the Technical Memos.

If you should have any further questions, pleases call me at (415) 972-3007.

Sincerely,

Martin Hausladen
Environmental Protection Agency

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser ROPDE.AL/6232
July 27, 2006

Mr. Martin Hausladen
U.S. Environmental Protection Agency
Region 9 - Federal Facilities/Superfund Division
75 Hawthorne Street
San Francisco, CA 94105

Ms. Cathy O'Connell
Arizona Department of Environmental Quality
Federal Projects Unit, Superfund Program Section,
Waste Program Division
1110 West Washington Street
Phoenix, AZ 85007

Dear Environmental Project Managers:

SUBJECT: REVISED PROPOSED CHANGES TO THE LONG TERM GROUNDWATER MONITORING (LTM) PLAN FOR MARINE CORPS AIR STATION YUMA, ARIZONA

In response to your recent comment, the Department of the Navy revised the enclosed LTM technical memorandum to include quarterly sampling at the "Hot Spot" in order to determine if a rebound in concentrations of Chlorinated Hydrocarbons occurs in preparation to a temporary shutdown of the Air Sparge/Soil Vapor Extraction system. However, the Department of the Navy is still proposing to reduce the number of monitoring wells being sampled base-wide including the "Hot Spot" and to reduce the frequency of groundwater monitoring from quarterly to semi-annual base-wide except at the "Hot Spot". The attached is a technical memorandum supporting these changes to the LTM Plan. The Department of the Navy will abandon the wells removed from the LTM Plan in accordance with Arizona Department of Water Resources well abandonment procedures.

The Department of the Navy is requesting your concurrence to the above-mentioned proposed LTM Plan changes in writing by September 25, 2006.

If you have any questions regarding this letter, please contact me at (619) 532-4228.

Sincerely,

ANGIE LIND
Remedial Project Manager
By direction of the Commanding Officer

Encl: 1. Technical Memorandum Groundwater Monitoring Schedule dated July 25, 2006

Copy to:
Mr. Ken Yargus, MCAS Yuma Environmental
Mr. Dan Nail, MCAS Yuma Installation Restoration Program Manager
Ms. Diane Silva, Admin Record

TECHNICAL MEMORANDUM
Groundwater Monitoring Schedule Revision
Marine Corps Air Station, Yuma, Arizona
Contract No. N68711-01-D-6009
Task Order No. 008

July 25, 2006

This technical memorandum summarizes the revisions to be made to the groundwater monitoring schedule developed in the *Final Work Plan for Long Term Groundwater Monitoring, Operable Unit 1 (Areas 1, 2, 3, 6, and Sub-Area 5A), MCAS, Yuma, Arizona*, dated September 2002, and as modified in the Technical Memorandum submitted by the Department of the Navy to the United States Environmental Protection Agency (U.S. EPA) and the Arizona Department of Environmental Quality (ADEQ) on December 1, 2003. The Long Term Monitoring (LTM) program was designed to evaluate the performance of the Vertical Circulation Treatment (VCT) system at the Leading Edge Plume Area (LEPA) and the Air Sparging/Soil Vapor Extraction (AS/SVE) system at the Hot Spot of Area 1 and to monitor contaminant concentrations in groundwater in Areas 2, 3 and 6 and SubArea 5A. Area 2, Area 3, Area 6, and SubArea 5A have received site closure approval from both U.S. EPA and ADEQ, and therefore are not included in the revised groundwater monitoring schedule described in this technical memorandum.

Site Description

MCAS Yuma is an active facility located immediately southeast of the city of Yuma, Arizona. Previous activities at MCAS Yuma resulted in the release of volatile organic compounds (VOCs) to the groundwater in the vicinity of the flight line, near Building 230. This area is currently referred to as the Hot Spot. The plume of contaminated groundwater extends to the northwest from the Hot Spot. The LEPA is located downgradient from the Hot Spot, adjacent to the Yuma Airport. The Hot Spot and LEPA are designated as Area 1 of OU-1. A final Record of Decision (ROD) for OU-1 was signed by the U.S. EPA and the ADEQ in September and October 2000, respectively. The remedial action objectives established for this effort are the Maximum Contaminant Levels (MCLs) based on the Safe Drinking Water Act (SDWA). The contaminants of concern (COCs) are 1,1-Dichloroethene (1,1-DCE), Perchloroethene (PCE), and Trichloroethene (TCE), and the MCLs are 7 μg/L, 5 μg/L, and 5 μg/L, respectively.

OU-1 is divided into six areas, of which five have received regulatory closure approval (Areas 2, 3, 4, 5, and 6). The remaining Area sampled under the LTM plan and the associated COCs are:

- Area 1 (Vicinity of Building 230): PCE, TCE, 1,1-DCE

Revisions to the current LTM plan are discussed below. Area 1 is divided into three zones (the Hot Spot, Interior Wells Central Plume, and LEPA/Northwest Station). The zones are discussed separately for clarity. The number of wells to be sampled at Area 1 is reduced to reflect the lack of detection of COCs at concentrations above the MCLs in many of the wells over the past two years. Area 2, Area 3, Area 6, and SubArea 5A have received regulatory closure approval since the last LTM revision and will not be included in the revised groundwater monitoring schedule.

Revisions to the Groundwater Monitoring Schedule

The groundwater monitoring schedule identifies groundwater wells selected for sampling, sampling frequency, and associated chemical analysis. Table 1 provides the current groundwater monitoring schedule established in the LTM Plan and modified according to the Technical Memorandum submitted by the Department of the Navy to the U.S. EPA and the ADEQ on December 1, 2003. Table 2 presents a revised schedule based on the monitoring results since June 2003. Wells in which the COCs were not detected above their respective MCLs for the last two years have been removed from the monitoring schedule, with the exception of selected wells retained due to their strategic locations. Two other wells (16-HS-13, with traditional low water levels, and 16-MW-18, with a small diameter) have been replaced with nearby wells to facilitate consistency in the purging and sampling method. The current LTM schedule incorporates four sampling events per year, including two quarterly events and a semi-annual event for VOCs, and an annual event for VOCs and natural attenuation parameters. The revised schedule reduces the sampling frequency to two events per year, with a semi-annual event for VOCs and an annual event for VOCs and natural attenuation parameters. The reduction in the sampling frequency is justified by the wealth of historical data from these wells, which demonstrates that significant changes in COC concentrations are not taking place from quarter to quarter. Quarterly sampling will be continued at the Hot Spot, to support the monitoring of potential COC rebound following the pending shutdown of the AS/SVE system. Figure 1 presents a map of the proposed monitoring well network. The proposed changes to be made in each area are discussed in the following paragraphs.

Area 1 Hot Spot. LTM activities in this area are being conducted as part of the performance monitoring of the AS/SVE System. Of the nine wells currently sampled at the Hot Spot, two wells (16-HS-11 and A1-MW-22) have not had COC concentrations above the MCLs for at least two years. These two wells have been removed from the proposed monitoring schedule. Well 16-HS-13 often has less than 2.5 ft of standing water in the well casing, which prevents the use of the purging pump used at the remainder of the wells. Well 16-MW-18 is a 2-inch diameter well, with a slight bend in the casing, that also prevents the use of the purging pump. Therefore, it is recommended that 16-HS-13 be replaced by A1-MW-18, which is 6 feet deeper than 16-HS-13 and which showed similar COC concentrations when sampled through August, 2002. It also is recommended that 16-MW-18 be replaced by 16-MW-08, a 4-inch diameter well which showed similar COC concentrations through August, 2002. The locations of the wells to be sampled in the Area 1 Hot Spot are shown in Figure 1.

Area 1 Interior Wells Central Plume. LTM activities in this area are conducted to assess the occurrence and extent of potential plume migration from the Hot Spot area towards the LEPA. Therefore, all wells in this group are located between the two areas. Of the sixteen wells sampled at the Area 1 Central Plume, eleven wells have not had COC concentrations above the MCLs for at least two years. Of these eleven wells (A1-MW-09, -10, -11A, -12, -15, -17, -20, -23, -38, -39, and 16-MW-12), two (A1-MW-15 and -23) have been retained, and the remaining nine have been removed from the proposed monitoring schedule. The locations of the wells to be sampled in the Area 1 Central Plume are shown in Figures 1 and 2.

LEPA/Northwest Station. Groundwater monitoring in this area is being conducted to monitor any rebounds in contaminant concentrations after the VCT system was temporarily shut down on May 6, 2003. No rebound in COC concentrations have been observed in the LEPA since the VCT system was turned off, and the Department of the Navy has submitted a request for permanent shutdown of the VCT system under the requirements set forth in the ROD. Of the twenty-seven wells sampled at the Area I LEPA/Northwest Station, twenty-five wells have not had COC concentrations above the MCLs for at least two years. The remaining two wells, A1-PZ-19 and A1-MW-27, are included in the revised monitoring schedule. Five other wells (A1-MW-01, -04, -05, -31, and -42) will be included in the monitoring schedule as downgradient wells, near the MCAS Yuma property boundary. The locations of the wells to be sampled in the Area 1 LEPA/Northwest Station are shown in Figures 2 and 3.

Area 2. The DON submitted a letter and Technical Memorandum to ADEQ and US EPA on March 13, 2006, requesting site closure of Area 2 and a termination of the LTM at Area 2. Site closure approval for Area 2 was received from the U.S. EPA on March 23, 2006. The Navy sent a second letter to ADEQ on May 25, 2006, indicating Navy plans to proceed with site closure and well abandonment activities if ADEQ did not respond within ten days. No response has been provided by ADEQ to this date. Therefore, no Area 2 monitoring wells are included in the revised LTM schedule.

Area 3. Groundwater monitoring has been conducted at Area 3 to monitor a former firefighter training area. None of the six wells sampled at Area 3 has had COC concentrations above the MCLs since sampling began in December 2001. The Navy also performed an investigation of the presence of free product at one of the Area 3 monitoring wells in June 2005. The Navy submitted a report detailing the free product investigation and a Technical Memorandum supporting site closure on December 14, 2005. The U.S. EPA provided their concurrence with the site closure request in a letter dated February 9, 2006. The Navy sent a second letter to ADEQ on February 15, 2006, indicating Navy plans to proceed with site closure and well abandonment activities if ADEQ did not respond within ten days. No response has been provided by ADEQ to this date. Therefore, the Area 3 wells have been removed from the revised groundwater monitoring schedule.

Area 6. The DON submitted a letter to ADEQ and US EPA on September 23, 2003, requesting site closure of Area 6 and a termination of the LTM at Area 6. Site closure approval for Area 6 was received from the U.S. EPA and ADEQ on October 21, 2003. Therefore, no Area 6 monitoring wells are included in the revised LTM schedule. All monitoring wells within Area 6 were abandoned in March 2005.

SubArea 5A. Site closure approval for SubArea 5A, a former underground storage tank (UST) site, was received from the ADEQ UST program on March 29, 2004. Therefore, the SubArea 5A wells have been removed from the revised LTM schedule. The SubArea 5A wells were abandoned in March 2005.

Table 1. Current Groundwater Monitoring Schedule for MCAS Yuma

	Quarterly VOCs	Semi-Annual VOCs	Annual VOCs	Annual Natural Attenuation Parameters[a]
Area 1 Hot Spot	**16-HS-03**	**A1-MW-19**		A1-MW-22
	16-HS-11	A1-MW-22		**A1-MW-37**
	16-HS-13	**A1-MW-37**		**16-HS-03**
	16-MW-18	**16-MW-06**		16-HS-11
	16-MW-09			**16-HS-13**
				16-MW-06
				16-MW-18
Area 1 Interior Wells Central Plume	A1-MW-12	**A1-MW-07**	16-MW-10	**A1-MW-07**
	A1-MW-13	**A1-MW-11**		**A1-MW-14**
	A1-MW-23	A1-MW-11A		16-MW-10
	A1-MW-38	**A1-MW-14**		
	A1-MW-39	A1-MW-15		
	A1-MW-09	A1-MW-20		
	A1-MW-17	16-MW-12		
	A1-MW-25			
LEPA Northwest Station	A1-MW-04	A1-MW-31	**A1-MW-27**	A1-MW-01
	A1-MW-05	A1-MW-33	A1-MW-28	A1-PZ-09
	A1-MW-01	A1-MW-42	A1-MW-29A	A1-PZ-21
	NW1-MW-01	A1-MW-43	A1-MW-30	A1-PZ-22
	A1-PZ-19	A1-MW-44		A1-PZ-24
	A1-PZ-15	A1-PZ-09		A1-PZ-28
	A1-PZ-16	A1-PZ-20		
	A1-PZ-17	A1-PZ-21		
	A1-PZ-18	A1-PZ-22		
	A1-PZ-24	A1-PZ-23		
	A1-PZ-26			
	A1-MW-06			
	A1-PZ-28			
AREA 2	A2-MW-02	A2-MW-03	A2-MW-01	A2-MW-01
	A2-MW-06	**A2-MW-04**		**A2-MW-09**
	A2-MW-07	A2-MW-05		FF-MW-24
		A2-MW-08		
		A2-MW-09		
		A2-MW-10		
		FF-MW-24		
AREA 3	A3-MW-03	W-5A	A3-MW-07	W-5A
	A3-MW-08	A3-MW-04		A3-MW-07
		A3-MW-11		

(a) Natural attenuation parameters: chloride, ferrous iron, sulfate, nitrate, pH, dissolved oxygen, redox potential.
Blue: sample results below MCLs previous 2 years. Bold: at least one sample result above MCLs in previous 2 years.
Red: one sample (of a duplicate pair) above an MCL in past 2 years (Jan-04, DCE = 10 and 6.9)

Table 2. Revised Groundwater Monitoring Schedule for MCAS Yuma

	Quarterly VOCs	Semi-Annual VOCs	Annual VOCs	Annual Natural Attenuation Parameters[a]
Area 1 Hot Spot	A1-MW-18	A1-MW-18	A1-MW-18	A1-MW-18
	A1-MW-19	A1-MW-19	A1-MW-19	A1-MW-37
	A1-MW-37	A1-MW-37	A1-MW-37	16-MW-06
	16-MW-06	16-MW-06	16-MW-06	16-MW-08
	16-MW-08	16-MW-08	16-MW-08	16-HS-03
	16-MW-09	16-MW-09	16-MW-09	
	16-HS-03	16-HS-03	16-HS-03	
Area 1 Interior Wells Central Plume		A1-MW-07	A1-MW-07	A1-MW-07
		A1-MW-11	A1-MW-11	A1-MW-14
		A1-MW-13	A1-MW-13	
		A1-MW-14	A1-MW-14	
		A1-MW-15	A1-MW-15	
		A1-MW-23	A1-MW-23	
		A1-MW-25	A1-MW-25	
Area 1 LEPA/Northwest Station		A1-PZ-19	A1-PZ-19	A1-MW-01
		A1-MW-01	A1-MW-01	A1-MW-27
		A1-MW-04	A1-MW-04	
		A1-MW-05	A1-NW-05	
		A1-MW-27	A1-MW-27	
		A1-MW-31	A1-MW-31	
		A1-MW-42	A1-MW-42	

(a) Natural attenuation parameters: chloride, ferrous iron, sulfate, nitrate, pH, dissolved oxygen, redox potential.

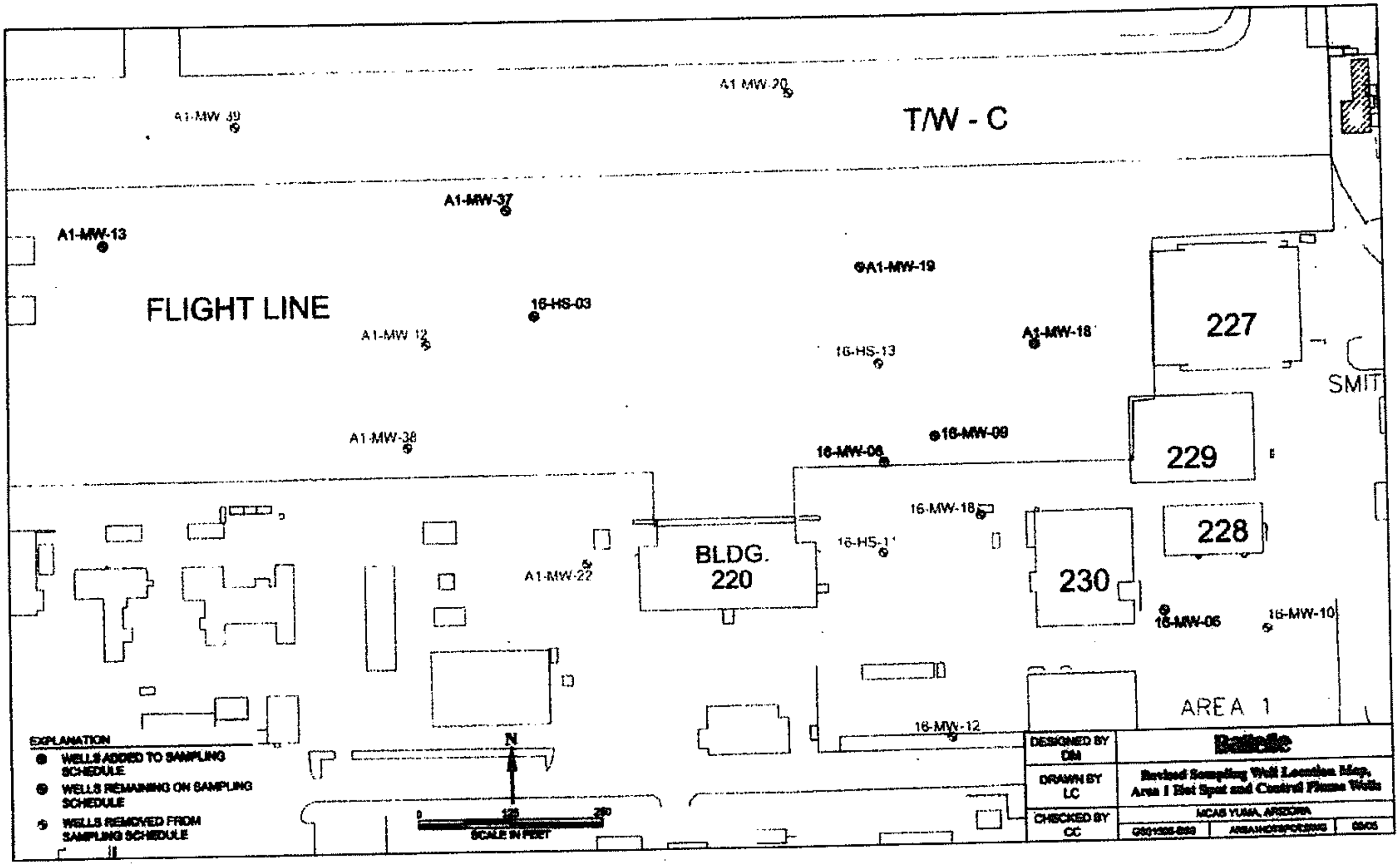


Figure 1. Revised Sampling Well Location Map, Area 1 Hot Spot and Central Plume

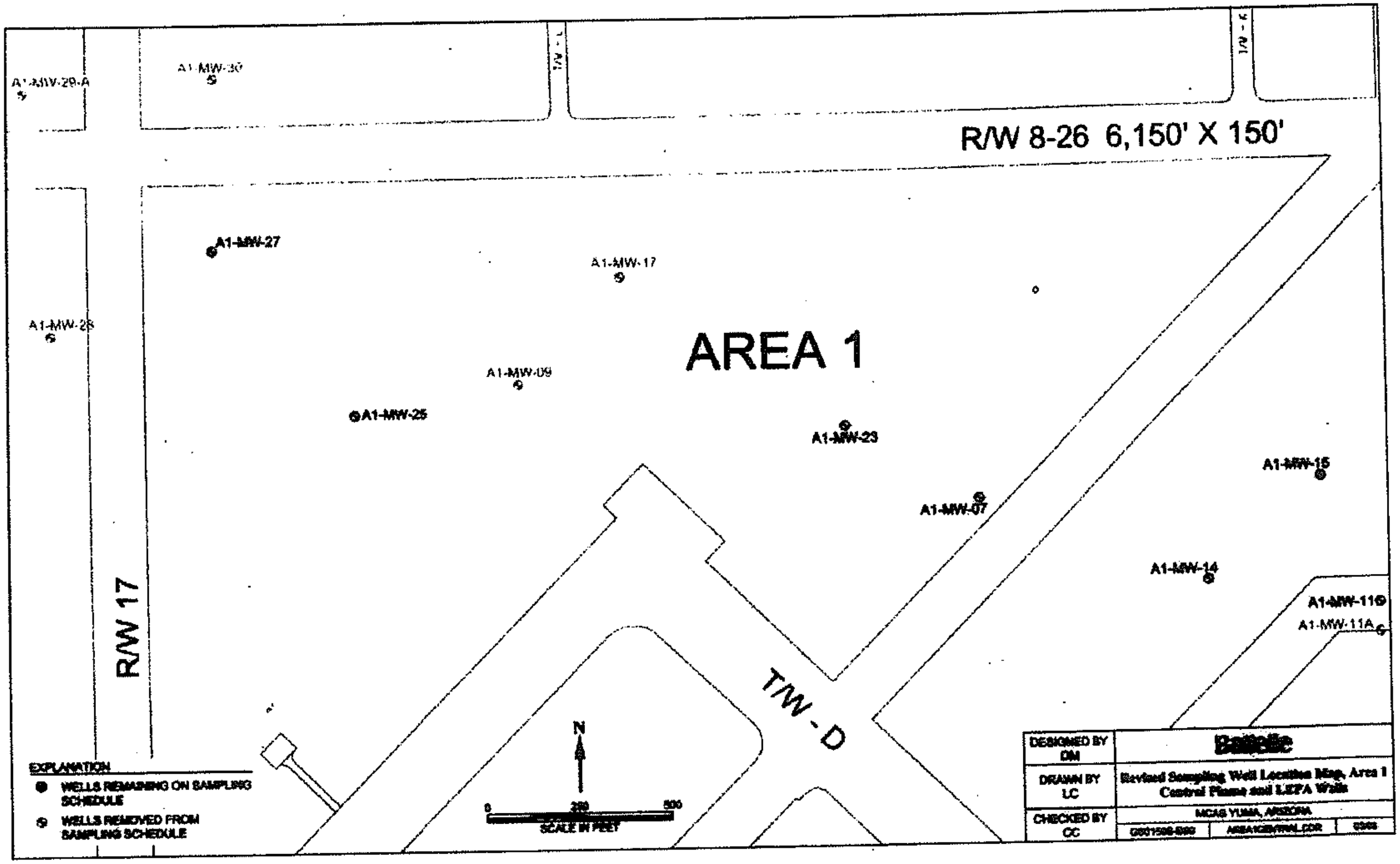


Figure 2. Revised Sampling Well Location Map, Area 1 Central Plume and LEPA

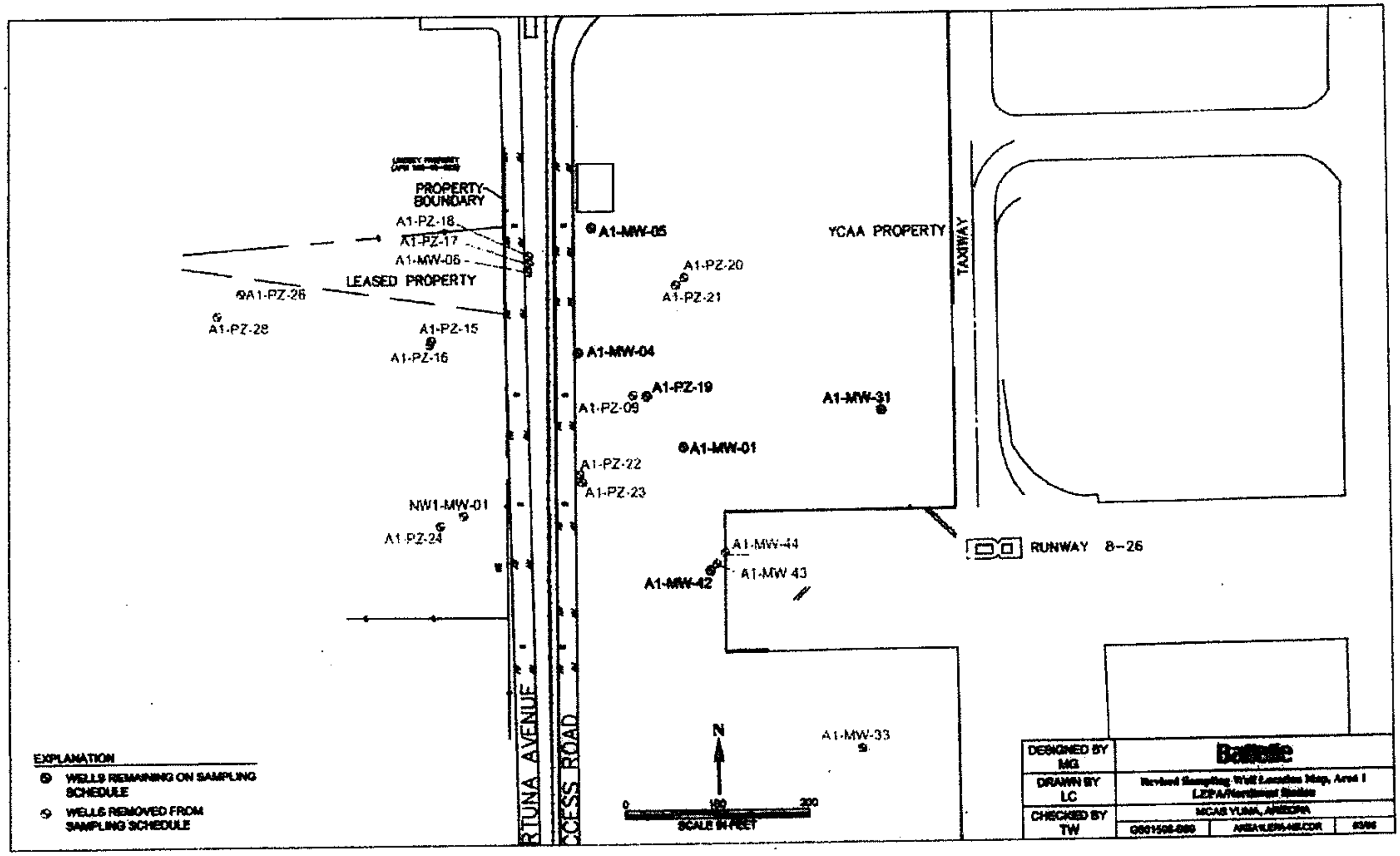


Figure 3. Revised Sampling Well Location Map, Area 1 LEPA/Northwest Station

Appendix B12

Five-Year Review Community Notification Bulletin

[illegible]

Publisher's Affidavit of Publication

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OF ARIZONA }
Y OF YUMA }

Joni Weerheim or Patrick Norris, having been first duly sworn, deposes and says: that The Sun is a newspaper of general circulation published daily in the City of Yuma, County of Yuma, State of Arizona; that (s)he is the publisher or business manager of said paper; that the

PUBLIC NOTICE:

a printed copy of which, as it appeared in said paper, is hereto attached and made a part of this affidavit, was published in The Sun

For ONE issues; that the date of the first publication of said PUBLIC NOTICE:

was MAY 10 ,2009 and the date of the last publication

being MAY 10 ,2009 and that the dates when said

PUBLIC NOTICE:

was printed and published in said paper were

MAY 10, 2009

Subscribed and sworn to before me, by the said Joni Weerheim or Patrick Norris

11 day of May, 2009

Barb Bajo
Notary Public

My commission expires

OFFICIAL SEAL
BARB BAJO
Commission # 254431
Notary Public - State of Arizona
YUMA COUNTY
My Comm. Expires November 1, 2009

PUBLIC NOTICE:

Marine Corps Air Station Yuma, AZ
Installation Restoration Program
Comprehensive Environmental Response,
Compensation, and Liability Act Five-Year Review
Begun for Operable Unit 1, Groundwater Cleanup, and
Operable Unit 2, Surface Soil Institutional Controls

Marine Corps Air Station (MCAS) Yuma has begun a five-year review of environmental cleanup actions (remedies) taken under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the MCAS Yuma Installation Restoration Program (IRP) to protect human health and the environment. CERCLA requires a review every five years for remedies that leave any contaminants within a cleanup site at levels greater than those allowed for residential use. The subject five-year review will look at the remedies for two CERCLA Operable Units (OUs) at MCAS Yuma. OU-1 includes active remediation and monitoring to clean up groundwater that has been affected by the release of chlorinated solvents from historical operations at MCAS Yuma. OU-2 restricts and controls the use of contaminated surface soil (0 to 10 feet below ground) at some MCAS industrial areas and an inactive landfill. These remedies were selected based on comments from state regulatory agencies and the public. All agreed that these remedies would: 1) reduce the amount of contamination to standards protective of public health and the environment; 2) maintain the chemical plumes to within the MCAS Yuma property boundary; and 3) ensure that personnel working on the base were not exposed to any unacceptable health risks.

The U.S. Environmental Protection Agency (EPA) signed the Record of Decision (ROD) for the OU-2 remedies on 2 December 1997, and the OU-1 ROD on 5 October 2000. The first five-year review for OU-2 was completed in December 2002, five years after the signing of the ROD. The first review for OU-1 was completed in November 2004, five years after the remedies discussed in the ROD were in place. The second scheduled review date for OU-2 (December 2007) was moved up to November 2004 so that both OUs would be on the same five-year cycle.

This review will not reconsider the remedies agreed upon in these RODs. Instead, it will re-evaluate each remedy's performance, and recommend improvements if the remedy is not performing as designed. The report's findings will be provided to the public when it is completed in November 2009. The full report will also be available at the Yuma County Public Library, 350 South Third Avenue, Yuma, AZ 85364; (928) 782-1871. Citizens with questions about the CERCLA Five-Year Review for Operable Units 1 & 2, MCAS Yuma, may contact: Mr. Dan Nail, Environmental Department, Marine Corps Air Station Yuma, Box 99110, Building 228, Yuma, AZ 85369-9110; (928) 269-5637; e-mail: danny.nail@usmc.mil.

Appendix C

Site Inspection Checklists and Associated Documentation

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: MCAS Yuma OU-1 Area 1	**Date of inspection:** 28-Jul-2009
Location and Region: Yuma County, AZ	**EPA ID:** AZ0971590062 (MCAS Yuma)
Agency, office, or company leading the five-year review: Naval Facilities Engineering Command Southwest	**Weather/temperature:** Sunny and Clear, 98 degrees F

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- Access controls
- ✓ Institutional controls
- Groundwater pump and treatment
- Surface water collection and treatment
- Other __________
- ✓ Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __________ __________ __________
Name Title Date
Interviewed at site at office by phone Phone no. __________
Problems, suggestions; Report attached __________

2. **O&M staff** __________ __________ __________
Name Title Date
Interviewed at site at office by phone Phone no. __________
Problems, suggestions; Report attached __________

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency MCAS Yuma Environmental Dept.

Contact	Name	Title	Date	Phone no.
	Dan Nail	IRP Manager	28-Jul-2009	928-269-5637

Problems; suggestions; ✓Report attached See Appendix D

Agency MCAS Yuma Environmental Dept.

Contact	Name	Title	Date	Phone no.
	Joe Britain	Environmental Engineer	28-Jul-2009	928-269-5581

Problems; suggestions; ✓Report attached See Appendix D

Agency NAVFAC Southwest

Contact	Name	Title	Date	Phone no.
	Derral VanWinkle	RPM	21-Oct-2009	

Problems; suggestions; ✓Report attached See Appendix D Email: derral.vanwinkle@navy.mil

Agency MCAS Yuma Environmental Dept.

Contact	Name	Title	Date	Phone no.
	Chris Kost	EMS Coordinator	14-Aug-2009	928-269-5207

Problems; suggestions; ✓Report attached See Appendix D

4. **Other interviews** (optional) ✓ Report attached.

Jeremy Nevin, MCAS Yuma ROICC, interviewed 28-Oct-2009, See Appendix D for details

David Rodriguez, MCAS Yuma Environmental Department Director, interviewed 06-Aug-2009, See Appendix D for details

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	**O&M Documents**			
	✓ O&M manual	✓ Readily available	✓ Up to date	N/A
	✓ As-built drawings	✓ Readily available	✓ Up to date	N/A
	✓ Maintenance logs	✓ Readily available	✓ Up to date	N/A
	Remarks________			
2.	✓ **Site-Specific Health and Safety Plan**	✓ Readily available	✓ Up to date	N/A
	✓ Contingency plan/emergency response plan	✓ Readily available	✓ Up to date	N/A
	Remarks________			
3.	✓ **O&M and OSHA Training Records**	✓ Readily available	✓ Up to date	N/A
	Remarks________			
4.	**Permits and Service Agreements**			
	✓ Air discharge permit	✓ Readily available	✓ Up to date	N/A
	✓ Effluent discharge	✓ Readily available	✓ Up to date	N/A
	✓ Waste disposal, POTW	✓ Readily available	✓ Up to date	N/A
	Other permits________	Readily available	Up to date	N/A
	Remarks________			
5.	**Gas Generation Records**	Readily available	Up to date	✓ N/A
	Remarks________			
6.	**Settlement Monument Records**	Readily available	Up to date	✓ N/A
	Remarks________			
7.	**Groundwater Monitoring Records**	✓ Readily available	✓ Up to date	N/A
	Remarks________			
8.	**Leachate Extraction Records**	Readily available	Up to date	✓ N/A
	Remarks________			
9.	**Discharge Compliance Records**			
	✓ Air	✓ Readily available	✓ Up to date	N/A
	✓ Water (effluent)	✓ Readily available	✓ Up to date	N/A
	Remarks________			
10.	**Daily Access/Security Logs**	Readily available	Up to date	✓ N/A
	Remarks________			

IV. O&M COSTS

1. **O&M Organization**

State in-house — Contractor for State
PRP in-house — Contractor for PRP
Federal Facility in-house — ✓ Contractor for Federal Facility
Other

2. **O&M Cost Records**

✓ Readily available ✓ Up to date
Funding mechanism/agreement in place
Original O&M cost estimate ____________ Breakdown attached

Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
7/04	6/05	$350,000	Breakdown attached
7/05	6/06	$355,000	Breakdown attached
7/06	9/07	$368,000	Breakdown attached
10/07	9/08	$203,000	Breakdown attached
10/08	9/09	$201,000	Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A

V. ACCESS AND INSTITUTIONAL CONTROLS ✓ Applicable N/A

A. Fencing

1. **Fencing damaged** ✓ Location shown on site map ✓ Gates secured N/A

Remarks contained within military installation boundaries

B. Other Access Restrictions

1. **Signs and other security measures** ✓ Location shown on site map N/A

Remarks flight-line access required for entry into OU-1 Area 1

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	✓ No	N/A
Site conditions imply ICs not being fully enforced	Yes	✓ No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) physical inspection

Frequency quarterly

Responsible party/agency MCAS Yuma Environmental Dept.

Contact	Joe Britain	Environmental Engineer	28-Jul-2009	928-269-5581
	Name	Title	Date	Phone no.

Reporting is up-to-date	✓ Yes	No	N/A
Reports are verified by the lead agency	✓ Yes	No	N/A
Specific requirements in deed or decision documents have been met	✓ Yes	No	N/A
Violations have been reported	Yes	No	✓ N/A

Other problems or suggestions: Report attached

2. **Adequacy** ✓ ICs are adequate ICs are inadequate N/A

Remarks

D. General

1. **Vandalism/trespassing** Location shown on site map ✓ No vandalism evident

Remarks restricted military site

2. **Land use changes on site** N/A

Remarks no changes

3. **Land use changes off site** N/A

Remarks no changes

VI. GENERAL SITE CONDITIONS

A. Roads ✓ Applicable N/A

1. **Roads damaged** Location shown on site map ✓ Roads adequate N/A

Remarks

B. Other Site Conditions
Remarks site located within and around the active flight-line area within MCAS Yuma; site conditions are good

VII. LANDFILL COVERS Applicable ✓ N/A
A. Landfill Surface
1. **Settlement** (Low spots) Location shown on site map Settlement not evident Areal extent______ Depth______ Remarks______
2. **Cracks** Location shown on site map Cracking not evident Lengths______ Widths______ Depths______ Remarks______
3. **Erosion** Location shown on site map Erosion not evident Areal extent______ Depth______ Remarks______
4. **Holes** Location shown on site map Holes not evident Areal extent______ Depth______ Remarks______
5. **Vegetative Cover** Grass Cover properly established No signs of stress Trees/Shrubs (indicate size and locations on a diagram) Remarks______
6. **Alternative Cover (armored rock, concrete, etc.)** N/A Remarks______
7. **Bulges** Location shown on site map Bulges not evident Areal extent______ Height______ Remarks______

8.	**Wet Areas/Water Damage**	Wet areas/water damage not evident		
	Wet areas	Location shown on site map	Areal extent______________	
	Ponding	Location shown on site map	Areal extent______________	
	Seeps	Location shown on site map	Areal extent______________	
	Soft subgrade	Location shown on site map	Areal extent______________	
	Remarks____			
9.	**Slope Instability**	Slides	Location shown on site map	No evidence of slope instability
	Areal extent______________			
	Remarks____			

B. Benches Applicable N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1.	**Flows Bypass Bench**	Location shown on site map	N/A or okay
	Remarks____		
2.	**Bench Breached**	Location shown on site map	N/A or okay
	Remarks____		
3.	**Bench Overtopped**	Location shown on site map	N/A or okay
	Remarks____		

C. Letdown Channels Applicable N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1.	**Settlement**	Location shown on site map	No evidence of settlement
	Areal extent______________	Depth____________	
	Remarks____		
2.	**Material Degradation**	Location shown on site map	No evidence of degradation
	Material type______________	Areal extent____________	
	Remarks____		
3.	**Erosion**	Location shown on site map	No evidence of erosion
	Areal extent______________	Depth____________	
	Remarks____		

4.	**Undercutting** Location shown on site map No evidence of undercutting Areal extent______________ Depth____________ Remarks____ ____
5.	**Obstructions** Type____________________ No obstructions Location shown on site map Areal extent______________ Size____________ Remarks____ ____
6.	**Excessive Vegetative Growth** Type____________________ No evidence of excessive growth Vegetation in channels does not obstruct flow Location shown on site map Areal extent______________ Remarks____ ____
D.	**Cover Penetrations** Applicable N/A
1.	**Gas Vents** Active Passive Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____
2.	**Gas Monitoring Probes** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____
3.	**Monitoring Wells** (within surface area of landfill) Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____
4.	**Leachate Extraction Wells** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____
5.	**Settlement Monuments** Located Routinely surveyed N/A Remarks____ ____

E. Gas Collection and Treatment Applicable N/A	
1.	**Gas Treatment Facilities** Flaring Thermal destruction Collection for reuse Good condition Needs Maintenance Remarks______________________________
2.	**Gas Collection Wells, Manifolds and Piping** Good condition Needs Maintenance Remarks______________________________
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition Needs Maintenance N/A Remarks______________________________
F. Cover Drainage Layer Applicable N/A	
1.	**Outlet Pipes Inspected** Functioning N/A Remarks______________________________
2.	**Outlet Rock Inspected** Functioning N/A Remarks______________________________
G. Detention/Sedimentation Ponds Applicable N/A	
1.	**Siltation** Areal extent__________ Depth__________ N/A Siltation not evident Remarks______________________________
2.	**Erosion** Areal extent__________ Depth__________ Erosion not evident Remarks______________________________
3.	**Outlet Works** Functioning N/A Remarks______________________________
4.	**Dam** Functioning N/A Remarks______________________________

H. Retaining Walls	Applicable	N/A	
1.	**Deformations**	Location shown on site map	Deformation not evident
	Horizontal displacement____________ Vertical displacement_______________ Rotational displacement____________ Remarks____		
2.	**Degradation**	Location shown on site map	Degradation not evident
	Remarks____		
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A	
1.	**Siltation**	Location shown on site map	Siltation not evident
	Areal extent______________ Depth____________ Remarks____		
2.	**Vegetative Growth**	Location shown on site map	N/A
	Vegetation does not impede flow Areal extent______________ Type____________ Remarks____		
3.	**Erosion**	Location shown on site map	Erosion not evident
	Areal extent______________ Depth____________ Remarks____		
4.	**Discharge Structure**	Functioning	N/A
	Remarks____		
VIII. VERTICAL BARRIER WALLS	Applicable	✓ N/A	
1.	**Settlement**	Location shown on site map	Settlement not evident
	Areal extent______________ Depth____________ Remarks____		
2.	**Performance Monitoring**	Type of monitoring__________________________	
	Performance not monitored Frequency___________________________ Evidence of breaching Head differential__________________________ Remarks____		

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	✓ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	Applicable	✓ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition   All required wells properly operating   Needs Maintenance   N/A
   Remarks____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition   Needs Maintenance
   Remarks____

3. **Spare Parts and Equipment**
   Readily available   Good condition   Requires upgrade   Needs to be provided
   Remarks____

B. Surface Water Collection Structures, Pumps, and Pipelines   Applicable   ✓ N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition   Needs Maintenance
   Remarks____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition   Needs Maintenance
   Remarks____

3. **Spare Parts and Equipment**
   Readily available   Good condition   Requires upgrade   Needs to be provided
   Remarks____

C. Treatment System	✓ Applicable N/A
1.	**Treatment Train** (Check components that apply) Metals removal Oil/water separation Bioremediation Air stripping Carbon adsorbers Filters Additive (*e.g.*, chelation agent, flocculent) Others Air Sparge/Soil Vapor Extraction (AS/SVE) and Vertical Circulation Treatment (VCT) ✓ Good condition Needs Maintenance ✓ Sampling ports properly marked and functional Sampling/maintenance log displayed and up to date ✓ Equipment properly identified Quantity of groundwater treated annually N/A Quantity of surface water treated annually N/A Remarks AS/SVE currently in temporary shutdown status; VCT has received permanent shutdown status
2.	**Electrical Enclosures and Panels** (properly rated and functional) N/A ✓ Good condition Needs Maintenance Remarks Treatment systems not in use
3.	**Tanks, Vaults, Storage Vessels** N/A ✓ Good condition ✓ Proper secondary containment Needs Maintenance Remarks Tanks present, but currently not in use due to shutdown; tanks contained on concrete pads with no apparent leaks
4.	**Discharge Structure and Appurtenances** ✓ N/A Good condition Needs Maintenance Remarks
5.	**Treatment Building(s)** ✓ N/A Good condition (esp. roof and doorways) Needs repair Chemicals and equipment properly stored Remarks
6.	**Monitoring Wells** (pump and treatment remedy) ✓ Properly secured/locked Functioning ✓ Routinely sampled ✓ Good condition ✓ All required wells located Needs Maintenance N/A Remarks all wells sampled during LTM events are in good condition

D. Monitoring Data	
1.	Monitoring Data ✓ Is routinely submitted on time ✓ Is of acceptable quality
2.	Monitoring data suggests: ✓ Groundwater plume is effectively contained ✓ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

✓ Properly secured/locked Functioning ✓ Routinely sampled ✓ Good condition

✓ All required wells located Needs Maintenance N/A

Remarks all wells sampled during LTM events are in good condition

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

remedy in-place is effective and functioning as designed

the current LTM program in place to monitor natural attenuation is functioning as designed

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. remedy is functioning as designed

D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. To assure the remedy continues to function as designed: 1) continue the LTM program 2) continue the MNA program

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: MCAS Yuma OU-1 Area 2	**Date of inspection:** 28-Jul-2009
Location and Region: Yuma County, AZ	**EPA ID:** AZ0971590062 (MCAS Yuma)
Agency, office, or company leading the five-year review: Naval Facilities Engineering Command Southwest	**Weather/temperature:** Sunny and Clear, 98 degrees F

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- Access controls
- ✓ Institutional controls
- Groundwater pump and treatment
- Surface water collection and treatment
- Other ____________________
- Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached   Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** ____________ ____________ ____________
   Name   Title   Date
   Interviewed at site at office by phone Phone no. ________
   Problems, suggestions; Report attached ____________________

2. **O&M staff** ____________ ____________ ____________
   Name   Title   Date
   Interviewed at site at office by phone Phone no. ________
   Problems, suggestions; Report attached ____________________

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency MCAS Yuma Environmental Dept.
Contact Dan Nail | IRP Manager | 28-Jul-2009 | 928-269-5637
Name | Title | Date | Phone no.
Problems; suggestions; ✓Report attached See Appendix D

Agency MCAS Yuma Environmental Dept.
Contact Joe Britain | Environmental Engineer | 28-Jul-2009 | 928-269-5581
Name | Title | Date | Phone no.
Problems; suggestions; ✓Report attached See Appendix D

Agency NAVFAC Southwest
Contact Derral VanWinkle | RPM | 21-Oct-2009 |
Name | Title | Date | Phone no.
Problems; suggestions; ✓Report attached See Appendix D Email: derral.vanwinkle@navy.mil

Agency MCAS Yuma Environmental Dept.
Contact Chris Kost | EMS Coordinator | 14-Aug-2009 | 928-269-5207
Name | Title | Date | Phone no.
Problems; suggestions; ✓Report attached See Appendix D

4. **Other interviews** (optional) ✓ Report attached.

Jeremy Nevin, MCAS Yuma ROICC, interviewed 28-Oct-2009, See Appendix D for details

David Rodriguez, MCAS Yuma Environmental Department Director, interviewed 06-Aug-2009, See Appendix D for details

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	**O&M Documents**			
	✓ O&M manual	✓ Readily available	✓ Up to date	N/A
	✓ As-built drawings	✓ Readily available	✓ Up to date	N/A
	✓ Maintenance logs	✓ Readily available	✓ Up to date	N/A
	Remarks			
2.	✓ **Site-Specific Health and Safety Plan**	✓ Readily available	✓ Up to date	N/A
	✓ Contingency plan/emergency response plan	✓ Readily available	✓ Up to date	N/A
	Remarks			
3.	✓ **O&M and OSHA Training Records**	✓ Readily available	✓ Up to date	N/A
	Remarks			
4.	**Permits and Service Agreements**			
	✓ Air discharge permit	✓ Readily available	✓ Up to date	N/A
	✓ Effluent discharge	✓ Readily available	✓ Up to date	N/A
	✓ Waste disposal, POTW	✓ Readily available	✓ Up to date	N/A
	Other permits	Readily available	Up to date	N/A
	Remarks			
5.	**Gas Generation Records**	Readily available	Up to date	✓ N/A
	Remarks			
6.	**Settlement Monument Records**	Readily available	Up to date	✓ N/A
	Remarks			
7.	**Groundwater Monitoring Records**	✓ Readily available	✓ Up to date	N/A
	Remarks			
8.	**Leachate Extraction Records**	Readily available	Up to date	✓ N/A
	Remarks			
9.	**Discharge Compliance Records**			
	✓ Air	✓ Readily available	✓ Up to date	N/A
	✓ Water (effluent)	✓ Readily available	✓ Up to date	N/A
	Remarks			
10.	**Daily Access/Security Logs**	Readily available	Up to date	✓ N/A
	Remarks			

IV. O&M COSTS

1. **O&M Organization**
   State in-house Contractor for State
   PRP in-house Contractor for PRP
   Federal Facility in-house ✓ Contractor for Federal Facility
   Other______________________________

2. **O&M Cost Records**
   ✓ Readily available ✓ Up to date
   Funding mechanism/agreement in place
   Original O&M cost estimate N/A Breakdown attached

   Total annual cost by year for review period if available

   From________ To________ ________ Breakdown attached
   Date Date Total cost
   From________ To________ ________ Breakdown attached
   Date Date Total cost
   From________ To________ ________ Breakdown attached
   Date Date Total cost
   From________ To________ ________ Breakdown attached
   Date Date Total cost
   From________ To________ ________ Breakdown attached
   Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: N/A

V. ACCESS AND INSTITUTIONAL CONTROLS ✓ Applicable N/A

A. Fencing

1. **Fencing damaged** ✓ Location shown on site map ✓ Gates secured N/A
   Remarks contained within military installation boundaries

B. Other Access Restrictions

1. **Signs and other security measures** ✓ Location shown on site map N/A
   Remarks signs restrict access to site; site within MCAS Yuma Installation boundaries

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	✓ No	N/A
Site conditions imply ICs not being fully enforced	Yes	✓ No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Drive-by

Frequency as required

Responsible party/agency MCAS Yuma Environmental Dept.

Contact			
Joe Britain	Environmental Engineer	28-Jul-2009	928-269-5581
Name	Title	Date	Phone no.

Reporting is up-to-date	✓ Yes	No	N/A
Reports are verified by the lead agency	✓ Yes	No	N/A
Specific requirements in deed or decision documents have been met	✓ Yes	No	N/A
Violations have been reported	Yes	No	✓ N/A

Other problems or suggestions: Report attached

2. **Adequacy** ✓ ICs are adequate ICs are inadequate N/A

Remarks

D. General

1. **Vandalism/trespassing** Location shown on site map ✓ No vandalism evident

Remarks restricted military site

2. **Land use changes on site** N/A

Remarks no changes

3. **Land use changes off site** N/A

Remarks no changes

VI. GENERAL SITE CONDITIONS

A. Roads ✓ Applicable N/A

1. **Roads damaged** Location shown on site map ✓ Roads adequate N/A

Remarks

B. Other Site Conditions

Remarks

site located adjacent to active flight-line area within MCAS Yuma; site conditions are good

VII. LANDFILL COVERS Applicable ✓ N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
   Areal extent______________ Depth____________
   Remarks

2. **Cracks** Location shown on site map Cracking not evident
   Lengths____________ Widths___________ Depths__________
   Remarks

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent______________ Depth____________
   Remarks

4. **Holes** Location shown on site map Holes not evident
   Areal extent______________ Depth____________
   Remarks

5. **Vegetative Cover** Grass Cover properly established No signs of stress
   Trees/Shrubs (indicate size and locations on a diagram)
   Remarks

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
   Remarks

7. **Bulges** Location shown on site map Bulges not evident
   Areal extent______________ Height____________
   Remarks

8. **Wet Areas/Water Damage**	Wet areas/water damage not evident		
Wet areas	Location shown on site map	Areal extent______________	
Ponding	Location shown on site map	Areal extent______________	
Seeps	Location shown on site map	Areal extent______________	
Soft subgrade	Location shown on site map	Areal extent______________	
Remarks______________			
9. **Slope Instability**	Slides	Location shown on site map	No evidence of slope instability
Areal extent______________			
Remarks______________			
B. Benches	Applicable	N/A	
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)			
1. **Flows Bypass Bench**	Location shown on site map	N/A or okay	
Remarks______________			
2. **Bench Breached**	Location shown on site map	N/A or okay	
Remarks______________			
3. **Bench Overtopped**	Location shown on site map	N/A or okay	
Remarks______________			
C. Letdown Channels	Applicable	N/A	
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)			
1. **Settlement**	Location shown on site map	No evidence of settlement	
Areal extent______________	Depth____________		
Remarks______________			
2. **Material Degradation**	Location shown on site map	No evidence of degradation	
Material type______________	Areal extent______________		
Remarks______________			
3. **Erosion**	Location shown on site map	No evidence of erosion	
Areal extent______________	Depth____________		
Remarks______________			

4.	**Undercutting** Location shown on site map No evidence of undercutting Areal extent______________ Depth____________ Remarks____ ____
5.	**Obstructions** Type____________________ No obstructions Location shown on site map Areal extent______________ Size____________ Remarks____ ____
6.	**Excessive Vegetative Growth** Type____________________ No evidence of excessive growth Vegetation in channels does not obstruct flow Location shown on site map Areal extent______________ Remarks____ ____
D. Cover Penetrations	Applicable N/A
1.	**Gas Vents** Active Passive Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____
2.	**Gas Monitoring Probes** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____
3.	**Monitoring Wells** (within surface area of landfill) Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____
4.	**Leachate Extraction Wells** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____
5.	**Settlement Monuments** Located Routinely surveyed N/A Remarks____ ____

E. Gas Collection and Treatment Applicable N/A

1. **Gas Treatment Facilities**
   Flaring Thermal destruction Collection for reuse
   Good condition Needs Maintenance
   Remarks____
   ____

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition Needs Maintenance
   Remarks____
   ____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   Good condition Needs Maintenance N/A
   Remarks____
   ____

F. Cover Drainage Layer Applicable N/A

1. **Outlet Pipes Inspected** Functioning N/A
   Remarks____
   ____

2. **Outlet Rock Inspected** Functioning N/A
   Remarks____
   ____

G. Detention/Sedimentation Ponds Applicable N/A

1. **Siltation** Areal extent______________ Depth____________ N/A
   Siltation not evident
   Remarks____
   ____

2. **Erosion** Areal extent______________ Depth____________
   Erosion not evident
   Remarks____
   ____

3. **Outlet Works** Functioning N/A
   Remarks____
   ____

4. **Dam** Functioning N/A
   Remarks____
   ____

H. Retaining Walls Applicable N/A

1. **Deformations** Location shown on site map Deformation not evident
Horizontal displacement____________ Vertical displacement_______________
Rotational displacement____________
Remarks____
____

2. **Degradation** Location shown on site map Degradation not evident
Remarks____
____

I. Perimeter Ditches/Off-Site Discharge Applicable N/A

1. **Siltation** Location shown on site map Siltation not evident
Areal extent______________ Depth____________
Remarks____
____

2. **Vegetative Growth** Location shown on site map N/A
Vegetation does not impede flow
Areal extent______________ Type____________
Remarks____
____

3. **Erosion** Location shown on site map Erosion not evident
Areal extent______________ Depth____________
Remarks____
____

4. **Discharge Structure** Functioning N/A
Remarks____
____

VIII. VERTICAL BARRIER WALLS Applicable ✓N/A

1. **Settlement** Location shown on site map Settlement not evident
Areal extent______________ Depth____________
Remarks____
____

2. **Performance Monitoring** Type of monitoring__________________________
Performance not monitored
Frequency_______________________________ Evidence of breaching
Head differential___________________________
Remarks____
____

IX. GROUNDWATER/SURFACE WATER REMEDIES Applicable ✓ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A
1. **Pumps, Wellhead Plumbing, and Electrical** Good condition All required wells properly operating Needs Maintenance N/A Remarks__________
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks__________
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks__________
B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A
1. **Collection Structures, Pumps, and Electrical** Good condition Needs Maintenance Remarks__________
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks__________
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks__________

C. **Treatment System**	Applicable	N/A

1. **Treatment Train** (Check components that apply)

Metals removal | Oil/water separation | Bioremediation

Air stripping | Carbon adsorbers

Filters____

Additive (*e.g.*, chelation agent, flocculent)____

Others____

Good condition | Needs Maintenance

Sampling ports properly marked and functional

Sampling/maintenance log displayed and up to date

Equipment properly identified

Quantity of groundwater treated annually________________________

Quantity of surface water treated annually________________________

Remarks____

____

2. **Electrical Enclosures and Panels** (properly rated and functional)

N/A | Good condition | Needs Maintenance

Remarks____

____

3. **Tanks, Vaults, Storage Vessels**

N/A | Good condition | Proper secondary containment | Needs Maintenance

Remarks____

____

4. **Discharge Structure and Appurtenances**

N/A | Good condition | Needs Maintenance

Remarks____

____

5. **Treatment Building(s)**

N/A | Good condition (esp. roof and doorways) | Needs repair

Chemicals and equipment properly stored

Remarks____

____

6. **Monitoring Wells** (pump and treatment remedy)

Properly secured/locked | Functioning | Routinely sampled | Good condition

All required wells located | Needs Maintenance | N/A

Remarks all wells have been decommissioned

____

D. Monitoring Data

1. Monitoring Data

Is routinely submitted on time | Is of acceptable quality

2. Monitoring data suggests:

Groundwater plume is effectively contained | Contaminant concentrations are declining

D. Monitored Natural Attenuation
1. **Monitoring Wells** (natural attenuation remedy) Properly secured/locked Functioning Routinely sampled Good condition All required wells located Needs Maintenance N/A Remarks all wells have been decommissioned

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

site has been granted closure

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: MCAS Yuma OU-1 Area 3	**Date of inspection:** 28-Jul-2009
Location and Region: Yuma County, AZ	**EPA ID:** AZ0971590062 (MCAS Yuma)
Agency, office, or company leading the five-year review: Naval Facilities Engineering Command Southwest	**Weather/temperature:** Sunny and Clear, 98 degrees F
Remedy Includes: (Check all that apply) Landfill cover/containment Access controls ✓ Institutional controls Groundwater pump and treatment Surface water collection and treatment Other ____________	Monitored natural attenuation Groundwater containment Vertical barrier walls
Attachments: Inspection team roster attached	Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** ____________ ____________ ____________
   Name Title Date
   Interviewed at site at office by phone Phone no. ____________
   Problems, suggestions; Report attached ____________

2. **O&M staff** ____________ ____________ ____________
   Name Title Date
   Interviewed at site at office by phone Phone no. ____________
   Problems, suggestions; Report attached ____________

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency MCAS Yuma Environmental Dept.

Contact	Name	Title	Date	Phone no.
	Dan Nail	IRP Manager	28-Jul-2009	928-269-5637

Problems; suggestions; ✓ Report attached See Appendix D

Agency MCAS Yuma Environmental Dept.

Contact	Name	Title	Date	Phone no.
	Joe Britain	Environmental Engineer	28-Jul-2009	928-269-5581

Problems; suggestions; ✓ Report attached See Appendix D

Agency NAVFAC Southwest

Contact	Name	Title	Date	Phone no.
	Derral VanWinkle	RPM	21-Oct-2009	

Problems; suggestions; ✓ Report attached See Appendix D Email: derral.vanwinkle@navy.mil

Agency MCAS Yuma Environmental Dept.

Contact	Name	Title	Date	Phone no.
	Chris Kost	EMS Coordinator	14-Aug-2009	928-269-5207

Problems; suggestions; ✓ Report attached See Appendix D

4. **Other interviews** (optional) ✓ Report attached.

Jeremy Nevin, MCAS Yuma ROICC, interviewed 28-Oct-2009, See Appendix D for details

David Rodriguez, MCAS Yuma Environmental Department Director, interviewed 06-Aug-2009, See Appendix D for details

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	**O&M Documents**			
	✓ O&M manual	✓ Readily available	✓ Up to date	N/A
	✓ As-built drawings	✓ Readily available	✓ Up to date	N/A
	✓ Maintenance logs	✓ Readily available	✓ Up to date	N/A
	Remarks			
2.	✓ **Site-Specific Health and Safety Plan**	✓ Readily available	✓ Up to date	N/A
	✓ Contingency plan/emergency response plan	✓ Readily available	✓ Up to date	N/A
	Remarks			
3.	✓ **O&M and OSHA Training Records**	✓ Readily available	✓ Up to date	N/A
	Remarks			
4.	**Permits and Service Agreements**			
	✓ Air discharge permit	✓ Readily available	✓ Up to date	N/A
	✓ Effluent discharge	✓ Readily available	✓ Up to date	N/A
	✓ Waste disposal, POTW	✓ Readily available	✓ Up to date	N/A
	Other permits______	Readily available	Up to date	N/A
	Remarks			
5.	**Gas Generation Records**	Readily available	Up to date	✓ N/A
	Remarks			
6.	**Settlement Monument Records**	Readily available	Up to date	✓ N/A
	Remarks			
7.	**Groundwater Monitoring Records**	✓ Readily available	✓ Up to date	N/A
	Remarks			
8.	**Leachate Extraction Records**	Readily available	Up to date	✓ N/A
	Remarks			
9.	**Discharge Compliance Records**			
	✓ Air	✓ Readily available	✓ Up to date	N/A
	✓ Water (effluent)	✓ Readily available	✓ Up to date	N/A
	Remarks			
10.	**Daily Access/Security Logs**	Readily available	Up to date	✓ N/A
	Remarks			

IV. O&M COSTS

1. **O&M Organization**

State in-house — Contractor for State
PRP in-house — Contractor for PRP
Federal Facility in-house — ✓ Contractor for Federal Facility
Other ____________________

2. **O&M Cost Records**

✓ Readily available ✓ Up to date
Funding mechanism/agreement in place
Original O&M cost estimate N/A — Breakdown attached

Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
			Breakdown attached
			Breakdown attached
			Breakdown attached
			Breakdown attached
			Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A

V. ACCESS AND INSTITUTIONAL CONTROLS ✓ Applicable N/A

A. Fencing

1. **Fencing damaged** ✓ Location shown on site map ✓ Gates secured N/A

Remarks contained within military installation boundaries

B. Other Access Restrictions

1. **Signs and other security measures** ✓ Location shown on site map N/A

Remarks signs restrict access to site; site within MCAS Yuma Installation boundaries

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	✓ No	N/A
Site conditions imply ICs not being fully enforced	Yes	✓ No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Drive-by

Frequency as required

Responsible party/agency MCAS Yuma Environmental Dept.

Contact	Name	Title	Date	Phone no.
	Joe Britain	Environmental Engineer	28-Jul-2009	928-269-5581

Reporting is up-to-date	✓ Yes	No	N/A
Reports are verified by the lead agency	✓ Yes	No	N/A
Specific requirements in deed or decision documents have been met	✓ Yes	No	N/A
Violations have been reported	Yes	No	✓ N/A

Other problems or suggestions: Report attached

2. **Adequacy** ✓ ICs are adequate ICs are inadequate N/A

Remarks

D. General

1. **Vandalism/trespassing** Location shown on site map ✓ No vandalism evident

Remarks restricted military site

2. **Land use changes on site** N/A

Remarks no changes

3. **Land use changes off site** N/A

Remarks no changes

VI. GENERAL SITE CONDITIONS

A. Roads ✓ Applicable N/A

1. **Roads damaged** Location shown on site map ✓ Roads adequate N/A

Remarks

B. Other Site Conditions
Remarks______ site located adjacent to active flight-line area within MCAS Yuma; site conditions are good

VII. LANDFILL COVERS Applicable ✓ N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
   Areal extent______ Depth______
   Remarks______

2. **Cracks** Location shown on site map Cracking not evident
   Lengths______ Widths______ Depths______
   Remarks______

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent______ Depth______
   Remarks______

4. **Holes** Location shown on site map Holes not evident
   Areal extent______ Depth______
   Remarks______

5. **Vegetative Cover** Grass Cover properly established No signs of stress
   Trees/Shrubs (indicate size and locations on a diagram)
   Remarks______

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
   Remarks______

7. **Bulges** Location shown on site map Bulges not evident
   Areal extent______ Height______
   Remarks______

8. **Wet Areas/Water Damage** Wet areas/water damage not evident

Wet areas Location shown on site map Areal extent______________

Ponding Location shown on site map Areal extent______________

Seeps Location shown on site map Areal extent______________

Soft subgrade Location shown on site map Areal extent______________

Remarks____

____

9. **Slope Instability** Slides Location shown on site map No evidence of slope instability

Areal extent______________

Remarks____

____

B. Benches Applicable N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** Location shown on site map N/A or okay

Remarks____

____

2. **Bench Breached** Location shown on site map N/A or okay

Remarks____

____

3. **Bench Overtopped** Location shown on site map N/A or okay

Remarks____

____

C. Letdown Channels Applicable N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** Location shown on site map No evidence of settlement

Areal extent______________ Depth____________

Remarks____

____

2. **Material Degradation** Location shown on site map No evidence of degradation

Material type_______________ Areal extent_____________

Remarks____

____

3. **Erosion** Location shown on site map No evidence of erosion

Areal extent______________ Depth____________

Remarks____

____

4.	**Undercutting** Location shown on site map No evidence of undercutting Areal extent______________ Depth____________ Remarks____	
5.	**Obstructions** Type____________________ No obstructions Location shown on site map Areal extent______________ Size____________ Remarks____	
6.	**Excessive Vegetative Growth** Type____________________ No evidence of excessive growth Vegetation in channels does not obstruct flow Location shown on site map Areal extent______________ Remarks____	
D.	**Cover Penetrations** Applicable N/A	
1.	**Gas Vents** Active Passive Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____	
2.	**Gas Monitoring Probes** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____	
3.	**Monitoring Wells** (within surface area of landfill) Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____	
4.	**Leachate Extraction Wells** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____	
5.	**Settlement Monuments** Located Routinely surveyed N/A Remarks____	

E. Gas Collection and Treatment	Applicable	N/A	
1. **Gas Treatment Facilities** Flaring Good condition Remarks______________________________	 Thermal destruction Needs Maintenance	 Collection for reuse	
2. **Gas Collection Wells, Manifolds and Piping** Good condition Remarks______________________________	 Needs Maintenance		
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition Remarks______________________________	 Needs Maintenance	 N/A	
F. Cover Drainage Layer	Applicable	N/A	
1. **Outlet Pipes Inspected** Remarks______________________________	Functioning	N/A	
2. **Outlet Rock Inspected** Remarks______________________________	Functioning	N/A	
G. Detention/Sedimentation Ponds	Applicable	N/A	
1. **Siltation** Areal extent__________ Siltation not evident Remarks______________________________	Depth__________		N/A
2. **Erosion** Areal extent__________ Erosion not evident Remarks______________________________	Depth__________		
3. **Outlet Works** Remarks______________________________	Functioning	N/A	
4. **Dam** Remarks______________________________	Functioning	N/A	

H. Retaining Walls	Applicable N/A
1. **Deformations** Location shown on site map Deformation not evident Horizontal displacement________ Vertical displacement________ Rotational displacement________ Remarks________	
2. **Degradation** Location shown on site map Degradation not evident Remarks________	
I. Perimeter Ditches/Off-Site Discharge	Applicable N/A
1. **Siltation** Location shown on site map Siltation not evident Areal extent________ Depth________ Remarks________	
2. **Vegetative Growth** Location shown on site map N/A Vegetation does not impede flow Areal extent________ Type________ Remarks________	
3. **Erosion** Location shown on site map Erosion not evident Areal extent________ Depth________ Remarks________	
4. **Discharge Structure** Functioning N/A Remarks________	
VIII. VERTICAL BARRIER WALLS	Applicable ✓N/A
1. **Settlement** Location shown on site map Settlement not evident Areal extent________ Depth________ Remarks________	
2. **Performance Monitoring** Type of monitoring________ Performance not monitored Frequency________ Evidence of breaching Head differential________ Remarks________	

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	✓ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition All required wells properly operating Needs Maintenance N/A
   Remarks____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks____

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks____

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition Needs Maintenance
   Remarks____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks____

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks____

C. Treatment System	Applicable	N/A

1. **Treatment Train** (Check components that apply)
   Metals removal   Oil/water separation   Bioremediation
   Air stripping   Carbon adsorbers
   Filters____________________
   Additive (*e.g.*, chelation agent, flocculent)____________________
   Others____________________
   Good condition   Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually____________________
   Quantity of surface water treated annually____________________
   Remarks____________________

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A   Good condition   Needs Maintenance
   Remarks____________________

3. **Tanks, Vaults, Storage Vessels**
   N/A   Good condition   Proper secondary containment   Needs Maintenance
   Remarks____________________

4. **Discharge Structure and Appurtenances**
   N/A   Good condition   Needs Maintenance
   Remarks____________________

5. **Treatment Building(s)**
   N/A   Good condition (esp. roof and doorways)   Needs repair
   Chemicals and equipment properly stored
   Remarks____________________

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked   Functioning   Routinely sampled   Good condition
   All required wells located   Needs Maintenance   N/A
   Remarks all wells have been decommissioned

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time   Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained   Contaminant concentrations are declining

D. Monitored Natural Attenuation
1. **Monitoring Wells** (natural attenuation remedy) Properly secured/locked Functioning Routinely sampled Good condition All required wells located Needs Maintenance N/A Remarks all wells have been decommissioned
X. OTHER REMEDIES
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). site has been granted closure
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. N/A

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: MCAS Yuma OU-1 Area 6	**Date of inspection:** 28-Jul-2009
Location and Region: Yuma County, AZ	**EPA ID:** AZ0971590062 (MCAS Yuma)
Agency, office, or company leading the five-year review: Naval Facilities Engineering Command Southwest	**Weather/temperature:** Sunny and Clear, 98 degrees F

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- Access controls
- ✓ Institutional controls
- Groundwater pump and treatment
- Surface water collection and treatment
- Other ______
- Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** ______ ______ ______
   Name Title Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

2. **O&M staff** ______ ______ ______
   Name Title Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency MCAS Yuma Environmental Dept.

Contact	Name	Title	Date	Phone no.
	Dan Nail	IRP Manager	28-Jul-2009	928-269-5637

Problems; suggestions; ✓Report attached See Appendix D

Agency MCAS Yuma Environmental Dept.

Contact	Name	Title	Date	Phone no.
	Joe Britain	Environmental Engineer	28-Jul-2009	928-269-5581

Problems; suggestions; ✓Report attached See Appendix D

Agency NAVFAC Southwest

Contact	Name	Title	Date	Phone no.
	Derral VanWinkle	RPM	21-Oct-2009	

Problems; suggestions; ✓Report attached See Appendix D Email: derral.vanwinkle@navy.mil

Agency MCAS Yuma Environmental Dept.

Contact	Name	Title	Date	Phone no.
	Chris Kost	EMS Coordinator	14-Aug-2009	928-269-5207

Problems; suggestions; ✓Report attached See Appendix D

4. **Other interviews** (optional) ✓ Report attached.

Jeremy Nevin, MCAS Yuma ROICC, interviewed 28-Oct-2009, See Appendix D for details

David Rodriguez, MCAS Yuma Environmental Department Director, interviewed 06-Aug-2009, See Appendix D for details

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)			
1. **O&M Documents**			
✓ O&M manual	✓ Readily available	✓ Up to date	N/A
✓ As-built drawings	✓ Readily available	✓ Up to date	N/A
✓ Maintenance logs	✓ Readily available	✓ Up to date	N/A
Remarks______			
2. ✓ **Site-Specific Health and Safety Plan**	✓ Readily available	✓ Up to date	N/A
✓ Contingency plan/emergency response plan	✓ Readily available	✓ Up to date	N/A
Remarks______			
3. ✓ **O&M and OSHA Training Records**	✓ Readily available	✓ Up to date	N/A
Remarks______			
4. **Permits and Service Agreements**			
✓ Air discharge permit	✓ Readily available	✓ Up to date	N/A
✓ Effluent discharge	✓ Readily available	✓ Up to date	N/A
✓ Waste disposal, POTW	✓ Readily available	✓ Up to date	N/A
Other permits______	Readily available	Up to date	N/A
Remarks______			
5. **Gas Generation Records**	Readily available	Up to date	✓ N/A
Remarks______			
6. **Settlement Monument Records**	Readily available	Up to date	✓ N/A
Remarks______			
7. **Groundwater Monitoring Records**	✓ Readily available	✓ Up to date	N/A
Remarks______			
8. **Leachate Extraction Records**	Readily available	Up to date	✓ N/A
Remarks______			
9. **Discharge Compliance Records**			
✓ Air	✓ Readily available	✓ Up to date	N/A
✓ Water (effluent)	✓ Readily available	✓ Up to date	N/A
Remarks______			
10. **Daily Access/Security Logs**	Readily available	Up to date	✓ N/A
Remarks______			

IV. O&M COSTS

1. **O&M Organization**

State in-house — Contractor for State
PRP in-house — Contractor for PRP
Federal Facility in-house — ✓ Contractor for Federal Facility
Other__________

2. **O&M Cost Records**

✓ Readily available ✓ Up to date
Funding mechanism/agreement in place
Original O&M cost estimate N/A Breakdown attached

Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
			Breakdown attached
			Breakdown attached
			Breakdown attached
			Breakdown attached
			Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A

V. ACCESS AND INSTITUTIONAL CONTROLS ✓ Applicable N/A

A. Fencing

1. **Fencing damaged** ✓ Location shown on site map ✓ Gates secured N/A
Remarks contained within military installation boundaries

B. Other Access Restrictions

1. **Signs and other security measures** ✓ Location shown on site map N/A
Remarks signs restrict access to site; site within MCAS Yuma Installation boundaries

C. Institutional Controls (ICs)			
1. **Implementation and enforcement**			
Site conditions imply ICs not properly implemented	Yes	✓ No	N/A
Site conditions imply ICs not being fully enforced	Yes	✓ No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Drive-by

Frequency as required

Responsible party/agency MCAS Yuma Environmental Dept.

Contact	Name	Title	Date	Phone no.
	Joe Britain	Environmental Engineer	28-Jul-2009	928-269-5581

Reporting is up-to-date	✓ Yes	No	N/A
Reports are verified by the lead agency	✓ Yes	No	N/A
Specific requirements in deed or decision documents have been met	✓ Yes	No	N/A
Violations have been reported	Yes	No	✓ N/A

Other problems or suggestions: Report attached

2. **Adequacy** ✓ ICs are adequate ICs are inadequate N/A

Remarks

D. General

1. **Vandalism/trespassing** Location shown on site map ✓ No vandalism evident

Remarks restricted military site

2. **Land use changes on site** N/A

Remarks no changes

3. **Land use changes off site** N/A

Remarks no changes

VI. GENERAL SITE CONDITIONS

A. Roads ✓ Applicable N/A

1. **Roads damaged** Location shown on site map ✓ Roads adequate N/A

Remarks

B. Other Site Conditions
Remarks site located near industrial area and active flight-line area within MCAS Yuma; site conditions are good
VII. LANDFILL COVERS Applicable ✓ N/A
A. Landfill Surface
1. **Settlement** (Low spots) Location shown on site map Settlement not evident Areal extent______ Depth______ Remarks______
2. **Cracks** Location shown on site map Cracking not evident Lengths______ Widths______ Depths______ Remarks______
3. **Erosion** Location shown on site map Erosion not evident Areal extent______ Depth______ Remarks______
4. **Holes** Location shown on site map Holes not evident Areal extent______ Depth______ Remarks______
5. **Vegetative Cover** Grass Cover properly established No signs of stress Trees/Shrubs (indicate size and locations on a diagram) Remarks______
6. **Alternative Cover (armored rock, concrete, etc.)** N/A Remarks______
7. **Bulges** Location shown on site map Bulges not evident Areal extent______ Height______ Remarks______

8.	**Wet Areas/Water Damage**	Wet areas/water damage not evident	
	Wet areas	Location shown on site map	Areal extent______________
	Ponding	Location shown on site map	Areal extent______________
	Seeps	Location shown on site map	Areal extent______________
	Soft subgrade	Location shown on site map	Areal extent______________
	Remarks____		
9.	**Slope Instability** Slides	Location shown on site map	No evidence of slope instability
	Areal extent______________		
	Remarks____		

B. Benches Applicable N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1.	**Flows Bypass Bench**	Location shown on site map	N/A or okay
	Remarks____		
2.	**Bench Breached**	Location shown on site map	N/A or okay
	Remarks____		
3.	**Bench Overtopped**	Location shown on site map	N/A or okay
	Remarks____		

C. Letdown Channels Applicable N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1.	**Settlement**	Location shown on site map	No evidence of settlement
	Areal extent______________	Depth____________	
	Remarks____		
2.	**Material Degradation**	Location shown on site map	No evidence of degradation
	Material type______________	Areal extent_____________	
	Remarks____		
3.	**Erosion**	Location shown on site map	No evidence of erosion
	Areal extent______________	Depth____________	
	Remarks____		

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent______________ Depth____________
Remarks____
____

5. **Obstructions** Type_____________________ No obstructions
Location shown on site map Areal extent______________
Size____________
Remarks____
____

6. **Excessive Vegetative Growth** Type____________________
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent______________
Remarks____
____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks____
____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks____
____

E. Gas Collection and Treatment	Applicable	N/A	
1. **Gas Treatment Facilities** Flaring Good condition Remarks______________________________	 Thermal destruction Needs Maintenance	 Collection for reuse	
2. **Gas Collection Wells, Manifolds and Piping** Good condition Remarks______________________________	 Needs Maintenance		
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition Remarks______________________________	 Needs Maintenance	 N/A	
F. Cover Drainage Layer	Applicable	N/A	
1. **Outlet Pipes Inspected** Remarks______________________________	Functioning	N/A	
2. **Outlet Rock Inspected** Remarks______________________________	Functioning	N/A	
G. Detention/Sedimentation Ponds	Applicable	N/A	
1. **Siltation** Areal extent__________ Siltation not evident Remarks______________________________	Depth__________		N/A
2. **Erosion** Areal extent__________ Erosion not evident Remarks______________________________	Depth__________		
3. **Outlet Works** Remarks______________________________	Functioning	N/A	
4. **Dam** Remarks______________________________	Functioning	N/A	

H. Retaining Walls	Applicable	N/A	
1.	**Deformations** Horizontal displacement___________ Rotational displacement___________ Remarks___________	Location shown on site map Vertical displacement___________	Deformation not evident
2.	**Degradation** Remarks___________	Location shown on site map	Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A	
1.	**Siltation** Areal extent___________ Remarks___________	Location shown on site map Depth___________	Siltation not evident
2.	**Vegetative Growth** Vegetation does not impede flow Areal extent___________ Remarks___________	Location shown on site map Type___________	N/A
3.	**Erosion** Areal extent___________ Remarks___________	Location shown on site map Depth___________	Erosion not evident
4.	**Discharge Structure** Remarks___________	Functioning	N/A
VIII. VERTICAL BARRIER WALLS	Applicable	✓ N/A	
1.	**Settlement** Areal extent___________ Remarks___________	Location shown on site map Depth___________	Settlement not evident
2.	**Performance Monitoring** Type of monitoring___________ Performance not monitored Frequency___________ Head differential___________ Remarks___________	Evidence of breaching	

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable ✓ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	Applicable N/A
1. **Pumps, Wellhead Plumbing, and Electrical** Good condition All required wells properly operating Needs Maintenance N/A Remarks______	
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks______	
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks______	
B. Surface Water Collection Structures, Pumps, and Pipelines	Applicable N/A
1. **Collection Structures, Pumps, and Electrical** Good condition Needs Maintenance Remarks______	
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks______	
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks______	

C. Treatment System	Applicable	N/A

1. **Treatment Train** (Check components that apply)
   Metals removal — Oil/water separation — Bioremediation
   Air stripping — Carbon adsorbers
   Filters______________________
   Additive (*e.g.*, chelation agent, flocculent)______________________
   Others______________________
   Good condition — Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually______________________
   Quantity of surface water treated annually______________________
   Remarks______________________

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A — Good condition — Needs Maintenance
   Remarks______________________

3. **Tanks, Vaults, Storage Vessels**
   N/A — Good condition — Proper secondary containment — Needs Maintenance
   Remarks______________________

4. **Discharge Structure and Appurtenances**
   N/A — Good condition — Needs Maintenance
   Remarks______________________

5. **Treatment Building(s)**
   N/A — Good condition (esp. roof and doorways) — Needs repair
   Chemicals and equipment properly stored
   Remarks______________________

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked — Functioning — Routinely sampled — Good condition
   All required wells located — Needs Maintenance — N/A
   Remarks all wells have been decommissioned

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time — Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained — Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks all wells have been decommissioned

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

site has been granted closure

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: MCAS Yuma OU-2 Area 8A	**Date of inspection:** 28-Jul-2009
Location and Region: Yuma County, AZ	**EPA ID:** AZ0971590062 (MCAS Yuma)
Agency, office, or company leading the five-year review: Naval Facilities Engineering Command Southwest	**Weather/temperature:** Sunny and Clear, 98 degrees F

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- Access controls
- ✓ Institutional controls
- Groundwater pump and treatment
- Surface water collection and treatment
- Other ______
- Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** ______ ______ ______
   Name Title Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

2. **O&M staff** ______ ______ ______
   Name Title Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency MCAS Yuma Environmental Dept.
Contact Dan Nail | IRP Manager | 28-Jul-2009 | 928-269-5637
Name | Title | Date | Phone no.
Problems; suggestions; ✓Report attached See Appendix D

Agency MCAS Yuma Environmental Dept.
Contact Joe Britain | Environmental Engineer | 28-Jul-2009 | 928-269-5581
Name | Title | Date | Phone no.
Problems; suggestions; ✓Report attached See Appendix D

Agency NAVFAC Southwest
Contact Derral VanWinkle | RPM | 21-Oct-2009 |
Name | Title | Date | Phone no.
Problems; suggestions; ✓Report attached See Appendix D Email: derral.vanwinkle@navy.mil

Agency MCAS Yuma Environmental Dept.
Contact Chris Kost | EMS Coordinator | 14-Aug-2009 | 928-269-5207
Name | Title | Date | Phone no.
Problems; suggestions; ✓Report attached See Appendix D

4. **Other interviews** (optional) ✓ Report attached.

Jeremy Nevin, MCAS Yuma ROICC, interviewed 28-Oct-2009, See Appendix D for details

David Rodriguez, MCAS Yuma Environmental Department Director, interviewed 06-Aug-2009, See Appendix D for details

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	**O&M Documents**			
	O&M manual	Readily available	Up to date	✓ N/A
	As-built drawings	Readily available	Up to date	✓ N/A
	Maintenance logs	Readily available	Up to date	✓ N/A
	Remarks______________________________			
2.	**Site-Specific Health and Safety Plan**	Readily available	Up to date	✓ N/A
	Contingency plan/emergency response plan	Readily available	Up to date	✓ N/A
	Remarks______________________________			
3.	**O&M and OSHA Training Records**	Readily available	Up to date	✓ N/A
	Remarks______________________________			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	✓ N/A
	Effluent discharge	Readily available	Up to date	✓ N/A
	Waste disposal, POTW	Readily available	Up to date	✓ N/A
	Other permits______________	Readily available	Up to date	N/A
	Remarks______________________________			
5.	**Gas Generation Records**	Readily available	Up to date	✓ N/A
	Remarks______________________________			
6.	**Settlement Monument Records**	Readily available	Up to date	✓ N/A
	Remarks______________________________			
7.	**Groundwater Monitoring Records**	Readily available	Up to date	✓ N/A
	Remarks______________________________			
8.	**Leachate Extraction Records**	Readily available	Up to date	✓ N/A
	Remarks______________________________			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	✓ N/A
	Water (effluent)	Readily available	Up to date	✓ N/A
	Remarks______________________________			
10.	**Daily Access/Security Logs**	Readily available	Up to date	✓ N/A
	Remarks______________________________			

IV. O&M COSTS

1. **O&M Organization**

State in-house | Contractor for State
PRP in-house | Contractor for PRP
✓ Federal Facility in-house | Contractor for Federal Facility
Other______________________________

2. **O&M Cost Records**

Readily available | Up to date
✓ Funding mechanism/agreement in place
Original O&M cost estimate N/A | Breakdown attached

Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
			Breakdown attached
			Breakdown attached
			Breakdown attached
			Breakdown attached
			Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A

V. ACCESS AND INSTITUTIONAL CONTROLS ✓ Applicable N/A

A. Fencing

1. **Fencing damaged** ✓ Location shown on site map ✓ Gates secured N/A

Remarks contained within military installation boundaries

B. Other Access Restrictions

1. **Signs and other security measures** ✓ Location shown on site map N/A

Remarks access is restricted to MCAS Yuma base security and environmental dept. personnel

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	✓ No	N/A
Site conditions imply ICs not being fully enforced	Yes	✓ No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) drive by

Frequency as needed

Responsible party/agency MCAS Yuma Environmental Dept.

Contact	Dan Nail	IRP Manager	28-Jul-2009	928-269-5637
	Name	Title	Date	Phone no.

Reporting is up-to-date	✓ Yes	No	N/A
Reports are verified by the lead agency	✓ Yes	No	N/A
Specific requirements in deed or decision documents have been met	✓ Yes	No	N/A
Violations have been reported	Yes	No	✓ N/A

Other problems or suggestions: Report attached

2. **Adequacy** ✓ ICs are adequate ICs are inadequate N/A

Remarks

D. General

1. **Vandalism/trespassing** Location shown on site map ✓ No vandalism evident

Remarks restricted military site

2. **Land use changes on site** N/A

Remarks no changes

3. **Land use changes off site** N/A

Remarks no changes

VI. GENERAL SITE CONDITIONS

A. Roads Applicable ✓N/A

1. **Roads damaged** Location shown on site map Roads adequate ✓N/A

Remarks

B. Other Site Conditions

Remarks
site located within secured area of MCAS Yuma; site conditions meet ICs

VII. LANDFILL COVERS Applicable ✓ N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
Areal extent__________ Depth__________
Remarks__________

2. **Cracks** Location shown on site map Cracking not evident
Lengths__________ Widths__________ Depths__________
Remarks__________

3. **Erosion** Location shown on site map Erosion not evident
Areal extent__________ Depth__________
Remarks__________

4. **Holes** Location shown on site map Holes not evident
Areal extent__________ Depth__________
Remarks__________

5. **Vegetative Cover** Grass Cover properly established No signs of stress
Trees/Shrubs (indicate size and locations on a diagram)
Remarks__________

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
Remarks__________

7. **Bulges** Location shown on site map Bulges not evident
Areal extent__________ Height__________
Remarks__________

8. **Wet Areas/Water Damage**	Wet areas/water damage not evident
Wet areas	Location shown on site map Areal extent______________
Ponding	Location shown on site map Areal extent______________
Seeps	Location shown on site map Areal extent______________
Soft subgrade	Location shown on site map Areal extent______________
Remarks____	
9. **Slope Instability** Slides	Location shown on site map No evidence of slope instability
Areal extent______________	
Remarks____	
B. Benches Applicable N/A	
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)	
1. **Flows Bypass Bench**	Location shown on site map N/A or okay
Remarks____	
2. **Bench Breached**	Location shown on site map N/A or okay
Remarks____	
3. **Bench Overtopped**	Location shown on site map N/A or okay
Remarks____	
C. Letdown Channels Applicable N/A	
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)	
1. **Settlement**	Location shown on site map No evidence of settlement
Areal extent______________ Depth____________	
Remarks____	
2. **Material Degradation**	Location shown on site map No evidence of degradation
Material type______________ Areal extent_____________	
Remarks____	
3. **Erosion**	Location shown on site map No evidence of erosion
Areal extent______________ Depth____________	
Remarks____	

4.	**Undercutting** Location shown on site map No evidence of undercutting Areal extent______________ Depth____________ Remarks____
5.	**Obstructions** Type____________________ No obstructions Location shown on site map Areal extent______________ Size____________ Remarks____
6.	**Excessive Vegetative Growth** Type____________________ No evidence of excessive growth Vegetation in channels does not obstruct flow Location shown on site map Areal extent______________ Remarks____
D.	**Cover Penetrations** Applicable N/A
1.	**Gas Vents** Active Passive Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____
2.	**Gas Monitoring Probes** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____
3.	**Monitoring Wells** (within surface area of landfill) Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____
4.	**Leachate Extraction Wells** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____
5.	**Settlement Monuments** Located Routinely surveyed N/A Remarks____

E. Gas Collection and Treatment Applicable N/A

1. **Gas Treatment Facilities**
   Flaring Thermal destruction Collection for reuse
   Good condition Needs Maintenance
   Remarks____
   ____

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition Needs Maintenance
   Remarks____
   ____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   Good condition Needs Maintenance N/A
   Remarks____
   ____

F. Cover Drainage Layer Applicable N/A

1. **Outlet Pipes Inspected** Functioning N/A
   Remarks____
   ____

2. **Outlet Rock Inspected** Functioning N/A
   Remarks____
   ____

G. Detention/Sedimentation Ponds Applicable N/A

1. **Siltation** Areal extent______________ Depth____________ N/A
   Siltation not evident
   Remarks____
   ____

2. **Erosion** Areal extent______________ Depth____________
   Erosion not evident
   Remarks____
   ____

3. **Outlet Works** Functioning N/A
   Remarks____
   ____

4. **Dam** Functioning N/A
   Remarks____
   ____

H. Retaining Walls	Applicable	N/A	
1. **Deformations** Horizontal displacement___________ Rotational displacement___________ Remarks________________________	Location shown on site map Vertical displacement_____________		Deformation not evident
2. **Degradation** Remarks________________________	Location shown on site map		Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A	
1. **Siltation** Areal extent____________ Remarks________________________	Location shown on site map Depth___________	Siltation not evident	
2. **Vegetative Growth** Vegetation does not impede flow Areal extent____________ Remarks________________________	Location shown on site map Type___________	N/A	
3. **Erosion** Areal extent____________ Remarks________________________	Location shown on site map Depth___________		Erosion not evident
4. **Discharge Structure** Remarks________________________	Functioning	N/A	
VIII. VERTICAL BARRIER WALLS	Applicable	✓ N/A	
1. **Settlement** Areal extent____________ Remarks________________________	Location shown on site map Depth___________		Settlement not evident
2. **Performance Monitoring** Type of monitoring______________________ Performance not monitored Frequency______________________________ Head differential_________________________ Remarks________________________		Evidence of breaching	

IX. GROUNDWATER/SURFACE WATER REMEDIES Applicable ✓ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A
1. **Pumps, Wellhead Plumbing, and Electrical** Good condition All required wells properly operating Needs Maintenance N/A Remarks______________________________
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks______________________________
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks______________________________
B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A
1. **Collection Structures, Pumps, and Electrical** Good condition Needs Maintenance Remarks______________________________
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks______________________________
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks______________________________

C. Treatment System Applicable N/A
1. **Treatment Train** (Check components that apply) Metals removal Oil/water separation Bioremediation Air stripping Carbon adsorbers Filters________ Additive (*e.g.*, chelation agent, flocculent)________ Others________ Good condition Needs Maintenance Sampling ports properly marked and functional Sampling/maintenance log displayed and up to date Equipment properly identified Quantity of groundwater treated annually________ Quantity of surface water treated annually________ Remarks________
2. **Electrical Enclosures and Panels** (properly rated and functional) N/A Good condition Needs Maintenance Remarks________
3. **Tanks, Vaults, Storage Vessels** N/A Good condition Proper secondary containment Needs Maintenance Remarks________
4. **Discharge Structure and Appurtenances** N/A Good condition Needs Maintenance Remarks________
5. **Treatment Building(s)** N/A Good condition (esp. roof and doorways) Needs repair Chemicals and equipment properly stored Remarks________
6. **Monitoring Wells** (pump and treatment remedy) Properly secured/locked Functioning Routinely sampled Good condition All required wells located Needs Maintenance N/A Remarks________
D. Monitoring Data
1. Monitoring Data Is routinely submitted on time Is of acceptable quality
2. Monitoring data suggests: Groundwater plume is effectively contained Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked   Functioning   Routinely sampled   Good condition
   All required wells located   Needs Maintenance   N/A
   Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

remedy in-place is effective and functioning as intended

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. A possible change to the in-place remedy would be the ultimate remediation for CAOC 8 due to up-coming JSF construction in that area of base proper

Appendix D

Interview Reports

Appendix D1

Interview Documentation Form

INTERVIEW DOCUMENTATION FORM

The following individuals were interviewed for the 5-year review or provided information in meetings, site visits, etc. See the attached contact records for a detailed summary of the interviews. The site inspection checklists provided in Appendix B contain additional information.

Name	Title	Organization	Date	Appendix
Derral Van Winkle	Remedial Project Manager	NAVFAC Southwest	21-Oct-2009	D2
Dan Nail	IRP Manager	MCAS Yuma Environmental Dept.	28-Jul-2009	D3
Joe Britain	Staff Environmental Engineer	MCAS Yuma Environmental Dept.	28-Jul-2009	D4
Chris Kost	Environmental Protection Specialist	MCAS Yuma Environmental Dept.	14-Aug-2009	D5
David Rodriguez	Environmental Director	MCAS Yuma Environmental Dept.	06-Aug-2009	D6
Jeremy Nevin	ROICC	MCAS Yuma	28-Oct-2009	D7
Joellen Meitl	Project Manager	ADEQ	10-Feb-2010	D8
Delfina Olivarez	Project Manager	ADEQ	10-Feb-2010	D9

ADEQ - Arizona Department of Environmental Quality
IRP - Installation Restoration Program
MCAS - Marine Corps Air Station
NAVFAC - Naval Facilities Engineering Command
ROICC - Resident Officer in Charge of Construction

Appendix D2

Interview Record for Derral VanWinkle

INTERVIEW RECORD		
Site Name: OU-1 and OU-2, MCAS Yuma, AZ	**EPA ID No.:** AZ0971590062	
Subject: Five-Year Review Interview	**Time:** 16:25	**Date:** 21 Oct 2009
Type: ☐ Telephone ☐ Visit ☑ Other **Location of Visit:** Email	☐ Incoming ☐ Outgoing	

Contact Made By		
Name: Derek Payne	**Title:** Task Order Leader	**Organization:** Battelle

Individual Contacted		
Name: Derral VanWinkle	**Title:** Navy RPM	**Organization:** NAVFAC SW

Telephone No: (619) 532-2220 **Fax No:** (619) 532-3384 **E-mail Address:** derral.vanwinkle@navy.mil	**Street Address:** 1220 Pacific Highway, Building 127 **City, State, Zip:** San Diego, CA 92132

Summary of Conversation

Question 1: Are the remedies functioning as intended by the decision documents?

Answer:

- The remedies for OU-1 are functioning to protect human health through implementation of remedial systems and institutional controls on land and groundwater use. The OU-1 remediation systems consist of an AS/SVE and VCT system for Area 1 (both not running currently), and currently an LTM program is in place to monitor natural attenuation for OU-1, Area 1.
- The response shown above seems appropriate.

Question 2: Are the exposure assumptions, toxicity data, cleanup levels, and RAO used at the time of remedy selection still valid?

Answer:

- Exposure assumptions presented in the ROD are still valid, although approach to calculation of the vapor exposure route has changed.
- The toxicity data provided in Tables 2-7 and 2-8 of the ROD are likely no longer valid. The slope factors and chronic reference doses for 1,1-DCE, TCE, PCE have changed since publication of the ROD for OU-1 9 years ago. However, even if the slope factors or reference doses have become more conservative since the ROD was signed, the cleanup goals (MCLs) are not risk-based. It is possible that achieving the MCLs will leave a greater risk than originally published in the ROD. This should be explored in more detail in the five year review.
- Cleanup levels are MCLs and hence are still valid because these are ARARs.
- RAOs defined in the ROD for OU-1 are still valid.

Question 3: Has any other information come to light that could call into question the protectiveness of the remedies?

Answer:

- No information has come to light that would call into question the remedy protectiveness. The results indicate that the remedies have prevented any further offsite migration of COCs, and appear to have reduced concentrations to levels meeting the cleanup goals in most areas without significant rebound. We are currently monitoring to demonstrate that rebound has not significantly occurred such that there would be a threat to human health through migration of the chemicals off base.
- I don't think the issues with IR Site 8 should be brought up in the summary of the five-year review. The FFA and RODs for OU-1 and 2 stipulate timeframes for letting regulatory agencies know about proposed changes like this. We have been having ongoing dialogue with the base regarding this issue, and they have been unable at this point to provide the concrete documentation that we need in order to re-open this site and engage the regulatory agencies with respect to re-opening the ROD.

Appendix D3

Interview Record for Dan Nail

<table>
<tr><td colspan="3">INTERVIEW RECORD</td></tr>
<tr><td colspan="2">Site Name: OU-1 and OU-2, MCAS Yuma, AZ</td><td colspan="2">EPA ID No.: AZ0971590062</td></tr>
<tr><td colspan="2">Subject: Five-Year Review Interview</td><td>Time: 10:30</td><td>Date: 28-July-2009</td></tr>
<tr><td colspan="2">Type: ☐ Telephone ☑ Visit ☐ Other
Location of Visit: MCAS Yuma</td><td colspan="2">☐ Incoming ☐ Outgoing</td></tr>
</table>

<table>
<tr><td colspan="3">Contact Made By</td></tr>
<tr><td>Name: Derek Payne</td><td>Title: Task Order Leader</td><td>Organization: Battelle</td></tr>
<tr><td colspan="3">Individual Contacted</td></tr>
<tr><td>Name: Dan Nail</td><td>Title: Installation Restoration Project (IRP) Manager</td><td>Organization: MCAS Yuma Environmental Department</td></tr>
</table>

<table>
<tr><td>Telephone No: (928) 269-5637
Fax No:
E-mail Address: danny.nail@usmc.mil</td><td>Street Address: P.O. Box 99110
City, State, Zip: Yuma, AZ 85369-9110</td></tr>
</table>

Summary of Conversation

Question 1: Are the remedies functioning as intended by the decision documents?

Answer:
- Yes.

Question 2: Are the exposure assumptions, toxicity data, cleanup levels, and RAO used at the time of remedy selection still valid?

Answer:
- Yes.

Question 3: Has any other information come to light that could call into question the protectiveness of the remedies?

Answer:
- Yes.
- One issue that has been brought to Battelle's attention by on-base environmental personnel is the ultimate remediation for CAOC#8 (landfill within OU-2) due to upcoming JSF construction in that area of base proper.

Appendix D4

Interview Record for Joe Britain

<table>
<tr><th colspan="6">INTERVIEW RECORD</th></tr>
<tr><td colspan="3">Site Name: OU-1 and OU-2, MCAS Yuma, AZ</td><td colspan="3">EPA ID No.: AZ0971590062</td></tr>
<tr><td colspan="3">Subject: Five-Year Review Interview</td><td colspan="2">Time: 12:20</td><td>Date: 28-July-2009</td></tr>
<tr><td colspan="3">Type: ☐ Telephone ☐ Visit ☑ Other
Location of Visit: Email</td><td colspan="3">☐ Incoming ☐ Outgoing</td></tr>
<tr><td colspan="6">Contact Made By</td></tr>
<tr><td>Name: Derek Payne</td><td colspan="3">Title: Task Order Leader</td><td colspan="2">Organization: Battelle</td></tr>
<tr><td colspan="6">Individual Contacted</td></tr>
<tr><td>Name: Joe Britain</td><td colspan="3">Title: Environmental Engineer</td><td colspan="2">Organization: MCAS Yuma Environmental Department</td></tr>
<tr><td colspan="2">Telephone No: (928) 269-5581
Fax No:
E-mail Address: joseph.c.britain@usmc.mil</td><td colspan="4">Street Address: P.O. Box 99110
City, State, Zip: Yuma, AZ 85369-9110</td></tr>
<tr><th colspan="6">Summary of Conversation</th></tr>
<tr><td colspan="6">Question 1: Are the remedies functioning as intended by the decision documents?</td></tr>
<tr><td colspan="6">Answer:
• Yes</td></tr>
<tr><td colspan="6">Question 2: Are the exposure assumptions, toxicity data, cleanup levels, and RAO used at the time of remedy selection still valid?</td></tr>
<tr><td colspan="6">Answer:
• Yes</td></tr>
<tr><td colspan="6">Question 3: Has any other information come to light that could call into question the protectiveness of the remedies?</td></tr>
<tr><td colspan="6">Answer:
• Yes
• Big concern for MCASY is still ultimate remediation for CAOC#8 (landfill) due to upcoming JSF construction in that area of base proper.</td></tr>
</table>

Appendix D5

Interview Record for Chris Kost

INTERVIEW RECORD			
Site Name: OU-1 and OU-2, MCAS Yuma, AZ		**EPA ID No.:** AZ0971590062	
Subject: Five-Year Review Interview		**Time:** 09:00	**Date:** 14 Aug 2009
Type: ☐ Telephone ☐ Visit ☑ Other **Location of Visit:** Email		☐ Incoming ☐ Outgoing	
Contact Made By			
Name: Derek Payne	**Title:** Task Order Leader	**Organization:** Battelle	
Individual Contacted			
Name: Chris Kost	**Title:** EMS Coordinator	**Organization:** MCAS Yuma Environmental Department	
Telephone No: (928) 269-5207 **Fax No:** **E-mail Address:** christian.kost@usmc.mil		**Street Address:** P.O. Box 99110 **City, State, Zip:** Yuma, AZ 85369-9110	
Summary of Conversation			
Question 1: Are the remedies functioning as intended by the decision documents?			
Answer: • Yes.			
Question 2: Are the exposure assumptions, toxicity data, cleanup levels, and RAO used at the time of remedy selection still valid?			
Answer: • Yes.			
Question 3: Has any other information come to light that could call into question the protectiveness of the remedies?			
Answer: • Yes. • One issue that has been brought to Battelle's attention by on-base environmental personnel is the ultimate remediation for CAOC#8 (landfill within OU-2) due to upcoming JSF construction in that area of base proper.			

Appendix D6

Interview Record for David Reodriguez

INTERVIEW RECORD

Site Name: OU-1 and OU-2, MCAS Yuma, AZ		**EPA ID No.:** AZ0971590062	
Subject: Five-Year Review Interview		**Time:** 13:12	**Date:** 06 Aug 2009
Type: ☐ Telephone ☐ Visit ☑ Other **Location of Visit:** Email		☐ Incoming ☐ Outgoing	
Contact Made By			
Name: Derek Payne	**Title:** Task Order Leader	**Organization:** Battelle	
Individual Contacted			
Name: David Rodriguez	**Title:** Environmental Director	**Organization:** MCAS Yuma Environmental Department	
Telephone No: **Fax No:** **E-mail Address:** david.rodriguez5@usmc.mil		**Street Address:** P.O. Box 99110 **City, State, Zip:** Yuma, AZ 85369-9110	

Summary of Conversation

Question 1: Are the remedies functioning as intended by the decision documents?

Answer:
- Yes.

Question 2: Are the exposure assumptions, toxicity data, cleanup levels, and RAO used at the time of remedy selection still valid?

Answer:
- Yes.

Question 3: Has any other information come to light that could call into question the protectiveness of the remedies?

Answer:
- Yes.
- One issue that has been brought to Battelle's attention by on-base environmental personnel is the ultimate remediation for CAOC#8 (landfill within OU-2) due to upcoming JSF construction in that area of base proper.
- CONCUR! This will be a point discussed in the summary of the five-year review. Yes, COAC#8 priority has been elevated. The space will be critical for the introduction of the JSF at MCASY. In addition, the MRP sites will also require remediation for same JSF reasons.

Appendix D7

Interview Record for Jeremy Nevin

INTERVIEW RECORD			
Site Name: OU-1 and OU-2, MCAS Yuma, AZ		**EPA ID No.:** AZ0971590062	
Subject: Five-Year Review Interview		**Time:** 22:30	**Date:** 28 Oct 2009
Type: ☐ Telephone ☐ Visit ☑ Other **Location of Visit:** Email		☐ Incoming ☑ Outgoing	
Contact Made By			
Name: Derek Payne	**Title:** Task Order Leader	**Organization:** Battelle	
Individual Contacted			
Name: Jeremy Nevin	**Title:** ROICC	**Organization:** MCAS Yuma	
Telephone No: **Fax No:** **E-mail Address:** jeremy.m.nevin@navy.mil		**Street Address:** **City, State, Zip:**	
Summary of Conversation			
Jeremy Nevin transferred from MCAS Yuma in June 2009. He managed construction work at MCAS Yuma, but did not work with Base Environmental on any groundwater projects during his tenure.			

Appendix D8

Interview Record for Joellen Meitl

INTERVIEW RECORD				
Site Name: OU-1 and OU-2, MCAS Yuma, AZ			**EPA ID No.:** AZ0971590062	
Subject: Five-Year Review Interview			**Time:** 15:33	**Date:** 10-Feb-2010
Type: ☐ Telephone ☐ Visit ☑ Other **Location of Visit:** Email			☐ Incoming ☐ Outgoing	
Contact Made By				
Name: Chris Coonfare	**Title:** Project Manager		**Organization:** Battelle	
Individual Contacted				
Name: Joellen Meitl	**Title:** Project Manager		**Organization:** ADEQ	
Telephone No: **Fax No:** **E-mail Address:**		**Street Address:** **City, State, Zip:**		
Summary of Conversation				
Question 1: Are the remedies functioning as intended by the decision documents?				
Answer: • No Response				
Question 2: Are the exposure assumptions, toxicity data, cleanup levels, and RAO used at the time of remedy selection still valid?				
Answer: • A few times in the 5-Year Review report, they (NAVFAC Southwest) reference groundwater quality cleanup standards as the State of Arizona and EPA MCLs. EPA uses MCLs but Arizona uses AWQS. They should be using the more conservative of the two values and clarify that MCLs are EPA				
Question 3: Has any other information come to light that could call into question the protectiveness of the remedies?				
Answer: • No Response				

Appendix D9

Interview Record for Delfina C. Olivarez

INTERVIEW RECORD		
Site Name: OU-1 and OU-2, MCAS Yuma, AZ	**EPA ID No.:** AZ0971590062	
Subject: Five-Year Review Interview	**Time:** 17:41	**Date:** 10-Feb-2010
Type: ☐ Telephone ☐ Visit ☑ Other **Location of Visit:** Email	☐ Incoming ☐ Outgoing	

Contact Made By		
Name: Chris Coonfare	**Title:** Project Manager	**Organization:** Battelle

Individual Contacted		
Name: Delfina C. Olivarez	**Title:** Project Manager	**Organization:** ADEQ

Telephone No: **Fax No:** **E-mail Address:** dco@azdeq.gov	**Street Address:** **City, State, Zip:**

Summary of Conversation

Question 1: Are the remedies functioning as intended by the decision documents?

Answer:
- So far it seems like the remedies implemented are making progress.

Question 2: Are the exposure assumptions, toxicity data, cleanup levels, and RAO used at the time of remedy selection still valid?

Answer:
- So far.

Question 3: Has any other information come to light that could call into question the protectiveness of the remedies?

Answer:
- Picture 6 of OU-2, CAOC 8A (in Appendix E of this Five-Year Review) shows enough visible ground debris to cause concern of hazardous windblown emissions. Maybe I missed it, but this report does not state or address any Air Analysis work done of OU-1 and OU-2, MCAS, Yuma, AZ.

Appendix E

Supporting Photographs

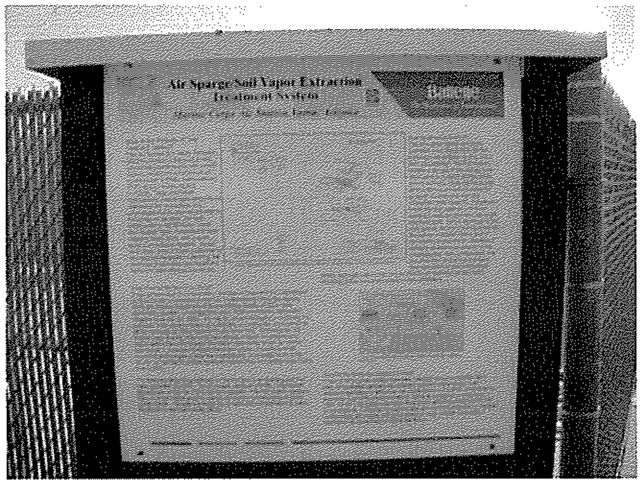

Figure 1. OU-1, Area 1 – Information Kiosk at the AS/SVE System

Figure 2. OU-1, Area 1 – Interior of Hot Spot AS/SVE Treatment Building

Figure 3. OU-1, Area 1 – Exterior of Hot Spot AS/SVE Treatment Building

Figure 4. OU-1, Area 1 – VCT System Tanks at the LEPA

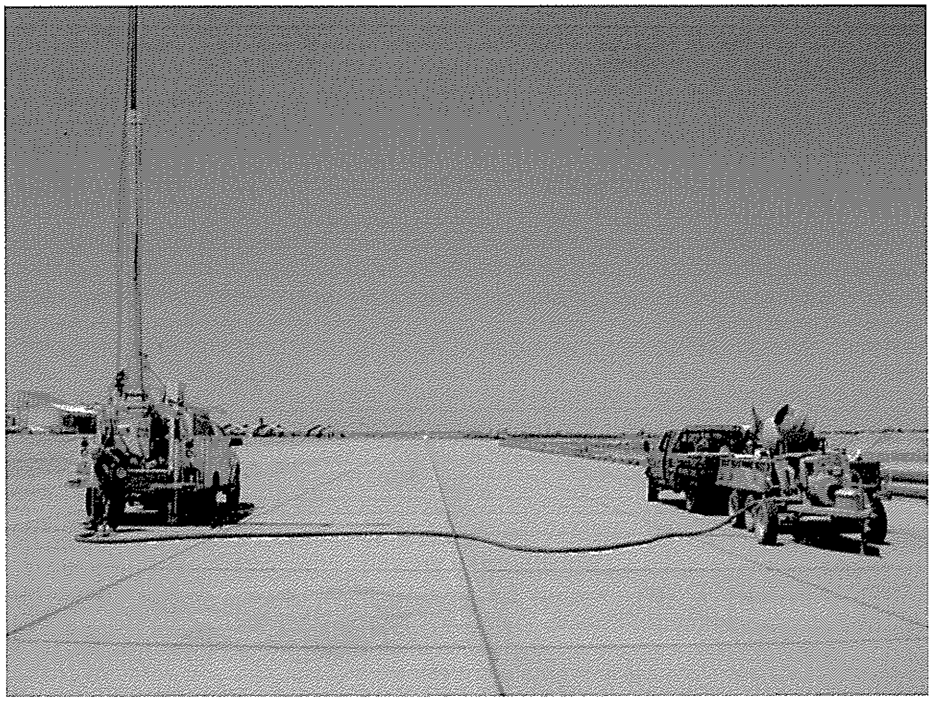

Figure 5. OU-1, Area 2 – Well Abandonment Activities (August 2006)

Figure 6. OU-2, CAOC 8