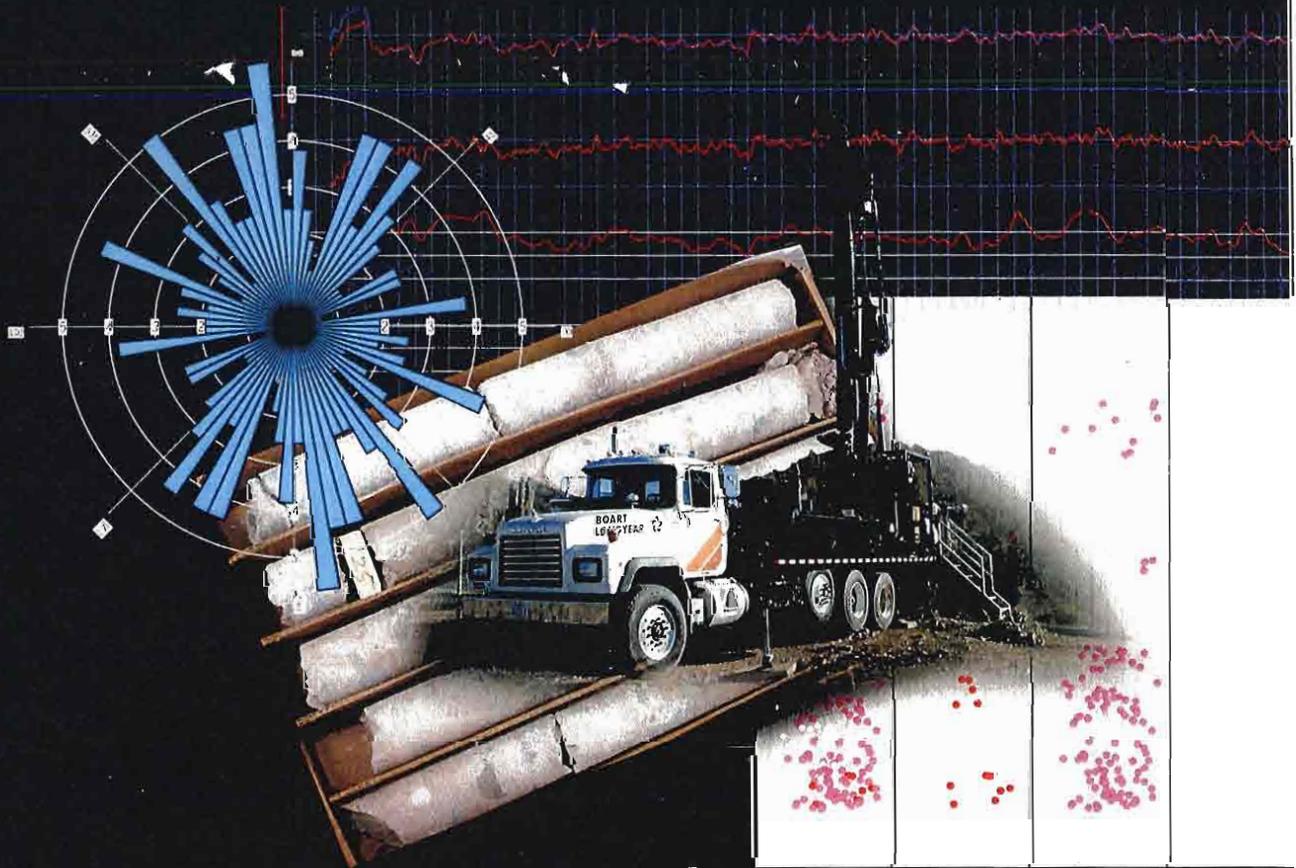


2008 ANNUAL MONITORING REPORT

Universal Propulsion Co., Inc.



DECEMBER 2009


GOODRICH

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PIRNIE**



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ARIZONA DEPARTMENT OF
ENVIRONMENTAL QUALITY

DEC 21 2009

Waste Programs Div.
Permits Section

December 18, 2009

Mr. Richard Olm, P.E.
Hazardous Waste Permits Unit
Arizona Department of Environmental Quality
1110 W. Washington Street
Phoenix, Arizona 85007

Re: Final 2008 Annual Monitoring Report
Consent Order P-136-04
Universal Propulsion Company, Inc.
Phoenix, Arizona 85085

Dear Mr. Olm:

Please find attached the Final 2008 Annual Monitoring Report for the Universal Propulsion Company, Inc. (UPCO). The draft report, dated March 2009, had been submitted to the Arizona Department of Environmental Quality (ADEQ) for review; however, no comments had been received on the draft report.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluated the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Please contact Ms. Karen Mittleider at (623) 516-3340, extension 2266 if you have any questions or need additional information.

Sincerely,

Jerry Ricketts
Value Stream Director

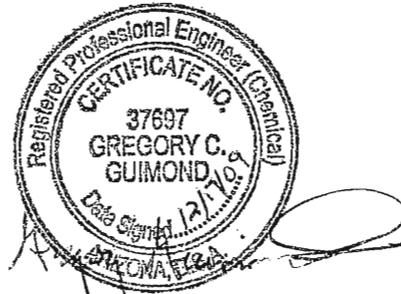
cc: Robin Thomas, ADEQ
David Haag, ADEQ
Philip McNeely, City of Phoenix
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Universal Propulsion Company, Inc.

25401 North Central Avenue • Phoenix, Arizona 85085

2008 Annual Monitoring Report

December 2009



Expires: 6/30/11

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

DEC 21 2009

Waste Programs Div.
Permits Section

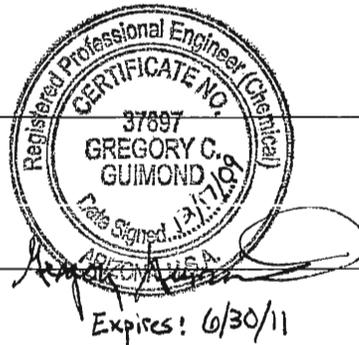
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3994-003





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1. Introduction

This Annual Monitoring Report (report) summarizes the monitoring activities and additional site investigations conducted at the Universal Propulsion Company, Inc. (UPCO) facility (site) in Phoenix, Arizona during 2008. The additional investigative activities included installation and monitoring of three site monitor wells and a nested multi-port soil vapor monitor well. This report continues to be part of an overall site characterization for soil and groundwater pursuant to Consent Order (Order) No. P-136-04 entered into between UPCO and the Arizona Department of Environmental Quality (ADEQ).

This report is supported by the Remedial Investigation Work Plan (Hargis+Associates, Inc. (H+A), 2004a), Quality Assurance Project Plan (QAPP) (H+A, 2004b), Groundwater Monitoring Plan (Malcolm Pirnie, 2004a), Updated Groundwater Monitoring Plan (Malcolm Pirnie, 2008a), and the Supplemental Soil and Soil Gas Investigation Work Plan (Malcolm Pirnie, 2008b). This report consists of the following:

- facility description;
- summary of previous groundwater investigations;
- additional site investigative activities;
- data evaluation and verification;
- summary of monitoring activities for the year;
- lists of wells that were sampled, including sample dates and analyses performed;
- table of water level measurements including, well identification, date and time of measurement, depth to water below measuring point and groundwater elevation above mean sea level;
- table of analytical data;
- hydrographs for the UPCO facility groundwater monitor wells;
- maps of groundwater elevation data;
- trend graphs of perchlorate concentrations for the UPCO facility groundwater monitor wells;
- investigation derived waste (IDW) documentation;
- copies of laboratory reports and data verification summaries; and
- recommendations for revisions to the monitoring plan.

1.1. Facility Description

The UPCO facility is located approximately two miles north of the Deer Valley Airport, Phoenix, Arizona (Figure 1). Specifically, the facility is at the intersection of Central Avenue and Happy Valley Road at an address of 25401 North Central Avenue. The site is within the southeast quarter of Section 5, Township 4 North, Range 3 East of the Gila and Salt River Baseline and Meridian. The UPCO facility is located on approximately 160 acres of land leased from the State of Arizona and consists of numerous manufacturing and administrative buildings (Figure 2). A fence surrounds the facility and restricts general access. The facility was initially constructed in 1972.

3. Monitoring Activities

3.1. Previous Groundwater Investigation Activities

A summary of previous groundwater investigation activities is presented below:

3.1.1. 2004 Activities

The UPCO facility production well (PW-1) and point of entry (POE) have been sampled periodically as part of county requirements for water service providers. During 2004, perchlorate was detected at concentrations ranging from non-detect to 2.1 micrograms per liter ($\mu\text{g/L}$).

Monitor wells MW-1 and MW-2 were installed in December 2003 and sampled three times during the first quarter of 2004. During those sampling events, perchlorate was detected in samples collected from MW-1 and MW-2 at concentrations ranging from 39 to 130 $\mu\text{g/L}$.

Monitor wells MW-3 through MW-6 were installed in August 2004 and sampled three times during the fourth quarter of 2004. Monitor wells MW-7 and MW-8 were installed in October 2004 and sampled twice during the second quarter of 2004. During those sampling events, perchlorate was detected in samples collected from MW-5 and MW-6 at concentrations of 6.4 and 18 $\mu\text{g/L}$, respectively. Perchlorate was not detected above the laboratory reporting limit (2 $\mu\text{g/L}$) in samples collected from MW-3, MW-4, MW-7, and MW-8.

UPCO and ADEQ sampled private domestic wells during the fourth quarter of 2004. ADEQ also sampled wells at the Arizona Department of Transportation (ADOT) facility located south west of the UPCO facility. Perchlorate was not detected above the laboratory reporting limit (2 $\mu\text{g/L}$) in samples collected from the private wells or at the ADOT facility.

Depth to groundwater measurements were collected monthly at each of the UPCO monitor wells during 2004.

3.1.2. 2005 Activities

Monitor wells MW-9 and MW-10 were installed in January 2005 and sampled quarterly during 2005. During those sampling events, perchlorate was not detected above the laboratory reporting limit (2 µg/L).

UPCO and ADEQ sampled private domestic wells semi-annually during 2005. Perchlorate was not detected above the laboratory reporting limit (2 µg/L) in samples collected from the private wells.

Depth to groundwater measurements were collected monthly at each of the UPCO monitor wells during 2005.

3.1.3. 2006 Activities

Monitor wells MW-11 and MW-12 were installed in December 2005 and initially sampled quarterly during 2006. During those sampling events, perchlorate was detected in samples collected from MW-11 at concentrations ranging from less than the laboratory reporting limit (2 µg/L) to 2.2 µg/L. Perchlorate was not detected above the laboratory reporting limit (2 µg/L) in samples collected from MW-12.

During the fourth quarter 2006 groundwater monitoring event conducted in November, the private wells were analyzed for perchlorate using two analytical methods. The two methods included EPA Method 314.0, which is specified in the Order, and EPA Method 332.0. This was performed for a comparative analysis between different perchlorate analytical testing methods. The results of the perchlorate comparative analysis showed concentration values ranging between 0.68 µg/L and 2.0 µg/L. The results of the perchlorate analysis for the UPCO monitor wells using both methods were analyzed for wells with perchlorate detection previously reported below 2 µg/L. Perchlorate analysis for UPCO monitor wells sampled during this quarter using Method 322.0 showed a range in concentration between 0.59 µg/L in monitor well MW-3 and 2.2 µg/L in monitor well MW-11. The HBGL specified in the order for perchlorate is 14 µg/L.

3.1.4. 2007 Activities

In an effort to expand the evaluation of the hydrogeological conditions at the site, additional pressure transducers were installed on April 4, 2007 in four site wells (PW-1, MW-7, MW-8, and MW-10) and two private wells along Yearling Road (218 E. Yearling and 520 E. Yearling). Between the weeks of July 7 and August 6, 2007, UPCO conducted a geophysical survey and installed a pressure transducer at a third private well located along Yearling Road (18 E. Yearling). A review of groundwater level data collected to

date from the transducers indicate that the groundwater elevation in the private wells are currently lower than at the nearest site wells, MW-3 and MW-4. Wells MW-3 and MW-4 are completed in bedrock units, and both show an overall declining water level trend. More recently, some of the private well owners have also resorted to drilling deeper wells as water levels have continued to decline in the area.

During the 2007 monitoring period, perchlorate was detected in monitor wells MW-1, MW-2, MW-5, MW-6 and MW-11. Perchlorate was detected in groundwater samples collected from MW-1 at concentrations ranging from 70 µg/L to 76 µg/L; from MW-2 at concentrations ranging from 80 µg/L to 87 µg/L; from MW-5 at concentrations ranging from 19 µg/L to 22 µg/L; from MW-6 at concentrations ranging from 15 µg/L to 18 µg/L; and from MW-11 at concentrations ranging from less than 2 µg/L to 2.4 µg/L. Perchlorate was not detected at concentrations above the laboratory reporting limit (2 µg/L) in the remaining UPCO monitor wells, including the deep monitor well (MW-12) located near MW-1. Perchlorate was detected in samples collected from PW-1 and the POE at concentrations ranging from less than 2 µg/L to 3 µg/L.

Perchlorate was detected once in one of the private domestic wells at a concentration above the EPA Method 314.0 laboratory reporting limit of 2 µg/L. Perchlorate was detected in one sample collected from 520 East Yearling at a concentration of 2.4 µg/L. During the 2007 groundwater monitoring period, the site wells were analyzed for perchlorate using three analytical methods. The three methods included EPA Method 314.0, which is specified in the Order, and EPA Methods 332.0 and 6850. This was performed for a comparative analysis between different perchlorate analytical testing methods. The newer methods for perchlorate analysis were utilized in an attempt to obtain lower reporting limits and minimize potential false positives. Method 332.0 was promulgated by EPA and was approved by ADHS in January 2007.

3.2. 2008 Groundwater Monitoring

3.2.1. Water Level Measurements

An Updated Groundwater Monitoring Plan for UPCO was submitted to ADEQ in March 2008 (Malcolm Pirnie, 2008a). Following ADEQ's approval, groundwater measurements were collected on a monthly basis. Depth to water was measured to the nearest 0.01 foot with respect to a surveyed measurement point at the top of each well using a decontaminated electronic meter.

Pressure transducer data from selected monitor wells was also transmitted to ADEQ in a separate letter dated May 15, 2008 (Malcolm Pirnie, 2008c). Some transducers were

removed from UPCO wells as described in that letter. UPCO agreed to ADEQ's request to leave the transducers in the three private wells (18 E. Yearling, 218 E. Yearling, and 520 E. Yearling) until new monitor wells MW-14 and MW-15 have been installed and aquifer testing completed. Additionally, UPCO agreed that the transducer in the private well located at 18 East Yearling will remain at least until a complete year of water level monitoring data has been recorded at that well.

3.2.2. UPCO Facility Wells Sampling

The 2008 Sampling activities were conducted in accordance with the schedule outlined in the 2007 Annual Groundwater Report (Malcolm Pirnie, 2008d). Project specific sampling procedures are outlined in the Groundwater Monitoring Plan (Malcolm Pirnie, 2004), the Updated Groundwater Monitoring Plan (Malcolm Pirnie, 2008a), and industry standard methods. Groundwater samples were collected from UPCO groundwater monitor wells (MW-1 to MW-12) on a quarterly basis in 2008. During the third quarter, installation of Phase IV monitor wells MW-13, MW-14, and MW-15 were completed. Monitor wells MW-13 and MW-15 were initially sampled on August 8, 2008 while monitor well MW-14 was sampled on August 19, 2008. Samples from the production well, PW-1, were collected at the well head and POE. It should be noted that the POE for the facility's drinking water system changed location at the beginning of 2007 due to implementation of point of use treatment at the various locations. Data presented for the POE represents the new location (at a sink in building A-1) starting in the second quarter of 2008. A list of UPCO monitor wells sampled, including dates and analysis performed, is provided in Table 3.

3.2.3. Private Wells Sampling

Private wells incorporated into the groundwater monitoring program were sampled using existing dedicated submersible pumps. Groundwater samples were collected semi-annually in the second and fourth quarter of 2008. A list of private wells that were sampled in 2008 including dates and analysis performed is included in Table 4.

3.3. Additional Monitor Well Installation

This section summarizes the Phase IV monitor well drilling and installation activities at UPCO in 2008. Phase IV involved installation of monitor wells MW-13 through MW-15 at the site. These wells were installed to address the objectives related to groundwater characterization discussed in the November 21, 2007 meeting between UPCO and ADEQ.

Monitor wells MW-13 through MW-15 were installed between May and June 2008. Monitor well installation activities were completed in general accordance with the Monitor Well Construction Work Plan (H+A, 2004c) and the Supplemental Groundwater Investigation Work Plan (Malcolm Pirnie, 2008e). The construction specifications and location of the Phase IV monitor wells were verified with ADEQ prior to construction. The Phase IV monitor well locations are included in Figure 3.

3.3.1. Drilling Methods

Drilling was accomplished using a combination of coring (4-inch outside diameter, 2.5-inch inner diameter core) and air rotary methods. The deep boring for MW-13 was drilled using a core rig. The other Phase IV wells (MW-14 and MW-15) were drilled directly with an air rotary drill rig.

At MW-13, a core rig was used to drill a 4-inch diameter pilot borehole from ground surface to total depth. Lithologic samples were collected using a core barrel advanced in five foot sections. The core samples were logged using the United Soil Classification System (USCS) in the unconsolidated units while the consolidated units (i.e. bedrock) was logged using the United States Geologic Survey (USGS) descriptions. The recovered cores were placed in labeled and wax-coated boxes and are currently stored off-site. Following borehole geophysics, the diameter of the pilot borehole was increased to 10 inches by reaming with an air rotary drill rig. Unconsolidated alluvium extended from ground surface to approximately 195 feet bgs; bedrock was present from 195 feet bgs to the total depth of the borehole at 500 feet bgs. The well was installed at a depth of 490.5 feet bgs.

Monitor wells MW-14 and MW-15 were drilled directly with an air rotary drill rig. Grab samples of the cuttings were collected at regular intervals and logged using the USCS method. The boring for each well was drilled to total depth of 503 and 350 feet bgs, respectively. The wells were installed at depths of 500, and 325 feet bgs, respectively.

At each location, a 20-foot section of low carbon steel conductor casing was grouted in place to provide a surface seal and prevent collapse of the borehole. Lithologic logs for each borehole are provided in Appendix A.

3.3.2. Rock Quality Designation (RQD) and Fracture Analysis

Rock Quality Designation (RQD) analysis was performed on the bedrock core recovered from the pilot borehole for MW-13. RQD evaluates the relative degree of fracturing of the bedrock unit and provides a systematic method of identifying the location and extent

of fracture zones. The RQD data collected from the boring for monitor well MW-13 indicates that fracture intensity of the bedrock was heterogeneous with depth. The RQD data per core run for MW-13 is provided in the draft Interim RI Summary Report (Malcolm Pirnie, 2009a).

3.3.3. Borehole Geophysics

Geophysical surveys were performed in the boreholes for monitor wells MW-13 and MW-14. The suite of geophysical techniques performed included:

- natural gamma ray;
- neutron;
- caliper;
- density;
- spontaneous potential (SP);
- temperature;
- Electric log resistivities;
- Sonic;
- acoustic borehole televiewer; and
- optical borehole televiewer.

The methods employed at each location depended upon the stability of the borehole, type of fluid in the hole such as mud or water, and potential of the borehole to retain fluid. The geophysical data was collected by a variety of source and receivers. The geophysical data are presented in the draft Interim RI Summary Report (Malcolm Pirnie 2009a).

3.3.4. Geophysical Fracture Analysis

Fracture analyses were performed in the borings for MW-13 and MW-14 to provide a quantitative assessment of the orientation and intensity of fractures. Acoustical and optical televiewer geophysical tools collected fracture data from the boreholes. The data was digitized and reduced to conduct the fracture analyses. The orientation and depth interval were recorded for each fracture observed. Borehole geophysics collected in these borings, as well as others at the site, indicates there is not a strong preferential orientation of the fractures, as fractures are observed in a variety of orientations. A summary of the fracture analyses of the geophysical logs for MW-13 and MW-14 are provided in the draft Interim RI Summary Report (Malcolm Pirnie, 2009a).

3.3.5. Hydrophysical Logging

Hydrogeophysical logging (HPL) activities were conducted at the borehole for monitor well MW-14 between June 23, 2008 and June 25, 2008. Hydrophysical analyses consisted of an ambient flow characterization (AFC) test, a hydraulic characterization (HC) test using a prescribed draw down to determine well productivity, and a pumping during injection (PDI) test to monitor changes in fluid electrical conductivity (FEC). HPL logging was only performed at the MW-14 borehole location. Planned HPL logging was not conducted at the MW-13 borehole location due to borehole instability. Results of the hydrophysical testing are summarized in the draft Interim RI Summary Report (Malcolm Pirnie 2009a).

3.3.6. Zonal Sampling

Depth specific (zonal) groundwater samples were collected during the drilling of monitor wells MW-13 and MW-14 using both packer assemblies and temporary wells (Malcolm Pirnie, 2009a). At MW-13, zonal samples were collected at 247 to 269 feet bgs with a temporary well set, and at 480 to 502 feet bgs with a packer assembly. At MW-14, zonal samples were collected at 285 to 305 feet bgs and 413.5 to 500 feet bgs with a packer assembly, and at 360 to 380 feet bgs with a temporary well set.

A zonal groundwater sample was also collected during the drilling of soil vapor monitor well SVMW-1 (see Section 3.4). At SVMW-1, a zonal sample was collected at 218 to 238 feet bgs (at the upper surface of groundwater) with a temporary well set (Malcolm Pirnie, 2009a).

3.3.7. Monitor Well Installation

Monitor wells were installed in each borehole following completion of drilling and geophysical survey activities. The wells were constructed in the manner outlined in the Supplemental Groundwater Investigation Work Plan (Malcolm Pirnie, 2008e). A summary of the well information for the UPCO facility monitor wells is included in Table 1. As-built well construction diagrams are provided in Appendix A.

3.3.8. Monitor Well Development

Monitor wells MW-13 through MW-15 were developed within one week of installation. The monitor wells were developed by swabbing, surging, bailing and pumping. Development activities were conducted for two to eight hours at each well. The well screen was surged in 10-foot sections from the top of the interval to the bottom for between 30 and 45 minutes. A bailer was used to remove settled solids that had entered the casing during surging for between two to five hours. A submersible Grundfos pump

been attributed to the well installation activities. On September 20, 2008, monitor well MW-13 was further developed and two additional groundwater samples were collected, one after purging three well volumes from the well and one after pumping for approximately eight hours. Results of the additional sampling are discussed in Section 4. Monitor well MW-15 was sampled on August 8, 2008 while monitor well MW-14 was sampled on August 19, 2008. In accordance with the Groundwater Monitoring Plan (Malcolm Pirnie, 2004c), and the Updated Groundwater Monitoring Plan (Malcolm Pirnie, 2008a), monitor wells MW-13, MW-14, and MW-15 were incorporated into UPCO's groundwater monitoring program in 2008. The results of the initial groundwater sampling activities were presented in the Third Quarter 2008 Monitoring Report (Malcolm Pirnie, 2008f).

3.4. Soil Vapor Monitor Well Installation

During the fourth quarter of 2008, a nested soil vapor monitor well (SVMW-1) was installed in B-Complex. Prior to installation, a temporary well was constructed in the borehole with a temporary well set screened at approximately 218-238 feet bgs. A grab groundwater sample was collected from the temporary well on October 23, 2008 and groundwater elevation was recorded from a surveyed measurement point on October 29, 2008. The temporary well was then removed, the bottom of the borehole was grouted, and the soil vapor monitor well was constructed. SVMW-1 consists of four nested wells, including one well with a 0.5-inch diameter schedule 80 PVC casing and 0.04-inch slot screen (installed at 190 to 200 feet bgs) and three wells with 2-inch diameter schedule 80 PVC casing with 0.02-inch slot screens. The screen interval for each sampling port was determined based on the analytical results for VOCs collected from boring BC-SG41 during the Supplemental Soil and Soil Gas Investigation. The soil gas monitoring screens, each ten feet in length, were installed at 190-200 feet bgs, 140-150 feet bgs, 90-100 feet bgs, and 30-40 feet bgs, respectively. Annular construction materials included #8-12 silica sand, 3/8"-inch washed pea gravel, bentonite pellets, and neat cement grout. Annular materials were delivered to the subsurface using a tremie pipe. The SVMW-1 lithologic log and as-built well construction diagram are included in Appendix A.

3.5. Survey

A state registered land surveyor established horizontal and vertical control at each Phase IV monitor well. The vertical coordinates of the sounding port, top of casing, and ground surface were surveyed in the Arizona State Plane Coordinate System (NGVD 29) with units of international feet above mean sea level. The measuring point elevation of the PVC sounding tube port contained in the well seal was measured to the nearest 0.01 foot.

The measuring point was marked on the north side of the port. The horizontal coordinates of the well were surveyed in the Arizona State Plane Coordinate System, Central Zone, North American Datum 1983 (NAD 83) with units of international feet. Survey information is provided in Table 1.

3.6. Investigative Derived Waste (IDW)

Soil cuttings and water generated during the drilling, installation, development, and sampling of the monitor wells was stored in roll-off bins or poly tanks. The soil and water were sampled and characterized prior to off site disposal. IDW documentation is included in the draft Interim RI Summary Report (Malcolm Pirnie 2009a). Water generated during well installation, well development, and sampling of the monitor wells was stored in 5,000 gallon poly tanks and a 20,000 frac tank. The water was sampled and characterized prior to offsite disposal. IDW documentation related to groundwater sampling during 2008 is presented in Appendix B.

4. Data Evaluation

4.1. Groundwater Level Measurements

Groundwater elevations have been monitored at and near the UPCO facility to evaluate potential gradients. These measurements have been collected at UPCO site wide monitor wells and private wells located near the north property boundary at 18 East Yearling, 218 East Yearling and 520 East Yearling Road using electronic water level equipment and dedicated pressure transducers.

Historic depth to groundwater measurements and groundwater elevations for site and private wells are summarized in Appendix C. Historic hydrographs are presented in Appendix D. Graphs of the transducer data collected to date are presented in Appendix D. Groundwater elevation maps for 2008 are provided on Figures 5 through 15.

The highest water elevations were observed in late 2004 to early 2005, and the lowest elevations for a majority of the wells were observed in 2008. A potential geologic structure (Malcolm Pirnie, 2009a) is located east of the area monitored by MW-6, MW-7 and MW-10, and generally on the west side of the UPCO facility. Groundwater elevations on the west side of the structure are approximately 30 feet higher than on the east side of the structure. The wells located east of the potential geologic structure, with the exception of MW-3 and MW-4, showed a nearly static/slightly declining water level trend. The difference between the minimum and maximum groundwater elevations measured in each of these wells in 2008 (i.e., the groundwater elevation decline) varied between 0.08 feet in newly installed monitor well MW-13 and 1.66 feet in monitor well MW-3. Monitor wells MW-3 and MW-4 continue to show a larger decline in groundwater elevations with differences in minimum and maximum groundwater elevations of 1.66 and 1.14 feet, respectively.

West of the potential geologic structure, groundwater elevations were also declining. However, monitor well MW-6 showed a mainly rising trend during the first half of 2008. The difference between the minimum and maximum groundwater elevations for these wells varied by 0.76 and 0.95 feet in monitor wells MW-7 and MW-10, and 4.12 feet in monitor well MW-6.

A review of groundwater level data collected from wells with transducers indicate a general declining trend. The observed declining trend in the transducers is in agreement

with the manual measurements. As stated previously, UPCO in consultation with ADEQ reduced the number of transducer measurements conducted in site wells, while installing additional transducers in the newly constructed monitor wells MW-14 and MW-15. Groundwater elevations in the private wells are currently lower than at the nearest site wells, MW-3 and MW-4. Hydrographs for the private wells show pumping level drawdowns ranging from 10 to 50 feet below static levels, particularly during the on-cycles which may correlate with cumulative peak periods of use (Appendix D). However, this drawdown has not been observed in the nearest site wells showing, at a minimum, that the short term pumping-related drawdown does not extend very far. Although, as noted above, wells MW-3 and MW-4 show steeper water level declines when compared to other onsite wells suggesting that the overall lowered water table to the north is propagating south toward the site.

4.2. Groundwater Quality Data

Tables presenting water quality analytical data for the UPCO monitor wells, UPCO production well, and the POE are summarized in Appendix E. The perchlorate results for the UPCO monitor wells are provided in Table 5. A table presenting water quality analytical data for the private wells is provided in Appendix F. The perchlorate results for the private wells are provided in Table 6. Perchlorate concentration trend plots for each UPCO monitor well are presented in Appendix G. Field parameter data collected during 2008 sampling events is provided in Appendix H. Figures 16 through 19 present perchlorate concentration maps for First Quarter 2008 through Fourth Quarter 2008.

4.2.1. Perchlorate

The Arizona Department of Health Services (ADHS) Health Based Guidance Level (HBGL) identified by ADEQ in the Order is 14 $\mu\text{g/L}$ for perchlorate. The laboratory reporting limit using the Order-specified EPA Method 314.0 is 2 $\mu\text{g/L}$. During the 2008 monitoring period, perchlorate was detected in monitor wells MW-1, MW-2, MW-5, MW-6, MW-11, MW-13 and MW-14. Perchlorate was detected in groundwater samples collected from MW-1 at concentrations ranging from 73 $\mu\text{g/L}$ to 76 $\mu\text{g/L}$; from MW-2 at concentrations ranging from 78 $\mu\text{g/L}$ to 88 $\mu\text{g/L}$; from MW-5 at concentrations ranging from 22 $\mu\text{g/L}$ to 25 $\mu\text{g/L}$; from MW-6 at concentrations ranging from 15 $\mu\text{g/L}$ to 18 $\mu\text{g/L}$; from MW-13 at concentrations ranging from 220 $\mu\text{g/L}$ to 330 $\mu\text{g/L}$, from MW-14 at concentrations ranging from ranging from less than 2 $\mu\text{g/L}$ to 2.5 $\mu\text{g/L}$ and from MW-11 at concentrations ranging from less than 2 $\mu\text{g/L}$ to 2.6 $\mu\text{g/L}$.

Perchlorate was not detected at concentrations above the laboratory reporting limit (2 $\mu\text{g/L}$) in the remaining UPCO monitor wells, including the newly installed monitor well

MW-15 and the deep monitor well (MW-12) located near MW-1. Perchlorate was detected in samples collected from PW-1 and the POE at concentrations ranging from less than 2 µg/L to 2.5 µg/L.

During the 2008 monitoring period, perchlorate was detected once in one of the private domestic wells at a concentration above the EPA Method 314.0 laboratory reporting limit of 2 µg/L. Perchlorate was detected in one sample collected from 25903 N. 2nd St at a concentration of 2.2 µg/L.

During the 2008 groundwater monitoring period, the site wells were analyzed for perchlorate using two analytical methods. The two methods included EPA Method 314.0, which is specified in the Order, and EPA Method 332.0. Two methods were performed for a comparative analysis between different perchlorate analytical testing methods. The results of the perchlorate comparative analyses for the site wells are included in Table 5, and show concentration values ranging between 0.46 µg/L in monitor well MW-3 and 210 µg/L in monitor well MW-13. The results of the perchlorate comparative analysis for the private wells are included in Table 6, and show concentration values ranging between 0.72 µg/L and 3.1 µg/L.

4.2.2. VOCs

Eight VOCs were detected during 2008 groundwater sampling activities including 1,1-DCE, 1,1-DCA, 1,4-dioxane, bromoform, chloroform, dibromochloromethane, toluene and trihalomethanes (Appendix E). These detections were at concentrations below the applicable Arizona Aquifer Water Quality Standard (AWQS). 1,1-DCE was detected in groundwater samples collected from PW-1 and POE at concentrations ranging from less than the laboratory reporting limit of 2 µg/L to 4.3 µg/L. The AWQS for 1,1-DCE is 7 µg/L. 1,1-DCA was detected in groundwater samples collected from PW-1 at concentrations ranging from less than the laboratory reporting limit of 0.50 µg/L to 0.52 µg/L. A numeric standard has not been established for 1,1-DCA. 1,4-Dioxane was detected in samples collected from MW-1, MW-2, MW-14, MW-15, PW-1 and POE at concentrations ranging from less than 1 µg/L to 3.7 µg/L. 1,4-Dioxane does not have an applicable AWQS; however, the EPA preliminary remediation goal (PRG) for 1,4-dioxane is 6.1 µg/L. Bromoform, chloroform, and dibromochloromethane were detected in samples collected from MW-15, PW-1 and POE. These chemicals are classified as trihalomethanes and were detected below the AWQS for total trihalomethanes, which is 100 µg/L. Toluene was detected in groundwater samples collected from MW-15 at concentrations ranging from less than the laboratory reporting limit of 0.5 µg/L to 0.77 µg/L. The AWQS for toluene is 1,000 µg/L.

4.2.3. Metals

Barium was detected in each of the UPCO monitor wells, except for MW-7, and ranged in concentration from 0.003 mg/L to 0.23 mg/L. The AWQS for barium is 2 mg/L. Arsenic was detected in monitor wells MW-2, MW-3, MW-4, MW-8, MW-9, MW-10, POE, and PW-1 and ranged in concentration from 0.0023 mg/L to 0.047 mg/L. The AWQS for arsenic is 0.05 mg/L. Cadmium was detected in monitor wells MW-2, MW-3, MW-4, MW-8, MW-9, MW-10, POE, and PW-1 at a concentration of 0.001 mg/L. The AWQS for cadmium is 0.005 mg/L. Chromium was detected in monitor wells MW-2, MW-3, MW-4, MW-5, MW-8, MW-9, MW-10, MW-14, POE, and PW-1 and ranged in concentration from 0.002 mg/L to 0.024 mg/L. The AWQS for chromium is 0.1 mg/L. Lead was detected in monitor wells MW-2, MW-3, MW-4, MW-8, MW-9, MW-10, POE, and PW-1 and ranged in concentration from 0.001 mg/L to 0.0037 mg/L. The AWQS for lead is 0.015 mg/L. Selenium was detected in monitor wells MW-2, MW-3, MW-4, MW-8, MW-9, MW-10, POE, and PW-1 and ranged in concentration from 0.002 mg/L to 0.0037 mg/L. The AWQS for selenium is 0.05 mg/L. Silver was detected in monitor well MW-2, MW-3, MW-4, MW-8, MW-9, MW-10, POE, and PW-1 at a concentration of 0.001 mg/L. The AWQS for silver is 0.035 mg/L. Calcium, potassium, sodium, and magnesium were detected in PW-1 and POE. However, no AWQS have been established for these metals. No other metals analyzed during the monitoring period were detected above the laboratory detection limits.

4.3. Zonal Groundwater Data

Zonal samples were collected prior to well completion within the boreholes for deeper monitor wells MW-13 and MW-14 and soil vapor monitor well SVMW-1. The zonal samples collected from MW-13, MW-14 and SVMW-1 were analyzed for perchlorate by EPA Method 314. The sample collected from the SVMW-1 borehole was also analyzed for VOCs by EPA Method 8260. Table 7 summarizes the zonal sampling analytical data for perchlorate.

The zonal sample collected from 247 to 269 feet bgs at MW-13, at the surface of the water table directly beneath the former Waterbore Area ponds, contained perchlorate at a concentration of 120,000 ug/L. The zonal sample collected at the bottom of the borehole (480 to 502 feet bgs) contained perchlorate at a concentration of 3.6 ug/L prior to reaming the borehole and well construction. These results also appear to indicate that limited vertical migration of perchlorate has occurred but has not extended to the depths that the private wells are screened. Perchlorate concentrations at MW-13 after well installation ranged between 220 and 330 ug/L in 2008 and have exhibited lower concentrations with additional purging. The initial elevated perchlorate concentration in

MW-13 may be related to well installation activities and not representative of the aquifer water quality at that location. Continued quarterly monitoring will be conducted to confirm this observation.

The zonal samples collected at MW-14 from 285 to 305 feet bgs, 360 to 380 feet bgs, and 413.5 to 500 feet bgs, did not contain perchlorate at a detectable concentration (<2 ug/L).

The zonal sample at SVMW-1, collected at 218 to 238 feet bgs, contained perchlorate at a concentration of 7.8 ug/L. Acetone and MEK were the only VOCs detected in the groundwater sample at concentrations of 45 ug/L and 4.6 ug/L, respectively. Acetone was also detected in the trip blank sample that was concurrently submitted to the laboratory with the zonal sample. AWQS' have not been established for acetone or MEK. The primary contaminant of concern in soil vapor, 1,1-DCE was not detected in the grab groundwater sample. The VOC analysis for the zonal sample collected at SVMW-1 is presented in Table 8.

4.4. Soil Vapor Data

Soil gas samples were collected from SVMW-1 on November 13, 2008 and analytical results are summarized in Table 9. The primary contaminant of concern, 1,1-DCE, was detected at 800 parts per billion vapor (ppbv) at 30 feet bgs, 11,000 ppbv at 90 feet bgs, at 3,100 ppbv at 140 feet bgs and at 180 ppbv at 190 feet bgs. As stated in Section 4.3, a grab groundwater sample was collected from a temporary well during the installation of SVMW-1. Analysis of the grab groundwater sample indicated that significant migration of VOCs from soil vapor to groundwater has not occurred. Soil vapor will continue to be sampled quarterly at this location to monitor potential VOC migration in soil beneath B-Complex.

5. Quality Assurance and Data Verification

Analytical data provided by the laboratories were subjected to data review for quality control/quality assurance. A summary of the data verification is presented in Appendix I. Copies of the analytical data reports are provided in Appendix J.

Groundwater monitoring activities followed the quality assurance procedures outlined in the QAPP (H+A, 2004b). The project specific QAPP establishes procedures and guidance for the following:

- data quality objectives;
- sample documentation and custody;
- sample container requirements;
- quality control procedures; and
- quality assurance management including, data management and data verification/validation procedures.

Samples were collected and submitted to the laboratory in a manner that provides data that are representative of site conditions. Laboratory analyses were conducted according to analytical methods described in EPA guidance manuals. Field quality control (QC) samples included field duplicates and trip blanks. Laboratory QC samples included method blanks, laboratory control samples (LCS), and matrix spike/matrix spike duplicate (MS/MSD) samples.

Laboratory deliverables consist of Level II data packages (including a QC summary). Data reported by the laboratory has been verified that the data meets the data quality objectives. The results were considered usable for the intended purposes, and the project data quality objectives (DQOs) specified in the QAPP (H+A, 2004b) were met.

6. Future Monitoring Activities

6.1. 2009 Monitoring Program

The 2009 monitoring program was conducted in accordance with the procedure and methods outlined in the Updated Groundwater Monitoring Plan (Malcolm Pirnie, 2008a). UPCO revised the monitoring program to include the quarterly monitoring requirements for the new groundwater wells (MW-13, MW-14, and MW-15) and the soil vapor monitor well (SVMW-1). The 2009 sampling and analysis schedule is summarized in Table 10. The current location of the POE, at the sink in the building A-1 lunchroom, no longer provides value-added data for monitoring groundwater quality at the UPCO site. Sampling at the POE for groundwater monitoring purposes did not occur in 2009. UPCO will continue to collect samples at the POE to remain in compliance with drinking water regulations.

The draft Interim RI Report (Malcolm Pirnie, 2009a) includes proposals to install three additional Phase V wells. The groundwater monitoring plan will be revised, as necessary, to include the new wells if approved by ADEQ.

Transducers were removed from the UPCO monitor wells and the private wells once at least one year of water level data had been obtained. Additional transducers will not be installed in future monitor wells.

7. References

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