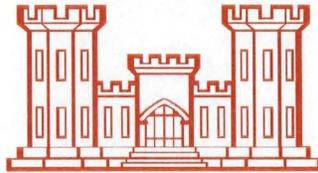


FINAL ROUND 2 QUARTERLY GROUNDWATER MONITORING REPORT

Remedial Investigation Part 1, At Acid Areas 2 & 3 Former Plum Brook Ordnance Works Sandusky, Ohio

Prepared for:



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NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE
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LIST OF ACRONYMS

AA2	Acid Area 2
AA3	Acid Area 3
amsl	above mean sea level
bgs	below ground surface
cm/sec	centimeters per second
COC	contaminants of concern
DERP	defense environmental restoration program
DOD	U.S. Department of Defense
EPA	U.S. Environmental Protection Agency
ft	feet
ID	inner diameter
IDW	investigative-derived waste
IT	IT Corporation
Jacobs	Jacobs Engineering
$\mu\text{g/L}$	micrograms per liter
mg/L	milligrams per liter
NTU	nephelometric turbidity unit
OEPA	Ohio Environmental Protection Agency
PAH	polyaromatic hydrocarbons
PBOW	Plum Brook Ordnance Works
PCB	polychlorinated biphenyls
pH	hydrogen ion concentration
PRG	preliminary remediation goal
PVC	polyvinylchloride
RBC	risk based concentration
RI	remedial investigation
SAP	sampling and analysis plan
SI	site investigation
SVOC	semivolatile organic compound
TAL	target analyte list
TNT	trinitrotoluene
TOC	top of casing
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compounds

1.0 INTRODUCTION

The U.S. Army is investigating the environmental impact at previously owned U.S. Department of Defense (DOD) properties. This work is being conducted by the U.S. Army Corps of Engineers (USACE) under the Defense Environmental Restoration Program (DERP). The Plum Brook Ordnance Works (PBOW) site, located in Sandusky, Erie County, Ohio, is a formerly used defense site under DERP. This Task Order is being managed by USACE Huntington District and technically overseen by the USACE Nashville District. Jacobs Engineering (Jacobs) is contracted to conduct Part 1 of a Remedial Investigation (RI) at Acid Areas 2 and 3 (AA2 and AA3).

Groundwater monitoring and sampling activities were conducted in accordance with plans and procedures defined in the Final Site-Wide Sampling and Analysis Plan (SAP) (Jacobs 2004a) and the Final Site-Specific SAP, Remedial Investigation, Part 1, at Acid Areas 2 & 3 (Jacobs 2004b).

This report summarizes the activities conducted during the second round of quarterly groundwater monitoring, the investigative methods used, and the hydrogeological and analytical results.

1.1 OBJECTIVES

The objectives of the remedial investigation of groundwater at Acid Areas 2 & 3 are as follows:

- Determine the physical characteristics of the shallow and bedrock groundwater, at both sites, including depth, gradient, flow direction, and hydraulic properties.
- Determine whether shallow and bedrock groundwater has been impacted by site contaminants.

The objective of the quarterly groundwater monitoring is to evaluate changes in contaminant concentrations and water levels in response to seasonal variability. Round 1 sampling and monitoring was conducted from 20 January 2005 to 1 February 2005. Round 2 sampling and monitoring was conducted 21 April through 29 April 2005. Two rounds of monitoring were proposed in the Final Site-Specific Sampling and Analysis Plan (Jacobs 2004b). Based on discussions at the December 8, 2005 team meeting, no further rounds of groundwater sampling will be required.

1.2 FACILITY LOCATION AND DESCRIPTION

AA2 and AA3 are located in the northwest portion of PBOW (Figure 1-1). The AA2 site is located south of Patrol Road approximately 2000 feet (ft) west of Campbell Street. The AA3 site is located at the intersection of Ransom Road and Maintenance Road, with the majority of the site in the area northwest of the intersection.

The AA2 site physical features include an open field bounded by drainage ditches to the north and south with scattered overgrowth throughout. Mature vegetation is mainly

limited to the site boundaries. The ground surface at AA2 is relatively flat, with minimal slope toward the drainage ditches to the north and south.

The AA3 site physical features include an open field with minimal low-lying overgrowth. The ground surface at AA3 is relatively flat, with minimal slope toward the north. A small drainage ditch borders the west side of the site.

1.3 SITE HISTORY AND POTENTIAL FOR CONTAMINATION

The acid areas were used to produce oleum, sulfuric acid, and nitric acid for the manufacture of trinitrotoluene (TNT). A review of the 1958 aerial photographs revealed several buildings and above-ground storage tanks at both AA2 and AA3. A records review was conducted by IT Corporation (IT) in preparation for a Site Investigation (SI) of the Acid Areas (IT, 1998). The SI of AA2 and AA3 was conducted to determine the presence of potential contaminants and to narrow the focus of future sampling (if necessary) to specific contaminants of concern (COC).

A total of fifteen soil borings were conducted at AA2, with two samples being collected at each location: one surface and one subsurface. The SI identified surface and subsurface soil contamination above U.S Environmental Protection Agency (EPA) Region III Risk Based Concentration (RBC). Organic contaminants in surface and subsurface soil exceeding the RBCs at AA2 include the following:

- Polyaromatic Hydrocarbons (PAHs): Benzo(a)pyrene, Benzo(a)Anthracene, Benzo(b)Flouranthene, Dibenzo(a,h)Anthracene, and Indeno(1,2,3-cd)Pyrene
- Semi-Volatile Organic Compounds (SVOCs): 3,3 Dichlorobenzidine.
- Polychlorinated biphenyls (PCBs): Aroclor 1260

Subsurface soil samples were not analyzed for PCBs; therefore it is not known if PCBs are present at depth. Inorganic contaminants were not detected in surface and subsurface soil at concentrations exceeding the RBCs or established background values.

A total of eighteen soil borings were completed at AA3, with two samples being collected at each location: one surface and one subsurface. An additional two surface soil samples were collected in the vicinity of the Power Substation Area on the East side of Ransom Road. The SI identified surface and subsurface soil contamination above U.S EPA Region III RBCs. Organic contaminants in surface and subsurface soil exceeding the RBCs at AA3 include the following:

- Polyaromatic Hydrocarbons (PAHs): Benzo(a)pyrene, Benzo(a)Anthracene, Benzo(b)Flouranthene, and Indeno(1,2,3-cd)Pyrene
- Polychlorinated biphenyls (PCBs): Aroclor 1260

Inorganic contaminants were not detected in surface and subsurface soil at concentrations exceeding the RBCs or established background values.

Four shallow overburden wells and three bedrock wells were installed at AA2. One shallow overburden well and one bedrock well were installed at AA3. Groundwater samples were collected from the bedrock wells as part of the 2002 site-wide

groundwater investigation (Shaw, 2004). Samples were collected during both dry season (September 2001 – October 2001) and wet season (April 2002).

Sampling results indicate volatile organic compounds (VOC) and SVOCs were detected in the bedrock groundwater at both sites at levels above RBCs. RBCs used for the 2002 groundwater investigation were based on EPA 2002 tap water criteria.

2.0 FIELD ACTIVITIES

Groundwater characterization activities conducted at AA2 and AA3 as a part of the 2004-2005 RI include the following:

- Installation of five temporary piezometers at each site
- Installation of three shallow overburden wells and three bedrock wells at AA3
- Development of all newly installed wells
- Monitoring of water levels in piezometers and wells
- Slug testing of all newly installed wells
- Groundwater sampling of existing and newly installed wells

Piezometer installation, well installation, well development, and slug testing are discussed in detail in the Round 1 Quarterly Groundwater Monitoring Report (Jacobs, 2005). Revised photographic logs of the bedrock cores, showing increased magnification, are provided in Appendix A.

2.1 WATER LEVEL MEASUREMENTS AND PIEZOMETER ABANDONMENT

Water level measurements were collected over a six-month period from 8 November 2004 through 21 April 2005 from all monitoring wells and piezometers at AA2 and AA3. Water level measurements were recorded using a Solinst water level meter, which was decontaminated between each well reading. The measurements coinciding with Round 1 and 2 groundwater sampling (January and April 2005) were conducted prior to initiating sampling activities.

The piezometers at AA2 and AA3 were abandoned 21 April 2005 after collecting the final water level measurements. All screen and casing material were removed from the borehole prior to placement of a tremmie pipe at the bottom of the hole. The boreholes remained open and exhibited no significant collapse of sand pack to obstruct placement of the tremmie pipe. The boreholes were grouted from the bottom up to ground surface using a bentonite slurry. Slurry volumes pumped in each borehole closely match the borehole volumes.

2.2 GROUNDWATER SAMPLING

Round 2 groundwater sampling was performed 21 April through 30 April 2005. Groundwater samples were collected from twelve monitoring wells at or near AA2 and AA3. Five existing wells in AA2 were sampled, which included AA2-GW-002, IT-MW10, MK-MW09, AA2-BEDGW-001, and PB-BED-MW19. Seven wells were sampled in AA3, which included the five newly installed wells (AA3-GW-003, AA3-GW-004, AA3-GW-005, AA3-BEDGW-002, and AA3-BEDGW-003) and existing wells (AA3-GW-002 and AA3-BEDGW-001).

Groundwater samples from each monitoring well were analyzed for VOCs, SVOCs, PCBs, nitroaromatics, target analyte list (TAL) metals (unfiltered), cyanide, total organic carbon, turbidity, alkalinity, total suspended solids, total dissolved solids, nitrate, chloride, sulfate, and hardness. In addition iron (Fe^{++}) and manganese (Mn^{++}) were analyzed in the field using Hach test kits, with detection levels set at 0-10 mg/L for (Fe^{++}) and 0-3 mg/L for (Mn^{++}). Water quality parameters were also monitored during purging and after sampling using a Horiba U22XD equipped with a flow-thru cell. Water quality parameters included temperature, pH, dissolved oxygen, oxidation reduction potential, specific conductance, and turbidity.

Purging and sampling of the wells was performed with a bladder pump using low-flow methods, whereby pumping rates were set at a level that maintained static water levels or slightly increasing water levels during sampling. The pump was lowered into the well slowly to minimize suspension of sediments while setting the pump intake slightly above the center of the screen. Purge volume and water parameter stabilization requirements, as specified in the Final Site-Wide SAP (Jacobs 2004a), were achieved for all wells sampled by low-flow methods. Purge volume requirements were not achieved for low-yield wells that were purged dry.

Several of the wells (AA2-BEDGW-001, AA3-GW-004, and AA3-GW-005) exhibited well yields too low to perform purging and sampling at low-flow rates within a 10-hour period. These wells were pumped dry and allowed to recover overnight. Additional purging was then conducted at low-flow rates before sampling, until water parameters stabilized.

Bedrock wells AA3-BEDGW-001 and PB-BED-MW19 also exhibited well yields too low to meet purging requirements and sampling within a 10-hour period, while trying to maintain the initial static water level. During the initial phases of purging these wells, water levels continued to drop even though the flow rate on the pump was reduced. It was determined that the wells could not be purged in a timely manner at these reduced pumping rates. The Jacobs geologist decided to purge the well dry and sample upon recovery. As the water level was lowered in these wells the increase in the gradient between the well and the surrounding formation resulted in increased recharge rates that eventually matched the maximum pumping rate, thus the well could not be purged dry. The Jacobs geologist reduced the flow rate slightly to initiate recovery of water levels while purging. As a result the purge volume requirements were met as well as the requirement to maintain static or rising water levels in the well.

Monitoring well IT-MW10 was sampled using a combination of a peristaltic pump and a disposable ½-inch diameter bailer, due to blockage in the casing near ground level. This condition was noted in the Second Quarterly Background Report (IT 2002), which precluded sampling from this well during the September – October 2001 and January 2002 sampling events. Low-flow methods were not possible due to low well yield. The well was purged dry with a peristaltic pump to remove all stagnant water from the well and was sampled the next day after water levels had recovered. VOC samples were collected with a disposable ½-inch bailer. All remaining samples were collected with a peristaltic pump. Water quality parameters were measured before and after sampling

using a grab sample, as opposed to continuous undisturbed readings from a flow-thru cell.

Aside from the above-mentioned exceptions, all sampling was performed after meeting the purge volume and water parameter stabilization requirements. Turbidity readings for many of the bedrock wells were often inaccurate due to the accumulation of hydrogen sulfide bubbles on the inside of the flow-thru cell. In all cases the water appeared very clear. Due to cold outside temperatures, the sampling equipment was placed inside of a vehicle on most days, to avoid freezing of the purge lines. Temperature readings were not considered for water parameter stabilization, due to considerable temperature swings inside the vehicle. Constant temperature swings were inevitable due to opening doors or hatches to adjust pump settings, to collect water level measurements, or to change purge buckets. Purge and sampling records are provided in Appendix B.

2.3 DECONTAMINATION PROCEDURES

All down-hole equipment was decontaminated prior to use and in between each well in accordance with the Final Site-Wide SAP (Jacobs 2004a). Decontamination procedures included a potable wash, potable rinse, and a final rinse with ASTM Type II deionized water. Equipment included pumps, tubing, security cables, and water level meters.

Decontamination of the flow-thru cell and Horiba was not necessary since the flow-thru cell was disconnected just prior to sampling. Decontamination of the bladder pump and tubing was performed by immersing the pump and cycling the decontamination fluids through the entire system. The outside of the pump and tubing was also immersed and decontaminated. Rinsate samples were collected after decontamination by immersing the pump in a container of ASTM Type II deionized water and cycling water through the system.

2.4 IDW MANAGEMENT

All investigative derived waste (IDW) was managed in accordance with the Final Site-Wide SAP (Jacobs 2004a). Liquid IDW associated with decontamination of down-hole sampling equipment was containerized in 55-gallon closed-top drums. Purge water generated during groundwater sampling was collected in 5-gallon buckets and transferred to 55-gallon closed-top drums, which were stored at a temperature-controlled indoor facility. Characterization sampling of liquid IDW was performed on 30 April 2005. One composite sample was collected from all liquid IDW drums. Sample results indicate the liquid IDW is non-hazardous. Liquid IDW is scheduled for transportation to an approved off-site facility on 15 September 2005.

3.0 ANALYTICAL PROGRAM

The second round of groundwater sampling at the Acid Areas consisted of sample collection at twelve groundwater monitoring wells at Acid Areas 2 and 3. The purpose of the groundwater monitoring samples is to determine impacts to the shallow and bedrock groundwater from the process facilities at the Acid Areas, and to collect data of appropriate quality to support a risk assessment and feasibility study. The groundwater monitoring samples were analyzed by USEPA SW-846 methodology capable of producing definitive data and EPA 600/4-79-020, *Method for Chemical Analysis of Water and Wastes* for the water quality parameters. Full level-four data packages including raw data chromatograms and calibration information were generated for data evaluation.

3.1 ANALYTICAL PROGRAM AND METHODOLOGIES

The analytical subcontractors supporting the Plum Brook Acid Areas Remedial Investigation were required to hold current letters of validation to perform analyses in support of the USACE Hazardous, Toxic, Radioactive Waste Center of Expertise, and maintain the certification for all applicable methods for the duration of the project. ELAB of Tennessee performed the primary sample analyses in support of this program. Jacobs performed data verification and validation on 100% of the primary sample data per the guidance of Section 2.1 of the Site Wide Quality Assurance Project Plan included as part of the *Final Site-Wide Sampling and Analysis Plan* (Jacobs 2004a).

GPL Laboratories of Frederick, Maryland served as the quality assurance laboratory and analyzed splits of 10% of the primary samples. The primary and quality assurance laboratories used the same preparation and analysis methods to maintain adequate comparability of the data. Stratum Engineering of Bridgeton, Missouri evaluated the QA data and performed the comparison of the QA and primary data results.

Laboratory analyses performed on the primary and quality assurance Acid Areas groundwater samples included:

- VOCs by SW-846 5030/8260B
- SVOCs by SW-846 3520/8270c
- PCBs by SW-846 8082
- Nitroaromatics by SW-846 8330
- Total Metals by SW-846 3005A/6010B
- Total Mercury by SW-846 7470A
- Cyanide by SW-846 9012A

The following water quality parameters were performed on the primary samples only:

- Turbidity by EPA 180.1
- Hardness by EPA 130.2
- Alkalinity by EPA 310.1
- TOC by SW-846 9060
- Total Dissolved Solids by EPA 160.1
- Total Suspended Solids by EPA 160.2
- Anions (chloride, nitrate, and sulfate) by EPA 300

3.2 DATA QUALITY EVALUATION

Jacobs evaluated 100% of the primary groundwater data collected in support of the Acid Areas RI. The data evaluation was performed in accordance with the requirements of the SAP (Jacobs 2004a), the guidance of EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA 1999), and EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA 1994). The Chemical Data Quality Report summarizing Jacobs' data evaluation in terms of precision, accuracy, representativeness, comparability, and completeness is provided in Appendix D. The qualifiers applied as part of the data evaluation are defined in Section 2.0 of the Chemical Data Quality Report and the limitations implied by the qualification should be considered when reviewing the data.

Stratum Engineering, an independent third party firm, performed the evaluation of the quality assurance sample data and comparison of the quality assurance data to the corresponding primary sample data. Stratum prepared a Chemical Quality Assurance Report as a result of their data evaluation in accordance with the requirements of the SAP (Jacobs 2004A) and the guidance of *Chemical Quality Assurance for HTRW Projects* (USACE HTRW-CX 1997). The Chemical Quality Assurance report is included as Appendix E to this report.

The DQOs for this project were to produce scientifically and technically valid data of known quality that were complete, comparable with similar data types, and representative of the media sampled so as to be useable for its intended purposes. The data evaluation process utilizing the DQOs set forth in the SAP (Jacobs 2004A) resulted in the determination that the majority of the data set is valid and of sufficient quality to meet the objectives of the investigation. The only unusable data points are several SVOC analytes in a few of the samples, and cyanide in one of the samples. All other analytes are 100% complete and usable as qualified. Three SVOC analytes had less than 90% completeness due to low biased surrogate recoveries; 2,4-dinitrophenol, hexachlorocyclopentadiene, and hexachloroethane. None of the three SVOC compounds failing the project completeness goals were detected in any of the samples, nor are the compounds expected to be contaminants of concern at the site. Overall the data were found to be complete and acceptable for the intended data usages as qualified.

4.0 INVESTIGATION RESULTS

Site groundwater characterization results include water level data and analytical data. The discussion and presentation of this data has been separated into hydrogeological results and analytical results as presented below.

4.1 HYDROGEOLOGICAL RESULTS

Water level data was collected from the piezometers during a six-month period from 8 November 2004 through 21 April 2005 (Tables 4-1 and 4-2, Figures 4-1 and 4-2). Water level data was used to generate groundwater elevation contour maps, which were useful in determining gradients and flow direction for the shallow and bedrock aquifers.

4.1.1 Acid Area 2

Two separate shallow overburden contour maps were created: one based on piezometer data only (Figures 4-3), and the other based on permanent overburden wells only (Figures 4-4). In general both sets of data yield similar contour profiles. Groundwater elevation contour maps for the bedrock aquifer at AA2 were not generated because of limited data. Monitoring wells AA2-BEDGW-001 and PB-BED-MW19 represent the only bedrock wells at AA2 monitored during this investigation. Site-wide bedrock groundwater contour maps provided in the 2004 Groundwater Data Summary and Evaluation Report (Shaw 2004) have been used to evaluate bedrock groundwater gradients at AA2.

Shallow groundwater at AA2 flows eastward toward Pipe Creek. The drainage ditches to the north and south of the site also influence the shallow groundwater flow, as evidenced by the steep gradients on the northern and southern perimeter of the site. Shallow groundwater levels observed in April 2005 from the piezometers range from 2.1 to 3.6 ft bgs (Table 4-1). Shallow groundwater levels observed from the permanent overburden wells range from 2.5 to 5.8 ft bgs (Table 4-1).

Based on the bedrock groundwater contour map provided in the 2004 Groundwater Data Summary and Evaluation Report (Shaw 2004), bedrock groundwater at AA2 flows to the east, west, and north, away from a groundwater high situated in the center of the site.

4.1.2 Acid Area 3

Two separate shallow overburden contour maps were created: one based on piezometer data only (Figures 4-5), and the other based on permanent overburden wells only (Figures 4-6). In general both sets of data yield similar contour profiles. Shallow groundwater at AA3 flows toward the center of the site and then westward toward the drainage ditch located on the western perimeter of the site. An underground drainage system was observed running north-south on the east side of the inner most railroad tracks. A discharge pipe was also observed on the east side of the drainage ditch near

the center of the site. This drainage feature likely accounts for the shallow groundwater gradient observed at the site. Shallow groundwater levels observed in April 2005 from the piezometers range from 1.0 to 4.9 ft bgs (Table 4-2). Shallow groundwater levels observed from the permanent overburden wells range from 2.7 to 6.0 ft bgs (Table 4-2).

Bedrock groundwater at AA3 flows to the north, east, and south, away from a groundwater high located in the center of the site (Figure 4-5).

4.2 ANALYTICAL RESULTS

The following sections address the analytical results from the second round of groundwater sampling associated with the Acid Areas 2 and 3 RI. Sample results were screened against the EPA Region 9 Tap Water Preliminary Remediation Goals (PRG) October 2004. Sample results for bedrock groundwater were also screened against the final background values for organic and inorganic constituents in bedrock groundwater as established in the Final Groundwater Report (Shaw 2005).

4.2.1 Acid Area 2

Analytes detected in the shallow groundwater at AA2 during Round 2 were limited to metals and one low-level detection of bis(2-Ethylhexyl)phthalate, a common laboratory artifact (Table 4-3). Contaminants found in soil at AA2 (SVOCs, PCBs, and PAHs) were not detected in the shallow groundwater. No compounds exceeded the EPA Region 9 Tap Water PRG in shallow groundwater.

As discussed in the Round 1 Report, VOCs were detected in Round 1 samples collected at AA2-GW-002. This was the only shallow well where bladder pump #2 was used during Round 1 sampling. This pump was used for sampling all of the bedrock wells during Round 1. It is possible that residual amounts of naturally occurring oil were left in the pump after decontamination during Round 1. VOCs were not detected in this well during Round 2.

Laboratory analysis for turbidity during Round 2 ranged from 1.7 to 20.3 NTUs in shallow wells at AA2. Suspended solids were non-detect in all overburden wells. Other water quality parameters such as total organic carbon, alkalinity, hardness, total dissolved solids, nitrate, sulfate, and chloride are also presented in Table 4-3. The Hach test results for Fe⁺⁺ and Mn⁺⁺ were all negative. Test range for the Fe²⁺ was 0-10 mg/L. Test range for MN²⁺ was 0-3 mg/L.

For comparison purposes, analyte detections in shallow groundwater during prior sampling events are provided in Table 4-4. Complete data results are also reported in Attachment 2, Appendix D.

Analytes detected in the bedrock groundwater at AA2 during Round 2 include VOCs, explosives, and metals (Table 4-5). Contaminants found in soil at AA2 (SVOCs, PCBs, and PAHs) were not detected in the bedrock groundwater. Compounds detected at levels above the EPA Region 9 Tap Water PRG and the established background values

(Shaw, 2005) include 1,1,2-Trichloroethane and benzene in monitoring well PB-BED-MW19. Benzene exceeded the PRG during Round 1, however 1,1,2-Trichloroethane was not detected during Round 1. The concentration of 1,1,2-Trichloroethane is between the detection limit and the reporting limit, suggesting that the detection is at trace levels and the value has a high degree of uncertainty.

Other VOCs detected in the bedrock groundwater at AA2 during Round 2 include the following analytes:

- Carbon Disulfide
- Cyclohexane
- Ethylbenzene
- Isopropylbenzene
- Methylcyclohexane
- Toluene
- Xylenes

All of these compounds were detected during Round 1 and at similar concentrations. The presence of VOCs in the bedrock groundwater can be attributed to naturally occurring petroleum in the Delaware Limestone, with the exception of 1,1,2-trichloroethane. Hydrogen sulfide gas, which is commonly associated with naturally occurring petroleum, was detected in most of the bedrock wells. The SVOC 2-methylnaphthalene, also associated with naturally occurring petroleum, was detected at PB-BED-MW19.

Arsenic exceeded the PRGs and background values in monitoring well AA2-BEDGW-001 during Round 1; however, arsenic was not detected in any of the AA2 bedrock wells during Round 2.

Other explosives detected during Round 2 include 3-nitrotoluene and RDX, all at low levels. The concentrations are between the detection limit and the reporting limit, suggesting that the detections are trace levels and the values have a high degree of uncertainty. Explosives were not detected during Round 1.

Laboratory analysis for turbidity ranged from 54.7 NTUs in AA2-BEDGW-001 to 89.3 NTUs in PB-BED-MW19. Suspended solids were non-detect in all bedrock wells. Because of the low suspended solids and overall clarity of the water, it is believed that chemical interference is causing elevated turbidity results. Much of the bedrock groundwater exhibited either a green or black tint. Other water quality parameters such as total organic carbon, alkalinity, hardness, total dissolved solids, nitrate, sulfate, and chloride are presented in Table 4-5. The Hach test results for Fe⁺⁺ and Mn⁺⁺ were all negative. Test range for the Fe²⁺ was 0-10 mg/L. Test range for MN²⁺ was 0-3 mg/L.

For comparison purposes, analyte detections in bedrock groundwater during prior sampling events are included in Table 4-6. Complete data results are also reported in Attachment 2, Appendix D.

4.2.2 Acid Area 3

Analytes detected in the shallow groundwater at AA3 during Round 2 were limited to metals and a few low-level VOC detections (Table 4-7). Contaminants found in soil at AA3 (PAHs and PCBs) were not detected in the shallow groundwater. No compounds exceeded the EPA Region 9 Tap Water PRG in shallow groundwater.

The VOCs detected during Round 2 include cyclohexane and methylcyclohexane at low levels. The results are J-flagged, indicating that the concentrations are between the detection limit and the reporting limit, suggesting that the detections are trace levels and the values have a high degree of uncertainty. VOCs were detected during Round 1.

Laboratory analysis for turbidity during Round 2 ranged from non-detect to 3.7 NTUs in shallow wells at AA3. Suspended solids were non-detect in all overburden wells. Other water quality parameters such as total organic carbon, alkalinity, hardness, total dissolved solids, nitrate, sulfate, and chloride are also included in Table 4-7. The Hach test results for Fe^{++} and Mn^{++} were all negative. Test range for the Fe^{2+} was 0-10 mg/L. Test range for MN^{2+} was 0-3 mg/L.

For comparison purposes, analyte detections in shallow groundwater during prior sampling events are included in Table 4-8. Complete data results are also reported in Attachment 2, Appendix D.

Analytes detected in the bedrock groundwater at AA3 during Round 2 include VOCs, explosives, and metals (Table 4-9). Contaminants found in soil at AA3 (PAHs and PCBs) were not detected in the bedrock groundwater. Compounds detected at levels above the EPA Region 9 Tap Water PRG and the established background values (Shaw, 2005) include benzene, xylene, tetrachloroethene, and 2-nitrotoluene. Benzene exceeded the PRGs at all three bedrock wells during Round 2, and at two wells during Round 1. Xylene exceeded the PRG in monitoring well AA3-BEDMW-003 during Round 2. The PRG was not exceeded at this well during Round 1, however the concentrations were of similar order of magnitude in both rounds. Concentrations of tetrachloroethene are between the detection limit and reporting limit, suggesting that the detections are trace levels and the values have a high degree of uncertainty. Tetrachloroethene and 2-nitrotoluene were not detected during Round 1.

Other VOCs detected in the bedrock groundwater at AA3 during Round 2 include the following analytes:

- Carbon Disulfide
- Cyclohexane
- Ethylbenzene
- Isopropylbenzene
- Methylcyclohexane
- Toluene

All of these compounds were detected during Round 1 and at similar concentrations. The presence of VOCs in the bedrock groundwater can be attributed to naturally occurring petroleum in the Delaware Limestone. Hydrogen sulfide gas, which is commonly associated with naturally occurring petroleum, was detected in most of the bedrock wells. The SVOCs 2-Methylnaphthalene and naphthalene, also associated with naturally occurring petroleum, were detected in AA3-BEDMW-003.

The explosives detected during Round 2 are all at low levels and the results are J-flagged. Explosives were not detected during Round 1.

Laboratory analysis for turbidity ranged from 5 NTUs in AA3-BEDGW-002 to 50 NTUs in AA3-BEDGW-003. Suspended solids were non-detect in all bedrock wells, except for AA3-BEDGW-001. Because of the low suspended solids and overall clarity of the water, it is believed that chemical interference is causing elevated turbidity results. Much of the bedrock groundwater exhibited either a green or black tint. Other water quality parameters such as total organic carbon, alkalinity, hardness, total dissolved solids, nitrate, sulfate, and chloride are also presented in Table 4-9. The Hach test results for Fe^{++} and Mn^{++} were all negative. Test range for the Fe^{2+} was 0-10 mg/L. Test range for MN^{2+} was 0-3 mg/L.

For comparison purposes, analyte detections in bedrock groundwater during prior groundwater sampling events are included in Table 4-10. Complete data results are also reported in Attachment 2, Appendix D.

5.0 PLANNED ACTIVITIES

Based on discussions at the December 8, 2005 team meeting, no further rounds of groundwater sampling will be required.

No appreciable water has collected in monitoring well AA3-BEDMW-004. Approximately 6 inches of oil has accumulated in the hole. Based on discussions at the December 2005 team meeting, samples of the oil should be collected to confirm that the signature is that of naturally occurring petroleum. It was not decided whether this sampling should be performed under the Acid Area investigation or under the site-wide groundwater study.

6.0 REFERENCES

IT Corporation (IT), 1998, *Site Investigations of Acid Areas, Former Plum Brook Ordnance Works, Sandusky, Ohio*, December 1998.

IT Corporation (IT), 2002, *Second Quarterly Background Report*, May 2002

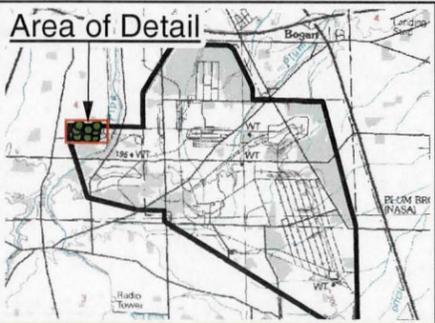
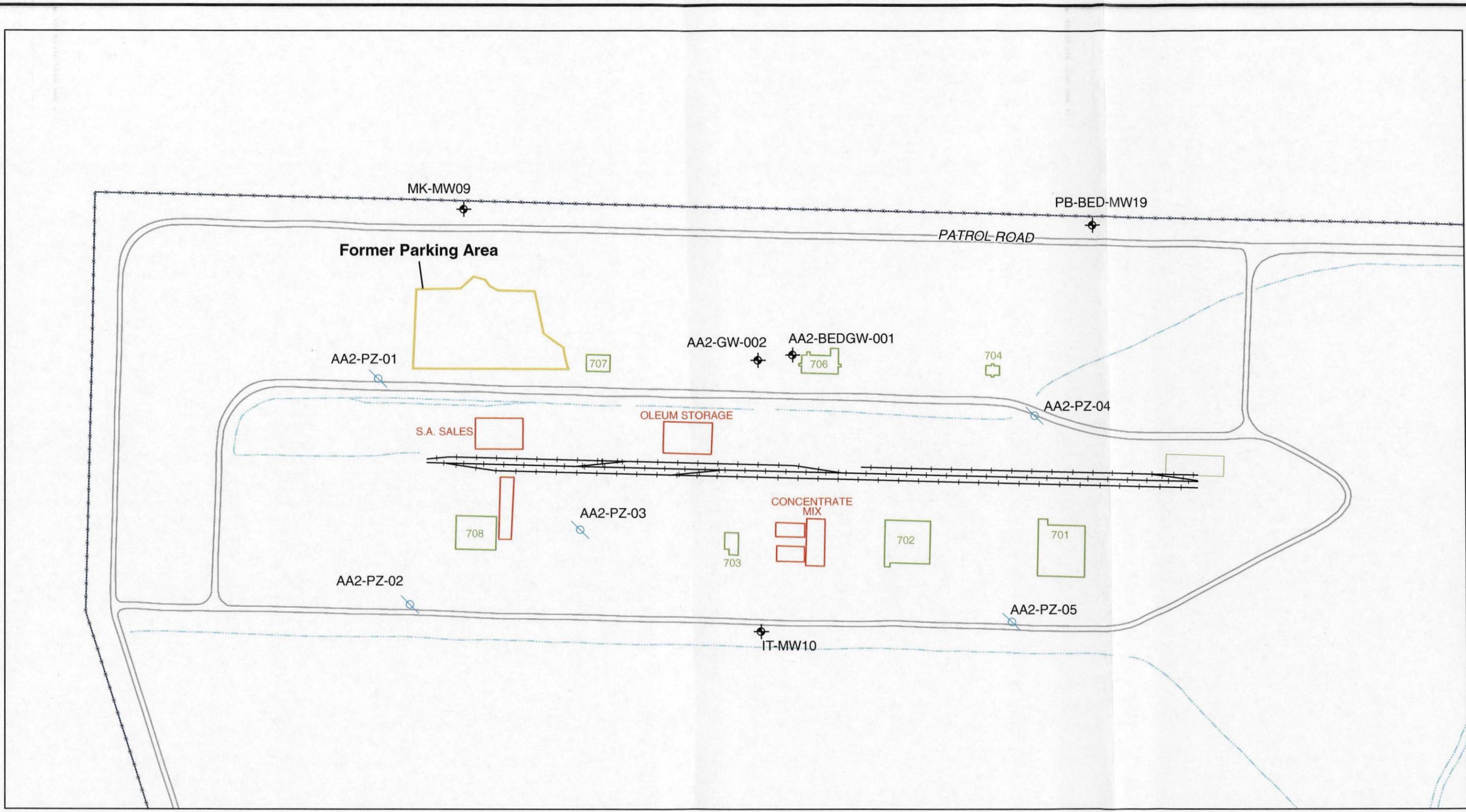
Jacobs, 2004a, *Final Site-Wide Sampling and Analysis Plan, Former Plum Brook Ordnance Works, Sandusky, Ohio*, May 2004.

Jacobs, 2004b, *Final Site-Specific Sampling and Analysis Plan, Remedial Investigation, Part 1, at Acid Areas 2 & 3*, October 2004.

Jacobs, 2005, *Round 1 Quarterly Groundwater Monitoring Report, Remedial Investigation Part 1, at Acid Areas 2 and 3, Former Plum Brook Ordnance Works, Sandusky, Ohio*, April 2005.

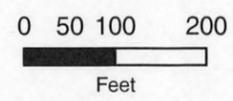
Shaw, 2004, *2004 Groundwater Data Summary and Evaluation Report*, December 2004

Shaw, 2005, *Final Groundwater Report*



Legend

- Storage Tank Areas from Engineering Drawings
- ~ Creek, Ditch, Conveyance
- Buildings
- +— Railway
- ⊕ Monitoring Wells
- ⊕ Piezometers



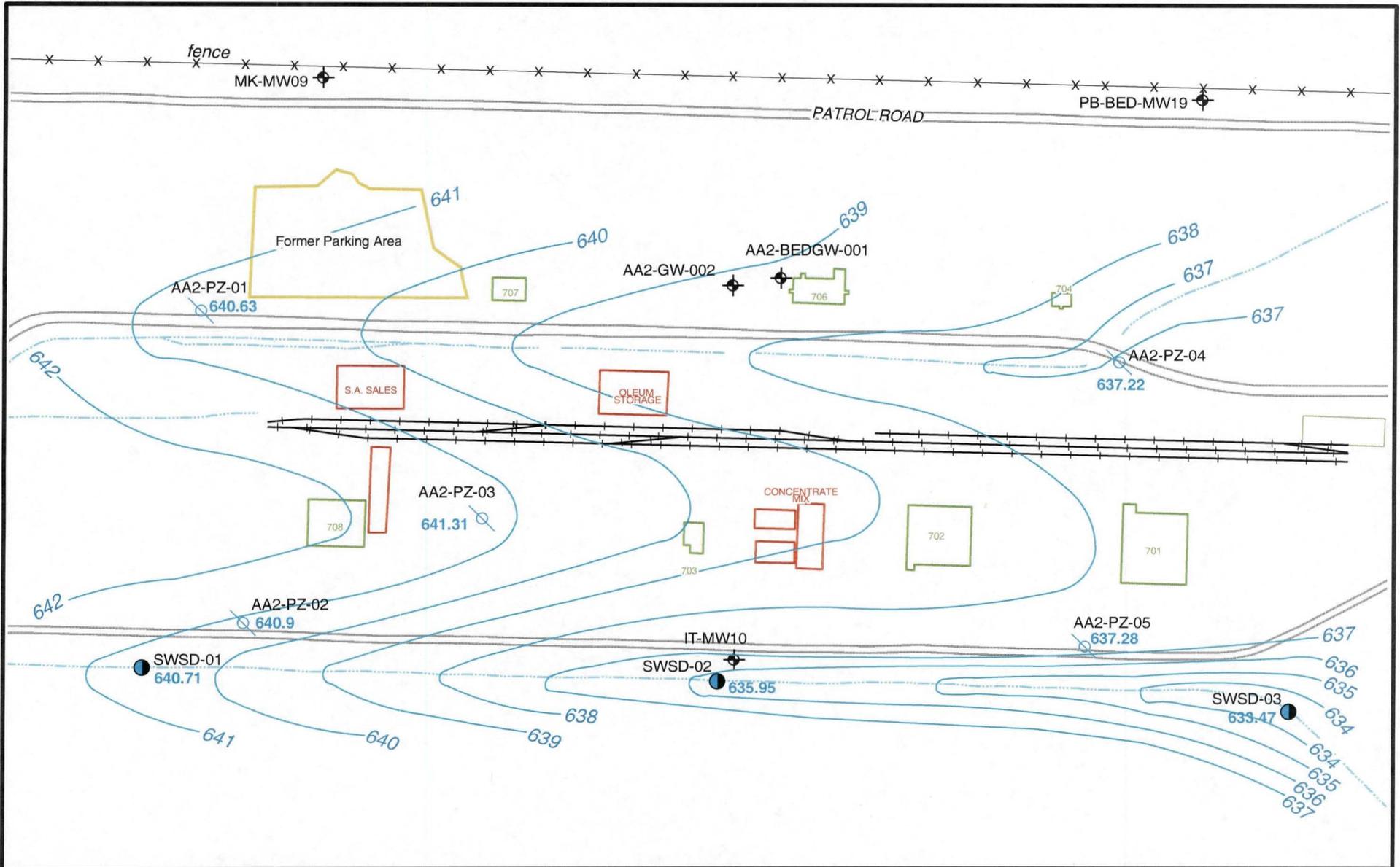
JE JACOBS

Final Piezometer and Well Locations at Acid Area 2

Plum Brook Ordnance Works
Sandusky, Ohio

Notes: Aerial Photography from 1958.
Data mapped to Ohio Stateplane North NAD83, map units are feet.

08/29/05 NZ D:\GIS\Plumbrook\Projects\Quarterly Reports\GW_Q2_2005\ArcGIS\AA2_GW_locs.mxd



- Legend**
- Storage Tank Areas from Engineering Drawings
 - ~ Creek, Ditch, Conveyance
 - Buildings
 - +— Railway
 - ⊕ Monitoring Wells
 - ⊗ Piezometers
 - Surface Water Sampling Locations

640 Groundwater Elevation (feet above mean sea level)

100 50 0 100
Feet

Notes:
Data mapped to Ohio State Plane North NAD83, map units are feet.

Shallow Groundwater Elevation Map Based on Piezometer Data at Acid Area 2 — April 2005

Plum Brook Ordnance Works
Sandusky, Ohio

08/29/05 NZ Y:\GIS\Plumbrook\Projects\Quarterly Reports\GW_Q2_2005\ArcGIS\AA2_GW_Shallow_Piezo.mxd

Figure 4-3

Table 4-3. Detected Analytes in Shallow Groundwater at AA2 (April 2005)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth	AA2-GW-002		IT-MW10		MK-MW09		MK-MW09 (field dup)	
						04/26/2005		04/28/2005		04/25/2005		04/25/2005	
						10.8-20.8 ft.	11.8-21.8 ft.	7.9-17.9 ft.	7.9-17.9 ft.	Result	VQ	Result	VQ
Wet Chemistry													
Nitrogen, Nitrate (as N)	E300	910		1000	ug/L	67		25	U	910			
Sulfate (as SO4)	E300	261			mg/L	86.8		261		18.8			
Metals													
Aluminum (total)	SW6010	1160	309	3600	ug/L	128	J	122	J	1160		1160	J
Barium (total)	SW6010	44.9	11800	260	ug/L	22.6	J	44.9	J	26.1	J	26.7	J
Calcium (total)	SW6010	181000	316000		ug/L	96600		181000		53900		55700	
Iron (total)	SW6010	1030	1550	1100	ug/L	36.6	J	155		1020		1030	
Magnesium (total)	SW6010	69700	217000		ug/L	27100		69700		13700		14100	
Manganese (total)	SW6010	222	636	88	ug/L	3	U	222		6.6	J	6.5	J
Mercury (total)	SW7470	0.091			ug/L	0.08	U	0.08	U	0.091	J	0.08	U
Nickel (total)	SW6010	4.5	8.6	73	ug/L	3	U	4.5	J	3	U	3	U
Potassium (total)	SW6010	2150	116000		ug/L	500	U	2150		629	J	630	J
Sodium (total)	SW6010	19700	1390000		ug/L	10900		19700		2750		2850	
Zinc (total)	SW6010	15.5	507	1100	ug/L	15.5	J	5	U	10.6	J	11.7	J
Semivolatile Organic Compounds													
bis(2-Ethylhexyl)phthalate	SW8270	1.2		4.8	ug/L	1	UJ	1.2	J	1	UJ	1	UJ
Volatile Organic Compounds													

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts. PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Table 4-4 Detected Analytes in Shallow Groundwater at AA2 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA2-GW-002 01/26/2005 10.8-20.8 ft.		IT-MW10 11/14/1997 11.8-21.8 ft.		IT-MW10 05/14/1998 11.8-21.8 ft.		IT-MW10 02/01/2005 11.8-21.8 ft.		MK-MW09 06/29/1993 7.9-17.9 ft.		MK-MW09 11/16/1997 7.9-17.9 ft.		MK-MW09 05/13/1998 7.9-17.9 ft.		MK-MW09 01/24/2005 7.9-17.9 ft.					
						Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
						Wet Chemistry																			
Nitrogen, Nitrate (as N)	E300	3980		1000	ug/L	14.9	U					71	J							3980					
Nitrogen, Nitrate (as N)	E353.2	200		1000	ug/L			100		200						200		200							
Sulfate (as SO4)	E300	308			mg/L	131						308								30					
Sulfate (as SO4)	E375.4	300			mg/L			300		270	J				32		31	J							
Metals																									
Aluminum	SW6010	2880	309	3600	ug/L	45.4	U	200	U	200	U	45.4	U	2880	N*	200	U	200	U	45.4	U				
Aluminum (total)	SW6010	11500	309	3600	ug/L	45.4	U	1040		11500		45.4	U			282	B	200	U	45.4	U				
Arsenic (total)	SW6010	36.8	7.4	0.045	ug/L	4.59	U	10	U	36.8		4.59	U			10	U	10	U	4.59	U				
Barium	SW6010	73.1	11800	260	ug/L	25.2		200	U	200	U	48.4		73.1	B	200	U	200	U	27.6					
Barium (total)	SW6010	372	11800	260	ug/L	25.9		200	U	372		40.5				200	U	200	U	29	J				
Beryllium (total)	SW6010	0.156		7.3	ug/L	0.156	J	5	U	5	U	0.109	U			5	U	5	U	0.109	U				
Calcium	SW6010	188000	316000		ug/L	106000		188000		188000		176000		81000	B*	106000	J	92700		74700					
Calcium (total)	SW6010	185000	316000		ug/L	109000		183000	J	185000		184000				103000		78500		75700	J				
Chromium (total)	SW6010	39.8			ug/L	0.77	J	10	U	39.8		0.236	U			10	U	10	U	0.236	U				
Cobalt	SW6010	1.29	12.1	73	ug/L	0.898	U	50	U	50	U	0.898	U	20	U	50	U	50	U	1.29	J				
Cobalt (total)	SW6010	1.62	12.1	73	ug/L	1.53	J	50	U	50	U	1.62	J			50	U	50	U	1.17	J				
Copper	SW6010	50.7	19.8	150	ug/L	4.09	J	25	U	25	U	2.55	U	5	U	25	U	50.7		2.55	U				
Copper (total)	SW6010	30.8	19.8	150	ug/L	3.1	J	25	U	30.8		2.55	U			25	U	25	U	2.55	U				
Iron	SW6010	4930	1550	1100	ug/L	29.8	J	100	U	100	U	22.9	U	4930	N*	329	B	100	U	22.9	U				
Iron (total)	SW6010	41000	1550	1100	ug/L	22.9	U	3040		41000		834				493	B	100	U	22.9	U				
Lead	SW6010	2			ug/L	2.44	U	3	U	3	U	2.44	U	2	B	3	U	3	U	2.44	U				
Lead (total)	SW6010	33.6			ug/L	2.44	U	4.5		33.6		2.44	U			8.5		3	U	2.44	U				
Magnesium	SW6010	86300	217000		ug/L	31600		86300		86200		69900		29200		28100		25500		20400					
Magnesium (total)	SW6010	83700	217000		ug/L	32400		83700		83500		73700				27600		21100		20700	J				
Manganese	SW6010	1630	636	88	ug/L	0.419	U	1630		621		49		149	*	15	U	15	U	0.7	J				
Manganese (total)	SW6010	1670	636	88	ug/L	0.419	U	1670		1480		103				15	U	15	U	0.419	U				
Nickel (total)	SW6010	4.15	8.6	73	ug/L	0.745	U	40	U	40	U	4.15	J			40	U	40	U	0.745	U				
Potassium	SW6010	2110	116000		ug/L	175	U	5000	U	5000	U	2110		1640	B	5000	U	5000	U	719	J				
Potassium (total)	SW6010	5550	116000		ug/L	277	J	5000	U	5550		2290				5000	U	5000	U	704	J				
Sodium	SW6010	50200	1390000		ug/L	13900		50200		26200		21500	J	7860		6470		5760		3140					
Sodium (total)	SW6010	48200	1390000		ug/L	14700		48200		24700		20700	J			6290		5000	U	3190	J				
Vanadium (total)	SW6010	54.4		3.6	ug/L	2.14	U	50	U	54.4		2.14	U			50	U	50	U	2.14	U				
Zinc	SW6010	30.3	507	1100	ug/L	20.4		20	U	20	U	1.46	U	30.3		20	U	20	U	1.46	U				
Zinc (total)	SW6010	92.6	507	1100	ug/L	22.8		20	U	92.6	B	1.46	U			20	U	29	B	1.46	U				
Semivolatile Organic Compounds																									
bis(2-Ethylhexyl)phthalate	SW8270	5.1		4.8	ug/L	3.49	U	5.1	J	10	U	3.59	U	12	U	10	U	10	U	3.49	U				
Volatile Organic Compounds																									
Benzene	SW8260	0.117	2.4	0.35	ug/L	0.117	J	1	U	1	U	0.104	U	5	U	1	U	1	U	0.104	U				
Carbon Disulfide	SW8260	0.17		100	ug/L	0.118	U	0.17	J	1	U	0.118	U	5	U	1	U	1	U	0.118	U				
Cyclohexane	SW8260	14.8		1000	ug/L	14.8						0.0999	U							0.0999	U				

Table 4-4 Detected Analytes in Shallow Groundwater at AA2 (Prior Sampling Events)

Analyte	Method	Max Detect	GW Bkg.	PRG*	Location Date Depth Units	AA2-GW-002 01/26/2005 10.8-20.8 ft.		IT-MW10 11/14/1997 11.8-21.8 ft.		IT-MW10 05/14/1998 11.8-21.8 ft.		IT-MW10 02/01/2005 11.8-21.8 ft.		MK-MW09 06/29/1993 7.9-17.9 ft.		MK-MW09 11/16/1997 7.9-17.9 ft.		MK-MW09 05/13/1998 7.9-17.9 ft.		MK-MW09 01/24/2005 7.9-17.9 ft.	
						Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Ethylbenzene	SW8260	0.68	0.87	130	ug/L	0.68	J	1	U	1	U	0.164	U	5	U	1	U	1	U	0.164	U
Isopropylbenzene (Cumene)	SW8260	0.325		66	ug/L	0.325	J					0.101	U							0.101	U
Methylcyclohexane	SW8260	10.2		520	ug/L	10.2						0.107	U							0.107	U
Methylene Chloride	SW8260	0.55		4.3	ug/L	0.128	U	1	U	0.55	B	0.128	U	5	U	0.3	B	0.34	B	0.128	U
Toluene	SW8260	0.13	1.7	72	ug/L	0.119	U	1	U	1	U	0.119	U	5	U	0.13	B	1	U	0.119	U
Xylenes, Total	SW8260	11.9	5.5	21	ug/L	11.9		1	U	1	U	0.307	U	5	U	0.13	B	1	U	0.307	U

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts. PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Table 4-5 Detected Analytes in Bedrock Groundwater at AA2 (April 2005)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA2-BEDGW-001 04/26/2005 30.3-45.3 ft.		PB-BED-MW19 04/25/2005 26.2-51.2 ft.	
						Result	VQ	Result	VQ
Wet Chemistry									
Sulfate (as SO4)	E300	17.3			mg/L	17.3		1.4	
Explosives									
1,3,5-Trinitrobenzene	SW8330	0.16		110	ug/L	0.16	J	0.096	U
3-Nitrotoluene	SW8330	0.15		12	ug/L	0.14	J	0.15	J
RDX	SW8330	0.14		0.61	ug/L	0.14	J	0.096	U
Tetryl	SW8330	0.088		36	ug/L	0.088	J	0.096	U
Metals									
Aluminum (total)	SW6010	103	309	3600	ug/L	103	J	100	U
Barium (total)	SW6010	1620	11800	260	ug/L	251		1620	
Calcium (total)	SW6010	165000	316000		ug/L	92100		165000	
Iron (total)	SW6010	80.1	1550	1100	ug/L	80.1	J	30	U
Magnesium (total)	SW6010	80000	217000		ug/L	52500		80000	
Manganese (total)	SW6010	105	636	88	ug/L	105		8.1	J
Potassium (total)	SW6010	29100	116000		ug/L	26500		29100	
Sodium (total)	SW6010	152000	1390000		ug/L	82000		152000	
Zinc (total)	SW6010	8.1	507	1100	ug/L	8.1	J	5	U
Semivolatile Organic Compounds									
2-Methylnaphthalene	SW8270	1.3			ug/L	1	UJ	1.3	J
Volatile Organic Compounds									
1,1,2-Trichloroethane	SW8260	0.33		0.2	ug/L	0.2	U	0.33	J
Benzene	SW8260	6.6	2.4	0.35	ug/L	1.6		6.6	
Carbon Disulfide	SW8260	0.38		100	ug/L	0.3	U	0.38	J
Cyclohexane	SW8260	38		1000	ug/L	7.8		38	
Ethylbenzene	SW8260	3.3	0.87	130	ug/L	1.4		3.3	
Isopropylbenzene (Cumene)	SW8260	1.3		66	ug/L	0.54	J	1.3	
Methylcyclohexane	SW8260	21		520	ug/L	4		21	
Toluene	SW8260	1.8	1.7	72	ug/L	0.32	J	1.8	
Xylenes, Total	SW8260	22	5.5	21	ug/L	11		22	

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts. PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Table 4-6 Detected Analytes in Bedrock Groundwater at AA2 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA2-BEDGW-001 11/20/1997 30.3-45.3 ft.		AA2-BEDGW-001 05/12/1998 30.3-45.3 ft.		AA2-BEDGW-001 10/8/2001 30.3-45.3 ft.		AA2-BEDGW-001 04/10/2002 30.3-45.3 ft.		AA2-BEDGW-001 01/27/2005 30.3-45.3 ft.		PB-BED-MW19 12/14/1994 26.2-51.2 ft.	
						Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Wet Chemistry																	
Cyanide	SW9010	16		73	ug/L	10	U	10	U								
Cyanide	SW9012	109		73	ug/L					3	U	3	U	7	UJ		
Nitrogen, Nitrate (as N)	UNK-AN	0.2		1000	ug/L												0.2
Nitrogen, Nitrate (as N)	E300	264		1000	ug/L									143			
Sulfate (as SO4)	E300	6.41			mg/L									6.41	J		
Sulfate (as SO4)	E375.4	70			mg/L	48		70	J	31.7		32.7					
Explosives																	
1,3,5-Trinitrobenzene	SW8330	0.8		110	ug/L	0.2	U	0.2	U	0.11	U	0.11	U	0.048	U	0.8	
1,3-Dinitrobenzene	SW8330	0.81		0.36	ug/L	0.2	U	0.81		0.08	U	0.08	U	0.0651	U	0.15	
2,4,6-Trinitrotoluene	SW8330	1.6		2.2	ug/L	0.2	U	0.2	U	1.6		0.08	U	0.139	U	0.64	
2,4-Dinitrotoluene	SW8330	2.5		7.3	ug/L	0.2	U	2.5		0.07	U	0.07	U	0.104	U	0.3	
2,6-Dinitrotoluene	SW8330	1.2		3.6	ug/L	0.2	U	1.2		0.11	U	0.11	U	0.195	U	0.2	
2-Nitrotoluene	SW8330	1.2		0.049	ug/L	0.31	U	0.2	U	0.14	U	0.14	U	0.2	U	1.2	
3-Nitrotoluene	SW8330	8.1		12	ug/L	0.2	U	0.2	U	0.13	U	0.13	U	0.368	U	8.1	
Nitrobenzene	SW8330	0.5		0.34	ug/L	0.2	U	0.2	U	0.07	U	0.07	U	0.108	U	0.65	
RDX	SW8330	0.17		0.61	ug/L	0.5	U	0.5	U	0.13	U	0.13	U	0.0838	U		
Metals																	
Aluminum	SW6010	378	309	3600	ug/L	200	U	200	U	75.6	B	42.6	J	45.4	U		
Aluminum (total)	SW6010	10200	309	3600	ug/L	1060	J	10200		1170	J	195	B	45.4	U		
Antimony	SW6010	8		1.5	ug/L	60	U	60	U	7	U	7	U	8.16	U	8	
Arsenic	SW6010	9	7.4	0.045	ug/L	10	U	10	U	3.7	J	9	J	7.04	J	10	
Arsenic (total)	SW6010	34.2	7.4	0.045	ug/L	10	U	34.2		9.1	J	6.6	J	7.95	J	10	
Barium	SW6010	2110	11800	260	ug/L	212		279		724		336		280			
Barium (total)	SW6010	2260	11800	260	ug/L	220		645		843		368		275			
Beryllium	SW6010	0.56		7.3	ug/L	5	U	5	U	0.56	B	0.5	U	0.109	U	1	
Calcium	SW6010	231000	316000		ug/L	88600		70400		59300		89900		88800			
Calcium (total)	SW6010	1970000	316000		ug/L	186000	J	1970000		81800		99400		85100			
Chromium (total)	SW6010	307			ug/L	10	U	307		2.4	J	1.3	J	0.236	U	10	
Cobalt	SW6010	3.4	12.1	73	ug/L	50	U	50	U	2.3	U	3.4	J	0.898	U		
Cobalt (total)	SW6010	63.3	12.1	73	ug/L	50	U	63.3		5.9	J	9.2	J	1.21	J		
Copper (total)	SW6010	99	19.8	150	ug/L	25	U	62.7		3.6	B	1.9	U	2.55	U	22	
Iron	SW6010	1300	1550	1100	ug/L	106	B	100	U	1300		124	J	131	J		
Iron (total)	SW6010	51600	1550	1100	ug/L	5240		51600		7210		2020	J	913			
Lead (total)	SW6010	38.6			ug/L	6.5	B	38.6		1.7	U	1.7	U	2.44	U	3	
Magnesium	SW6010	117000	217000		ug/L	54800		54300		54600		57100		53500			
Magnesium (total)	SW6010	132000	217000		ug/L	56900		132000		60000		58000		50600			
Manganese	SW6010	995	636	88	ug/L	351		995		946		207		93.8		40	
Manganese (total)	SW6010	5130	636	88	ug/L	522		5130		1030		228		90.6		40	
Nickel	SW6010	8.7	8.6	73	ug/L	40	U	40	U	1.9	U	1.9	U	0.745	U	20	
Nickel (total)	SW6010	238	8.6	73	ug/L	40	U	238		3.7	J	4	J	0.745	U	20	

Table 4-6 Detected Analytes in Bedrock Groundwater at AA2 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA2-BEDGW-001 11/20/1997 30.3-45.3 ft.		AA2-BEDGW-001 05/12/1998 30.3-45.3 ft.		AA2-BEDGW-001 10/8/2001 30.3-45.3 ft.		AA2-BEDGW-001 04/10/2002 30.3-45.3 ft.		AA2-BEDGW-001 01/27/2005 30.3-45.3 ft.		PB-BED-MW19 12/14/1994 26.2-51.2 ft.	
						Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
						Potassium	SW6010	46200	116000		ug/L	30000		31200		27500	J
Potassium (total)	SW6010	49500	116000		ug/L	29100		34200		30100	J	28900		25800			
Selenium	SW6010	2.6		18	ug/L	5	U	5	U	3.8	U	3.8	U	11.1	UJ	10	
Sodium	SW6010	161000	1390000		ug/L	104000		124000		127000		103000		90200			
Sodium (total)	SW6010	173000	1390000		ug/L	99100	J	124000		132000		100000		91600			
Thallium	SW6010	4.4		0.24	ug/L	10	U	10	U	4.8	U	4.8	U	14.1	U	0.5	
Thallium (total)	SW6010	5.3		0.24	ug/L	10	U	10	U	5.3	B	5.2	B	14.1	U	0.6	
Vanadium	SW6010	51.8		3.6	ug/L	50	U	50	U	1.8	U	1.8	U	2.14	U		
Vanadium (total)	SW6010	108		3.6	ug/L	50	U	108		1.8	U	1.8	U	2.14	U		
Zinc	SW6010	66.2	507	1100	ug/L	66.2	J	29.1	B	7.1	J	5	J	1.46	U	20	
Zinc (total)	SW6010	144	507	1100	ug/L	55		137	B	10.2	J	6.2	J	19.1	J	24	
Semivolatile Organic Compounds																	
2,4-Dimethylphenol	SW8270	8.6		73	ug/L	1.3	J	8.6	J	2.5	J	1.8	J	4.48	UJ	10	U
2-Methylnaphthalene	SW8270	12			ug/L	1.3	J	5.6	J	9.8	J	3.2	J	2.08	U	10	U
2-Methylphenol (o-Cresol)	SW8270	1.6		180	ug/L	10	U	1.6	J	0.8	U	0.8	U	4.18	U	10	U
4-Methylphenol (p-Cresol)	SW8270	1.6		18	ug/L	10	U	1.6	J	0.85	U	0.85	U	4.52	U	10	U
Naphthalene	SW8270	12		0.62	ug/L	10	U	8.1	J	12		2.5	J	1.09	J	10	U
Phenanthrene	SW8270	0.89			ug/L	10	U	10	U	0.72	U	0.72	U	0.691	U	10	U
Phenol	SW8270	74		1100	ug/L	10	U	74		2.2	J	0.82	U	4.31	U	10	U
bis(2-Ethylhexyl)phthalate	SW8270	24		4.8	ug/L	10	U	5.6	B	0.8	U	2	J	3.52	U	3	U
Volatile Organic Compounds																	
2-Butanone (Methyl ethyl ketone)	SW8260	18		700	ug/L	120	U	18	J					0.815	U	20	
Acetone	SW8260	220		550	ug/L	250	U	41	J	54	B			1.73	U	59	
Benzene	SW8260	130	2.4	0.35	ug/L	33		130		45	J	4.8	J	0.439	J	5	
Bromomethane	SW8260	7.9		0.87	ug/L	50	U	10	U	18	UJ	0.9	U	0.101	U	2	
Carbon Disulfide	SW8260	26		100	ug/L	5.5	J	1.7	J	10	U	0.84	J	0.257	J	26	
Chlorobenzene	SW8260	21		11	ug/L	21	J	5	U	24	U	1.2	U	0.115	U	1	
Chloromethane	SW8260	30		16	ug/L	50	U	10		30	J	0.5	U	0.142	U	2	
Cyclohexane	SW8260	55		1000	ug/L									24.2			
Ethylbenzene	SW8260	64	0.87	130	ug/L	23	J	43		64	J	13		1.48		3	
Isopropylbenzene (Cumene)	SW8260	1.23		66	ug/L									0.737	J		
Methylcyclohexane	SW8260	30.3		520	ug/L									14.5			
Methylene Chloride	SW8260	100		4.3	ug/L	7.4	B	3.2	B	100	J	3.9	J	0.128	U	1	
Toluene	SW8260	32	1.7	72	ug/L	32	B	20		25	U	2.2	J	0.192	J	5	
Xylenes, Total	SW8260	360	5.5	21	ug/L	200		220		360		98		17.9		26	

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts.

PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Table 4-6 Detected Analytes in Bedrock Groundwater at AA2 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	PB-BED-MW19 10/17/1996 26.2-51.2 ft.		PB-BED-MW19 (field dup) 10/17/1996 26.2-51.2 ft.		PB-BED-MW19 11/14/1997 26.2-51.2 ft.		PB-BED-MW19 05/16/1998 26.2-51.2 ft.		PB-BED-MW19 10/4/2001 26.2-51.2 ft.		PB-BED-MW19 (field dup) 10/4/2001 26.2-51.2 ft.	
						Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Wet Chemistry																	
Cyanide	SW9010	16		73	ug/L			10	U	10	U	16					
Cyanide	SW9012	109		73	ug/L								3	UJ			
Nitrogen, Nitrate (as N)	UNK-AN	0.2		1000	ug/L												
Nitrogen, Nitrate (as N)	E300	264		1000	ug/L												
Sulfate (as SO4)	E300	6.41			mg/L												
Sulfate (as SO4)	E375.4	70			mg/L					14		49		27.7	J		
Explosives																	
1,3,5-Trinitrobenzene	SW8330	0.8		110	ug/L	0.2	U	0.2	U	0.2	U	0.2	U	0.11	U	0.11	U
1,3-Dinitrobenzene	SW8330	0.81		0.36	ug/L	0.2	U	0.2	U	0.22		0.2	U	0.08	U	0.08	U
2,4,6-Trinitrotoluene	SW8330	1.6		2.2	ug/L	0.2	U	0.2	U	0.2	U	0.2	U	0.08	U	0.08	U
2,4-Dinitrotoluene	SW8330	2.5		7.3	ug/L	0.2	U	0.2	U	0.2	U	0.2	U	0.07	U	0.07	U
2,6-Dinitrotoluene	SW8330	1.2		3.6	ug/L	0.2	U	0.2	U	0.2	U	0.2	U	0.11	UJ	0.11	UJ
2-Nitrotoluene	SW8330	1.2		0.049	ug/L	0.2	U	0.2	U	0.2	U	0.2	U	0.14	U	0.14	U
3-Nitrotoluene	SW8330	8.1		12	ug/L	0.2	U	0.2	U	0.2	U	0.62		0.13	U	0.13	U
Nitrobenzene	SW8330	0.5		0.34	ug/L	0.5		0.44		0.32		0.2	U	0.07	U	0.07	U
RDX	SW8330	0.17		0.61	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	0.13	U	0.13	U
Metals																	
Aluminum	SW6010	378	309	3600	ug/L	378		200	U	200	U	200	U	86	B	76.7	B
Aluminum (total)	SW6010	10200	309	3600	ug/L	200	U	200	U	200	U	200	U	94.8	B	89	B
Antimony	SW6010	8		1.5	ug/L	60	U	60	U	60	U	60	U	7	U	7	UJ
Arsenic	SW6010	9	7.4	0.045	ug/L	10	U	10	U	10	U	10	U	2.5	U	2.5	UJ
Arsenic (total)	SW6010	34.2	7.4	0.045	ug/L	10	U	10	U	10	U	10	U	2.5	U	2.5	U
Barium	SW6010	2110	11800	260	ug/L	1940		2110		1520		1740		1080		1090	J
Barium (total)	SW6010	2260	11800	260	ug/L	2130		2260		1520		1800		1060		982	
Beryllium	SW6010	0.56		7.3	ug/L	5	U	5	U	5	U	5	U	0.5	U	0.5	UJ
Calcium	SW6010	231000	316000		ug/L	210000		231000		220000		162000		202000		200000	J
Calcium (total)	SW6010	1970000	316000		ug/L	228000		245000		255000	J	171000		221000		207000	
Chromium (total)	SW6010	307			ug/L	13.8		10.7		10		10	U	1.2	J	1.2	U
Cobalt	SW6010	3.4	12.1	73	ug/L	50	U	50	U	50	U	50	U	2.3	U	2.3	UJ
Cobalt (total)	SW6010	63.3	12.1	73	ug/L	50	U	50	U	50	U	50	U	2.3	U	2.3	U
Copper (total)	SW6010	99	19.8	150	ug/L	25	U	25	U	61.7		25	U	99		89.9	
Iron	SW6010	1300	1550	1100	ug/L	100	U	100	U	100	U	100	U	36.1	U	36.1	UJ
Iron (total)	SW6010	51600	1550	1100	ug/L	129		100	U	376	B	141	J	149		143	
Lead (total)	SW6010	38.6			ug/L	3	U	3	U	6.8		3	U	1.7	U	1.7	U
Magnesium	SW6010	117000	217000		ug/L	107000		117000		65100		77900		81000		81500	J
Magnesium (total)	SW6010	132000	217000		ug/L	117000	J	125000	J	57200		80000		66200		65000	
Manganese	SW6010	995	636	88	ug/L	16.5		17.2		15	U	16.3		4	J	3.5	J
Manganese (total)	SW6010	5130	636	88	ug/L	20.5		21.7		30.4		15	U	2.2	J	1.9	J
Nickel	SW6010	8.7	8.6	73	ug/L	40	U	40	U	40	U	40	U	7.9	J	8.7	J
Nickel (total)	SW6010	238	8.6	73	ug/L	40	U	40	U	40	U	40	U	13.8	J	12.7	J

Table 4-6 Detected Analytes in Bedrock Groundwater at AA2 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth	PB-BED-MW19 10/17/1996 26.2-51.2 ft.		PB-BED-MW19 (field dup) 10/17/1996 26.2-51.2 ft.		PB-BED-MW19 11/14/1997 26.2-51.2 ft.		PB-BED-MW19 05/16/1998 26.2-51.2 ft.		PB-BED-MW19 10/4/2001 26.2-51.2 ft.		PB-BED-MW19 (field dup) 10/4/2001 26.2-51.2 ft.	
						Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
						Units		Units		Units		Units		Units		Units	
Potassium	SW6010	46200	116000		ug/L	32300		33900		46200		24800		42100		41800	J
Potassium (total)	SW6010	49500	116000		ug/L	37400		41600		49500		26000		43800		41400	
Selenium	SW6010	2.6		18	ug/L	5	U	5	U	5	U	5	U	3.8	U	3.8	UJ
Sodium	SW6010	161000	1390000		ug/L	147000	J	161000	J	125000		127000		94900		95600	J
Sodium (total)	SW6010	173000	1390000		ug/L	162000	J	173000	J	120000		129000		75400		71700	
Thallium	SW6010	4.4		0.24	ug/L	10	U	10	U	10	U	10	U	4.8	U	4.8	UJ
Thallium (total)	SW6010	5.3		0.24	ug/L	10	U	10	U	10	U	10	U	4.8	U	4.8	U
Vanadium	SW6010	51.8		3.6	ug/L	50	U	51.8		50	U	50	U	1.8	U	1.8	UJ
Vanadium (total)	SW6010	108		3.6	ug/L	50	U	50	U	50	U	50	U	1.8	U	1.8	U
Zinc	SW6010	66.2	507	1100	ug/L	20	U	20	U	57.4		24.4	B	5.2	J	2.6	UJ
Zinc (total)	SW6010	144	507	1100	ug/L	30	J	29.6	J	62.3		29.5	B	144		135	
Semivolatile Organic Compounds																	
2,4-Dimethylphenol	SW8270	8.6		73	ug/L	10	U	10	U	10	U	10	U	0.59	U	0.59	U
2-Methylnaphthalene	SW8270	12			ug/L	3.5	J	3.6	J	3.3	J	1.5	J	12		12	
2-Methylphenol (o-Cresol)	SW8270	1.6		180	ug/L	10	U	10	U	10	U	10	U	0.8	U	0.8	U
4-Methylphenol (p-Cresol)	SW8270	1.6		18	ug/L	10	U	10	U	10	U	10	U	0.85	U	0.85	U
Naphthalene	SW8270	12		0.62	ug/L	2.2	J	2.5	J	2.1	J	10	U	8.6	J	8.9	J
Phenanthrene	SW8270	0.89			ug/L	10	U	10	U	10	U	10	U	0.82	J	0.89	J
Phenol	SW8270	74		1100	ug/L	10	U	10	U	55		10	U	1.2	J	1.3	J
bis(2-Ethylhexyl)phthalate	SW8270	24		4.8	ug/L	10	U	10	U	5.8	J	24	B	0.8	U	1.6	J
Volatile Organic Compounds																	
2-Butanone (Methyl ethyl ketone)	SW8260	18		700	ug/L			20	U								
Acetone	SW8260	220		550	ug/L			20	U	68	J			66	B	59	B
Benzene	SW8260	130	2.4	0.35	ug/L	3.7	J	3.1	J	11		1.9	J	46		54	
Bromomethane	SW8260	7.9		0.87	ug/L	10	U	10	U	2	U	10	U	7.9	J	3.6	UJ
Carbon Disulfide	SW8260	26		100	ug/L	5	U	5	U	2		6.9		3.3	U	2.1	J
Chlorobenzene	SW8260	21		11	ug/L	5	U	5	U	1	U	5	U	8	U	4.8	U
Chloromethane	SW8260	30		16	ug/L	10	U	10	U	2	U	10	U	3.3	U	2	U
Cyclohexane	SW8260	55		1000	ug/L												
Ethylbenzene	SW8260	64	0.87	130	ug/L	2.4	J	1.6	J	5.1		1.2	J	17	J	19	J
Isopropylbenzene (Cumene)	SW8260	1.23		66	ug/L												
Methylcyclohexane	SW8260	30.3		520	ug/L												
Methylene Chloride	SW8260	100		4.3	ug/L	5	U	5	U	1	U	2.3	B	30	J	7.4	J
Toluene	SW8260	32	1.7	72	ug/L	2	J	1.5	J	8.9		1.5	B	21	J	24	
Xylenes, Total	SW8260	360	5.5	21	ug/L	19		14		38		10		180		210	

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts.

PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Table 4-6 Detected Analytes in Bedrock Groundwater at AA2 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	PB-BED-MW19 04/04/2002 26.2-51.2 ft.		PB-BED-MW19 05/05/2004 26.2-51.2 ft.		PB-BED-MW19 01/24/2005 26.2-51.2 ft.	
						Result	VQ	Result	VQ	Result	VQ
						Wet Chemistry					
Cyanide	SW9010	16		73	ug/L						
Cyanide	SW9012	109		73	ug/L	3	U	3	UJ	109	J
Nitrogen, Nitrate (as N)	UNK-AN	0.2		1000	ug/L						
Nitrogen, Nitrate (as N)	E300	264		1000	ug/L					264	
Sulfate (as SO4)	E300	6.41			mg/L					3.75	J
Sulfate (as SO4)	E375.4	70			mg/L	32.2		21			
Explosives											
1,3,5-Trinitrobenzene	SW8330	0.8		110	ug/L	0.11	U	0.049	U	0.048	UJ
1,3-Dinitrobenzene	SW8330	0.81		0.36	ug/L	0.08	U	0.04	U	0.0651	UJ
2,4,6-Trinitrotoluene	SW8330	1.6		2.2	ug/L	0.08	U	0.13	U	0.139	UJ
2,4-Dinitrotoluene	SW8330	2.5		7.3	ug/L	0.07	U	0.09	U	0.104	UJ
2,6-Dinitrotoluene	SW8330	1.2		3.6	ug/L	0.11	U	0.073	U	0.195	UJ
2-Nitrotoluene	SW8330	1.2		0.049	ug/L	0.14	U	0.12	U	0.2	UJ
3-Nitrotoluene	SW8330	8.1		12	ug/L	0.13	U	0.13	U	0.368	UJ
Nitrobenzene	SW8330	0.5		0.34	ug/L	0.07	U	0.049	U	0.108	UJ
RDX	SW8330	0.17		0.61	ug/L	0.17	J	0.067	U	0.0838	UJ
Metals											
Aluminum	SW6010	378	309	3600	ug/L	66.6	B	45.2	J	45.4	U
Aluminum (total)	SW6010	10200	309	3600	ug/L	56.2	J	61.7	J	45.4	U
Antimony	SW6010	8		1.5	ug/L	7	U	4	U	8.16	U
Arsenic	SW6010	9	7.4	0.045	ug/L	2.5	U	2.6	U	4.59	U
Arsenic (total)	SW6010	34.2	7.4	0.045	ug/L	2.5	U	2.6	U	4.59	U
Barium	SW6010	2110	11800	260	ug/L	852		1050		1570	
Barium (total)	SW6010	2260	11800	260	ug/L	892		1120		1640	J
Beryllium	SW6010	0.56		7.3	ug/L	0.5	U	0.56	U	0.109	U
Calcium	SW6010	231000	316000		ug/L	109000		170000		150000	
Calcium (total)	SW6010	1970000	316000		ug/L	121000		184000		148000	J
Chromium (total)	SW6010	307			ug/L	1.2	U	2.8	U	0.236	U
Cobalt	SW6010	3.4	12.1	73	ug/L	2.3	U	2	U	1.27	J
Cobalt (total)	SW6010	63.3	12.1	73	ug/L	2.3	U	2	U	0.898	U
Copper (total)	SW6010	99	19.8	150	ug/L	15.6	J	52.2		2.55	U
Iron	SW6010	1300	1550	1100	ug/L	36.1	U	45.8	U	22.9	U
Iron (total)	SW6010	51600	1550	1100	ug/L	36.1	U	45.8	U	22.9	U
Lead (total)	SW6010	38.6			ug/L	1.7	U	1.6	U	2.44	U
Magnesium	SW6010	117000	217000		ug/L	44000		44800		72500	
Magnesium (total)	SW6010	132000	217000		ug/L	41900		44600		71300	J
Manganese	SW6010	995	636	88	ug/L	2.5	J	2.2	J	10.2	
Manganese (total)	SW6010	5130	636	88	ug/L	2.2	J	1.6	U	8.49	J
Nickel	SW6010	8.7	8.6	73	ug/L	4.3	J	7.9	J	0.745	U
Nickel (total)	SW6010	238	8.6	73	ug/L	3.5	J	9.2	J	0.745	U

Table 4-6 Detected Analytes in Bedrock Groundwater at AA2 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	PB-BED-MW19 04/04/2002 26.2-51.2 ft.		PB-BED-MW19 05/05/2004 26.2-51.2 ft.		PB-BED-MW19 01/24/2005 26.2-51.2 ft.	
						Result	VQ	Result	VQ	Result	VQ
						Potassium	SW6010	46200	116000		ug/L
Potassium (total)	SW6010	49500	116000		ug/L	41500	J	36500	J	25400	
Selenium	SW6010	2.6		18	ug/L	3.8	U	2.6	B	11.1	UJ
Sodium	SW6010	161000	1390000		ug/L	92900		75400	J	118000	
Sodium (total)	SW6010	173000	1390000		ug/L	88400		74300	J	118000	J
Thallium	SW6010	4.4		0.24	ug/L	4.8	U	4.4	B	14.1	U
Thallium (total)	SW6010	5.3		0.24	ug/L	4.8	U	5.1	B	14.1	U
Vanadium	SW6010	51.8		3.6	ug/L	1.8	U	3.6	U	2.14	U
Vanadium (total)	SW6010	108		3.6	ug/L	1.8	U	3.6	U	2.14	U
Zinc	SW6010	66.2	507	1100	ug/L	3.1	J	2.4	U	1.46	U
Zinc (total)	SW6010	144	507	1100	ug/L	31.3		65.9		1.46	U
Semivolatile Organic Compounds											
2,4-Dimethylphenol	SW8270	8.6		73	ug/L	0.59	U	3.7	U	4.44	UJ
2-Methylnaphthalene	SW8270	12			ug/L	10		5.2	J	2.08	J
2-Methylphenol (o-Cresol)	SW8270	1.6		180	ug/L	0.8	U	2	U	4.14	U
4-Methylphenol (p-Cresol)	SW8270	1.6		18	ug/L	0.85	U	3.6	U	4.48	U
Naphthalene	SW8270	12		0.62	ug/L	6.1	J	3.7	J	1.57	J
Phenanthrene	SW8270	0.89			ug/L	0.74	J	0.84	UJ	0.684	U
Phenol	SW8270	74		1100	ug/L	0.82	U	1.8	U	4.27	U
bis(2-Ethylhexyl)phthalate	SW8270	24		4.8	ug/L	9.7	J	2.2	UJ	3.49	U
Volatile Organic Compounds											
2-Butanone (Methyl ethyl ketone)	SW8260	18		700	ug/L					0.815	U
Acetone	SW8260	220		550	ug/L			220	B	1.73	U
Benzene	SW8260	130	2.4	0.35	ug/L	42	J	18	J	6.73	U
Bromomethane	SW8260	7.9		0.87	ug/L	9	U	7.6	U	0.101	U
Carbon Disulfide	SW8260	26		100	ug/L	5	U	3.2	J	0.203	J
Chlorobenzene	SW8260	21		11	ug/L	12	U	2.2	J	0.115	U
Chloromethane	SW8260	30		16	ug/L	5	U	2.4	UJ	0.142	U
Cyclohexane	SW8260	55		1000	ug/L					55	
Ethylbenzene	SW8260	64	0.87	130	ug/L	16	J	6.8	J	3.04	
Isopropylbenzene (Cumene)	SW8260	1.23		66	ug/L					1.23	
Methylcyclohexane	SW8260	30.3		520	ug/L					30.3	
Methylene Chloride	SW8260	100		4.3	ug/L	9.7	J	7.3	J	0.128	U
Toluene	SW8260	32	1.7	72	ug/L	18	J	8	J	1.73	
Xylenes, Total	SW8260	360	5.5	21	ug/L	170		66		22.6	

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts.

PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Table 4-7 Detected Analytes in Shallow Groundwater at AA3 (April 2005)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA3-GW-002 04/21/2005 8.3-18.3 ft.		AA3-GW-002 (field dup) 04/21/2005 8.3-18.3 ft.		AA3-GW-003 04/24/2005 10.0-20.0 ft.		AA3-GW-004 04/29/2005 10.3-20.3 ft.		AA3-GW-005 04/28/2005 10.1-20.1 ft.	
						Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Wet Chemistry															
Nitrogen, Nitrate (as N)	E300	64		1000	ug/L	25	U			64	J	62	J	25	U
Sulfate (as SO4)	E300	268			mg/L	39				268		37.5		114	
Metals															
Aluminum (total)	SW6010	177	309	3600	ug/L	100	U	100	U	103	J	112	J	177	J
Arsenic (total)	SW6010	8.1	7.4	0.045	ug/L	3	U	3	U	3	U	3	U	8.1	J
Barium (total)	SW6010	237	11800	260	ug/L	55.3	J	54.7	J	84.4	J	237		100	J
Calcium (total)	SW6010	187000	316000		ug/L	124000		120000		187000		93800		113000	
Iron (total)	SW6010	167	1550	1100	ug/L	30	U	30	U	40.4	J	38.2	J	167	
Magnesium (total)	SW6010	56500	217000		ug/L	24900		24800		56500	J	36300		38200	
Manganese (total)	SW6010	277	636	88	ug/L	3	U	3	U	277		81.7		73.4	
Mercury (total)	SW7470	0.091			ug/L	0.091	J	0.08	U	0.08	U	0.08	U	0.08	U
Nickel (total)	SW6010	5.2	8.6	73	ug/L	3	U	3	U	5.2	J	3	U	3	U
Potassium (total)	SW6010	1790	116000		ug/L	500	U	500	U	1110	J	1790	J	1310	J
Sodium (total)	SW6010	33500	1390000		ug/L	6120		6000		33500	J	17300		8820	
Zinc (total)	SW6010	128	507	1100	ug/L	11.5	J	56.7	J	24.6		117		128	
Volatile Organic Compounds															
Cyclohexane	SW8260	0.44		1000	ug/L	0.3	U	0.3	U	0.6	U	0.44	J	0.3	U
Methylcyclohexane	SW8260	0.6		520	ug/L	0.2	U	0.2	U	0.5	U	0.6	J	0.49	J

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts. PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Table 4-8 Detected Analytes in Shallow Groundwater at AA3 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA3-GW-002 11/19/1997 0.0-0.0 ft.		AA3-GW-002 05/14/1998 0.0-0.0 ft.		AA3-GW-002 01/21/2005 8.3-18.3 ft.		AA3-GW-003 01/25/2005 10.0-20.0 ft.		AA3-GW-003 (field dup) 01/25/2005 10.0-20.0 ft.		AA3-GW-004 01/30/2005 10.3-20.3 ft.		AA3-GW-005 01/27/2005 10.1-20.1 ft.	
						Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Wet Chemistry																			
Nitrogen, Nitrate (as N)	E300	76		1000	ug/L					76	J	14.9	U			14.9	UJ	14.9	U
Sulfate (as SO4)	E300	253			mg/L					45.5		253				38.4	J	157	J
Sulfate (as SO4)	E375.4	37			mg/L	18		37	J										
Metals																			
Aluminum (total)	SW6010	11600	309	3600	ug/L	11600	J	200	U	45.4	U	45.4	U	45.4	U	45.4	U	45.4	U
Arsenic	SW6010	12.5	7.4	0.045	ug/L	10	U	10	U	4.59	U	4.59	U	4.59	U	4.59	U	12.5	J
Arsenic (total)	SW6010	12.1	7.4	0.045	ug/L	10.3		10	U	4.59	U	4.59	U	4.59	U	4.59	U	12.1	J
Barium	SW6010	198	11800	260	ug/L	200	U	200	U	53.4		89.8		90.2		198		108	
Barium (total)	SW6010	206	11800	260	ug/L	200	U	200	U	56.4	J	92.9		92.9		206		113	
Calcium	SW6010	166000	316000		ug/L	131000		118000		115000		164000		166000		89600		111000	
Calcium (total)	SW6010	205000	316000		ug/L	205000		118000		119000	J	165000		167000		88800		115000	
Chromium (total)	SW6010	22.8			ug/L	22.8		10	U	0.695	J	0.236	U	0.236	U	0.236	U	0.236	U
Cobalt	SW6010	2.79	12.1	73	ug/L	50	U	50	U	1.44	J	2.79	J	2.4	J	1.03	J	0.898	U
Cobalt (total)	SW6010	2.63	12.1	73	ug/L	50	U	50	U	1.66	J	2.6	J	2.63	J	0.898	U	1.75	J
Copper	SW6010	44.2	19.8	150	ug/L	25	U	25	U	2.55	U	2.55	U	2.55	U	2.55	U	44.2	
Copper (total)	SW6010	33.6	19.8	150	ug/L	33.6		25	U	2.55	U	2.55	U	6.93	J	2.55	U	2.55	U
Iron	SW6010	64.9	1550	1100	ug/L	100	U	100	U	22.9	U	39.9	J	38.8	J	22.9	U	64.9	J
Iron (total)	SW6010	27300	1550	1100	ug/L	27300		100	U	22.9	U	22.9	U	22.9	U	22.9	U	165	J
Lead (total)	SW6010	16.6			ug/L	16.6		3	U	2.44	U	2.44	U	2.44	U	2.44	U	2.44	U
Magnesium	SW6010	55200	217000		ug/L	29300		28100		25400		54700		55200		37800		42400	
Magnesium (total)	SW6010	55800	217000		ug/L	52100		28000		26100	J	55200		55800		37700		44500	
Manganese	SW6010	296	636	88	ug/L	78.8		139		0.567	J	295		296		47.8		74.3	
Manganese (total)	SW6010	816	636	88	ug/L	816		123		0.419	U	324		320		51.3		75.4	
Nickel	SW6010	3.08	8.6	73	ug/L	40	U	40	U	0.745	U	3.06	J	3.08	J	0.745	U	0.745	U
Potassium	SW6010	2330	116000		ug/L	5000	U	5000	U	470	J	1040	J	1130	J	2330		175	U
Potassium (total)	SW6010	2410	116000		ug/L	5000	U	5000	U	469	J	1220	J	1170	J	2410		1480	J
Sodium	SW6010	36000	1390000		ug/L	7180		12200		6290		36000		35900		24600	J	11600	
Sodium (total)	SW6010	36600	1390000		ug/L	7800		7220		6480	J	36300		36600		24800	J	12500	
Zinc	SW6010	109	507	1100	ug/L	49.9		48.8	B	17.1	J	13.8	J	13	J	52.9		109	
Zinc (total)	SW6010	99.9	507	1100	ug/L	99.9		20	U	15.1	J	14.8	J	19.5	J	58.3		82.8	
Volatile Organic Compounds																			
Methylene Chloride	SW8260	0.49		4.3	ug/L	1	U	0.49	B	0.128	U	0.128	U	0.128	U	0.128	U	0.128	U

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts. PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Table 4-8 Detected Analytes in Shallow Groundwater at AA3 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA3-GW-002 11/19/1997 0.0-0.0 ft.		AA3-GW-002 05/14/1998 0.0-0.0 ft.		AA3-GW-002 01/21/2005 6.3-18.3 ft.		AA3-GW-003 01/25/2005 10.0-20.0 ft.		AA3-GW-003 (field dup) 01/25/2005 10.0-20.0 ft.		AA3-GW-004 01/30/2005 10.3-20.3 ft.		AA3-GW-005 01/27/2005 10.1-20.1 ft.	
						Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Wet Chemistry																			
Nitrogen, Nitrate (as N)	E300	76		1000	ug/L					76	J	14.9	U			14.9	UJ	14.9	U
Sulfate (as SO4)	E300	253			mg/L					45.5		253				38.4	J	157	J
Sulfate (as SO4)	E375.4	37			mg/L	18		37	J										
Metals																			
Aluminum (total)	SW6010	11600	309	3600	ug/L	11600	J	200	U	45.4	U	45.4	U	45.4	U	45.4	U	45.4	U
Arsenic	SW6010	12.5	7.4	0.045	ug/L	10	U	10	U	4.59	U	4.59	U	4.59	U	4.59	U	12.5	J
Arsenic (total)	SW6010	12.1	7.4	0.045	ug/L	10.3		10	U	4.59	U	4.59	U	4.59	U	4.59	U	12.1	J
Barium	SW6010	198	11800	260	ug/L	200	U	200	U	53.4		89.8		90.2		198		108	
Barium (total)	SW6010	206	11800	260	ug/L	200	U	200	U	56.4	J	92.9		92.9		206		113	
Calcium	SW6010	166000	316000		ug/L	131000		118000		115000		164000		166000		89600		111000	
Calcium (total)	SW6010	205000	316000		ug/L	205000		118000		119000	J	165000		167000		88800		115000	
Chromium (total)	SW6010	22.8			ug/L	22.8		10	U	0.695	J	0.236	U	0.236	U	0.236	U	0.236	U
Cobalt	SW6010	2.79	12.1	73	ug/L	50	U	50	U	1.44	J	2.79	J	2.4	J	1.03	J	0.898	U
Cobalt (total)	SW6010	2.63	12.1	73	ug/L	50	U	50	U	1.66	J	2.6	J	2.63	J	0.898	U	1.75	J
Copper	SW6010	44.2	19.8	150	ug/L	25	U	25	U	2.55	U	2.55	U	2.55	U	2.55	U	44.2	
Copper (total)	SW6010	33.6	19.8	150	ug/L	33.6		25	U	2.55	U	2.55	U	6.93	J	2.55	U	2.55	U
Iron	SW6010	64.9	1550	1100	ug/L	100	U	100	U	22.9	U	39.9	J	38.8	J	22.9	U	64.9	J
Iron (total)	SW6010	27300	1550	1100	ug/L	27300		100	U	22.9	U	22.9	U	22.9	U	22.9	U	165	J
Lead (total)	SW6010	16.6			ug/L	16.6		3	U	2.44	U	2.44	U	2.44	U	2.44	U	2.44	U
Magnesium	SW6010	55200	217000		ug/L	29300		28100		25400		54700		55200		37800		42400	
Magnesium (total)	SW6010	55800	217000		ug/L	52100		28000		26100	J	55200		55800		37700		44500	
Manganese	SW6010	296	636	88	ug/L	78.8		139		0.567	J	295		296		47.8		74.3	
Manganese (total)	SW6010	816	636	88	ug/L	816		123		0.419	U	324		320		51.3		75.4	
Nickel	SW6010	3.08	8.6	73	ug/L	40	U	40	U	0.745	U	3.06	J	3.08	J	0.745	U	0.745	U
Potassium	SW6010	2330	116000		ug/L	5000	U	5000	U	470	J	1040	J	1130	J	2330		175	U
Potassium (total)	SW6010	2410	116000		ug/L	5000	U	5000	U	469	J	1220	J	1170	J	2410		1480	J
Sodium	SW6010	36000	1390000		ug/L	7180		12200		6290		36000		35900		24600	J	11600	
Sodium (total)	SW6010	36600	1390000		ug/L	7800		7220		6480	J	36300		36600		24800	J	12500	
Zinc	SW6010	109	507	1100	ug/L	49.9		48.8	B	17.1	J	13.8	J	13	J	52.9		109	
Zinc (total)	SW6010	99.9	507	1100	ug/L	99.9		20	U	15.1	J	14.8	J	19.5	J	58.3		82.8	
Volatile Organic Compounds																			
Methylene Chloride	SW8260	0.49		4.3	ug/L	1	U	0.49	B	0.128	U	0.128	U	0.128	U	0.128	U	0.128	U

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts. PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Table 4-9 Detected Analytes in Bedrock Groundwater at AA3 (April 2005)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA3-BEDGW-001 04/21/2005 40.3-55.3 ft.		AA3-BEDGW-002 04/25/2005 47.4-57.4 ft.		AA3-BEDGW-003 04/29/2005 43.0-53.0 ft.	
						Result	VQ	Result	VQ	Result	VQ
Wet Chemistry											
Sulfate (as SO4)	E300	5.4			mg/L	0.25	U	5.4		2.7	
Explosives											
2-Nitrotoluene	SW8330	2.1		0.049	ug/L	0.09	U	0.096	U	2.1	J
3-Nitrotoluene	SW8330	0.44		12	ug/L	0.43	J	0.096	U	0.44	J
RDX	SW8330	0.32		0.61	ug/L	0.09	U	0.096	U	0.32	J
Metals											
Aluminum (total)	SW6010	102	309	3600	ug/L	100	U	100	U	102	J
Barium (total)	SW6010	967	11800	260	ug/L	74.1	J	195	J	967	
Calcium (total)	SW6010	113000	316000		ug/L	113000		58700		65400	
Copper (total)	SW6010	12.5	19.8	150	ug/L	4	U	4	U	12.5	J
Iron (total)	SW6010	321	1550	1100	ug/L	30	U	30	U	321	
Magnesium (total)	SW6010	66900	217000		ug/L	66900		30100		37900	
Manganese (total)	SW6010	30.8	636	88	ug/L	12.4	J	10.2	J	30.8	
Mercury (total)	SW7470	0.091			ug/L	0.08	U	0.091	J	0.08	U
Potassium (total)	SW6010	41000	116000		ug/L	41000		10800		28400	
Sodium (total)	SW6010	234000	1390000		ug/L	234000		35700		172000	
Semivolatile Organic Compounds											
2-Methylnaphthalene	SW8270	4.6			ug/L	1	UJ	1.1	UJ	4.6	J
Naphthalene	SW8270	5.3		0.62	ug/L	1	UJ	1.1	UJ	5.3	J
Volatile Organic Compounds											
Benzene	SW8260	120	2.4	0.35	ug/L	3.3		17		120	
Carbon Disulfide	SW8260	1.4		100	ug/L	0.3	U	0.45	J	1.4	
Cyclohexane	SW8260	160		1000	ug/L	60		31		160	
Ethylbenzene	SW8260	31	0.87	130	ug/L	1.7		4.8		31	
Isopropylbenzene (Cumene)	SW8260	7.6		66	ug/L	0.6	J	1		7.6	
Methylcyclohexane	SW8260	62		520	ug/L	23		18		62	
Tetrachloroethene (PCE)	SW8260	0.5		0.1	ug/L	0.5	J	0.42	J	0.3	U
Toluene	SW8260	68	1.7	72	ug/L	4.4		11		68	
Xylenes, Total	SW8260	260	5.5	21	ug/L	11		33		260	

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts. PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Table 4-10 Detected Analytes in Bedrock Groundwater at AA3 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA3-BEDGW-001 11/19/1997 40.3-55.3 ft.		AA3-BEDGW-001 05/14/1998 40.3-55.3 ft.		AA3-BEDGW-001 09/27/2001 40.3-55.3 ft.		AA3-BEDGW-001 04/10/2002 40.3-55.3 ft.		AA3-BEDGW-001 (field dup) 04/10/2002 40.3-55.3 ft.		AA3-BEDGW-001 01/23/2005 40.3-55.3 ft.		
						Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	
Wet Chemistry																		
Cyanide	SW9012	26.8		73	ug/L					3	UJ	3	U				26.8	J
Nitrogen, Nitrate (as N)	E300	413		1000	ug/L												225	
Sulfate (as SO4)	E300	23.6			mg/L												1.21	
Sulfate (as SO4)	E375.4	31.1			mg/L	0.005	U	8	J	31.1		0.28	U					
Metals																		
Aluminum	SW6010	61.2	309	3600	ug/L	200	U	200	U	50.2	B	49.2	J	61.2	B		45.4	U
Aluminum (total)	SW6010	397	309	3600	ug/L	200	U	397		59.6	B	104	B	104	B		45.4	U
Arsenic (total)	SW6010	5.08	7.4	0.045	ug/L	10	U	10	U	2.5	U	2.5	U	2.5	U		4.59	U
Barium	SW6010	837	11800	260	ug/L	200	U	200	U	99.5	J	78.1	J	78.5	J		76.2	
Barium (total)	SW6010	844	11800	260	ug/L	200	U	200	U	102	J	80.2	J	77.7	J		74.4	J
Calcium	SW6010	160000	316000		ug/L	160000		143000		122000		104000		105000			109000	
Calcium (total)	SW6010	189000	316000		ug/L	189000		131000		122000	J	104000		101000			108000	J
Chromium (total)	SW6010	1.6			ug/L	10	U	10	U	1.6	B	1.2	U	1.2	U		0.236	U
Cobalt	SW6010	1.13	12.1	73	ug/L	50	U	50	U	2.3	U	2.3	U	2.3	U		1.13	J
Copper	SW6010	4	19.8	150	ug/L	25	U	25	U	1.9	U	1.9	U	1.9	U		2.55	U
Iron (total)	SW6010	450	1550	1100	ug/L	168	B	450		126		118	J	91.8	J		22.9	U
Magnesium	SW6010	96300	217000		ug/L	96300		89400		80900		67100		67900			68700	
Magnesium (total)	SW6010	108000	217000		ug/L	108000		76800		80700		69300		67200			67800	J
Manganese	SW6010	57.6	636	88	ug/L	57.6		51.3		23.9		17		17.2			13.4	
Manganese (total)	SW6010	83.8	636	88	ug/L	74.6		83.8		28.7		20.7		20			11.8	
Potassium	SW6010	44700	116000		ug/L	44700		43800		43100		40000		40700			37100	
Potassium (total)	SW6010	49600	116000		ug/L	49600		38500		43900		40400		39300			36200	
Sodium	SW6010	331000	1390000		ug/L	331000		321000		293000		237000		241000			260000	
Sodium (total)	SW6010	368000	1390000		ug/L	368000		282000		293000		237000		231000			260000	J
Thallium	SW6010	6.4		0.24	ug/L	10	U	10	U	6.4	B	4.8	U	4.8	U		14.1	U
Thallium (total)	SW6010	10.1		0.24	ug/L	10	U	10.1	B	4.8	U	6.9	B	4.8	U		14.1	U
Zinc	SW6010	42.8	507	1100	ug/L	23		42.8	B	2.6	U	2.6	U	2.6	U		1.46	U
Zinc (total)	SW6010	67.6	507	1100	ug/L	29.2		67.6	B	2.6	U	2.6	U	2.6	U		1.46	U
Semivolatile Organic Compounds																		
2-Methylnaphthalene	SW8270	5.47			ug/L	10	U	10	U	1.7	U	0.87	U	0.87	U		2.06	U
Naphthalene	SW8270	5.53		0.62	ug/L	10	U	10	U	1.3	U	0.7	J	0.72	J		0.54	U
Phenol	SW8270	3.1		1100	ug/L	3.1	J	10	U	1.6	U	0.82	U	0.82	U		4.27	U
bis(2-Ethylhexyl)phthalate	SW8270	5.8		4.8	ug/L	5.8	J	10	U	1.6	U	0.8	U	0.8	U		3.49	U
Volatile Organic Compounds																		
Acetone	SW8260	36		550	ug/L	36	J			22	B						1.73	U
Benzene	SW8260				ug/L	5	U	200	U	11		8	J	7.5	J		0.763	J
Carbon Disulfide	SW8260				ug/L	4.2	J	200	U	0.5	U	1	U	1	U		0.118	U
Chloromethane	SW8260				ug/L	10	U	400	U	0.5	U	1	U	1	U		0.142	U
Cyclohexane	SW8260				ug/L												16.7	
Ethylbenzene	SW8260				ug/L	5	U	200	U	4	J	4.6	J	4.1	J		0.353	J

Table 4-10 Detected Analytes in Bedrock Groundwater at AA3 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA3-BEDGW-001 11/19/1997 40.3-55.3 ft.		AA3-BEDGW-001 05/14/1998 40.3-55.3 ft.		AA3-BEDGW-001 09/27/2001 40.3-55.3 ft.		AA3-BEDGW-001 04/10/2002 40.3-55.3 ft.		AA3-BEDGW-001 (field dup) 04/10/2002 40.3-55.3 ft.		AA3-BEDGW-001 01/23/2005 40.3-55.3 ft.	
						Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
						Isopropylbenzene (Cumene)	SW8260				ug/L						
Methylcyclohexane	SW8260				ug/L											7.16	
Methylene Chloride	SW8260				ug/L	2.1	B	160	B	2.2	B	9.2	J	9.6	J	0.128	U
Toluene	SW8260				ug/L	5	U	29	B	11		12	J	11		1.28	
Xylenes, Total	SW8260				ug/L	5	U	200	U	28		31		28		2.56	

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts. PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Table 4-10 Detected Analytes in Bedrock Groundwater at AA3 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA3-BEDGW-002		AA3-BEDGW-003		AA3-BEDGW-003 (field dup)	
						01/25/2005		01/30/2005		01/30/2005	
						47.4-57.4 ft.		43.0-53.0 ft.		43.0-53.0 ft.	
					Result	VQ	Result	VQ	Result	VQ	
Wet Chemistry											
Cyanide	SW9012	26.8		73	ug/L	7	UJ	8.6	J	7	U
Nitrogen, Nitrate (as N)	E300	413		1000	ug/L	14.9	U	413	J		
Sulfate (as SO4)	E300	23.6			mg/L	7.15		23.6			
Sulfate (as SO4)	E375.4	31.1			mg/L						
Metals											
Aluminum	SW6010	61.2	309	3600	ug/L	45.4	U	45.4	U	45.4	U
Aluminum (total)	SW6010	397	309	3600	ug/L	45.4	U	45.4	U	45.4	U
Arsenic (total)	SW6010	5.08	7.4	0.045	ug/L	4.59	U	4.59	U	5.08	J
Barium	SW6010	837	11800	260	ug/L	187		806		837	
Barium (total)	SW6010	844	11800	260	ug/L	194		825		844	
Calcium	SW6010	160000	316000		ug/L	57500		76300		75400	
Calcium (total)	SW6010	189000	316000		ug/L	59000		73200		75800	
Chromium (total)	SW6010	1.6			ug/L	0.236	U	0.236	U	0.236	U
Cobalt	SW6010	1.13	12.1	73	ug/L	0.898	U	0.898	U	0.898	U
Copper	SW6010	4	19.8	150	ug/L	2.55	U	2.55	U	4	J
Iron (total)	SW6010	450	1550	1100	ug/L	22.9	U	58.4	J	55.7	J
Magnesium	SW6010	96300	217000		ug/L	30400		44600		44400	
Magnesium (total)	SW6010	108000	217000		ug/L	31500		43200		44200	
Manganese	SW6010	57.6	636	88	ug/L	12.9		41.9		43.5	
Manganese (total)	SW6010	83.8	636	88	ug/L	13.3		41.1		42.3	
Potassium	SW6010	44700	116000		ug/L	11100		28600		28500	
Potassium (total)	SW6010	49600	116000		ug/L	11400		27900		28600	
Sodium	SW6010	331000	1390000		ug/L	41600		194000	J	191000	J
Sodium (total)	SW6010	368000	1390000		ug/L	43600		187000	J	192000	J
Thallium	SW6010	6.4		0.24	ug/L	14.1	U	14.1	U	14.1	U
Thallium (total)	SW6010	10.1		0.24	ug/L	14.1	U	14.1	U	14.1	U
Zinc	SW6010	42.8	507	1100	ug/L	1.46	U	1.46	U	1.46	U
Zinc (total)	SW6010	67.6	507	1100	ug/L	1.46	U	11.8	J	9.56	J
Semivolatile Organic Compounds											
2-Methylnaphthalene	SW8270	5.47			ug/L	2.08	U	5.47	J	4.92	J
Naphthalene	SW8270	5.53		0.62	ug/L	0.545	U	5.53	J	4.66	J
Phenol	SW8270	3.1		1100	ug/L	4.31	U	4.31	U	4.27	U
bis(2-Ethylhexyl)phthalate	SW8270	5.8		4.8	ug/L	3.52	U	3.52	U	3.49	U
Volatile Organic Compounds											
Acetone	SW8260	36		550	ug/L	1.73	UJ	1.73	U	1.73	U
Benzene	SW8260				ug/L	5.06		41.8		41.4	
Carbon Disulfide	SW8260				ug/L	0.661	J	0.606	J	0.619	J
Chloromethane	SW8260				ug/L	11.4		0.142	U	0.142	U
Cyclohexane	SW8260				ug/L	39.8		96		93.5	
Ethylbenzene	SW8260				ug/L	1.58		15.5		15.3	

Table 4-10 Detected Analytes in Bedrock Groundwater at AA3 (Prior Sampling Events)

Analyte	Method	Max. Detect	GW Bkg.	PRG*	Location Date Depth Units	AA3-BEDGW-002		AA3-BEDGW-003		AA3-BEDGW-003 (field dup)	
						01/25/2005		01/30/2005		01/30/2005	
						47.4-57.4 ft.		43.0-53.0 ft.		43.0-53.0 ft.	
					Result	VQ	Result	VQ	Result	VQ	
Isopropylbenzene (Cumene)	SW8260				ug/L	0.423	J	4.64		4.65	
Methylcyclohexane	SW8260				ug/L	30.9		55.9		54.4	
Methylene Chloride	SW8260				ug/L	0.128	U	0.128	U	0.128	U
Toluene	SW8260				ug/L	3.24		27.4		26.9	
Xylenes, Total	SW8260				ug/L	12.1		128		127	

* PRGs were obtained from the U.S. EPA Region 9 Web-Site. PRGs based on non-cancer effects (designated in the Region 9 tables with an "nc") were divided by 10 to account for potential cumulative impacts. PRGs designated in the Region 9 tables with a "sat", or "max" code indicating a soil saturation limit or maximum possible concentration were not modified, rather the PRG based on the underlying non-cancer effect was modified

Appendix C
Chain of Custody Forms

ELAB OF TENNESSEE C IN OF CUSTODY RECORD

No. 3396

Ship to:
ELAB of Tennessee

227 French Landing Drive
Suite 550
Nashville, TN 37228
Attn: Analytical Laboratory
(615) 345-1115 (phone)
(615) 846-5426 (fax)

Send Results to:

Name Mike Houck
Company Jacobs Engineering
Address 125 Broadway
City, State, Zip Oak Ridge TN 37830
Phone 865-220-4866
Fax _____
E-mail mike.houck@jacobs.com

Send Invoice To:

Name _____
Company _____
Address _____
City, State, Zip _____
Phone _____
Purchase Order _____
E-mail _____

Details:

Page 1 of 1
Cooler No. _____ of _____
Date Shipped 4-21-05
Shipped By A Hardcastle
Turnaround _____
(Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name						Samplers (Signature)*							
Lab Use Only Lab #	Date Sampled	Time	Comp./Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.			
	4-21-05	1515		PBOW-05-GW-AA3-GW002-OZA	ground water			SVOC, PCB, Nitroaromatics w/ back-up	4				
				"				metals, Cyanide Hardness	2				
				"				VOC's	3				
				"				TOC, TSS, TDS	2				
				"				turbidity, alkalinity chloride, nitrate, sulfate	1				
	4-21-05	1515		PBOW-05-GW-AA3-GW002-OZD	ground water			SVOC, PCB, Nitroaromatics w/ back-up	4				
				"				metals, cyanide	2				
				"				VOC's	3				
Sample Kit Prep'd by: (Signature) <i>A. L. [Signature]</i>			Date 4-15-05	Received By: (Signature)			REMARKS *Signature required to ensure validity				Lab Use Only VOA Headspace Y N NA Field Filtered Y N NA Correct Containers Y N NA Discrepancies Y N NA Cust. Seals intact Y N NA Containers Intact Y N NA		
Relinquished by: (Signature) <i>[Signature]</i>			Date/Time 4/21/05 1738	Received By: (Signature)							Airbill # _____		
Relinquished by: (Signature)			Date/Time	Received By: (Signature)							CAR # _____		
Received for Laboratory by: (Signature)			Date/Time	Temperature									

ELAB OF TENNESSEE C IN OF CUSTODY RECORD

N 3305

Ship to:
ELAB of Tennessee

227 French Landing Drive
Suite 550
Nashville, TN 37228
Attn: Analytical Laboratory
(615) 345-1115 (phone)
(615) 846-5426 (fax)

Send Results to:

Name Mike Hawk
Company Jacobs Engineering
Address 125 Broadway
City, State, Zip Oak Ridge, TN 37830
Phone 865-330-4466
Fax _____
E-mail _____

Send Invoice To:

Name _____
Company _____
Address _____
City, State, Zip _____
Phone _____
Purchase Order _____
E-mail _____

Details:

Page 1 of 1
Cooler No. _____ of _____
Date Shipped 4/21/05
Shipped By Al Hawkley
Turnaround _____
(Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name						Samplers (Signature)*				
Lab Use Only Lab #	Date Sampled	Time	Comp./ Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.
	4/21/05	1545		PBOW-05-GIU-APS-RED- GIU001-02A	ground liquidity			SVOC, PCB, Nitroaromatics, backup	4	
				"	"			metals cyanide hardness	2	
				"				VOC	3	
				"				TOC, TSS, TDS	2	
				"				turb, Alk, chloride, nitrate sulfate	1	
	4/21/05	1700		PBOW-05-TR-C42105-02				VOC	2	

Sample Kit Prep'd by: (Signature) <u>Al Hawkley</u>	Date 4-15-05	Received By: (Signature)	REMARKS *Signature required to ensure validity	Lab Use Only
Relinquished by: (Signature) <u>Al Hawkley</u>	Date/Time 4/21/05 1738	Received By: (Signature)		VOA Headspace Y N NA
Relinquished by: (Signature)	Date/Time	Received By: (Signature)		Field Filtered Y N NA
Received for Laboratory by: (Signature)	Date/Time	Temperature		Correct Containers Y N NA
				Discrepancies Y N NA
				Cust. Seals intact Y N NA
				Containers Intact Y N NA
				Airbill # _____
				CAR # _____

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers

ELAB OF TENNESSEE MAIN OF CUSTODY RECORD

33263

Ship to:
ELAB of Tennessee
 227 French Landing Drive
 Suite 550
 Nashville, TN 37228
 Attn: Analytical Laboratory
 (615) 345-1115 (phone)
 (615) 846-5426 (fax)

Send Results to:
 Name Mike Houck
 Company Jacobs Engineering
 Address 125 Brown Hwy NW
 City, State, Zip Cook Ridge, TN 37030
 Phone 615-220-4466
 Fax 615-220-4418
 E-mail _____

Send Invoice To:
 Name _____
 Company _____
 Address _____
 City, State, Zip _____
 Phone _____
 Purchase Order _____
 E-mail _____

Details:
 Page 1 of 2
 Cooler No. _____ of _____
 Date Shipped _____
 Shipped By _____
 Turnaround _____
 (Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name					Samplers (Signature)*					
Lab Use Only Lab #	Date Sampled	Time	Comp./ Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.
	4/24/05	1330		PEW-05-GW-AA3-61003-02A	GW			VOC (ms/msd)	4/24/05 9	
								SVOC (ms/msd)	* 3	
								PCB (ms/msd)	+ 3	
								nitroaromatics (ms/msd)	* 3	
								metals, hardness (ms/msd)	+ 3	
								cyanide (ms/msd)	3	
								total hardness, alkalinity, chloride, nitrate, sulfate	1	
								TOL	1	
								TSS/TDS	1	
								Back up (ms/msd)	* 3	

Sample Kit Prep'd by: (Signature)	Date <u>4/19/05</u>	Received By: (Signature)	REMARKS *Signature required to ensure validity	Lab Use Only
Relinquished by: (Signature)	Date/Time <u>4/25/05 1725</u>	Received By: (Signature)		VOA Headspace Y N NA
Relinquished by: (Signature)	Date/Time	Received By: (Signature)		Field Filtered Y N NA
Received for Laboratory by: (Signature)	Date/Time	Temperature		Correct Containers Y N NA
				Discrepancies Y N NA
				Cust. Seals intact Y N NA
				Containers Intact Y N NA
				Airbill # _____
				CAR # _____

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers

ELAB OF TENNESSEE | PLAN OF CUSTODY RECORD

No. 3269

Ship to:
ELAB of Tennessee
 227 French Landing Drive
 Suite 550
 Nashville, TN 37228
 Attn: Analytical Laboratory
 (615) 345-1115 (phone)
 (615) 846-5426 (fax)

Send Results to:
 Name Mike Houck
 Company Jacobs Eng.
 Address 125 Broadway
 City, State, Zip Cork Ridge, TN 37019
 Phone 615-330-4666
 Fax 615-330-4648
 E-mail _____

Send Invoice To:
 Name _____
 Company _____
 Address _____
 City, State, Zip _____
 Phone _____
 Purchase Order _____
 E-mail _____

Details:
 Page 2 of 2
 Cooler No. _____ of _____
 Date Shipped _____
 Shipped By _____
 Turnaround _____
 (Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name						Samplers (Signature)*				
Lab Use Only Lab #	Date Sampled	Time	Comp./Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.
	4/25/05	1115		PEBW-05-G10-AA3 PEBG1002-02A	G10			VOL	3	
								SVOC, PCB, nitroaromatics + backup	4	
								metals hardness	1	
								cyanide	1	
								barb, alkalinity, chloride nitrate, sulfate	1	
								TOL	1	
								TSS / TDS	1	
	4/30/05	1710		PEBW-05-TB1042405-01				VOL		

Sample Kit Prep'd by: (Signature)	Date	Received By: (Signature)	REMARKS *Signature required to ensure validity	Lab Use Only
Relinquished by: (Signature)	Date/Time	Received By: (Signature)		VOA Headspace Y N NA
Relinquished by: (Signature)	Date/Time	Received By: (Signature)		Field Filtered Y N NA
Received for Laboratory by: (Signature)	Date/Time	Temperature		Correct Containers Y N NA
				Discrepancies Y N NA
			Cust. Seals intact Y N NA	
			Containers Intact Y N NA	
			Airbill # _____	
			CAR # _____	

ELAB OF TENNESSEE / IN OF CUSTODY RECORD

3270

Ship to:
ELAB of Tennessee

227 French Landing Drive
Suite 550
Nashville, TN 37228
Attn: Analytical Laboratory
(615) 345-1115 (phone)
(615) 846-5426 (fax)

Send Results to:

Name Mike Huck
Company JACKS INC
Address 125 Broadway
City, State, Zip Oak Ridge, TN
Phone 615-220-4866
Fax 615-220-4849
E-mail _____

Send Invoice To:

Name _____
Company _____
Address _____
City, State, Zip _____
Phone _____
Purchase Order _____
E-mail _____

Details:

Page 1 of 4
Cooler No. _____ of _____
Date Shipped _____
Shipped By _____
Turnaround _____
(Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name					Samplers (Signature)*					
Lab Use Only Lab #	Date Sampled	Time	Comp./ Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.
	4/25/05	1515		PBOW-05-610-AAZ R.M.W.001-02D -continued				cyanide	1	
	4/25/05	1300		PBOW-05-610-PB R.D.M.W.19				VOL SVOC, PCB, nitroaromatics back-up	3 4	
								metals, hardness	1	
								cyanide	1	
								tr(Pb), alkalinity chloride nitrate, sulfate	1	
								TOL	1	
								TSS/ TDS	1	
	4/25/05	1000		PBOW-05-TB-042505-02 PBOW-05-TB-042505-04				VOL	3	

Sample Kit Prep'd by: (Signature)	Date	Received By: (Signature)	REMARKS *Signature required to ensure validity	Lab Use Only
Relinquished by: (Signature)	Date/Time	Received By: (Signature)		VOA Headspace
Relinquished by: (Signature)	Date/Time	Received By: (Signature)		Field Filtered
Received for Laboratory by: (Signature)	Date/Time	Temperature		Correct Containers
				Discrepancies
				Cust. Seals intact
				Containers Intact
				Airbill # _____
				CAR # _____

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers

ELAB OF TENNESSEE

IN OF CUSTODY RECORD

3268

Ship to:
ELAB of Tennessee

227 French Landing Drive
Suite 550
Nashville, TN 37228
Attn: Analytical Laboratory
(615) 345-1115 (phone)
(615) 846-5426 (fax)

Send Results to:

Name Duke Hawk
Company Jacobs
Address 125 Broadway
City, State, Zip Cole Park TN 37800
Phone 865.220.4866
Fax 865.220.4848
E-mail _____

Send Invoice To:

Name _____
Company _____
Address _____
City, State, Zip _____
Phone _____
Purchase Order _____
E-mail _____

Details:

Page 2 of 4
Cooler No. _____ of _____
Date Shipped _____
Shipped By _____
Turnaround _____
(Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name					Samplers (Signature)*								
Lab Use Only Lab #	Date Sampled	Time	Comp./Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.			
	4/23/05	1515		PEOU.05.G11.AA2. MKMWO9.02A	G11			VOL	3				
								SVOL, PCB, nitroaromatics back-up	4				
								metals, hardness	1				
								cyanide	1				
								Turb/Alkalinity, chloride nitrate, sulfate	1				
								TOL	1				
								TSS/TDS	1				
	4/25/02	1515		PEOU.05.G11.AA2. MKMWO9.02D				VOL	3				
								SVOL, PCB, nitroaromatics back-up	4				
								metals	1				
Sample Kit Prep'd by: (Signature)			Date	Received By: (Signature)		REMARKS *Signature required to ensure validity				Lab Use Only			
Relinquished by: (Signature)			Date/Time	Received By: (Signature)						VOA Headspace	Y	N	NA
Relinquished by: (Signature)			Date/Time	Received By: (Signature)						Field Filtered	Y	N	NA
Received for Laboratory by: (Signature)			Date/Time	Temperature						Correct Containers	Y	N	NA
						Discrepancies	Y	N	NA	Airbill # _____			
						Cust. Seals intact	Y	N	NA	CAR # _____			
						Containers Intact	Y	N	NA				

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers

ELAB OF TENNESSEE () IN OF CUSTODY RECORD

3277

Ship to:
ELAB of Tennessee

227 French Landing Drive
Suite 550
Nashville, TN 37228
Attn: Analytical Laboratory
(615) 345-1115 (phone)
(615) 846-5426 (fax)

Send Results to:

Name Mike Hawk
Company Galops Engineering
Address 1125 Broadway
City, State, Zip Clark Ridge, TN 37833
Phone 865-220-4866
Fax 865-220-4848
E-mail _____

Send Invoice To:

Name _____
Company _____
Address _____
City, State, Zip _____
Phone _____
Purchase Order _____
E-mail _____

Details:

Page 3 of 4
Cooler No. _____ of _____
Date Shipped _____
Shipped By _____
Turnaround _____
(Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name						Samplers (Signature)*					
Lab Use Only Lab #	Date Sampled	Time	Comp./ Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.	
	4/26/05	1515		PEOW-05-ENV-AAZ G1V02-02A	ENV.			VOL SVOC, PCB, nitroaromatics + backup	3		
								metals + hardness	1		
								cyanide	1		
								total dissolved alkalinity chloride, nitrate, sulfate	1		
								TOC	1		
								TSS/TDS	1		

Sample Kit Prep'd by: (Signature) <u>[Signature]</u>	Date <u>4/17/05</u>	Received By: (Signature) _____	REMARKS *Signature required to ensure validity	Lab Use Only
Relinquished by: (Signature) <u>[Signature]</u>	Date/Time <u>4/26/05 1706</u>	Received By: (Signature) _____		VOA Headspace Y N NA
Relinquished by: (Signature) _____	Date/Time _____	Received By: (Signature) _____		Field Filtered Y N NA
Received for Laboratory by: (Signature) _____	Date/Time _____	Temperature _____		Correct Containers Y N NA
				Discrepancies Y N NA
				Cust. Seals intact Y N NA
				Containers Intact Y N NA
				Airbill # _____
				CAR # _____

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers

ELAB OF TENNESSEE () IN OF CUSTODY RECORD

NO 3275

Ship to:
ELAB of Tennessee

227 French Landing Drive
Suite 550
Nashville, TN 37228
Attn: Analytical Laboratory
(615) 345-1115 (phone)
(615) 846-5426 (fax)

Send Results to:

Name Mike Horick
Company JACOBS ENGINEERING
Address 125 Broadway
City, State, Zip Oriskany, TN 37830
Phone 615-220-4866
Fax 615-220-4848
E-mail _____

Send Invoice To:

Name _____
Company _____
Address _____
City, State, Zip _____
Phone _____
Purchase Order _____
E-mail _____

Details:

Page 4 of 4
Cooler No. _____ of _____
Date Shipped _____
Shipped By _____
Turnaround _____
(Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name					Samplers (Signature)*					
Lab Use Only Lab #	Date Sampled	Time	Comp./ Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.
	4/26/15	1520	B	PECIU.05-GIW-AAZ BEDDLEMAN.02A	GIW			VOC	3	
								SVE, nitroaromatics, pcb + backup	4	
								metals + hardness	1	
								cyanide	1	
								turbidity, alkalinity, chloride, nitrate, sulfate	1	
								TCX	1	
								TSI/TDS	1	

Sample Kit Prep'd by: (Signature)	Date	Received By: (Signature)	REMARKS *Signature required to ensure validity	Lab Use Only
Relinquished by: (Signature)	Date/Time	Received By: (Signature)		VOA Headspace
Relinquished by: (Signature)	Date/Time	Received By: (Signature)		Field Filtered
Received for Laboratory by: (Signature)	Date/Time	Temperature		Correct Containers
				Discrepancies
				Cust. Seals intact
				Containers Intact
				Airbill # _____
				CAR # _____

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers

ELAB OF TENNESSEE

CHAIN OF CUSTODY RECORD

13272

Ship to:
ELAB of Tennessee
 227 French Landing Drive
 Suite 550
 Nashville, TN 37228
 Attn: Analytical Laboratory
 (615) 345-1115 (phone)
 (615) 846-5426 (fax)

Send Results to:
 Name Mike Houck
 Company James Engineering
 Address 425 Iron Works Ave
 City, State, Zip Cole Pkwy TN 37630
 Phone 615 220 4846
 Fax 615 220 4845
 E-mail _____

Send Invoice To:
 Name _____
 Company _____
 Address _____
 City, State, Zip _____
 Phone _____
 Purchase Order _____
 E-mail _____

Details:
 Page 1 of 1
 Cooler No. _____ of _____
 Date Shipped 4/27/05
 Shipped By FREY
 Turnaround _____
 (Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name						Samplers (Signature)*							
Lab Use Only Lab #	Date Sampled	Time	Comp./ Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.			
	4/27/05	1340		PEOW.05.GW.AA2. GW002.C2C	H2O			VOC	3				
								SVOC, nitroaromatics, PCB + Back-up	4				
								metals	1				
								cyanide	1				
	4/27/05	1415		PEOW.05.GW.AA2. PEDE11001.C2C	H2O			VOC	3				
								SVOC, nitroaromatics, PCB + back-up	4				
								metals	1				
								cyanide	1				
	4/27/05	1158		PEOW.05.TB.042705/1				VOC	2				
Sample Kit Prep'd by: (Signature)			Date	Received By: (Signature)			REMARKS *Signature required to ensure validity				Lab Use Only VOA Headspace Y N NA Field Filtered Y N NA Correct Containers Y N NA Discrepancies Y N NA Cust. Seals intact Y N NA Containers Intact Y N NA		
Relinquished by: (Signature)			Date/Time	Received By: (Signature)							Airbill # _____		
Relinquished by: (Signature)			Date/Time	Received By: (Signature)							CAR # _____		
Received for Laboratory by: (Signature)			Date/Time	Temperature									

ELAB OF TENNESSEE () IN OF CUSTODY RECORD

NO 3271

Ship to:
ELAB of Tennessee

227 French Landing Drive
Suite 550
Nashville, TN 37228
Attn: Analytical Laboratory
(615) 345-1115 (phone)
(615) 846-5426 (fax)

Send Results to:

Name Mike Houck
Company JACOBS ENGINEERING
Address 125 Franklin Ave
City, State, Zip Oak Ridge, TN 37830
Phone 865.220.4866
Fax 865.220.4848
E-mail _____

Send Invoice To:

Name _____
Company _____
Address _____
City, State, Zip _____
Phone _____
Purchase Order _____
E-mail _____

Details:

Page 1 of 2
Cooler No. _____ of _____
Date Shipped _____
Shipped By _____
Turnaround _____
(Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name					Samplers (Signature)*					
Lab Use Only Lab #	Date Sampled	Time	Comp./ Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.
	4/28/05	1000		PEOW-05-TP-042805-01	H ₂ O			VOC	2	
	4/28/05	1030		PEOW-05-GW-AA2	GW			VOC	3	
				ITMW10-02A				SVOC, PCB, nitroaromatics + break up	4	
								metals, hardness	1	
								cyamide	1	
								turbidity, alkalinity, chloride, sulfate, sulfide	1	
								TOL	1	
								TSS/TDS	1	

Sample Kit Prep'd by: (Signature) <u>[Signature]</u>	Date <u>4/28/05</u>	Received By: (Signature) <u>[Signature]</u>	REMARKS *Signature required to ensure validity	Lab Use Only
Relinquished by: (Signature) <u>[Signature]</u>	Date/Time <u>4/28/05 1557</u>	Received By: (Signature) <u>[Signature]</u>		VOA Headspace Y N NA
Relinquished by: (Signature) <u>[Signature]</u>	Date/Time	Received By: (Signature)		Field Filtered Y N NA
Received for Laboratory by: (Signature)	Date/Time	Temperature		Correct Containers Y N NA
				Discrepancies Y N NA
				Cust. Seals intact Y N NA
				Containers Intact Y N NA
				Airbill # _____
				CAR # _____

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers

ELAB OF TENNESSEE

CHAIN OF CUSTODY RECORD

NO 13393

Ship to:
ELAB of Tennessee

227 French Landing Drive
Suite 550
Nashville, TN 37228
Attn: Analytical Laboratory
(615) 345-1115 (phone)
(615) 846-5426 (fax)

Send Results to:

Name M. Howard
Company ...
Address 135 Poplar Ave
City, State, Zip Memphis TN 38103
Phone 901 520 4866
Fax 901 520 4848
E-mail _____

Send Invoice To:

Name _____
Company _____
Address _____
City, State, Zip _____
Phone _____
Purchase Order _____
E-mail _____

Details:

Page 2 of 2
Cooler No. _____ of _____
Date Shipped _____
Shipped By _____
Turnaround _____
(Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name						Samplers (Signature)*				
Lab Use Only Lab #	Date Sampled	Time	Comp./ Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.
	4/29/05	1200		PEW-05-GW-AAB- PEW-GW03-02A	GW			VOL	2	
		1245						VOC, nitroaromatics, PCB + back-up	4	
		1245						metals nutrients	1	
								cyanide	1	
								total hardness, alkalinity, chloride, nitrate, sulfate	1	
								TOC	1	
								TSS / TDS	1	
				4/29/05 PEW-05-GW						
	4/29/05	1050		PEW-05-TR-042905-01				VOL	2	

Sample Kit Prep'd by: (Signature) <u>[Signature]</u>	Date 4/29/05	Received By: (Signature) <u>[Signature]</u>	REMARKS *Signature required to ensure validity	Lab Use Only
Relinquished by: (Signature) <u>[Signature]</u>	Date/Time 4/29/05 11:00	Received By: (Signature)		VOA Headspace Y N NA
Relinquished by: (Signature)	Date/Time	Received By: (Signature)		Field Filtered Y N NA
Received for Laboratory by: (Signature)	Date/Time	Temperature		Correct Containers Y N NA
				Discrepancies Y N NA
				Cust. Seals intact Y N NA
				Containers Intact Y N NA
				Airbill # _____
				CAR # _____

ELAB OF TENNESSEE CONTAINER OF CUSTODY RECORD

No. 3394

Ship to:
ELAB of Tennessee
 227 French Landing Drive
 Suite 550
 Nashville, TN 37228
 Attn: Analytical Laboratory
 (615) 345-1115 (phone)
 (615) 846-5426 (fax)

Send Results to:

Name Mike Houck
 Company Jacobs Engineering
 Address 125 Parkway
 City, State, Zip Oriskany TN 37854
 Phone 615-220-4848
 Fax 615-220-4848
 E-mail _____

Send Invoice To:

Name _____
 Company _____
 Address _____
 City, State, Zip _____
 Phone _____
 Purchase Order _____
 E-mail _____

Details:

Page 2 of 3
 Cooler No. _____ of _____
 Date Shipped _____
 Shipped By _____
 Turnaround _____
 (Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name					Samplers (Signature)*																																
Lab Use Only Lab #	Date Sampled	Time	Comp./ Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.																											
	4/29/05	1335		PBOW-05-SW-AA3-SW01-A	SW			SVOC, nitroaromatics + PCB	5																												
								VOC	3																												
								metals	1																												
	4/29/05	1310		PBOW-05-SW-AA3-SW02-A	SW			SVOC, nitroaromatics + PCB	5																												
								VOC	3																												
								metals	1																												
	4/29/05	1140		PBOW-05-SW-AA3-SW03-A	SW			SVOC, nitroaromatics + PCB	5																												
								VOC	3																												
								metals	1																												
	4/29/05	1000		PBOW-05-012-05-03	H2O			VOC	2																												
Sample Kit Prep'd by: (Signature)			Date	Received By: (Signature)			REMARKS *Signature required to ensure validity																														
Relinquished by: (Signature)			Date/Time	Received By: (Signature)																																	
Relinquished by: (Signature)			Date/Time	Received By: (Signature)																																	
Received for Laboratory by: (Signature)			Date/Time	Temperature																																	
<table border="0"> <tr> <td>Lab Use Only</td> <td></td> <td></td> <td></td> </tr> <tr> <td>VOA Headspace</td> <td>Y</td> <td>N</td> <td>NA</td> </tr> <tr> <td>Field Filtered</td> <td>Y</td> <td>N</td> <td>NA</td> </tr> <tr> <td>Correct Containers</td> <td>Y</td> <td>N</td> <td>NA</td> </tr> <tr> <td>Discrepancies</td> <td>Y</td> <td>N</td> <td>NA</td> </tr> <tr> <td>Cust. Seals intact</td> <td>Y</td> <td>N</td> <td>NA</td> </tr> <tr> <td>Containers Intact</td> <td>Y</td> <td>N</td> <td>NA</td> </tr> </table>										Lab Use Only				VOA Headspace	Y	N	NA	Field Filtered	Y	N	NA	Correct Containers	Y	N	NA	Discrepancies	Y	N	NA	Cust. Seals intact	Y	N	NA	Containers Intact	Y	N	NA
Lab Use Only																																					
VOA Headspace	Y	N	NA																																		
Field Filtered	Y	N	NA																																		
Correct Containers	Y	N	NA																																		
Discrepancies	Y	N	NA																																		
Cust. Seals intact	Y	N	NA																																		
Containers Intact	Y	N	NA																																		
Airbill # _____ CAR # _____																																					

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers

ELAB OF TENNESSEE () IN OF CUSTODY RECORD

M 3387

Ship to:
ELAB of Tennessee
 227 French Landing Drive
 Suite 550
 Nashville, TN 37228
 Attn: Analytical Laboratory
 (615) 345-1115 (phone)
 (615) 846-5426 (fax)

Send Results to:

Name Mike Houck
 Company Jacobs Engineering
 Address 125 Broadway Ave
 City, State, Zip Old Ridge, TN 37050
 Phone 615-320-4866
 Fax 615-320-4848
 E-mail _____

Send Invoice To:

Name _____
 Company _____
 Address _____
 City, State, Zip _____
 Phone _____
 Purchase Order _____
 E-mail _____

Details:

Page 1 of 3
 Cooler No. _____ of _____
 Date Shipped _____
 Shipped By _____
 Turnaround _____
 (Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name						Samplers (Signature)*				
Lab Use Only Lab #	Date Sampled	Time	Comp./ Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.
	4/29/05	1140		PBOW-05-SW-AA3. SW03-D	SW			SVOC, nitroaromatics + PCB	5	
								VOX	3	
								metals	1	
	4/29/05	1610		PBOW-05-SW-AA2. SW01-A	SW			SVOC, nitroaromatics + PCB	5	
								VOX	3	
								metals	1	
	4/29/05	1550		PBOW-05-SW-AA2. SW02-A	SW			SVOC, nitroaromatics + PCB	5	
								VOX	3	
								metals	1	
Sample Kit Prep'd by: (Signature)			Date	Received By: (Signature)			REMARKS *Signature required to ensure validity Note - 6 coolers w/ this shipment			
Relinquished by: (Signature)			Date/Time	Received By: (Signature)						
Relinquished by: (Signature)			Date/Time	Received By: (Signature)						
Received for Laboratory by: (Signature)			Date/Time	Temperature						
							Lab Use Only VOA Headspace Y N NA Field Filtered Y N NA Correct Containers Y N NA Discrepancies Y N NA Cust. Seals intact Y N NA Containers Intact Y N NA Airbill # _____ CAR # _____			

ELAB OF TENNESSEE () IN OF CUSTODY RECORD

M 3389

Ship to:
ELAB of Tennessee
 227 French Landing Drive
 Suite 550
 Nashville, TN 37228
 Attn: Analytical Laboratory
 (615) 345-1115 (phone)
 (615) 846-5426 (fax)

Send Results to:
 Name Mike Huck
 Company Jacob Engineering
 Address 125 Broadway Ave
 City, State, Zip Oak Ridge, TN 37830
 Phone 865 220 4863
 Fax 865 220 4848
 E-mail _____

Send Invoice To:
 Name _____
 Company _____
 Address _____
 City, State, Zip _____
 Phone _____
 Purchase Order _____
 E-mail _____

Details:
 Page 3 of 3
 Cooler No. _____ of _____
 Date Shipped _____
 Shipped By _____
 Turnaround _____
 (Std. Turn unless noted otherwise / There may be a surcharge for RUSH-contact lab)

Project No./Name				Samplers (Signature)*						
Lab Use Only Lab #	Date Sampled	Time	Comp./ Grab	Sample Location/Description	Sample Matrix	Field pH/Temp	Field Cond.	ANALYSIS REQUIRED	No. of Bottles	Lab Use Only Containers/Pres.
	4/29/05	1505		PEOW-05-SW-AA2 SW03.A				SVC, nitro (on/line) + p B (msd/ms)	15	
								VOL (ms/msd)	9	
								metals (ms/msd)	3	
	4/30/05	1300		PEOW-05-GW-AA2 GLW02-02A				cyanide	1	

Sample Kit Prep'd by: (Signature) 	Date 4/19/05	Received By: (Signature)	REMARKS *Signature required to ensure validity	Lab Use Only
Relinquished by: (Signature) 	Date/Time 4/20/05 1400	Received By: (Signature)		VOA Headspace Y N NA
Relinquished by: (Signature)	Date/Time	Received By: (Signature)		Field Filtered Y N NA
Received for Laboratory by: (Signature)	Date/Time	Temperature		Correct Containers Y N NA
				Discrepancies Y N NA
				Cust. Seals intact Y N NA
				Containers Intact Y N NA
				Airbill # _____
				CAR # _____

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers

GPL LABORATORIES, LLLP

7216 Corporate Court
 Frederick, MD 21703
 (301) 694-5310
 Fax (301) 620-0731

Contract #/Billing Reference

of Pgs.

Project: Acid Areas 2+3 Plum Brook					Turnaround Time									
Client: USACE-Nashville / Jacobs					# of Containers									
Send Results To: MIKE HOUCK					Container Type									
Address: 125 Broadway					Preservative Used									
Oak Ridge, TN 37830					Type of Analysis									
Phone: 865-220-4860					Lab Cooler No.									
Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	VOC	SVOC	PBB	Nitroaromatics	Back tit	metals	Cyanide	CLIENT COMMENTS		
PBOW-05-GW-A43	4-21-05	1515		AFH	✓	✓	✓	✓	✓	✓	✓			
GW02-02B														
PBOW-05-TB	4-21-05	1412			✓									
042105-01														
Relinquished By:		Date/Time	Received By:			Relinquished By:			Received for Laboratory By:			Date/Time		
<i>[Signature]</i>		<i>4/21/05 1714</i>												
Relinquished By:		Date/Time	Received By:			Date/Time	Shipper:		Airbill No.:					
Relinquished By:		Date/Time	Received By:			Lab Comments:					Temp:			

G.P. W.O. _____

GPI LABORATORIES, LLLP

721 Corporate Court
 Frederick, MD 21703
 (301) 694-5310
 Fax (301) 620-0731

Contract #/Billing Reference	of	Pgs.
------------------------------	----	------

Project: Plum Brook Groundwater					Turnaround Time																								
Client: Jacobs Engineering					# of Containers																								
Send Results To: Mike Houck					Container Type																								
Address: 125 Broadway Ave Oak Ridge, TN					Preservative Used																								
Phone:					Type of Analysis																								
Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	VOL SVOL RB H ₂ O metals cyanide										Lab Cooler No.	CLIENT COMMENTS													
PBOW-05-GW																													
AAZ-MKMW-05-02B	4/25/05	1515	GW		✓	✓	✓	✓																					
PBOW-05-TB-042505-01	4/25/05		H ₂ O		✓																								
Relinquished By: <i>[Signature]</i>					Date/Time: 4/25/05 1744					Received By:					Relinquished By:					Received for Laboratory By:					Date/Time:				
Relinquished By:					Date/Time:					Received By:					Date/Time:					Shipper:					Airbill No.:				
Relinquished By:					Date/Time:					Received By:					Lab Comments:										Temp:				

G.P. W.O. _____

GPL LABORATORIES, LLLP

7210 Corporate Court
 Frederick, MD 21703
 (301) 694-5310
 Fax (301) 620-0731

Contract #/Billing Reference	of	Pgs.
------------------------------	----	------

Project: <i>Blue Book Ammunition</i>					Turnaround Time													
Client: <i>Amtech Engineering</i>					# of Containers													
Send Results To: <i>Mike Abuck</i>					Container Type													
Address: <i>125 Bonding Ave Curt Ridge, TN 37830</i>					Preservative Used													
Phone: <i>865 330 4666</i>					Type of Analysis													
Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	<div style="display: flex; justify-content: space-around;"> VOC SVOC Explosives PCB metals </div>										Lab Cooler No.	CLIENT COMMENTS		
<i>PBOW-05-TB 042905-02</i>	<i>4/29/05</i>	<i>1056</i>	<i>H2O</i>	<input checked="" type="checkbox"/>													<input type="checkbox"/>	<input type="checkbox"/>
<i>PBOW-05-SW</i>	<i>4/29/05</i>	<i>1140</i>	<i>SW</i>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>								
<i>AA3-SW03-B</i>					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relinquished By:		Date/Time	Received By:		Relinquished By:		Received for Laboratory By:		Date/Time									
<i>[Signature]</i>		<i>4/29/05 0150</i>																
Relinquished By:		Date/Time	Received By:		Date/Time	Shipper:		Airbill No.:										
Relinquished By:		Date/Time	Received By:		Lab Comments:					Temp:								

G.P. W.O. _____

Appendix F
Response To Comments on Draft Round 2 Report

SUBJECT: Review Comments for the Draft Round 2 Quarterly Groundwater Monitoring Report, Remedial Investigation Part 1, at Acid Areas 2 & 3, Former Plum Brook Ordnance Works, Sandusky, Ohio, prepared by Jacobs Engineering, August 2005

Reviewer: Frank Albert, USACE CELRH

1. **General Comment – Minor comment; the cover should have likely identified this report as a *Draft*.**

Response: Comment noted. A final has been prepared.

2. **List of Acronyms, RBC – The *C* should be defined as *concentration*, and not *criteria*.**

Response: The wording will be changed to “concentration”.

3. **Section 1.1 (and 5.0) – 2nd paragraph, last sentence. It is stated here (and also in the 1st paragraph in Section 5.0), that ‘*after review of both rounds of data...evaluation...will be conducted by the USACE in conjunction with the ...OEPA*’. It is recommended that if Jacobs Engineering will be performing review of Rounds 1 and 2 data and preparing a data review report (for USACE and OEPA evaluation), that this be so noted.**

Response: A review and summary report of both rounds is not anticipated. This section has been revised. Based on discussions at the December 8, 2005 team meeting, no further rounds of groundwater sampling will be required.

4. **Section 1.3, 2nd paragraph, 2nd sentence. The word *Criteria* should be revised to *Concentration*.**

Response: The wording will be changed to “concentration”.

5. **Section 2.1, 2nd paragraph. I believe that piezometer abandonment would be addressed similarly to monitoring well abandonment. In that case, you should note that the piezometers were abandoned in accordance with OEPA and Ohio Department of Natural Resources (ODNR) requirements. OEPA requirements are noted in the following document: Ohio Environmental Protection Agency, Division of Drinking and Ground Waters, *Technical Guidance for Ground Water Investigations, Chapter 9, Sealing Abandoned Monitoring Wells and Boreholes*, February 2005 (Revision 1). ODNR requires that a *Water Well Sealing Report* be submitted following the abandonment. Also, Ohio Administrative Code (OAC) 3745-9-03 and Ohio Revised Code 1521.05(B)(9) also state requirements for well (assume piezometers too) abandonment. Water Well Sealing Reports, if applicable, should be included in the appendices.**

Response: Piezometer abandonment and the associated well sealing forms are addressed and provided in the Site Characterization Report for Acid Areas 2 & 3.

6. **Section 3.2, 3rd paragraph, 3rd sentence (grammatical). The word *in* should be inserted between *cyanide* and *one*.**

Response: The text will be revised as suggested.

7. **Section 4.2.1, 1st paragraph, 1st sentence (grammatical). The word *was* should be revised to *were*.**

Response: The text will be revised as suggested.

8. **Section 4.2.1, 1st paragraph, 2nd sentence. It is noted that Section 1.3, 2nd paragraph states that contaminants found in soil also included PAHs.**

Response: PAHs will be added to the list of contaminants not detected in shallow groundwater.

9. **Section 4.2.1, 5th paragraph, 2nd sentence. See comment above regarding PAHs in soil at AA2.**

Response: PAHs will be added to the list of contaminants not detected in shallow groundwater.

10. **Section 4.2.1, 9th paragraph, 1st sentence. It is noted that RDX was reported during Round 2. Should this detection be discussed since it is not apparent that RDX was produced at PBOW? Such detections have been noted at the WV Ordnance Works site and Ms. Paula Coleman, LRN Chemist, has performed research. She may be able to assist on the explanation; if it is determined that one might be offered in this report.**

Response: The referenced text indicates that the detection of RDX in one bedrock well was at trace levels and was between the RL and DL, suggesting a high degree of uncertainty. Because of this uncertainty and the fact that RDX was not detected during Round 1, further explanations regarding the possible presence of the contaminant do not seem warranted.

11. **Section 4.2.2, 1st paragraph, 1st sentence (grammatical). The word *was* should be revised to *were*.**

Response: The text will be revised as suggested.

12. **Section 4.2.2, 1st paragraph, 2nd sentence. It is noted that Section 1.3, 4th paragraph states that contaminants found in soil included PAHs and PCBs; no statement about SVOCs.**

Response: "SVOC" will be replaced with "PAH" as noted.

13. **Section 4.2.2, 5th paragraph, 2nd sentence. Please see above comment regarding detections of PAHs and PCBs only (not SVOCs) in AA3 soil. Also, AA2 should be revised to AA3.**

Response: "SVOC" will be replaced with "PAH" as noted and "AA2" has been changed to "AA3".

14. **Section 4.2.2, 5th paragraph, last sentence. It is noted, similar to the findings from Round 1 for AA2, that nitroaromatics were not detected at AA3 during Round 1. Please determine if this discovery should/could be explained (seasonal fluctuation or another explanation) or will (should) this non-occurrence be explained in a subsequent report?**

Response: The referenced text indicates that the detection of nitroaromatics in one bedrock well was at trace levels and was between the RL and DL, suggesting a high degree of uncertainty. Because of this uncertainty and the fact that RDX was not detected during Round 1, further explanations regarding the possible presence of nitroaromatics do not seem warranted.

15. **Section 5.0, 1st paragraph, 2nd sentence. Please refer to comment for Section 1.1.**

Response: A review and summary report of both rounds is not anticipated.

16. **Section 6.0. Depending upon the resolution to the comment offered for Section 2.1, the following references may need to be added:**

- **Ohio Environmental Protection Agency, Division of Drinking and Ground Waters, *Technical Guidance for Ground Water Investigations, Chapter 9, Sealing Abandoned Monitoring Wells and Boreholes*, February 2005 (Revision 1)**
- **Ohio Administrative Code (OAC) 3745-9-03**
- **Ohio Revised Code 1521.05(B)(9)**

Response: Piezometer abandonment and the associated well sealing forms are addressed and provided in the Site Characterization Report for Acid Areas 2 & 3.

17. **Figure 2-1 and Figure 4-3. It is noted that Figure 2-1 shows an *Unknown Disturbed Area* (in yellow) while Figure 4-3 notes this same area as a *Former Parking Area*.**

Response: Figure 2-1 will be revised to indicate the area is a former parking lot.

18. **Figure 4-3. It is noted that there is a 638 contour elevation along the 639 line, in the “upper portion” of the figure.**

Response: The “638” will be removed.

SUBJECT: Review Comments for the Draft Round 2 Quarterly Groundwater Monitoring Report, Remedial Investigation Part 1, at Acid Areas 2 & 3, Former Plum Brook Ordnance Works, Sandusky, Ohio, prepared by Jacobs Engineering, August 2005

Reviewer: Lannae Long, USACE CELRN

- 1. Data Tables 4-X. All of the data shall be sorted by Area 2, then Area 3 first, not by date or sampling event first. For example, Table 4-3 should be Area 2 Shallow GW current sample results followed by Area 2 Shallow GW prior sample results, etc, then, separate set of tables should have all of Area 3 results.**

Response: The requested changes will be made.

- 2. U.S. EPA reference: Throughout this document, change the reference to correctly and accurately reference U.S. EPA Region 9 PRG October 2004. Please refer to U.S. EPA regions with Arabic Numerals, not Roman Numerals, and reference the screening table version DATE, as they may change as quickly as every 6 months.**

Response: The requested changes will be made.

- 3. Change the format of these tables to match historical groundwater tables, and the new Acid Areas soils tables (as of Nov 2005). With the updated format of the tables, it does not seem necessary to have the "sample number/id" row represented here because all of the sample number/id is represented with the information in the other identifiers such as date, location, and depth headers.**

Response: The table format will be revised as requested.

- 4. Planned Activities: Is there enough appropriate data to suggest that current conditions in groundwater are fully characterized, or should there be another one or 2 rounds of GW sampling?**

Response: Based on discussions at the December 8, 2005 team meeting, no further rounds of groundwater sampling will be required.

- 5. Appendix C: The copies of the chain-of-custody forms are not legible.**

Response: Appendix C represents photo duplication of carbon copies, which are poorly defined to begin with. The carbon copies will be retraced to provide increased definition prior to photo copying.

SUBJECT: Review Comments for the Draft Round 2 Quarterly Groundwater Monitoring Report, Remedial Investigation Part 1, at Acid Areas 2 & 3, Former Plum Brook Ordnance Works, Sandusky, Ohio, prepared by Jacobs Engineering, August 2005

Reviewer: OEPA

- 1. The fourth paragraph, page 2-2, Section 2.2 of the Jacob's August 2005 Round 2 Quarterly Groundwater Monitoring Report (Round 2 Report) is very confusing. Jacobs states that during the low-flow purging of bedrock wells AA3-BEDGW-001 and PB-BED-MW19, the wells displayed increased yields as the water levels were lowered. Therefore, the increase yield prohibited a complete purging of the wells. Jacobs further states that purge volume requirements were met for the wells. Ohio EPA requests that Jacobs clarify this paragraph.**

Response: Further clarification will be provided as follows: During the initial phases of purging, water levels continued to drop even though the flow rate on the pump was reduced. It was determined that the wells could not be purged at low-flow rates and still meet purge volume requirements in a timely manner. The Jacobs geologist decided to purge the well dry and sample upon recovery. As the water level was lowered in these wells the increase in the gradient between the well and the surrounding formation resulted in increased recharge rates that eventually matched the maximum pumping rate, thus the well could not be purged dry. The Jacobs geologist reduced the flow rate slightly to initiate recovery of water levels while purging. As a result the purge volume requirements were met. Sampling was then conducted while maintaining rising water levels in the wells.

- 2. Copies of chain of custody documentation in Appendix C of the Round 2 Report are completely illegible.**

Response: Appendix C represents photo duplication of carbon copies, which are poorly defined to begin with. The carbon copies will be retraced to provide increased definition prior to photo copying.

- 3. Ohio EPA recommends that Jacobs perform the necessary maintenance to remove the blockage in the casing at Acid Area 2 overburden well IT-MW10.**

Response: Based on team discussions at the December 2005 team meeting no efforts would be taken to repair this well.

- 4. Jacobs states on page 4-3 and 4-5 that VOCs detected in the bedrock saturated zone are attributed to naturally occurring hydrocarbons in the Delaware Limestone that exists beneath NPBS. Ohio EPA cautions Jacobs that while naturally occurring hydrocarbons have been documented in the bedrock, not all VOCs (e.g. 1,1,2-trichloroethane) should be attributed to this phenomenon by default.**

Response: The referenced text indicates that the detection of 1,1,2-trichloroethane in one bedrock well was at trace levels and was between the RL and DL, suggesting a high degree of uncertainty. 1,1,2-trichloroethane was also not detected during Round 1. Additional text will be provided in Section 4.2.1, 7th ppg, as follows: "The presence of VOCs in the bedrock

groundwater can be attributed to naturally occurring petroleum in the Delaware Limestone, *with the exception of 1,1,2-trichloroethane.*

- 5. Sections 4.2.1 and 4.2.2 of the Round 2 Report indicate that background concentrations have been developed for several constituents in the bedrock saturated zone at NPBS and that these background values were used to evaluate concentrations of constituents at Acid Areas 2 and 3. Ohio EPA requests that Jacobs prepare a briefing memo or similar document that presents these background concentrations and their relationship to background screening concentrations (BSCs) as contained in Appendix M of the 2004 Annual Report.**

Response: Background values for bedrock groundwater were calculated by Shaw and are reported in the 2004 Groundwater Data Summary and Evaluation Report (April 2005).

- 6. Based upon a review of Tables 4-3, 4-4, 4-6, and 4-7 of the Round 2 Report, analytical data suggests that the bedrock saturated zone has been impacted although it is unclear whether by naturally occurring hydrocarbons or by historical NPBS activities. As an alternative to performing additional rounds of ground water sampling at Acid Areas 2 and 3, a more logical approach would be to incorporate the bedrock zone into the sitewide ground water investigation for further evaluation.**

Response: Acid Area 2 and 3 will be considered for future site-wide investigations of the bedrock groundwater.

- 7. Please review the above comments and submit a revised final document that addresses Ohio EPA concerns.**

Response: Revised text, tables, and figures have been provided.