UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON
ALASKA

ENVIRONMENTAL RESTORATION PROGRAM

TREATABILITY STUDY REPORT
DA089 – ARMORED VEHICLE MAINTENANCE AREA

FINAL

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TREATABILITY STUDY REPORT
DA089 – ARMORED VEHICLE MAINTENANCE AREA

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

Prepared for
Air Force Civil Engineer Center

Contract No. FA8903-09-D-8589 / Task Order 0016

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EXECUTIVE SUMMARY

The Air Force Civil Engineer Center (AFCEC) has conducted a treatability study at DA089 – Armored Vehicle Maintenance Area, located at Joint Base Elmendorf-Richardson (JBER), Alaska (Figure 1-1), pursuant to the process established in the Fort Richardson Federal Facility Agreement (1994) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986. The purpose of the treatability study was to assess the effectiveness of enhanced reductive dechlorination (ERD), which AFCEC considers to be an innovative treatment technology, to enhance the natural degradation of tetrachloroethene (PCE), reduce the time to achieve cleanup goals and, consequently, reduce life-cycle costs for the site.

To assess the effectiveness of ERD at achieving the previously listed goals, the following objectives were outlined for the treatability study:

- Assess the effectiveness of in situ treatment for reducing PCE concentrations in groundwater at the site through ERD, using an emulsified vegetable oil (EVO) substrate. The effectiveness of the treatability study EVO injections will be evaluated by calculating the reduction in the concentration of PCE in the performance well and comparing the value to the pre-injection baseline PCE concentrations.

- Evaluate the ability to distribute substrate into the subsurface using permanent injection wells.

- Evaluate substrate dosing requirements and lateral spacing of injection points (radius of influence) required for possible full-scale application at DA089, pending a post-Record of Decision (ROD) change (i.e., ROD amendment).

- Assess the ability of the substrate to sustain anaerobic biodegradation (biotic) processes and promote reduction of PCE.

- Assess the potential need for substrate replenishment or other contingency measures.

This work was conducted by CH2M HILL under subcontract to Weston Solutions, Inc. (WESTON) within the scope of the Joint Base Elmendorf-Richardson (JBER) Performance-Based Remediation project authorized by AFCEC Contract Number FA8903-09-D-8589, Task Order 0016. Work was performed in accordance with the *Uniform Federal Policy-Quality Assurance Project Plan, DA089 – Armored Vehicle Maintenance Area Treatability Study Work Plan, Joint Base Elmendorf-Richardson, Alaska* (Work Plan) and *Uniform Federal Policy-Quality Assurance Project Plan – Addendum DA089 – Armored Vehicle Maintenance Area Treatability Study Work Plan – Additional Injection, Joint Base Elmendorf-Richardson, Alaska*.

DA089 is located in the western region of the cantonment area of JBER-Richardson (JBER-R), near the intersection of Otter Lake Road and D Street. DA089 consists of a PCE groundwater plume that was investigated as a part of the Operable Unit (OU) E Remedial Investigation in 2004. The dissolved-phase PCE contamination in groundwater originated in the area immediately downgradient from Building 726. Dry cleaning solvents (PCE or Stoddard solvent) were stored in underground storage tanks at the site from 1951 until 1972, and tank bottoms were disposed of in a dumpster at the site. Low levels of PCE contamination were detected in soils at the Building 726

site, indicating that PCE had been released from the facility. Regulatory concurrence for no further action under CERCLA for soils at Building 726 (Site SS045) was obtained under the OU D ROD.

ERD is a form of anaerobic biodegradation in which microbes are stimulated with a carbon substrate (such as EVO) to break down chlorinated aliphatic hydrocarbons (CAHs) such as PCE and trichloroethene (TCE), and their daughter products, the dichloroethene (DCE) isomers (cis-1,2-DCE, trans-1,2-DCE, and 1,1-DCE) and vinyl chloride. During ERD, PCE is degraded to TCE, and TCE is degraded to the DCE isomers, which are then degraded to vinyl chloride and then to ethene. The generation of daughter products is a key line of evidence indicating that ERD is occurring.

This treatability study report provides the results of eight rounds of quarterly groundwater monitoring at performance monitoring well AP-4413 that followed two EVO substrate injections (four rounds of monitoring followed the initial EVO injection and four rounds of monitoring followed the second EVO injection, details of which are provided in this document). Details of the injection well installation, baseline soil and groundwater sampling results, and initial EVO injection were provided in the *Treatability Study Implementation Report, DA089 – Armored Vehicle Maintenance Area, Joint Base Elmendorf-Richardson, Alaska*.

Post-Injection Quarterly Groundwater Monitoring and Second EVO Injection

Following the initial EVO injection in September 2013, four rounds of groundwater monitoring (October 2013, January 2014, April 2014, and September 2014) were conducted at the performance monitoring well AP-4413. Following the initial four rounds of quarterly groundwater monitoring, results showed that, although geochemically reducing conditions were evolving, PCE concentrations were not decreasing as anticipated. Based on these results, the United States Air Force decided to implement Contingency 1, outlined in the Work Plan:

- Contingency 1: Conduct another round of EVO injections, possibly with the addition of ferrous sulfate solution, depending upon the success of the treatability study at CG039, or injection of in situ chemical oxidation (ISCO) using sodium permanganate, depending upon the results of the natural oxidant demand (NOD) analyses and effectiveness of ISCO injection during the treatability study at CG039.

It was determined that the contingency measure would be to conduct a second EVO injection to increase reducing conditions within the aquifer and promote ERD of PCE.

The second EVO injection was performed at DA089 in October 2014. Following the second EVO injection, four subsequent rounds of groundwater monitoring (March 2015, June 2015, September 2015, and December 2015) were conducted.

Performance Monitoring Well AP-4413

Geochemical parameters indicate that the injections of EVO have been effective at generating anaerobic conditions necessary for reductive dechlorination. Concentrations of PCE in groundwater at AP-4413 decreased substantially after the second injection of EVO in October 2014 but have since begun to rebound. In turn, concentrations of PCE daughter products, TCE,

cis-1,2-DCE and vinyl chloride, increased compared to pre-injection concentrations. Concentrations of cis-1,2-DCE and vinyl chloride have since begun to decrease.

Treatability Study Conclusions

The following treatability study conclusions have been drawn based on pre-injection data collection, two rounds of EVO injections, and eight rounds of quarterly groundwater monitoring at AP-4413:

- Use of sodium permanganate is not a viable contingency treatment option because of the high and heterogeneous NOD results from across the site.

- Groundwater samples collected from injection wells prior to substrate injections indicated that PCE concentrations within each target treatment zone were similar to each other and to historical PCE concentrations.

- The design of the treatability study was sufficient to distribute substrate throughout the target treatment zone. The aquifer readily accepted the injection of EVO substrate at rates between 20 to 35 gallons per minute with an observed distribution radius of influence of at least 15 feet.

- Geochemical parameters indicate that injection of EVO has proven effective in generating anaerobic conditions necessary for reductive dechlorination in the aquifer. However, there are indications (increasing oxidation-reduction potential and decreasing total organic carbon) that anaerobic conditions in the aquifer may only be sustainable for short time frames (2 to 3 years) after injection.

- Concentrations of PCE in groundwater at monitoring well AP-4413 have been reduced by 70 percent when compared to the 2013 pre-injection concentrations. However, concentrations of PCE have begun to increase (23.7 micrograms per liter [µg/L] in December 2015) since reaching a low concentration of 5.56 µg/L in March 2015.

- Generation of vinyl chloride and ethene, through the degradation of DCE, indicates that a microbial consortium capable of facilitating complete dechlorination of PCE is present in the subsurface at DA089. However, while the appropriate microbes are present, it is not yet known if the population is sufficient to effectively reduce all CAHs.

Recommendations

Based on the results of this treatability study report, the following actions are recommended:

- Annual groundwater monitoring for 2 years (2016 and 2017) to assess potential rebound of PCE concentrations, degradation of PCE daughter products, and persistence of geochemically reducing groundwater conditions.

    - The annual groundwater monitoring at DA089 will be modified to better monitor the progress of the treatability study. Analytical and field parameters will be added as necessary so that the performance monitoring well (AP-4413) continues to be monitored as outlined in Table 18-1 of the Work Plan.

- The 2016 and 2017 groundwater monitoring work plans will formally outline this plan.
- Continuing treatability study monitoring results from AP-4413 will be reported in a distinct section of the annual groundwater monitoring report.

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LIST OF ABBREVIATIONS AND ACRONYMS

µg/L	microgram(s) per liter
µm	micrometer(s)
µmol/L	micromoles per liter
AFCEC	Air Force Civil Engineer Center
Army	United States Army
bgs	below ground surface
CAH	chlorinated aliphatic hydrocarbon
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DCE	dichloroethene
DQE	data quality evaluation
EB	equipment blank
ENSR	ENSR Corporation
EPA	United States Environmental Protection Agency
ERD	enhanced reductive dechlorination
ESF	Environmental Staging Facility
EVO	emulsified vegetable oil
FD	field duplicate
gpm	gallon(s) per minute
GW	groundwater
ID	identification
IDW	investigative-derived waste
ISCO	in situ chemical oxidation
JBER	Joint Base Elmendorf-Richardson
JBER-R	JBER-Richardson
MCL	maximum contaminant level
mg/L	milligram(s) per liter
MS	matrix spike
MSD	matrix spike duplicate
mV	millivolt(s)
NOD	natural oxidant demand
ORP	oxidation-reduction potential
OU	Operable Unit

PBR	Performance-based Remediation
PCE	tetrachloroethene
PPE	personal protective equipment
psi	pound(s) per square inch
QC	quality control
ROD	Record of Decision
TB	trip blank
TCE	trichloroethene
TOC	total organic carbon
USAF	United States Air Force
VFA	volatile fatty acid
VOC	volatile organic compound
WESTON	Weston Solutions, Inc.

1.0 INTRODUCTION

The Air Force Civil Engineer Center (AFCEC) has conducted a treatability study at DA089 – Armored Vehicle Maintenance Area, located at Joint Base Elmendorf-Richardson (JBER), Alaska (Figure 1-1), pursuant to the process established in the Fort Richardson Federal Facility Agreement (1994) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986. The DA089 treatability study effort was administered by AFCEC. This Treatability Study Report has been prepared by CH2M HILL in support of Weston Solutions, Inc.'s (WESTON's) prime contract FA8903-09-D-8589 with AFCEC, Task Order 0016.

The purpose of the treatability study was to evaluate whether the injection of emulsified vegetable oil (EVO) into the tetrachloroethene (PCE)-contaminated aquifer would be able to enhance the natural degradation of PCE, thus reducing the time to achieve cleanup goals and reducing life-cycle costs for the site. Additionally, the treatability study tested how easily EVO can be injected into the ground and how far it travels.

This treatability study report provides the results of eight rounds of groundwater monitoring following the two enhanced reductive dechlorination (ERD) injections of EVO substrate (four rounds of monitoring followed the initial EVO injection and four rounds of monitoring followed the second injection) at DA089. Details of the injection well installation, baseline soil and groundwater sampling results, and the initial EVO injections are provided in the *Treatability Study Implementation Report DA089 – Armored Vehicle Maintenance Area Joint Base Elmendorf-Richardson, Alaska* (Implementation Report) (United States Air Force [USAF], 2014a).

Quarterly groundwater monitoring was conducted from October 2013 through December 2015, in accordance with the Final *Uniform Federal Policy-Quality Assurance Project Plan, DA085 – Armored Vehicle Maintenance Area Treatability Study Work Plan, Joint Base Elmendorf-Richardson, Alaska* (Work Plan) (USAF, 2013a) and *Uniform Federal Policy-Quality Assurance Project Plan – Addendum DA089 – Armored Vehicle Maintenance Area Treatability Study Work Plan – Additional Injection, Joint Base Elmendorf-Richardson, Alaska* (Work Plan Addendum) (USAF, 2014b). The USAF identification number was changed from DA085 to DA089 following the approval of the initial Work Plan.

1.1 Project Objectives

The objectives of the treatability study are as follows:

- Assess the effectiveness of in situ treatment for reducing PCE concentration in groundwater at the site through ERD using EVO. The effectiveness of the treatability study substrate injections will be evaluated by calculating the reduction in the PCE concentration in the performance well compared to the pre-injection baseline PCE concentrations.

- Evaluate the ability to distribute substrate into the subsurface using permanent injection wells.

- Evaluate amendment dosing requirements and lateral spacing of injection points (radius of influence) required for possible full-scale application at DA089, pending a post-Record of Decision (ROD) change (i.e., ROD amendment).

- Assess the ability of the substrate to sustain anaerobic biodegradation (biotic) processes and promote reduction of PCE.

- Assess the potential need for substrate replenishment or other contingency measures.

The approach for the treatability study was described in the Work Plan (USAF, 2013a) and Work Plan Addendum (USAF, 2014b). The Work Plan described the injection protocols, data quality objectives, sampling methodologies, and analytical program for assessing conditions at DA089 to facilitate success of the treatability study.

1.2 Site Description

DA089 is located in the western region of the cantonment area of Fort Richardson, near the intersection of Otter Lake Road and D Street (Figure 1-1). DA089 consists of a PCE groundwater plume that was investigated as part of the Remedial Investigation Report, Operable Unit E, Fort Richardson, Alaska in 2002 and 2003 (United States Army [Army], 2004). DA089 covers an area of approximately 140 acres on both the northern and southern sides of Davis Highway. The area north of Davis Highway is mostly open fields, grasslands, and woods with numerous small buildings and roads throughout. The area south of Davis Highway is more industrial. Several buildings are situated overlying the footprint of the dissolved PCE plume including Buildings 726, 728, 730, 732, and 733.

DA089 was used as a gravel source in 1950 during construction of the railroad. Later, in the 1950s and 1960s, it served as a military vehicle wash area. Since 1973, the area has been used as a training area and obstacle course (Astley et al., 2001). In addition, the area was used for field maintenance of tanks, which included disposal of oil and other waste material (Army, 2000).

The dissolved-phase PCE contamination in groundwater originated in the area immediately downgradient from Building 726. Dry cleaning solvents (tetrachloroethene [PCE] or Stoddard solvent) were stored in underground storage tanks at the site from 1951 until 1972, and tank bottoms were disposed of in a dumpster at the site. Low levels of PCE contamination were detected in soils at the Building 726 site, indicating that PCE had been released at the facility (ENSR Corporation [ENSR], 1998). Regulatory concurrence for no further action under CERCLA for soils at Building 726 (Site SS045) was obtained under the OU D ROD (Army, 2000).

DA089 lies on an alluvial plain, often referred to as the Anchorage Lowland. The Elmendorf Moraine can be found approximately 0.5 mile north of the site. The underlying geology at DA089 is complex and highly variable. The Mountain View Fan is approximately 40 to 60 feet thick under most of the site. The fan consists of mostly sands and gravels with localized deposits of silt and clay. There are no wetlands or surface water features located on the site.

Groundwater directly underlying DA089 is encountered in a shallow perched aquifer and a deeper confined aquifer separated by a low-permeability silt confining layer. The thickness of the confining layer varies across the site and pinches out toward the northern edge of the site. The

northern extent of the confining unit was determined to be adjacent to the Davis Highway, northwest of Building 732. A cross section/conceptual site model for DA089 is presented on Figure 1-2. Regional groundwater flow is to the northwest.

In areas where the confining layer is present, a shallow perched aquifer is encountered at approximately 60 feet below ground surface (bgs), and a deeper confined aquifer is encountered at approximately 100 feet bgs. The aquifers merge where the confining layer pinches out, just north of Davis Highway (D Street), forming a thick unconfined aquifer (Figure 1-2). Groundwater flow at the site is complex because of the nature of the geology; however, the general groundwater flow direction is toward the northwest (Army, 2004). The hydraulic gradient of the unconfined aquifer generally trends northwesterly, following the topography of the Mountain View Fan.

Refer to the Implementation Report (USAF, 2014a) for a more complete discussion of the site history and hydrogeology.

1.3 Summary of Treatability Study Implementation Report

The Implementation Report (USAF, 2014a) documents the implementation of the treatability study and includes injection well installation details, baseline soil and groundwater sampling results, and data from the initial September 2013 substrate injection. Sections 1.3.1 through 1.3.4 provide a summary of the information provided in the Implementation Report.

1.3.1 Well Installation and Development

Four injection wells and one monitoring well to measure the distribution of EVO (known as a radius of influence well) were installed within the area of highest PCE concentrations, known as the target treatment zone (Figure 1-3). The target treatment zone is hydrologically upgradient from the designated performance monitoring well AP-4413, which is used to evaluate the effectiveness of the EVO treatment. The four injection wells and radius of influence well were installed within the perched aquifer, which is approximately 65 feet bgs and is located on top of a silt confining layer. All wells were installed and developed in accordance with the Work Plan, with the exception of injection wells IW02-4413, IW03-4413, and IW04-4413, which were not developed because they were dry.

1.3.2 Soil Sampling and Analysis

Subsurface soil samples were collected from soil cores recovered during well installation. The samples were analyzed for natural oxidant demand (NOD), fraction of organic carbon, and grain size distribution. Grain size distribution testing indicated that the soil is composed primarily of silty gravels and sand. Analytical results indicated that the subsurface contained high NOD and the NOD within the subsurface was variable. As a result it was determined that in situ chemical oxidation (ISCO) would be inefficient and expensive to implement; therefore, ISCO was not selected as a potential future contingency treatment option.

1.3.3 Baseline Groundwater Sampling and Analysis

Prior to injecting EVO into the groundwater, baseline groundwater samples were collected from wells within the target treatment zone (IW01-4413, AP-4413, and ROI-4413). Because wells

IW02-4413, IW03-4413, or IW04-4413 were dry, no baseline groundwater samples were collected. All groundwater samples were analyzed for volatile organic compounds (VOCs), which includes PCE. Additionally, groundwater from AP-4413 was analyzed for other chemical indicators that can help assess the effectiveness of EVO, including total organic carbon (TOC), dissolved mercury, dissolved iron, dissolved manganese, dissolved gases, sulfide, nitrate+nitrite, alkalinity, chloride, sulfate, and volatile fatty acids (VFAs).

These baseline groundwater sample results showed a slight variability in PCE concentrations within the target treatment zone; however, PCE concentrations were generally similar to each other and to historical PCE concentrations measured at AP-4413 (Figure 1-3). The similarity of PCE concentrations throughout the target treatment zone suggested that the ERD effects created by the EVO injections would be relatively uniform.

1.3.4 Initial Substrate Injection

EVO was injected into injection wells within a target treatment zone on September 16, 2013, as summarized in Table 1-1. An equal amount of EVO solution was injected into each injection well, with the exception of IW03-4413, into which only 53 gallons of EVO solution were injected because of an unreasonably slow injection rate of less than 1 gallon per minute (gpm). After injecting the EVO solution into the wells, an additional 150 gallons of clean water were injected to flush the EVO solution from each well (except IW03-4413).

Table 1-1: Initial EVO Injection Summary

Field Location	Total Injection Volume (gallons)	Volume of EVO (gallons)	Mass of EVO (pounds)	Injection Rate (gpm)	Injection Pressure (psi)
IW01-4413	1,269	74	592	30-35	0-5
IW02-4413	1,290	75	602	30-35	0
IW03-4413	53	3	25	<1	14-15
IW04-4413	1,319	77	616	30-35	0

Note:
psi = pound(s) per square inch

Other than at IW03-4413, the silty gravels and sands at DA089 easily accepted the injection of EVO. The injection rate at IW01-4413, IW02-4413, and IW04-4413 (35 gpm) was limited only by the injection system capabilities (injection of up to 40 gpm). The inability of EVO to be efficiently injected at IW03-4413 was possibly related to the lack of well development because there were no issues with injecting into the well during the second round of injections (see Section 3.2).

Before, during, and after the EVO injections, the wells within the target treatment zone were monitored to assess how far the EVO solution traveled. Groundwater within the wells was monitored both visually and with a water level indicator and water quality meter. Visual breakthrough of the EVO solution (which is milky white) in wells confirmed that EVO had travelled at least 22 feet during injection at IW04-4413 and less than 15 feet during injection at IW01-4413. During the injections, visual breakthrough of EVO was also observed in the

performance monitoring well AP-4413. Based on these observations, possible future full-scale implementation of EVO injections should deploy an injection well spacing similar to the 15-foot well spacing of the treatability study.

The observed distribution of EVO substrate in the aquifer is presented on Figure 1-3.

1.4 Organization of Report

This report is organized into the following sections:

- **Section 1.0: Introduction** – presents project objectives, site description, summary of the Implementation Report, and the organization of this report.
- **Section 2.0: Description of Technology** – provides a description of how ERD functions to reduce concentrations of PCE.
- **Section 3.0: Field Activities** – summarizes the activities performed including the second EVO injection event and quarterly groundwater monitoring events.
- **Section 4.0: Groundwater Quarterly Monitoring Results** – presents results of the quarterly groundwater monitoring following substrate injections.
- **Section 5.0: Conclusions** – presents conclusions following quarterly groundwater monitoring.
- **Section 6.0: Recommendations** – presents a proposed approach for continued monitoring of the treatability study.
- **Section 7.0: References** – lists reference material used in preparation of this report.

Figures and appendixes follow Section 7.0.

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2.0 DESCRIPTION OF TECHNOLOGY

2.1 Biotic Reductive Dechlorination

Chlorinated aliphatic hydrocarbons (CAHs) are typically composed of one or two carbon atoms and between one and six chlorine atoms. Common CAHs include PCE, trichloroethene (TCE), 1,2-dichloroethene (DCE), and vinyl chloride. This treatability study was designed to evaluate the effectiveness of ERD (a form of biotic reductive dechlorination) at reducing concentrations of CAHs, particularly PCE, in groundwater at DA089.

Biotic reductive dechlorination is a microbial-mediated reaction where microorganisms gain energy for growth as one or more of the chlorine atoms on a CAH molecule are replaced by hydrogen atoms in an anaerobic environment. In general, biotic reductive dechlorination occurs by sequential removal of chlorine atoms. For example, the chlorinated ethenes are transformed sequentially from PCE to TCE to the 1,2-DCE isomers (cis-1,2-DCE or trans-1,2-DCE) to vinyl chloride to ethene (United States Environmental Protection Agency [EPA], 2000). These microbial mediated degradation reactions proceed via oxidation-reduction (redox) reactions, where electrons are sequentially transferred from one compound, the electron donor, to an electron acceptor (pathway shown on Figure 2-1).

Microorganisms couple the oxidation of organic compounds or hydrogen to the reduction of an electron acceptor to generate energy in a process called microbial respiration. In the reductive dechlorination process, CAH molecules serve as electron acceptors. The reduction of oxygen is the most energetically favorable and efficient metabolic pathway; however, oxygen can be rapidly depleted in systems with elevated organic carbon contents and low recharge rates, rendering the environment anaerobic. Anaerobic respiration uses oxidized compounds (e.g., CAH molecules) in groundwater as electron acceptors, in order of their respective thermodynamic favorability (EPA, 2000).

The carbon atoms in PCE and TCE are in a more highly oxidized state than the less oxidized compounds cis-1,2-DCE and vinyl chloride (Christ et al., 2005). As such, the highly chlorinated compounds PCE and TCE are more readily and rapidly biodegraded through reductive dechlorination reactions than the less chlorinated compounds cis-1,2-DCE and vinyl chloride (Wiedemeier et al., 1999). Biotic reductive dechlorination of CAHs occurs most favorably under conditions where the environment is highly anaerobic, is elevated in dissolved hydrogen concentrations, is strongly reducing, and where an appropriate microbial population is present.

2.2 Enhanced Reductive Dechlorination Treatment Technology

ERD is a treatment method that aims to increase the propensity for biotic reductive dechlorination. ERD treatments manipulate the geochemical environment through injection of short- and long-term carbon sources. The consumption of the short-term carbon source (typically lactate) rapidly transitions the contaminated aquifer into a highly anaerobic and strongly reducing environment, consequently affecting the microbial community. The prolonged consumption of the long-term carbon source (typically EVO) effectively sustains the geochemical conditions and supplies the chemical requirements for reductive dechlorination. The carbon source serves as a supplemental

energy source for microbial processes in the subsurface, and provides a pool of electron donors to stimulate dechlorinating bacteria that can use chlorinated compounds as electron acceptors.

ERD injection treatments are engineered to create treatment zones. EVO substrates are sparingly soluble and will adsorb to sediments. Consequently, the substrate typically has the greatest effect on contaminants in the immediate vicinity of the injection location, depending on substrate distribution. An EVO substrate manufactured by Terra Systems was selected for injection at the target treatment zone. The EVO substrate used in the first round of injections was a custom blend of 60 percent SRS-SD (0.6-micrometer [µm] droplet size) and 40 percent SRS-FR (5-µm droplet size). Each SRS solution contains 60 percent soybean oil and 4 percent potassium or sodium lactate, with the remainder being water, surfactants, and organic and inorganic nutrients. The custom blend of small and large EVO droplet sizes was designed to allow for the transport of the small EVO droplets through the aquifer to treat a larger area, and the larger EVO droplets allow for greater retention within the injection area. The second round of injections in 2014 used an EVO substrate of 100 percent Terra Systems SRS-FR (5-µm droplet size) for larger droplets to help retain more EVO near the injection zone.

2.3 Evaluating Anaerobic Degradation Processes

Adding an organic substrate (such as EVO) to the subsurface creates anaerobic conditions that may directly or indirectly initiate the degradation reactions described above. The primary line of evidence for evaluation of contaminant degradation is the observation of changes in contaminant concentrations (or mass) over time and space. Biogeochemical data can then be used as a secondary or confirmatory line of evidence.

Biotic reductive dechlorination of CAHs is a sequential process where PCE and TCE are sequentially dechlorinated to the DCE isomers (cis-DCE, trans-1,2-DCE, and 1,1-DCE), then to vinyl chloride, and finally to ethene. This sequential dechlorination pattern is evident as sequential peaks in the concentration of each dechlorination product over time. Therefore, the formation of intermediate dechlorination products is indicative of sequential biotic reductive dechlorination.

3.0 FIELD ACTIVITIES

Details of the injection well installation, baseline soil and groundwater sampling, and the initial September 2013 substrate injection were presented in the Implementation Report (USAF, 2014a) and summarized above in Section 1.3. Field activities documented in this report include the four rounds of quarterly groundwater sampling conducted following the initial injection, the second round of EVO injections, and the following four rounds of quarterly groundwater sampling. Field notes are provided in Appendix A-1.

3.1 2013-2014 Quarterly Groundwater Monitoring

Four rounds of groundwater monitoring (October 2013, January 2014, April 2014, and September 2014) were conducted at the performance monitoring well AP-4413 following the initial EVO injections. Groundwater samples were analyzed for VOCs, TOC, dissolved iron, dissolved manganese, dissolved gases, sulfide, nitrate+nitrite, alkalinity, chloride, sulfate, and VFAs. Field quality control (QC) samples were collected during the quarterly groundwater sampling. The rationale and objective of the field QC samples are presented in Worksheet #20 of the Work Plan (USAF, 2013a).

Table 3-2 presents a summary of the groundwater samples and analyses. Groundwater sampling logs are included in Appendix A-2.

3.2 Second Substrate Injection

Following the initial four rounds of quarterly groundwater monitoring, results showed that although geochemically reducing conditions were evolving, PCE concentrations were not decreasing as anticipated. Based on these results, the USAF decided to implement Contingency 1, outlined in the Work Plan:

- Contingency 1: Conduct another round of EVO injections, possibly with the addition of ferrous sulfate solution, depending upon the success of the treatability study at CG039, or injection of ISCO using sodium permanganate, depending upon the results of the NOD analyses and effectiveness of ISCO injection during the treatability study at CG039.

It was determined that the contingency measure would be to conduct another round of EVO injections with the following parameters adjusted to increase reducing conditions within the aquifer and promote ERD of PCE (USAF, 2014b):

- Triple the EVO volume to increase the mass of carbon in the aquifer.
- Triple the total injection volume to improve distribution.
- Triple the mass of lactate injected into the aquifer to accelerate the evolution of anaerobic conditions.
- Change EVO substrate to 100 percent Terra Systems SRS-FR (5-µm droplet size) for larger droplets to help retain more EVO near the injection zone.

The second round of EVO injections was completed on October 14 and 15, 2014, as summarized in Table 3-1. An approximately equal amount of EVO solution was injected into each injection well. After injecting the EVO solution into the wells, a minimum of 250 gallons of clean water was injected to flush the EVO solution from each well.

Table 3-1: Second EVO Injection Summary

Field Location	Total Injection Volume (gallons)	Volume of EVO (gallons)	Mass of EVO (pounds)	Injection Rate (gpm)	Injection Pressure (psi)
IW01-4413	4,810	200	1,606	30-31	0-2
IW02-4413	4,002	209	1,678	33-34	0
IW03-4413	4,623	193	1,550	20-26	13-20
IW04-4413	3,803	190	1,528	33	0

The second round of EVO injections were similar to the initial injections. The silty gravels and sands at DA089 easily accepted the injection of EVO with minimal injection pressure. However, the full amount of EVO solution was successfully injected at IW03-4413, although the injection rate was slightly less than that at the other wells, so the injection at that well was performed with a substantially higher injection pressure. The injection rate at IW01-4413, IW02-4413, and IW04-4413 (approximately 30 to 34 gpm) was limited only by the injection system capabilities (injection of up to 40 gpm).

Similar to monitoring done during the initial injection, the wells within the target treatment zone were monitored to assess how far the EVO solution was traveling. Groundwater within the wells was monitored visually using a bailer and with a water level indicator and water quality meter. Visual breakthrough of the EVO solution (which is milky white) in wells confirmed that the radius of influence during injections was at least 15 feet. During the injections, visual breakthrough of EVO was also observed in the performance monitoring well AP-4413.

3.3 2015 Quarterly Groundwater Sampling and Analysis

Four additional rounds of groundwater sampling (March 2015, June 2015, September 2015, and December 2015) were conducted at the performance monitoring well AP-4413 following the second EVO injections. Groundwater samples were analyzed for VOCs, TOC, dissolved iron, dissolved manganese, dissolved gases, sulfide, nitrate+nitrite, alkalinity, chloride, sulfate, and VFAs. Field QC samples were collected during the quarterly groundwater sampling. The rationale and objective of the field QC samples are presented in Worksheet #20 of the Work Plan (USAF, 2013a).

Table 3-2 presents a summary of the groundwater samples and analyses. Groundwater sampling logs are included in Appendix A-2.

Table 3-2: Groundwater Samples and Analyses

Location	Sample ID	Matrix	Sample Type	Depth (feet)	Collection Date	E310.1	E300.0M	E300.0	E353.2	E376.2	RSK-175	SW6010B/C	SW9060	SW8260C
AP-4413	AP-4413-13-0830-0	GW	N	64.4-74.4	26-Aug-13	X	X	X	X	X	X	X	X	X
	AP-4413-13-0830-1	GW	FD	64.4-74.4	26-Aug-13	X	X	X	X	X	X	X	X	X
	13Q4DA085-AP4413-GW-0	GW	N	64.4-74.4	16-Oct-13	X		X	X	X	X	X	X	X
	13Q4DA085-AP4413-GW-1	GW	FD	64.4-74.4	16-Oct-13	X		X	X	X	X	X	X	X
	14Q1DA085-AP4413-GW-0	GW	N	64.4-74.4	14-Jan-14	X	X	X	X	X	X	X	X	X
	14Q2DA085-AP4413-GW-0	GW	N	64.4-74.4	14-Apr-14	X	X	X	X	X	X	X	X	X
	14Q2DA085-AP4413-GW-1	GW	FD	64.4-74.4	14-Apr-14	X	X	X	X	X	X	X	X	X
	14Q3DA089-AP4413-GW-0	GW	N	64.4-74.4	15-Sep-14	X	X	X	X	X	X	X	X	X
	14Q3DA089-AP4413-GW-1	GW	FD	64.4-74.4	15-Sep-14			X	X		X	X		X
	15Q1DA089-AP4413-GW-0	GW	N	64.4-74.4	17-Mar-15	X	X	X	X	X	X	X	X	X
	15Q1DA089-AP4413-GW-1	GW	FD	64.4-74.4	17-Mar-15	X	X	X	X	X	X	X	X	X
	15Q2DA089-AP4413-GW-0	GW	N	64.4-74.4	26-Jun-15	X	X	X	X	X	X	X	X	X
	15Q2DA089-AP4413-GW-1	GW	FD	64.4-74.4	26-Jun-15	X	X	X	X	X	X	X	X	X
	15Q3DA089-GW-AP4413-0	GW	N	64.4-74.4	28-Sep-15	X	X	X	X	X	X	X	X	X
	15Q3DA089-GW-AP4413-GW-1	GW	FD	64.4-74.4	28-Sep-15	X	X	X		X			X	
	15Q4DA089-AP4413-GW-0	GW	N	64.4-74.4	16-Dec-15	X	X	X	X	X	X	X	X	X
	15Q4DA089-AP4413-GW-1	GW	FD	64.4-74.4	16-Dec-15	X	X	X	X	X	X	X	X	X

Notes:
FD = field duplicate
GW = groundwater
ID = identification
N = primary sample
E310.1 = Alkalinity
E300.0M = VFAs
E300.0 = Chloride and sulfate
E353.2 = Nitrate+nitrite
E376.2 = Sulfide
RSK-175 = Dissolved gases
SW6010C = Dissolved iron and manganese
SW9060 = TOC
SW8260C = VOCs

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3.4 Management of Investigative-Derived Waste

Wastes generated during the second EVO injection and the quarterly groundwater sampling portion of the treatability study include general refuse (expended personal protective equipment [PPE], paper towels, plastic bags, and plastic water containers) and investigative-derived waste (IDW) (purge water from well sampling and wastewater from decontamination activities).

Consistent with the *Basewide Uniform Federal Policy – Quality Assurance Project Plan, Joint Base Elmendorf-Richardson* (USAF, 2013b), wastes were taken to the Environmental Staging Facility (ESF), which is located at Building 955 on Warehouse Street near the intersection with Otter Lake Road. Access to the facility is coordinated through the current operations contractor. Specific wastes were handled as follows:

- General refuse and expended PPE were disposed of daily in JBER refuse waste containers at the ESF.

- Decontamination and purge water was collected in 15-gallon containers, transported to the ESF, transferred into open-top 55-gallon drums, and labeled. Decontamination and purge water was then batch treated with other IDW water. After treatment, the water was sampled for constituents in the JBER water discharge permit and was discharged to the sanitary sewer after verifying that constituent concentrations were below permit requirements. Treated IDW from DA089 discharged to the sanitary sewer is considered to be exempt from the CERCLA Off-Site Rule as a de minimis release.

3.5 Deviations from the Work Plan

The treatability study field activities described in this document were conducted in accordance with the Work Plan (USAF, 2013a) and Work Plan Addendum (USAF, 2014b). The following deviation from the planning documents occurred:

- The primary sample and FD collected from AP-4413 during the October 2013 sampling event were not analyzed for VFAs because of an inadvertent omission.

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4.0 GROUNDWATER QUARTERLY MONITORING RESULTS

The results of the quarterly groundwater sampling are presented in Section 4.1. Complete analytical results are presented in Appendix B. The data quality evaluation (DQE) reports are included in Appendix C, and the laboratory analytical reports are included in Appendix D.

4.1 AP-4413 Groundwater Results

A baseline sample from AP-4413 prior to EVO injection was collected in August 2013 and was presented in the Implementation Report (USAF, 2014a). Four groundwater samples were collected from AP-4413 from October 2013 to September 2014 following the initial EVO injection. Another four groundwater samples were collected from March 2015 to December 2015 following the second EVO injection in October 2014. Analyte concentration trends are summarized in the following sections. CAH results for AP-4413 and an updated representation of the PCE plume are presented on Figure 4-1. Graphs presenting CAH concentration and total molar concentration trends are presented on Figure 4-2. Graphs presenting geochemical parameter concentration trends are presented on Figure 4-3. Complete analytical results for AP-4413 are presented in Appendix B.

4.1.1 Chlorinated Aliphatic Hydrocarbons

Concentrations of PCE in groundwater at AP-4413 began decreasing approximately 1 year following the first EVO injection and decreased substantially after the second EVO injection in October 2014, but have since begun to rebound. In turn, concentrations of PCE daughter products, TCE, cis-1,2-DCE and vinyl chloride, have increased compared to pre-injection concentrations. Concentrations of cis-1,2-DCE and vinyl chloride have begun to decrease, indicating that those compounds are being dechlorinated. A summary of the concentrations observed for the CAHs at AP-4413 is provided in Table 4-1.

To estimate the quantity of PCE that has been degraded by reductive dechlorination, the concentrations of PCE and each of the daughter products were converted to molar concentrations (measured in micromoles per liter [µmol/L]). In molar concentrations, the quantities of PCE and daughter products can be related on a one-to-one basis, where 1 µmol/L of daughter product represents the reduction of 1 µmol/L of PCE. In this manner, a conservative estimate can be obtained for the quantity of PCE that has been degraded. This is a conservative estimate since (1) the daughter products do not include the final reductive dechlorination end members of ethene, ethane, and carbon dioxide, which are difficult to quantify and are therefore left out of the evaluation, and (2) degradation mechanisms other than reductive dechlorination are not considered.

Figure 4-2 shows a graphical representation of the relative molar concentrations of all the detected CAHs (including PCE and daughter products) at AP-4413 though time. The following observations can be made from total CAH molar concentration trends:

- Most of the PCE has been degraded to cis-1,2-DCE; other daughter products like TCE, trans-1,2-DCE, and vinyl chloride make up very little of the total CAH molar mass.

- PCE and cis-1,2-DCE now constitute 21 percent and 70 percent of the CAHs at AP-4413, respectively.

- The latest molar concentration of cis-1,2-DCE (0.47 µmol/L) is similar to the baseline molar concentration of PCE and TCE combined (0.48 µmol/L)

- The total CAH molar concentration at AP-4413 has increased from 0.49 to 0.67 µmol/L (and as high as 1.09 µmol/L) since the beginning of the treatability study.

Based on these observations, the following conclusion can be drawn:

- As PCE is degraded, it is expected that the total molar concentration of daughter products should be equal to (if daughter products are not degraded) or less than (if daughter products are being degraded) the baseline molar concentrations of PCE. The observed cis-1,2-DCE molar concentration is similar to the baseline PCE and TCE molar concentration at AP-4413, which could indicate that cis-1,2-DCE is not being degraded. However, concentration data indicate that cis-1,2-DCE is being degraded to vinyl chloride and ethene (which should result in the cis-1,2-DCE molar concentration being less than the baseline PCE and TCE molar concentration). The similarity of the cis-1,2-DCE molar concentration to the baseline PCE and TCE molar concentration can be explained by an influx of dissolved PCE from the area of the plume immediately upgradient of the target treatment zone, some of which is being degraded to cis-1,2-DCE. This influx of dissolved PCE from the area of the plume immediately upgradient of the target treatment zone would also explain the increase in PCE concentration and the increase in the total CAH molar concentrations relative to the baseline concentration.

4.1.2 Geochemical Parameters

The geochemical parameters measured in groundwater at AP-4413 indicate that the groundwater environment has been and likely remains sufficiently anaerobic for reductive dechlorination to occur. Following the second EVO injection, the TOC concentration increased to 875 milligrams per liter (mg/L) and still remains well above the 20 mg/L threshold condition for reductive dechlorination to occur. Oxidation-reduction potential (ORP) decreased to negative values (-53.2 millivolts [mV]) following the initial EVO injection and has since increased to slightly positive values (10.1 mV in December 2015). This increase in ORP could be indicative of geochemical conditions becoming less reducing; however, the December 2015 DO result (0.12 mg/L) indicates that geochemical conditions are still favorable for reductive dechlorination. A summary of the geochemical parameters measured at AP-4413 is provided in Table 4-2, and graphs presenting geochemical parameter concentration trends are presented on Figure 4-3.

Table 4-1: AP-4413 Chlorinated Aliphatic Hydrocarbon Results

Analyte (µg/L)	Cleanup Level	August 2013 (pre-injections)	Initial Injection – September 2013	Oct 2013	Jan 2014	April 2014	Sept 2014	Second Injection – October 2014	March 2015	June 2015	Sept 2015	Dec 2015	Comments
PCE	5[a]	**78.8**		**135**	**130**	**171**	**52.8**		**5.56**	**7.13**	**14.9**	**23.7**	Decrease indicates that PCE is being dechlorinated, but recent increase indicates influx of dissolved PCE from upgradient of target treatment zone.
TCE	2.8[b]	0.25 U		0.25 U	0.32	0.31	**4.24**		1.68	2.14	**4.26**	**4.86**	Increase indicates that PCE is being dechlorinated.
cis-1,2-DCE	36[b]	0.25 U		0.25 U	0.63	0.3 U	**46.1**		**45.9**	**76.4**	**88.4**	**45.1 J**	Increase indicates that TCE is being dechlorinated. Subsequent decrease indicates that cis-1,2-DCE is being dechlorinated.
trans-1,2-DCE	100[c]	0.25 U		0.25 U	0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U	0.3 U	Non-detect concentrations indicate that trans-1,2-DCE is not a primary dechlorination pathway.
1,1-DCE	7[c]	0.25 U		0.25 U	0.3 U	0.3 U	0.3 U		0.3 U	0.16 J	0.3 U	0.3 U	Non-detect concentrations indicate that 1,1-DCE is not a primary dechlorination pathway.
Vinyl chloride	0.19[b]	0.25 U		0.25 U	0.3 U	0.3 U	0.3 U		**0.54**	**2.42**	**3.31**	**0.85**	Increase indicates that DCE is being dechlorinated. Subsequent decrease indicates that vinyl chloride is being dechlorinated.
Ethene	No Cleanup Level	0.27 U		0.12 U	0.123 U	0.0735 J	0.188 J		0.552 J	0.169 J	0.141 J	0.985	Increase indicates that complete dechlorination is occurring.

[a] The MCL is the cleanup level selected in the OU E ROD (Army, 2005); therefore, it is used for comparison.
[b] The 18 AAC 75 Table C Groundwater Cleanup Level (November 6, 2016) is less than the MCL; therefore, it is used for comparison.
[c] The MCL is less than the 18 AAC 75 Table C Groundwater Cleanup Level (November 6, 2016); therefore, it is used for comparison.

Notes:

µg/L = microgram(s) per liter
J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.
MCL = maximum contaminant level
U = The analyte was analyzed for, but was not detected above limit of detection.
Bold values indicate that the result exceeded the MCL.

Table 4-2: AP-4413 Geochemical Parameter Results

Analyte	August 2013 (baseline)	Initial Injection – September 2013	Oct 2013	Jan 2014	April 2014	Sept 2014	Second Injection – October 2014	March 2015	June 2015	Sept 2015	Dec 2015	Comments
ORP (millivolts)	47.9		51.8	16.6	-39.7	-53.2		25.3	28.4	44.7	10.1	A negative value indicates reduced conditions, favorable for dechlorination. Slightly positive current result could indicate that conditions are becoming more aerobic; however, other geochemical parameters are indicative of highly reduced conditions.
DO (mg/L)	8.82		0.49	10.3	2.14	4.56		0.86	2.33	1.82	0.12	DO values below 1 mg/L indicate that conditions are favorable for dechlorination.
TOC (mg/L)	0.482 B		1.34 B	74.6	40.2	50.9		875	518	350	277 B	Greater than 20 mg/L is considered a sufficient carbon and energy source to drive dechlorination.
VFAs* - acetic acid (µg/L)	60 U		NA	16,500	37,500	46,800		176,000	229,000	227,000 J	110,000	VFAs are a degradation product of EVO, and concentrations of VFAs greater than 10,000 to 20,000 µg/L are a good indicator of sufficient EVO distribution at a given location.
VFAs* - propionic acid (µg/L)	60 U		NA	113,000	12,900	4,690		202,000	48,800	39,600 J	27,400 J	
Methane (µg/L)	1.184 B		0.0436 B	0.109 J	0.218 B	78.4		102	271 J	397	367	Levels greater than 1,000 µg/L are an indicator of highly reducing conditions, which are desirable for dechlorination to occur.
Manganese (mg/L)	0.000601 B		0.543 B	12.6	10.4	10.1		34.2	25.5	22	11.2	An increase in manganese concentrations can indicate that groundwater conditions are sufficiently reducing for anaerobic dechlorination to occur.

Table 4-2: AP-4413 Geochemical Parameter Results

Analyte	August 2013 (baseline)	Initial Injection – September 2013	Oct 2013	Jan 2014	April 2014	Sept 2014	Second Injection – October 2014	March 2015	June 2015	Sept 2015	Dec 2015	Comments
Dissolved Iron (mg/L)	0.0173 J		0.029 J	1.6	3.33	4.27		51.3	32.9	25.8	9.44	An increase in ferrous iron concentrations can indicate that groundwater is sufficiently reducing for anaerobic dechlorination to occur. Although dissolved iron reported from laboratory analysis did not speciate between ferric and ferrous iron, ferrous iron was measured using a field test kit (Appendix A). The ferrous iron results from the field test kit ranged from 2 to greater than 3.3 mg/l (exceeds the range of the test kit), which, along with reducing conditions in the groundwater environment, indicate that most of the dissolved iron concentration is likely to be in the ferrous form of iron.
Sulfate (mg/L)	24.1		21.8 B	0.449	0.29	2.72		1.94	2.2	1.18 B	1.13	Depleted concentrations of sulfate compared to baseline indicate that groundwater conditions are sufficiently reducing for anaerobic dechlorination to occur.
Sulfide (mg/L)	0.017 J		0.241 B	0.0187 J	0.0193 U	0.0134 J		0.0926	0.0531	0.0557	0.0342	Low concentrations could indicate that iron sulfide minerals are being formed.
Nitrate (mg/L)	3.6		0.0223 B	0.018	0.0349	0.0386 B		0.0799	0.0921	0.109 B	0.0482	A nitrate level of <1.0 mg/L is desirable for dechlorination.
pH	6.74		7.28	7.13	6.93	7.31		6.19	6.39	6.36	6.61	pH values are within the acceptable range (6 to 8) for reductive dechlorination.

*Acetic acid and propionic acid are the most prevalent VFAs detected at AP-4413. See Appendix B.

Notes:

B = The analyte was detected in the associated method or calibration blank.

J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.

DO = dissolved oxygen

NA = not analyzed

U = The analyte was analyzed for, but was not detected above the limit of detection.

4.2 Data Quality Evaluation

Sample receipt forms, laboratory data review checklists, and a comprehensive DQE report are included in Appendix C. The goal of the DQE is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision making process. Because of the concurrent monitoring schedule, the 2013-2014 DQE report includes samples from the quarterly monitoring at DA089, samples from the 2014 groundwater monitoring event for DA089 and CG039, and the CG039 treatability study. The 2015 DQE report includes only samples collected during the 2015 quarterly monitoring at DA089. The following summary highlights the DQE findings:

2013-2014

- No data were rejected, and completeness was 100 percent for all method/matrix/analyte combinations.

- Approximately 5 percent of the E300.0 (chloride/sulfate) data and 5 percent of the E376.2 (sulfide) data were qualified because of low-level detections in the EBs. The degree to which blank contamination was observed is within reasonable method expectations considering the small size of the dataset.

- Approximately 9 percent of the E353.2 (nitrate+nitrite) data were qualified because of low-level detections in the EBs. The degree to which blank contamination was observed suggests a contamination issue during sample collection.

- Approximately 16 percent of the RSK-175 (dissolved gases) data were qualified because of low-level detections in the laboratory blanks, TBs, and EBs. The degree to which blank contamination was observed suggests a contamination issue at the laboratory or during sample collection.

- Approximately 11 percent of the SW6010B (iron and manganese) data were qualified because of low-level detections in the EBs. The degree to which blank contamination was observed suggests a contamination issue during sample collection.

- Less than 1 percent of the SW8260C (VOCs) data were qualified because of low-level detections in the EBs. The degree to which blank contamination was observed is within reasonable method expectations.

- Approximately 18 percent of the SW9060 (TOC) data were qualified because of low-level detections in the EBs. The degree to which blank contamination was observed suggests a contamination issue during sample collection.

- Two sample containers were received frozen; three results were qualified as estimated.

- FD relative percent difference exceedances were observed for Methods E300.0 (chloride/sulfate), E376.2 (sulfide), and SW8260C (VOCs); 11 results were qualified as estimated.

- MS/MSD recovery exceedances were observed for Methods SW9060 (TOC) and SW8260C (VOCs); three results were qualified as estimated.

2015

- No data were rejected, and completeness was 100 percent for all method/matrix/analyte combinations.

- Approximately 12.5 percent of the E300.0 data, 14 percent of the E353.2 data, and 25 percent of the SW9060 data, were qualified because of low-level detections in the EBs. The degree to which blank contamination was observed is within reasonable method expectations considering the small size of the dataset.

- Less than 1 percent of the SW8260C data were qualified because of low-level detections in the EBs. The degree to which blank contamination was observed is within reasonable method expectations.

- A continuing calibration verification recovery exceedance was observed for Method E300.0M; four results were qualified as estimated.

- FD relative percent difference exceedances were observed for Methods E300.0M, E310.1, and RSK-175; 16 results were qualified as estimated.

- MS/MSD recovery exceedances were observed for Methods E300.0M and SW8260C; eight results were qualified as estimated.

Although data were qualified as estimated because of QC exceedances as noted, overall precision and accuracy of the data as measured by field and laboratory QC indicators suggest that data are usable for project objectives.

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5.0 CONCLUSIONS

The following treatability study conclusions have been drawn based on pre-injection data collection, two rounds of EVO injections, and eight rounds of quarterly groundwater monitoring at AP-4413:

- Use of sodium permanganate was not a viable treatment option because of the high and heterogeneous NOD results from across the site.

- Results from groundwater samples collected from injection wells prior to substrate injections indicated that PCE concentrations within each target treatment zone were similar to each other and to historical PCE concentrations.

- Design of the treatability study was sufficient to distribute substrate throughout the target treatment zone. The aquifer readily accepted the injection of EVO substrate at rates between 20 to 35 gpm, with an observed distribution radius of influence of at least 15 feet.

- Geochemical parameters indicate that the injection of EVO has proven effective in generating anaerobic conditions necessary for reductive dechlorination in the aquifer. However, there are indications (such as increasing ORP and decreasing TOC) that anaerobic conditions in the aquifer may only be sustainable for short time frames (2 to 3 years) after injection.

- As of December 2015, PCE concentrations in groundwater at monitoring well AP-4413 have been reduced by 70 percent when compared to the 2013 pre-injection concentrations. However, concentrations of PCE have begun to increase (23.7 µg/L in December 2015) since reaching a low concentration of 5.56 µg/L (over 90 percent reduction) in March 2015. The increase in PCE concentrations can be explained by an influx of dissolved PCE from the area of the plume immediately upgradient of the target treatment zone.

- Generation of vinyl chloride and ethene through the degradation of DCE indicates that a microbial consortium capable of facilitating complete dechlorination of PCE is present in the subsurface at DA089. However, while the appropriate microbes are present, it is not yet known if the population is sufficiently robust to effectively reduce all CAHs.

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6.0 RECOMMENDATIONS

Based on the results of this treatability study, the following actions are recommended:

- Annual groundwater monitoring for 2 years (2016 and 2017) to assess potential rebound of PCE concentrations, continued degradation of PCE daughter products, and persistence of reducing groundwater conditions.

  - The annual groundwater monitoring at DA089 will be modified to better monitor the progress of the treatability study. Analytical and field parameters will be added as necessary so that performance monitoring well AP-4413 continues to be monitored as outlined in Table 18-1 of the Work Plan.

  - 2016 and 2017 groundwater monitoring work plans will formally outline this plan.

  - Continuing treatability study monitoring results from AP-4413 will be reported in a distinct section of the annual groundwater monitoring report.

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7.0 REFERENCES

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Figures

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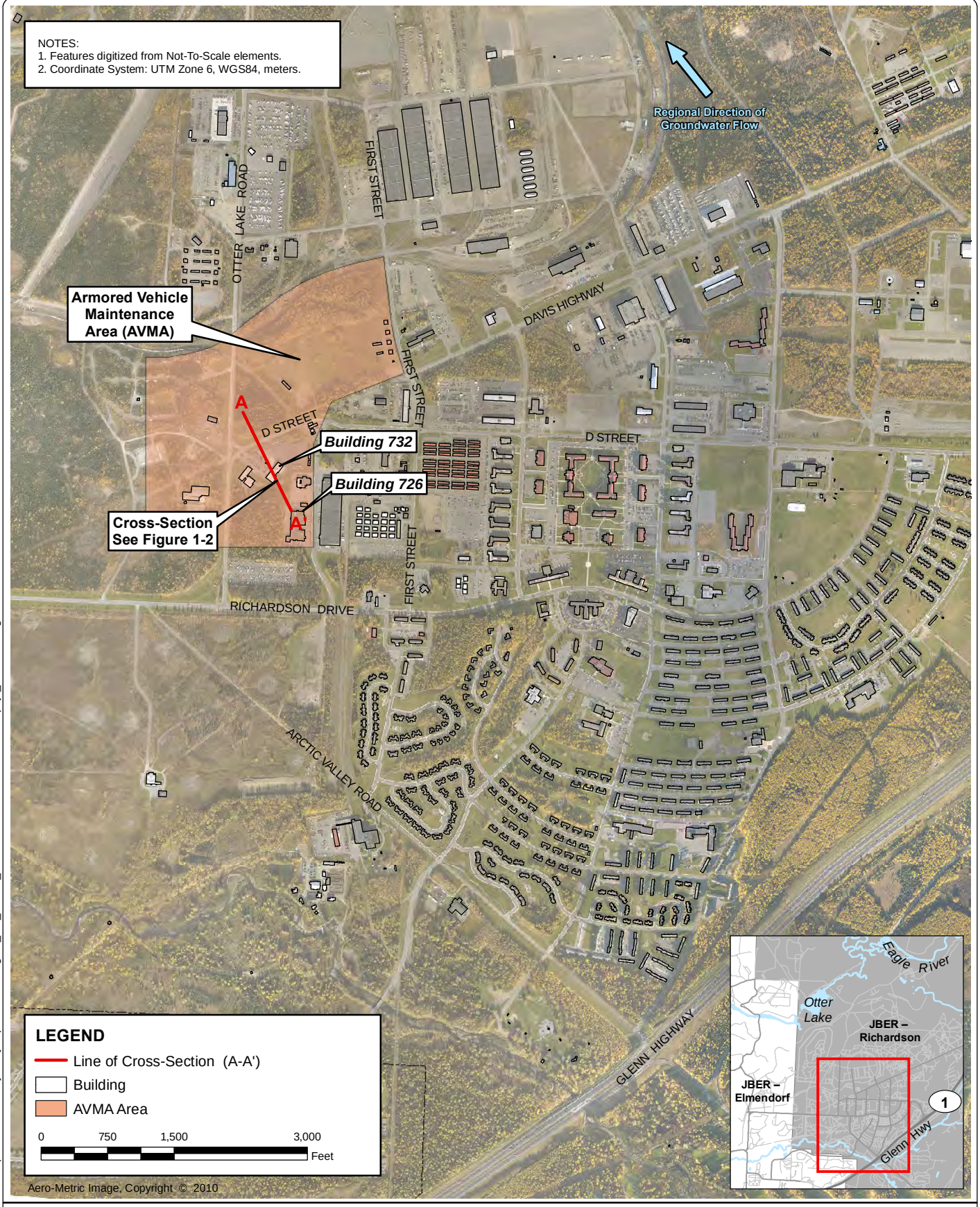

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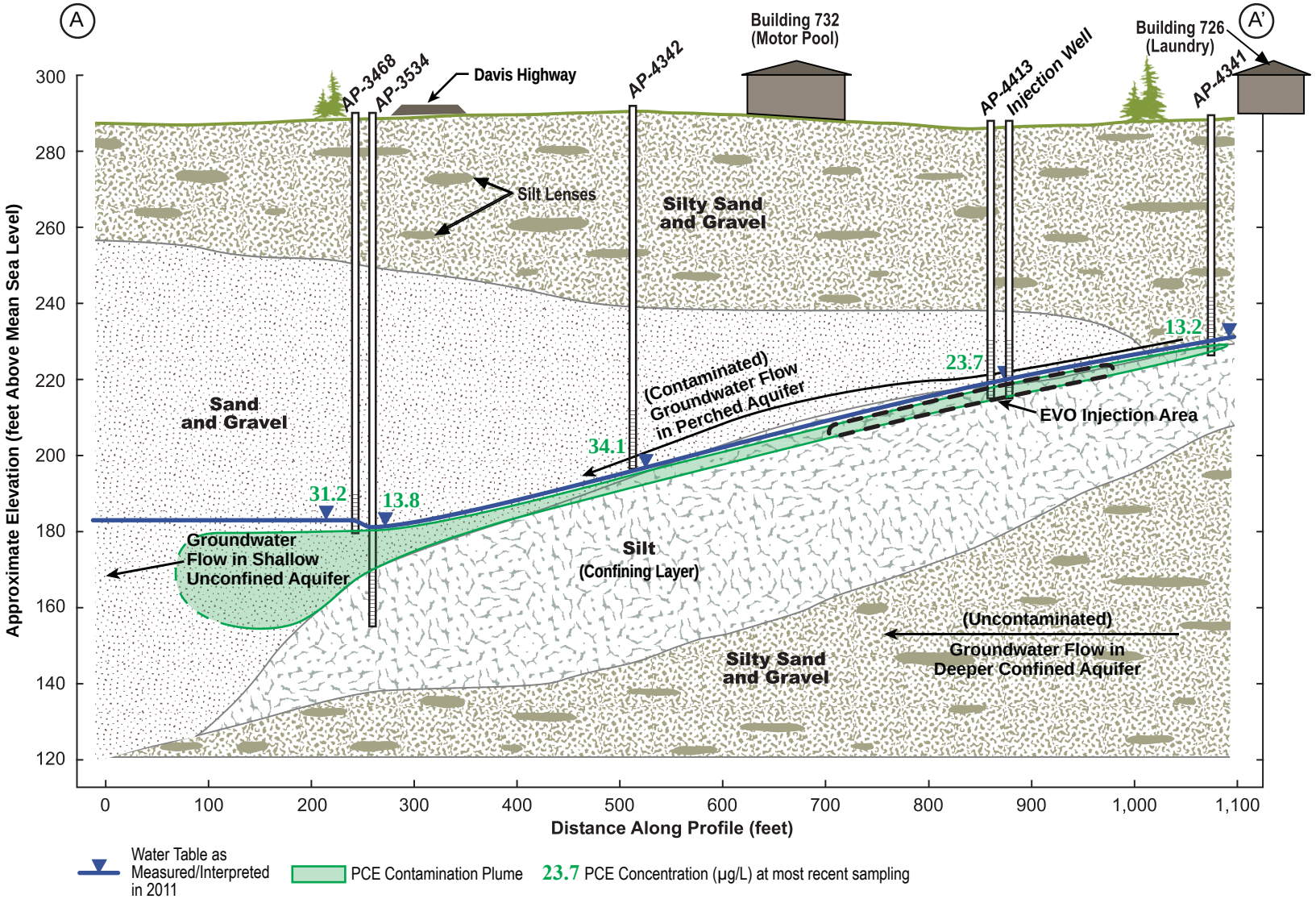
SITE LOCATION

Figure **1-1**

Treatability Study Report
DA089 - Armored Vehicle Maintenance Area
Joint Base Elmendorf-Richardson, Alaska



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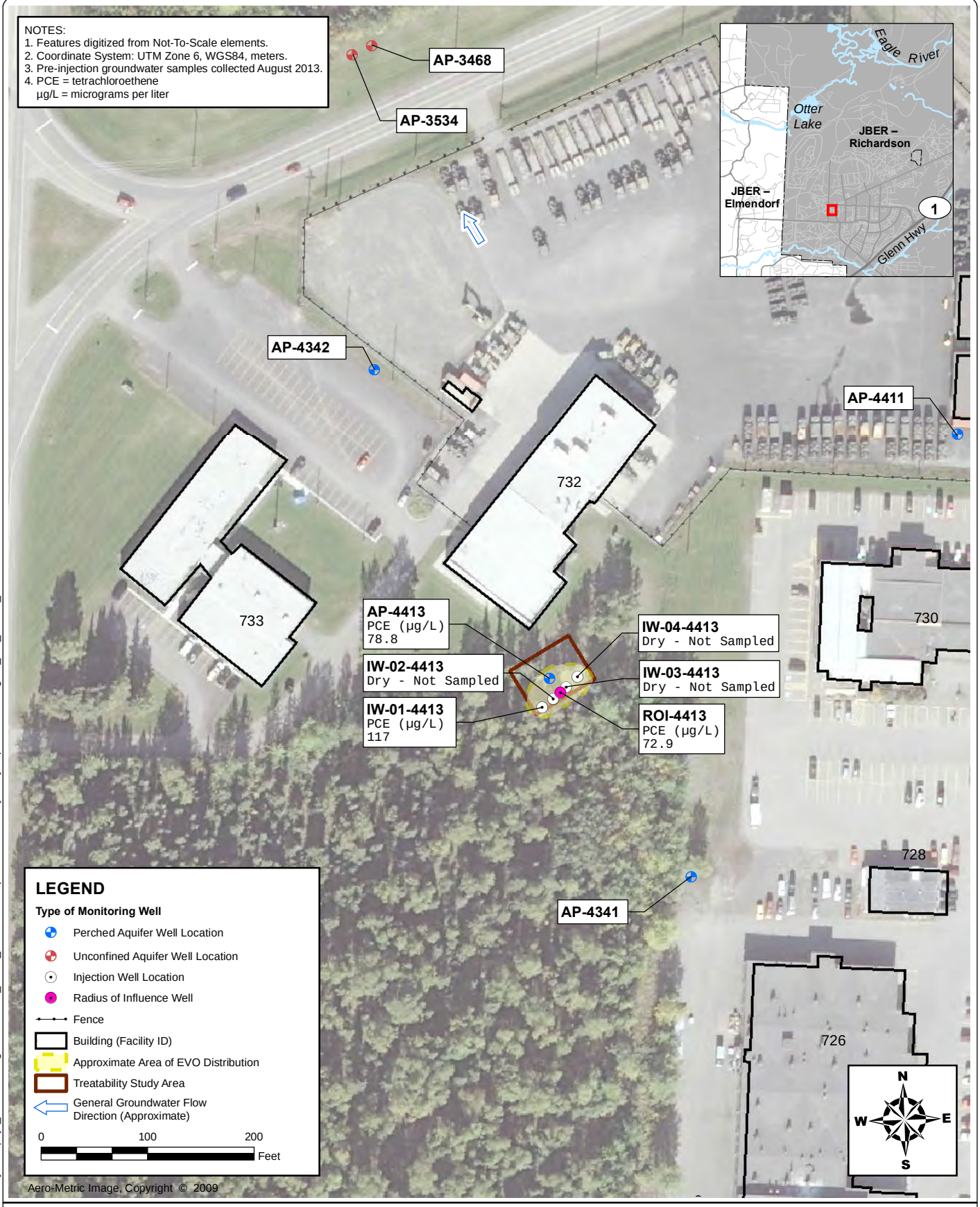
CONCEPTUAL SITE MODEL

Treatability Study Report
DA089 Armored Vehicle Maintenance Area
Joint Base Elmendorf-Richardson, Alaska

Figure
1-2



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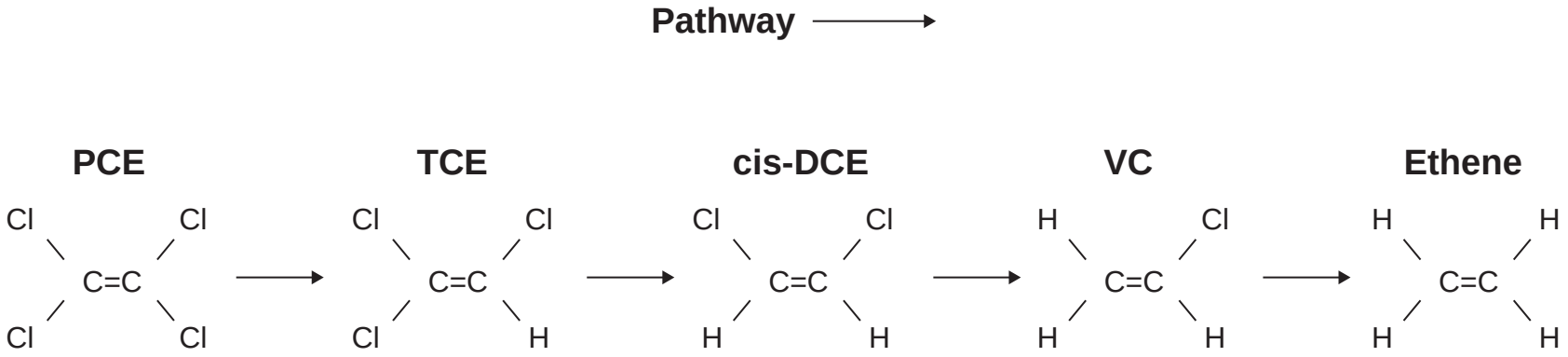
PRE-INJECTION PCE GROUNDWATER CONCENTRATIONS AND EVO INJECTION DISTRIBUTION

Figure **1-3**

Treatability Study Report
DA089 - Armored Vehicle Maintenance Area
Joint Base Elmendorf-Richardson, Alaska



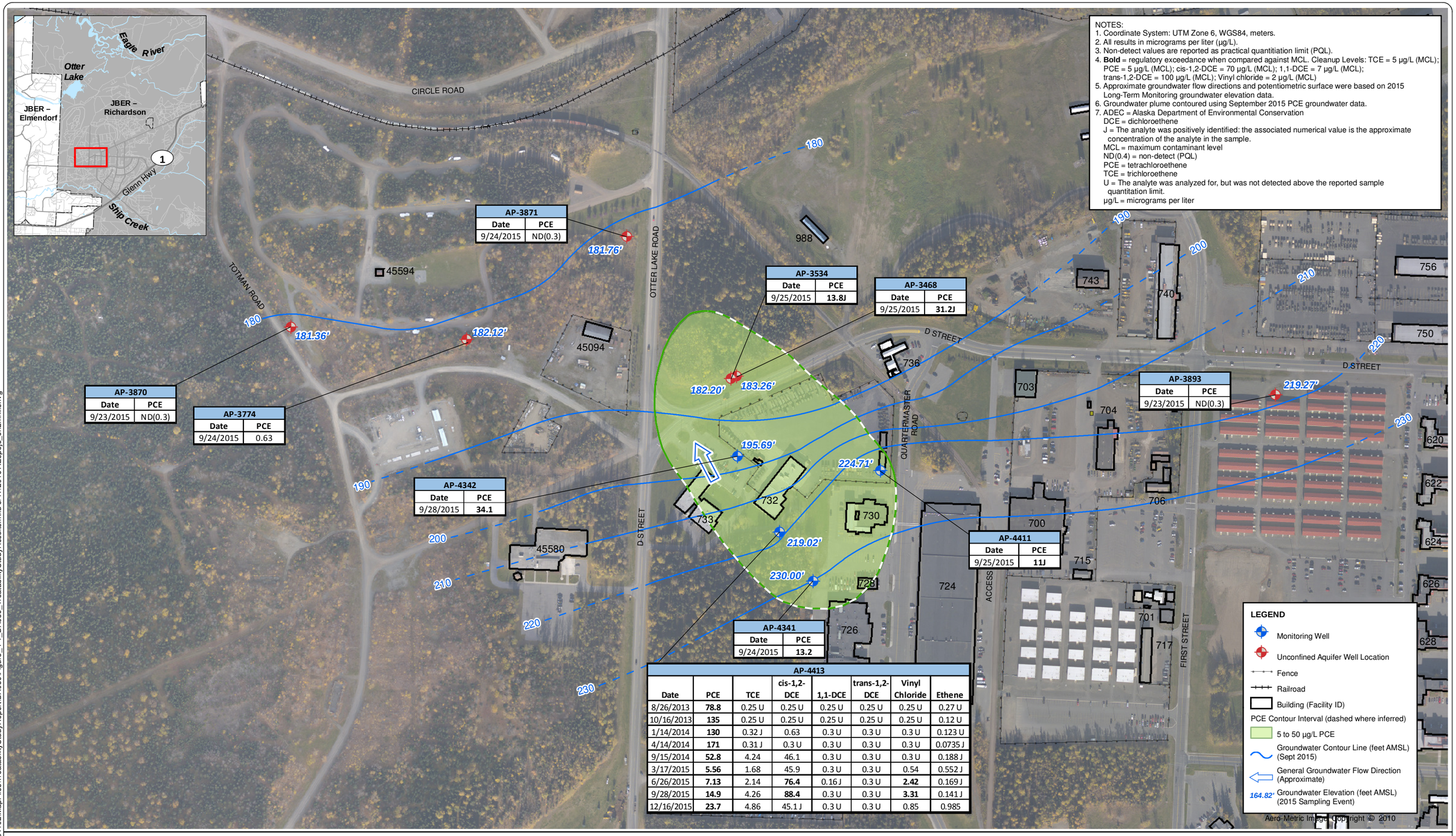
Pathway for Biotic Reduction of Chlorinated Ethenes

Modified from Butler and Hayes, 2001

BIOTIC REDUCTIVE DECHLORINATION PATHWAY

Figure **2-1**

Treatability Study Report
DA089 Armored Vehicle Maintenance Area
Joint Base Elmendorf-Richardson, Alaska



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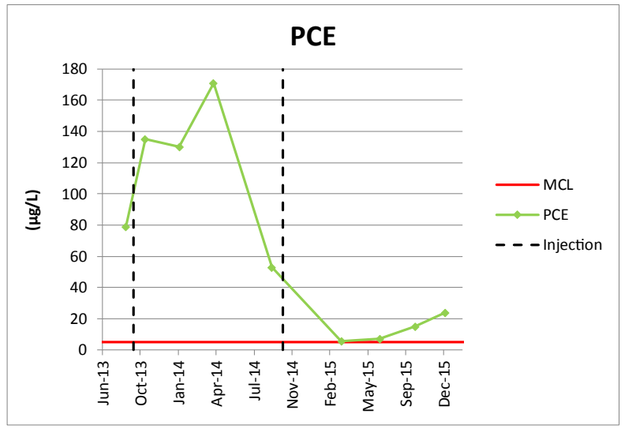
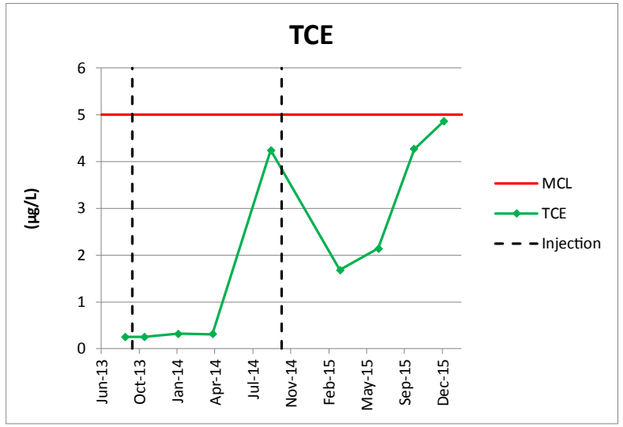
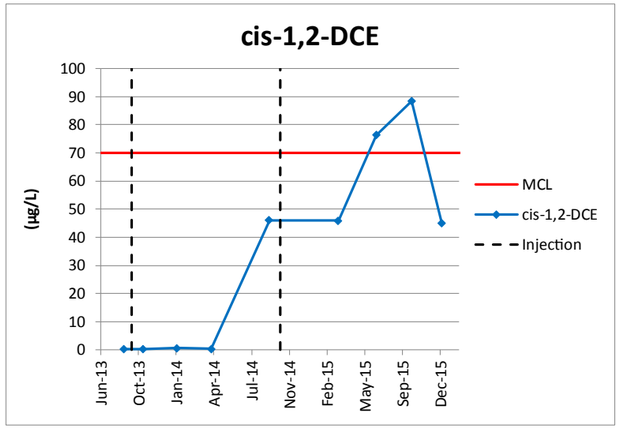
TREATABILITY STUDY RESULTS

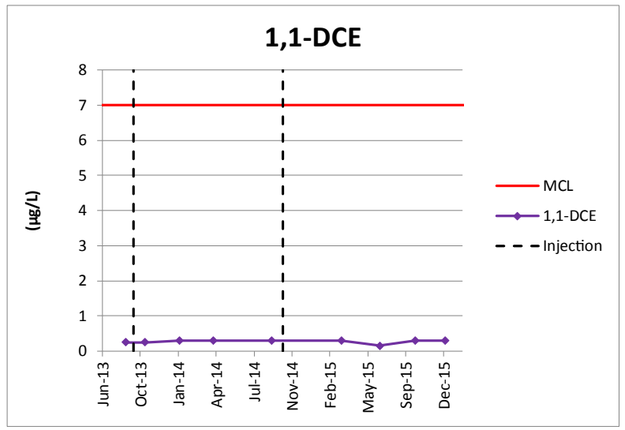
Treatability Study Report
DA089 - Armored Vehicle Maintenance Area
Joint Base Elmendorf-Richardson, Alaska

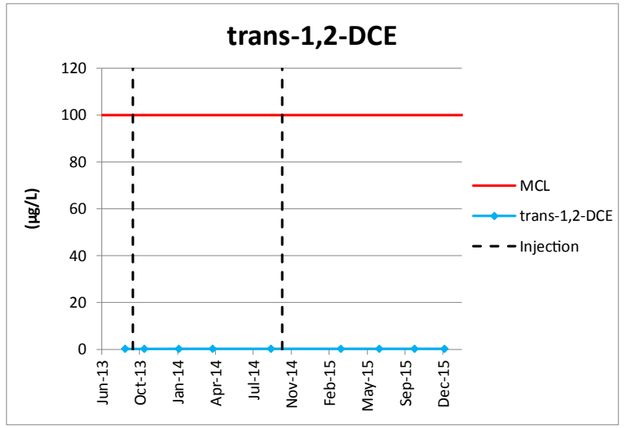
Figure
4-1

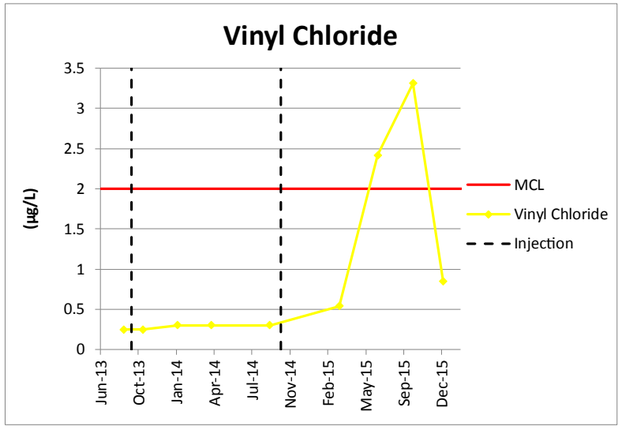


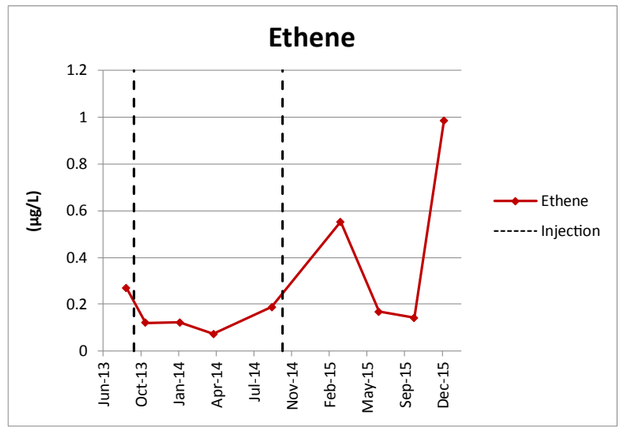


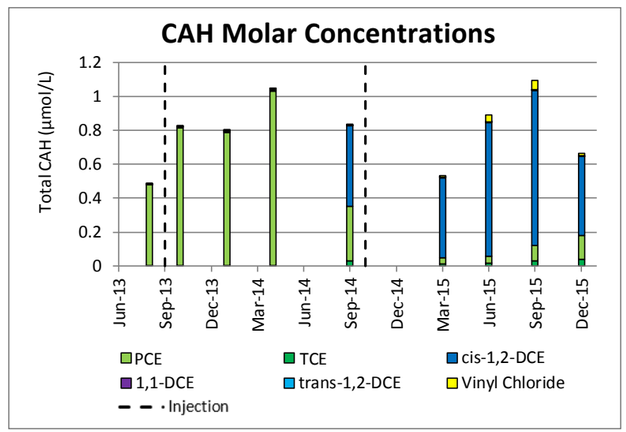












NOTES:

µg/L	microgram(s) per liter
µmol/L	micromole(s) per liter
1,1-DCE	1,1-dichloroethene
CAH	chlorinated aliphatic hydrocarbon
cis-1,2-DCE	cis-1,2-dichloroethene
MCL	maximum contaminant level
PCE	tetrachloroethene
TCE	trichloroethene
trans-1,2-DCE	trans-1,2-dichloroethene

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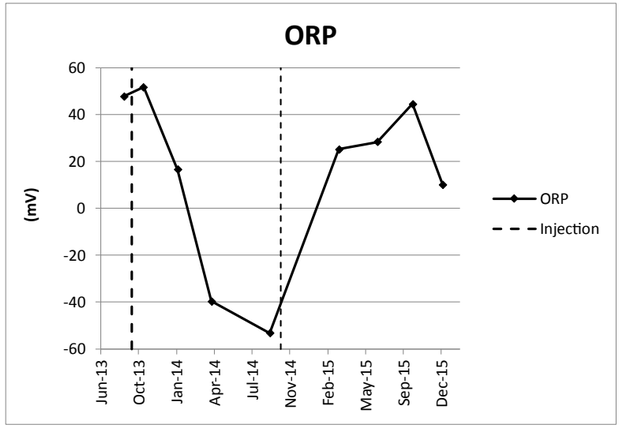
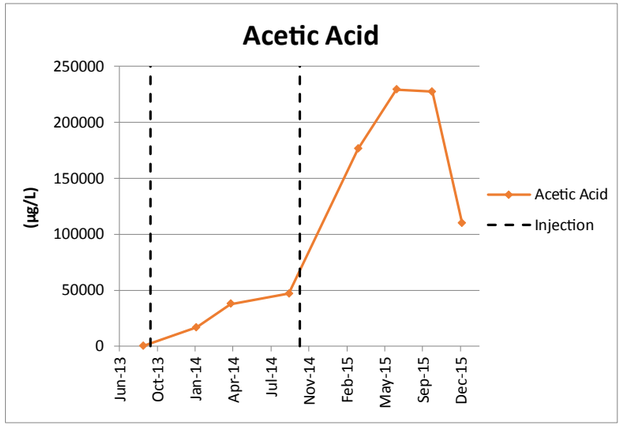
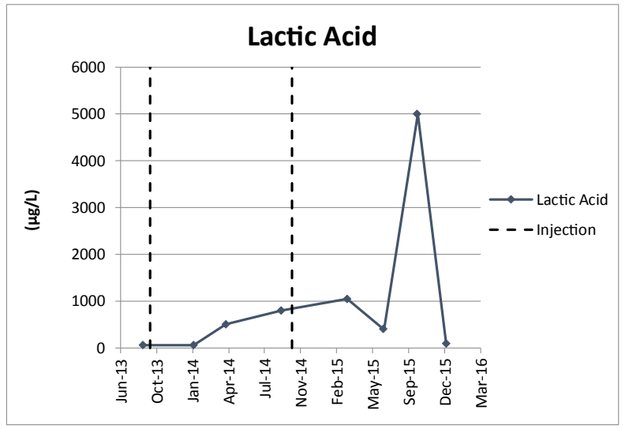
CHLORINATED ALIPHATIC HYDROCARBON CONCENTRATION TRENDS

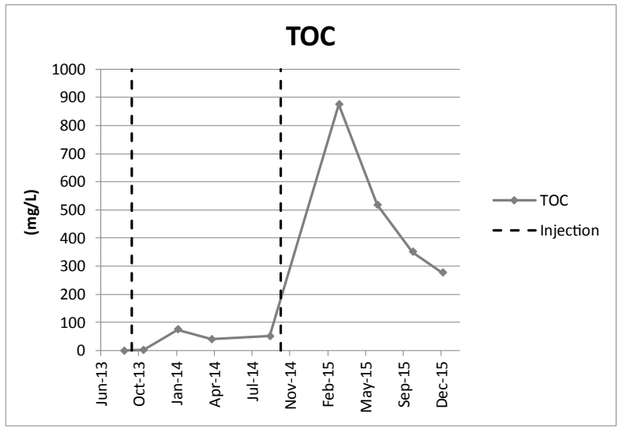
Treatability Study Report
DA089 Armored Vehicle Maintenance Area
Joint Base Elmendorf-Richardson, Alaska

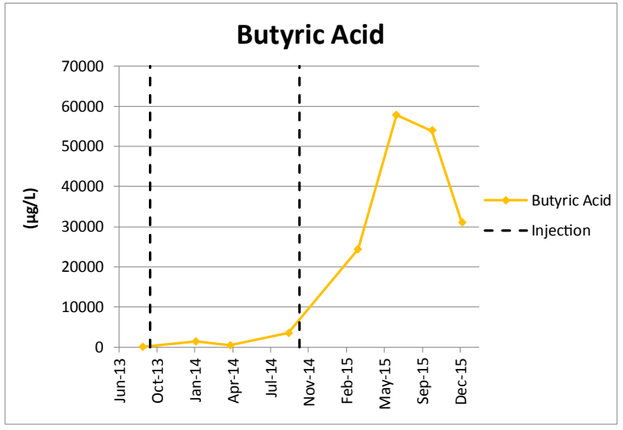
Figure
4-2

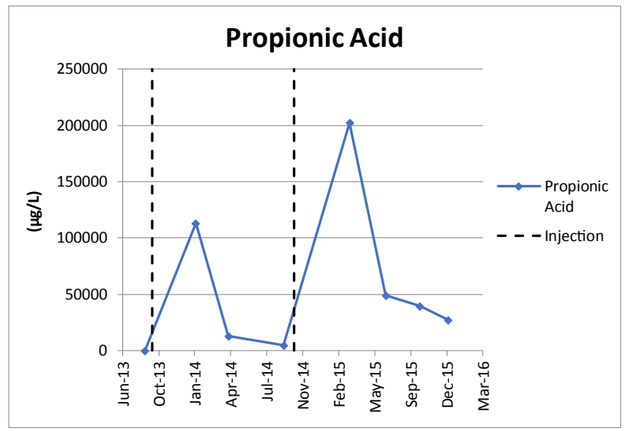


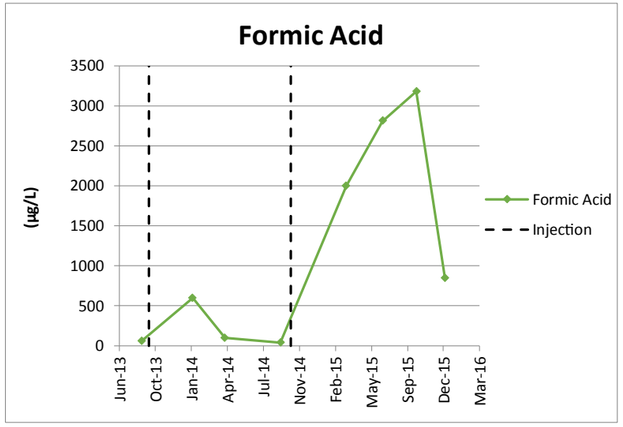


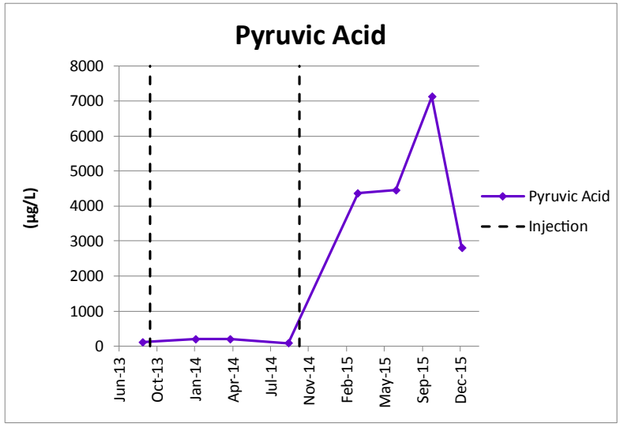












NOTES:

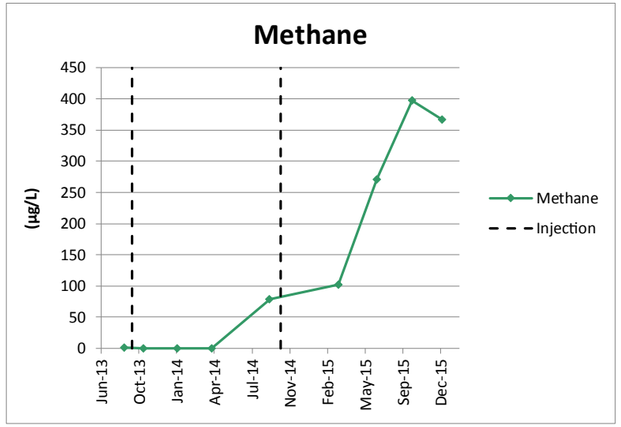
µg/L	microgram(s) per liter
mg/L	milligram(s) per liter
mV	millivolt(s)
ORP	oxidation-reduction potential
TOC	total organic carbon

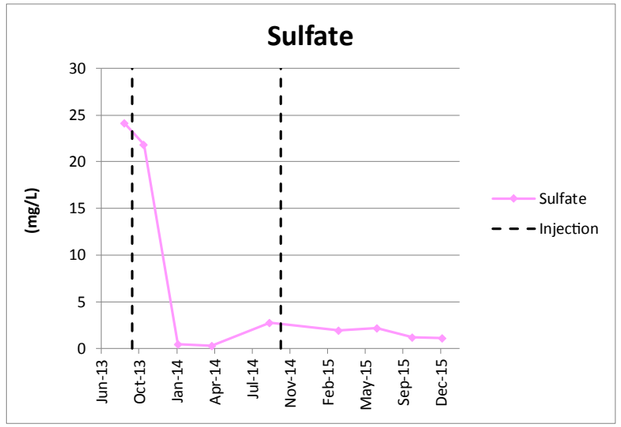
ES062612224557SAC DA089_Figure_4-3_V4.ai tdaus 5.18.2016

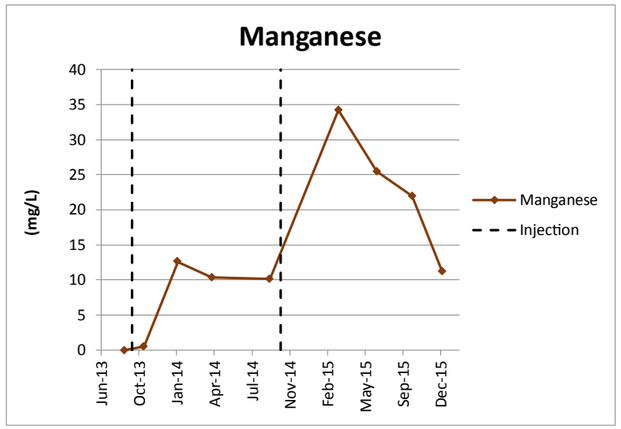
GEOCHEMICAL PARAMETER CONCENTRATION TRENDS

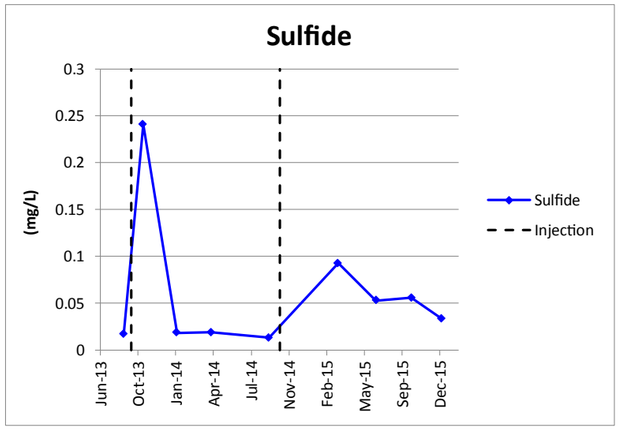
Treatability Study Report
DA089 Armored Vehicle Maintenance Area
Joint Base Elmendorf-Richardson, Alaska

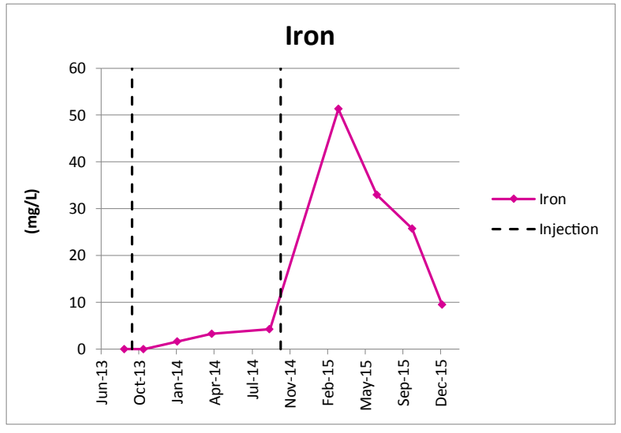
Figure
4-3

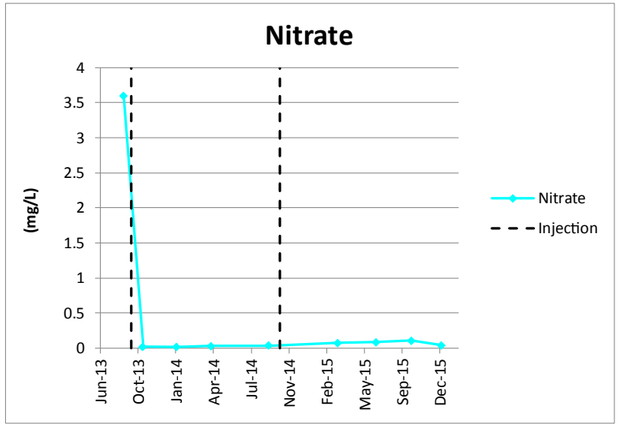












NOTES:

µg/L	microgram(s) per liter
mg/L	milligram(s) per liter

ES062612224557SAC DA089_Figure_4-3_V4.ai tdaus 5.18.2016

GEOCHEMICAL PARAMETER CONCENTRATION TRENDS

Treatability Study Report
DA089 Armored Vehicle Maintenance Area
Joint Base Elmendorf-Richardson, Alaska

Figure
4-3 Cont.

Appendix A
Field Documentation

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Appendix A-1
Field Notes

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10/16/13 Wednesday — M Oakley & J. Braun — JBER GW LTM — 50° F Overcast & Wind

0830 - Monica & Joel met at CG039 Poleline Rd. Joel previously calr equipment.
0900 - Set up on AP-4551.
1020 - Collect 13Q4CG039-AP4551-GW-0 for E300M, E376.4, E310.1, E353.2 E376.1, RSK-175, SW6020A-Diss, SW8260C, SW9060
1100 - Decon Pump. Set up on AP-3983R.
1145 - Collect 13Q4CG039-AP3983R-GW-0 for E300M, E375.4, E310.1, E353.2, E376.1, RSK-175, SW6020A-Diss SW8260C, SW9060
1230 - Decon Pump & Collect EB: 13Q4CG039-GWEB01 for E300.0, E353.2, RSK-175, SW6010B-Diss, SW8260C
1250 - Pack up gear and move to DA085
1315 - set up on AP-4413.
1410 - Collect 13Q4DA085-AP4413-GW-0 for E300.0, E310.1, E353.2, E376.1, RSK-175, SW6010B-Diss, SW8260C, 9060

Scale: 1 square = _____

10/16/13 (cont'd) — H. Oakley & J. Braun — JBER GW LTM — 50° F Lt Rain + Wind

Also collect:
13Q4DA085-AP4413-GW-0MS
13Q4DA085-AP4413-GW-0SD
1415 - 13Q4DA085-AP4413-GW-1
1500 - Decon Pump and collect EB: 13Q4DA085-EB01-GW-0 for E300.0, E353.2, RSK-175, SW6010B-Diss, SW8260C, E376.1 and SW9060.
1530 - Pack up gear. Drop off ~10 gallons purge water @ POL Yard.
Drop off pump, decon tubes, compressor, controller, HACH, Fe Ampules at CH2M Hill job trailer. Dedicated tubing also placed in conex #1.
1545 - Switch out Petro-Sock @ AP-
1600 - Off base for day.

Monica Oakley
10-16-13

Scale: 1 square = _____

Rite in the Rain

JBER LTM
AUMA DA089

1/13/14

Scope - Sample T.S. wells @ DA089.
Staff - J. Braun + H. Oakley (Aktrue)
Weather - Overcast ~18°F.
1015 - J. Braun & H. Oakley meet Jen Frame (CH2M Hill) @ DA089 site for H&S briefing
1030 - Set up on AP-413.
Controller for QED bladder pump freezes up. Connections are drained out to wastes.
1200 - Thaw out equip. and try again.
1330 - YSI flow cell is not holding water.
1500 - Pack up gear & depart site. Will work @ office to troubleshoot equip problems.
EOD

Monica Oakley
1/13/14

JBER LTM
AUMA DAC89

1/14/14

Scope - Sample AP-4413 @ DAC89
Staff - J. Brann & M Oakley (Alitna)
Weather - Overcast 20°F.
0900 - Pack up gear and crash to site.
1000 - M Oakley & J. Brann onsite.
Set up QED Bladder pump & YSI on AP-4413
1115 - Collect sample:
1401DAC85-AP4413-GW-0 for SO4 VFA, Alkalinity, Nitrate, Sulfide, Diss. Gases, Fe & Mn, VOC, TOC & Field test for ferrous iron.
→ (Ten Frame bring preserved amber bottles for TOC).
11.30 - Decon Pump.
1200 - Drop off water @ POL Storage Yard ~ 4 gal purge + decon water.
1230 - Change out Petro sock @ TU058 - AP-5007. No staining observed. Very Faint odor. Flip sock.
1300 - Arrive @ TU03. Change out & replace socks in AP-3875 and AP-5013. Both have POL odor & staining.
Attempt to locate AP-5014 but

1/14/14 (cont'd)

buried beneath ~ 4' of ice and cannot locate.
1400 - Arrive @ TU01.
AP-3876 → Flip Sock. POL odor & stain on one side.
AP-3794 → Change sock.
Strong POL odor and Brown sludge-like material.
AP-3796 → Change sock.
POL odor & slight staining
AP-3885 → Change sock.
Strong POL odor & black/brown sludge.
1500 - Drop off Petrosocks to Hazmat Facility on Elmendorf.
Demob from base.
EOD.

Unsigned Oakley 1/14/14

JBER LTM
DA089

4/14/13

Scope - Collect GW samples @ DA089 for 3rd Quarterly sampling.
Staff - M. Oakley & L. Hess
Weather - Clear & 40°F
0845 - Calibrate YSI & Turbidimeter.
1000 - Meet Jenn Frame (CH) @ DA089 site. Conduct H&S briefing
1030 - Set up on AP-4413.
Jenn Departs site
1130 - Collect 1402DA089-AP4413-GW-0
1135 - Collect FD 1402DA089-AP4413-GW-0 for E300.0 & E300.0M, E310.1, E353.2, E376.2, RSK-175, SW6010B-DISS, SW8260C, SW9060
HACH field test Fe = 3.18 mg/L
1230 - Decon pump. Drop off purge DW @ JBER POL Yard
1330 - EOD

4/14/14

JBER LTM
CG039

4/15/14

Scope - GW sampling @ Poleline Rd CG039
Staff - M. Oakley, L. Hess, J. Brenn (Antea)
Weather - AM Rain & Overcast & Clearing in afternoon.
0900 - Calibrate YSI, turbidimeter.
0945 - Mob to Poleline Rd. Meet Jenn Frame at driveway into Poleline Rd site & conduct H&S briefing.
1015 - Snowshoe & pull sleds to MW's.
1045 - Set up on AP-3983R & begin purging. Tubing coated in black. Water is relatively clear w/ a few black pieces/sediment.
1125 - Collect 1402CG039-AP3983R-GW-0 for E300.0 & E300.0M, E310.1, E353.2, E376.2, RSK-175, SW-6010 DISS, SW8260C, SW9060
Field HACH Fe = 3.30 mg/L (limit)

Chenny Oakley

DURA Rite WATERPROOF

JBER GW LTM | TREAT STUDY 9|15|14

↳ collect MSD sample 14Q3DA089-AP4413-GW-QSD

1305 - Collect DUP sample 14Q3DA089-AP4413-GW-1

+ PRIMARY SAMPLED FOR:
- Sulfate, VFA
- Alkalinity
- nitrite/nitrate
- Sulfide
- methane, ethane, ethene
- Diss. Fe & Mn
- VOCs
- TOC ~~VOC~~ (UF)

+ MS|MSD & FD SAMPLED FOR:
- Sulfate
- nitrite/nitrate
- methane, ethane, ethene
- VOCs

* Ferrous Iron yield test = 2.98 mg/L

1410

~~1420~~ (UF) - Decon pump. ~~Retu~~ (UF)

1420 - CONDUCT Water Level Survey for DA089

DA089 Water Level Survey

DATE	TIME	Well ID	DTW (ft bgs)	TD (ft bgs)	NOTES
9|15|14	1205	AP-4413	71.91	76.55	—
	1042	AP-4342	97.10	102.30	—
	1422	AP-4411	68.02	72.80	Access requires check in w/ Bldg. 732 manager
	1430	AP-3534	106.21	140.30	—
	~~1432~~ (UF) 1435	AP-3468	106.64	116.30	—
	1440	AP-3870	95.98	111.36	Needs new outer casing cap
	1448	AP-3774	103.09	117.90	Needs PVC to be cut & re-surveyed
	1447	AP-3871	107.01	122.13	—
	1500	AP-4341	63.92	69.00	—
	1505	AP-3893	84.61	125.90	Replaced lock

1515 - return to field office. Demobe from DA089 sampling effort

1535 - Collect Equipment Blank sample 14Q3DA089-GWEB01 for:
- AK101
- AK102
- Chloride/sulfate/VFA
- Alkalinity
- nitrite/nitrate
- Diss Fe & Mn
- VOCs
- TOC

1600 - ML offsite

10/14/14 AVMA EVO INJECTIONS JBER 458958.09.LC.02

SITE PERSONNEL: ANDREW CASTOR - SITE MANAGER / FIELD TEAM LEAD / NOTES
CH2M HILL JENN FRAME - SITE SAFETY COORDINATOR / FIELD QUALITY MANAGER

* QTY of MIXTURE OF EVOs CONFIRMED UPON ITS ARRIVAL 10/13/14 FQM ✓ qmf 10/14/14

830 A. CASTOR AND J. FRAME ARRIVE AT FIELD TRAILER.

900 REVIEW AHAs AND HEALTH AND SAFETY PLAN. CONDUCT PRE TASK SAFETY MEETING.

930 CALIBRATE YSI WATER QUALITY METER AND LOAD EQUIPMENT

1030 MOB TO AVMA. MEASURE WATER LEVELS. REVIEW ROUTE TO HOSPITAL / EMERGENCY CONTACTS

PRE INJECTION WATER LEVELS. SITE CONDITIONS AS EXPECTED FQM ✓ qmf 10/14/14

~~TW04-4413~~	DTW (TOC) (FT)	TD (TOC) (FT)	PID (PPM)	WELL HEAD SPACE	NOTES
IW04-4413	—	72.45	0.0	DRY	COARSE SAND ON PROBE
IW03-4413	72.41	72.45	0.0		
RO1-4413	71.55	73.00	0.0		
IW02-4413	—	70.83	0.0	DRY	
IW01-4413	71.42	74.11	0.0		
AP-4413	71.94	75.10	0.0		
AP-4412	103.68	128.00	0.0		
AP-4341	63.89	67.90	0.0		
AP-4342	96.97	102.33	0.0		

1120 PRE INJECTION WATER QUALITY MEASUREMENTS COLLECTED FROM BAILER

~~AP-4413~~ Well ID	°C TEMP	mS/cm COND	mV ORP	PH	DO mg/L	NTU TURB	
~~AP-4413~~ AP-4413	5.93	0.682	~~-101.3~~	6.93	~~2.62~~	42.2	
IW01-4413	5.78	0.560	-78.4	6.95	2.60	58.6	
RO1-4413	5.87	0.689	-92.1	6.95	1.56	444	GRAY
IW03-4413	NO MEASUREMENTS - INSUFFICIENT WATER						
IW02-4413	NO MEASUREMENTS - INSUFFICIENT WATER						
IW04-4413	NO MEASUREMENTS - INSUFFICIENT WATER						

1240 PERFORM BUCKET TEST TO CHECK CALIBRATION OF FLOW METER
AFTER FILLING 5 GALLON BUCKET FLOW METER READ 4.9 GALLONS

1245 BEGIN INJECTING INTO IW01-4413 AT ~30 GPM

TIME	TOTALIZER (Gals)	EVO VOL ON TOTE (GAL)	GPM	PSI	EVO INJECTED (GAL)Δ
1300	400	*	31.5	0	—
1321	1050	*	31.1	0	—
1345	1800	*	31.1	0	—
1405	2338	170	31.1	0	94
1425	3045	135	31.1	0	129
1515	4575	75	30.8	2	189
1522	4810	64	—	—	200

1535 MOVE INJECTION HOSE TO IW03-4413 TO BEGIN INJECTION

1530 BREATHING ZONE MONITORING = 0.0 PPM

* COULD NOT READ GRADUATIONS ON TOTE - INJECTION SYSTEM IN THE WAY.
Δ EACH TOTE CONTAINS 264 GALLONS TO BEGIN WITH

10/14/14

10/14/14

AVMA EVO INJECTIONS

MONITORING

TIME	WELL ID	°C TEMP	ms/cm COND	m/v ORP	pH	mg/L DO	NTU TURB	WELL INJECTED
1330	R01-4413	5.89	0.658	-93.9	7.16	2.64	102	IW01-4413
1435	R01-4413	6.31	0.614	-89.2	7.28	2.26	NA	IW01-4413

WATER LEVELS (TOC) Ft

INJECTION WELL	TIME	IW01-4413	IW02-4413	IW03-4413	IW04-4413	R01	AP-4413
IW01-4413	1350	—	70.90	72.05	DRY	71.05	71.30
IW01-4413	1430	—	69.82*	72.02	DRY	70.96	71.23
IW03-4413	1540	70.97	70.83	—	72.82	70.46*	71.20*
	1610	AP-4342	DTW = 96.97				
	1715	AP-4412	DTW = 103.65	NO HYDRAULIC CONNECTION			

* FIRST VISUAL BREAKTHROUGH OF EVO - MILKY WHITE. NO MORE MONITORING FOR WATER QUALITY PARAMETERS TO AVOID GETTING EVO ON PROBES.

10/14/14

10/14/14 AVMA EVO INJECTIONS

1530 BEGIN INJECTING AT IW03-4413 WITH 64 GALLONS OF EVO IN TOTE

TIME	TOTALIZER (GAL)	EVO IN TOTE (GAL)	CAM	PSI	EVO INJECTED (GAL)
1535	200	60	20	13	4
1555	560	55	23		9*

* INJECTION SYSTEM WAS PULLING AIR AND NOT EVO

1635	1637	10	23	20	54
1647	1878	0	—	—	64

1700 STOP INJECTING FOR TODAY AFTER FINISHING EVO IN 2 TOTE. FLUSH SYSTEM AND IW01-4413 WITH 325 GALLONS OF WATER

1715 ROLL UP HOSES AND PICK UP MATERIALS AT SITE. WILL FINISH INJECTING AT IW03-4413 TOMORROW. LOCK ALL WELLS.

1730 DEPART SITE. TAKE PURGE WATER (~1 GALLON) TO ~~POLARIS~~ AND TAKE EQUIPMENT TO FIELD TRAILER.

FQMR 10/15/14 JWS

10/14/14

10/15/14 AVMA EVO INJECTIONS 457958.09.LC.02

CH2M HILL PERSONNEL: ANDREW CASTOR - SITE MANAGER / FTL / NOTES
JENN FRAME - SSC / FOM

RESUME INJECTING AT IW03-4413, BEGIN INJECTING IW02-4413, IW04-4413

800 ARRIVE AT FIELD OFFICE. LOAD INJECTION SYSTEM

820 MOB TO AVMA. CONDUCT HEALTH AND SAFETY MEETING, HALLOM TRAINING

830 SET UP INJECTION SYSTEM

840 TAKE WATER LEVEL MEASUREMENTS, NO WATER QUALITY READINGS BECAUSE MONITORING WELLS HAVE EVO IN THEM. TOC DEPTH TO WATER MEASUREMENTS BELOW

INJECTION WELL	TIME	TOC(FT) IW01	TOC(FT) IW02	TOC(FT) IW03	TOC(FT) IW04	TOC(FT) R01	TOC(FT) AP-4413	TOC(FT) 4412	TOC(FT) 4341	TOC(FT) 4342
INITIAL	845	71.38	DRY	72.36	DRY	71.52	71.89	103.68	63.89	96.98
IW03-4413	1040	71.03	70.72	—	72.13*	70.24	71.19	N/A	N/A	N/A
IW02-4413	1130	70.75	—	71.67	72.47	70.60	71.24	103.70	N/A	N/A
IW12-4413	1230	70.72	—	71.61	72.42	70.59	71.15	N/A	N/A	N/A
IW04-4413	1345	71.30	DRY	71.30	—	70.85	71.36	10368	N/A	N/A
~~N/A~~ FINAL	1550	70.89	DRY	71.54	72.20	70.89	71.37	103.68	63.89	96.98

* BREAKTHROUGH AT WELL - FIRST OCCURENCE

900 BEGIN INJECTING INTO IW03-4413. NEW FULL TOTE 264 GAL. 187B GAL / 64 GAL EVO FROM YESTERDAY

TIME	TOTALIZER (GAL)	EVO IN TOTE (GAL)	GPM	PSI	EVO INJECTED (GAL)
927	630	231	26.9	15	33

940 CALIBRATE PID, 100 ISOBUTYLENE. BREATHING ZONE = 0.0 PPM

956	1400	197	26.7	15	67
1032	2350	153	26.4	18	111
1047	2745	135	—	—	129
TOTAL	4623				193

1052 BEGIN INJECTING AT IW02-4413. 135 GAL EVO REMAINING IN TOTE AT BEGINNING OF INJECTION.

TIME	TOTALIZER (GAL)	EVO IN TOTE (GAL)	GPM	PSI	EVO INJECTED (GAL)
1127	836	90	33.6	0	45
1205	2135	20	34.0	0	115
1220	2614	0	34.1	0	135

CHANGE EVO TOTE. FULL 264 GAL IN TOTE

1240 BREATHING ZONE = 0.0 PPM

1304	4002	190	—	0	209

1304 FINISH INJECTING AT IW02-4413.

10/15/14

10/15/14 AVMA EVO INJECTIONS

1305 BEGIN INJECTING IN IW04-4413. 190 GALLONS OF EVO IN TOTE

TIME	TOTALIZER (GAL)	EVO IN TOTE (GAL)	GPM	PSI	EVO INJECTED (GAL)
1330	720	150	33.7	0	40
1350	1440	110	33.2	0	80
1430	2780	37	33.2	0	153
1500	3803	0	—	0	190

1500 FINISH INJECTING AT IW04-4413. BEGIN FLUSHING WELLS IW04-4413, IW03-4413, AND IW02-4413.

1510 FINISH FLUSHING W/ 250 GALLONS OF WATER AT IW04-4413

1525 FLUSH IW03-4413 WITH 250 GALLONS OF WATER

1540 FLUSH IW02-4413 WITH 250 GALLONS OF WATER

1600 TEAR DOWN INJECTION SYSTEM AND PACK UP EQUIPMENT. LOCK ALL WELLS.

1630 DEPART SITE AND TAKE EQUIPMENT BACK TO FIELD TRAILER.

FQM ✓
10/15/14

10/15/14

JBER 2015 1st Qrt DA089 Treat Study Sampling 3.17.15

0900 - Annika Seay (AS) and Michael Landon (ML) arrive at the CH field office. Begin loading the van with equipment for the day. temp: 26.6°F, Slight wind (1.1 mph NNE), clear

0915 - Calibrate the YSI, turbidimeter, colorimeter. Check pump to see if bladder needs to be changed - it is clean.
- Site DA089
- Task / Activity for the day: Groundwater sampling at 1 well (AP4413)
- Personnel: Annika Seay (geologist, logbook scribe, qualified sampler)
Mike Landon (field technician AS and qualified sampler)
- PN: 457958.09.LC.02

1000 - Hold Health and Safety tailgate briefing ~~via tc~~ AS with Site Manager Jennifer Ulrich-Frame (via telephone). Discuss the activity for the day, including ferrous iron testing, the work plan sample table, labels, COC, shipping instructions, and equipment shipment return this evening.
Health and Safety topics discussed include:
- slips / trips / falls
- heavy lifting
- working behind an active building has the potential for pedestrian and/or vehicular traffic.
- wooded area behind wells, look for any animals that may be around. Bear spray and deterrant horn will be kept on site.
- wear PPE
- stay hydrated; it is a little more sunny today

1100 - Depart field office, stop for water at gas station, arrive at site DA089.

1105 - Begin setup at DA089-AP4413 take (DTW) WL and TD:
- DTW = 72.49' bgs
- TD = ~~78.70' bgs~~ AS 76.6' bgs
(did a TD retake after comparison to historical TD measurements)

1123 - Set pump 2 ft off of the bottom of the well (~76.6' bgs) and turn pump on. Did pressure check on tubing - getting good pressure.

1129 - got water. Take turbidity reading. It is at 53.9 NTU One more reading will be taken before parameter collection

1135 - turbidity taken, reading at 16 NTU. Hook up YSI and AS

JBER 2015 1st QTR DA089 Treat Study Sampling 3.17.15

Begin parameter collection. Flow rate is 0.05 gpm. Starting parameter DTW = 72.59' bgs.

1145 – parameter documentation begins. See Well purge and sampling field sheet.

1205 – Parameters stable. Set up for sample collection.

1210 – Collect sample 15Q1DAØ89-AP4413-GW-Ø for:

- E300.0 Sulfate, Chloride
- E300.0M VFA
- E310.1 Alkalinity
- E353.2 Nitrate + Nitrite
- E376.2 Sulfide
- RSK-175 Diss Gases
- SW6010B-DISS Fe and Mn
- SW8260C VOC
- SW9060 TOC
- Ferrous Iron

Collect samples 15Q1DAØ89-AP4413-GW-ØMS and 15Q1DAØ89-AP4413-GW-ØSD for same parameters as above, except Ferrous Iron.

1215 – Collect Sample DUP 15Q1DA089-AP4413-GW-1 for same parameters as 15Q1DAØ89-AP4413-GW-0 except for Ferrous Iron. 2 VOAs only for SW8260C due to broken VOA.

Late entry: trip blank 15Q1DAØ89-GW-TBØ1 at Ø9ØØ

133Ø – Sample collection complete. Note: as sampling progressed, an odor was observed, a faint cooking oil smell. Some sample VOAs were unable to have headspace eliminated ~~and~~ At ~~Begin packing up site and heading back to the field office.~~ As The groundwater became a yellowish color as sampling progressed and some specks (white in color) were observed floating in the water. These observations were not made during ~~sampling~~ well purge.

Begin packing up site and heading back to the field office

1545 – drop purge water at POL Yard, label drum it is transferred into.

1600 – arrive at field office. Decon equipment and ready samples for shipment. Bladder pump is changed in pump.

1645 – ML departs field office to ship Samples. AS departs field office for CH ANC office to prep Equipment to ship to warehouse.

1800 – End of day.

3.17.15

JBER 2015 2nd Quarter DA089 Treatability Study Sampling 6.25.15

1550 – Annika Seay (AS) and Kristen Stevens (KS) arrive at the site to begin set up for ground water sampling.
- Site: DA089
- Task/Activity for the day: groundwater sampling at 1 well (AP4413)
- Personnel: Annika Seay (geologist, logbook scribe, qualified sampler)
Kristen Stevens (field technician, qualified sampler)
- PN: 457958.09.LC.02

1640 – DTW = 72.65 ~~bgs~~ BTOC; 72.95' bgs from top of the well
~~TD~~ AS = 69.92' bgs (subtracted height of casing)
TD = 75.50' bgs (BTOC) at DA089-AP4413

1653 – AS mobes to CH field office to retrieve tubing for flo-through cell

1715 – AS back on site. Set well ~1 ft off bottom of the well

1720 – Start pump. Do pressure check on tubing. Getting good pressure

late entry 1600 – Hold health and safety briefing. Discuss:
- Potential for vehicular and pedestrian traffic by site
- Wildlife potential (site near wooded area)

1725 – got water ~~turbidity~~ turbidity = 2.45 NTU

1735 – AS returns to field office to retrieve supplies

1820 – Pack up site for the day. Cannot obtain equipment until tomorrow. AS and KS will meet up in the morning to complete sampling.

1830 – Pack up site; drop off equipment at CH field office. Mobe to CH ANC office

1930 – End of day.

Annika Seay 6.25.15

JBER 2015 2nd Qtr DA089 Treatability Study Sampling 6.26.15

0800 – Annika Seay (AS) arrives at CH ANC office. Communicates with Kristen Stevens (KS) who is at TIT Environmental picking up supplies. AS prepares for the day.

0900 – AS and KS depart CH ANC office for JBER.

0920 – Turned away from Ft Richardson gate and redirected to Post Road (Ship Creek) gate for work truck inspection.

0940 – Arrive at Post Road gate. Very long wait for inspection. Personnel informed AS and KS that this is the new protocol for work truck inspection (as of 1 June 2015)

1000 – got through security. Mobe to CH field office on Ft Rich side

1045 – arrive at CH field office. Calibrate YSI (see calibration form) and pack van for work. Hold health and safety briefing (see daily form)

1205 – depart CH field office for site.

- Site: DA089
- Task/Activity for the day: groundwater sampling at 1 well (AP4413)
- Personnel: Annika Seay (geologist, logbook scribe, qualified sampler)
  Kristen Stevens (field technician, qualified sampler)

Weather: 58°F, light rain, winds from WSW @ 8 pm

1230 – Arrive on site. Set up at DA089-AP4413

1240 – DTW = 72.65 ft bgs (from TOC); 72.95 ft bgs from top of well; 69.92 ft bgs
TD = 75.50 ft bgs (from TOC)

1250 – Start pump. Do pressure check on tubing. Pressure OK. Pump is ~1 ft above bottom of well.

1300 – Water is produced from well. Take turbidity reading. Turbidity = 197 NTU allow well to purge longer (~5 min) and retake turbidity reading
Water is slightly murky, brown-tinge

1315 – take turbidity reading. Turbidity = 48.7 NTU
Hook up YSI

1325 – Begin taking water quality measurements. WL = 72.71' ft bgs (BTOC)
turbidity = 15.8 NTU

1350 – parameters stable. Set up for sample collection.

*WL	pH	Cond mS/cm	turbidity	DO (mg/L)	Temp (C)	ORP (mV)
72.71'	6.39	1.219	4.61	2.33	8.58	28.4

* ft bgs (BTOC)

Annika Seay 6.26.15

JBER 2nd Q ~~Treatability~~ AFS - DA089 Treatability Study Sampling 6.26.15

1355 - Collect sample 15Q2DA089-AP4413-GW-0 for:
- E300.0 Sulfate, Chloride
- E300.0M VFA
- Ferrous iron
- E310.1 Alkalinity
- E353.2 Nitrate + Nitrite
- E376.2 Sulfide
- RSK-175 Diss Gases
- SW6010B - DISS Fe and Mn
- SW8260C VOC
- SW9060 TOC

Collect sample 15Q2DA089-AP4413-GW-0MS and 15Q2DA089-AP4413-GW-0SD for same parameters as above, except ferrous iron and RSK-175 Diss Gases

1400 - Collect sample 15Q2DA089-AP4413-GW-1 (DUP sample) for the same parameters as 15Q2DA089-AP4413-GW-0 except for ferrous iron

Late entry Trip Blank 15Q2DA089-GW-TB01 @ 0900

~~1745~~ AS 1730 - Complete sampling. Pack up site. Note: the odor observed during the 1st Qtr sampling was not observed. Mobe to POL yard to drop off purge water and refuse.

1745 - Mobe from POL yard to JBER field office. Unpack equipment. Pack samples for shipping. Decon pump (note: bladder was not changed). QC paperwork. Take trash to POL yard before leaving JBER field office and mobing to CH ANC office.

2000 - Unpack van. KS is shipping samples this evening.

2020 - End of day.

2100 - Samples could not be shipped today due to courier issue. Jamie Beckett is consulted. Field team is advised to keep samples iced over weekend and ship Monday. AS will ice samples. 6.26.15

JBER JBER PBR LTM DAØ89 AVMA 9.28.2Ø18

1300 – Mike Landon (ML) picks up Annika Seay (AS) from poleline Road. Mobes to AVMA.
- Project site: DAØ89 AVMA
- Task/Activity for the day: complete groundwater sampling at the site
- Personnel: Annika Seay (geologist, qualified sampler, site safety coordinator, logbook scribe)
- Project number: 457958.Ø9.LC.Ø5

Weather: 42°F, rain
Winds variable

1320 – Arrive at AVMA. Break for lunch.
1345 – Set up at ~~CC1Ø~~ AP1 DAØ89-AP4342
DTW = 97.4Ø' bgs (from TOC), TD = 1Ø1.Ø8' bgs (from TOC)
1400 – Begin purge; pump is on. Manual pressure check passes.
1410 – water is produced. DTW = 97.64 ft bgs
1415 – DTW = 97.68 ft bgs. Turbidity is out of range. Continue to purge to clear water.
1425 – turbidity is read at 259 NTU. DTW = 97.79 ft bgs
1435 – turbidity = 99.1 NTU. Hook YSI up to flow-through cell and begin taking measurements DTW = 97.82 ft bgs (see well purge and samples sheet)
1535 – parameters stabilize

WL	pH	Cond (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp °C	ORP (mV)
97.83	7.29	Ø.527	11.4	8.85	8.Ø3	145.1

1540 – collect sample 15Q3DAØ89-AP4342-GW-Ø for analysis of:
- E35Ø.Ø (Sulfate)
- E353.2 (Nitrite/Nitrate)
- RSK175
- SW6Ø1ØB-DISS (Fe and Mn) field filtered with a Ø.45 um filter
- SW8260C

1550 – complete sampling. Decon pump. Clean up at well.
1605 – mobe to DAØ89-AP4413 Set up.
1615 – Start pump to begin purge.
1620 – GW is produced during the purge. Turbidity = 38 NTU
1630 DTW = 72.35 ft bgs (from TOC) Hook up YSI to flow-through cell
1650 – Begin taking measurements (see well purge and sampling field sheet)
1650 – parameters stabilize

WL	pH	cond (mS/cm)	turb (NTU)	DO (mg/L)	temp (°C)	ORP (mV)
72.33	6.36	1.167	4.71	1.82	6.71	44.7

AS 9.28.15

JBER AS GW JBER PBR LTM DA089 AVMA 9.28.2015

1655 – collect sample 15Q3DA089-AP4413-GW-0 for analysis of:
- E300.0 M (VFA)
- Ferrous iron field test result = 2.22 mg/L
- E310.1 E300.0 (Sulfate, Chloride, Alkalinity)
- E353.2 (Nitrate + Nitrite)
- E376.2 (sulfide)
- RSK175
- SW6010B-DISS (Fe and Mn) field filtered with a 0.45 um filter
- SW8260C
- SW9060 (TOC)

collect sample 15Q3DA089-AP4413-GW-0MS and 15Q3DA089-AP4413-GW-0SD for analysis of:
- E300.0 M (VFA)
- E310.1 E300.0 (Chloride Alkalinity, sulfate)
- E376.2 (Sulfide)
- SW9060 (TOC)

1700 – Collect sample 15Q3DA089-AP4413-GW-1 for analysis of:
- E300.0 M (VFA)
- E310.1 E300.0 (sulfate, chloride alkalinity)
- E376.2 (sulfide)
- SW9060 (TOC)

+AS

1730 – Pause during sampling to allow the well to recharge. Well has not gone dry but is slowing down during sampling.

1815 – Sample collection complete. Clean up site. Mobe to field ~~office~~ AS POL yard to drop off IDW water (decon and purge water)

1830 – ~~AS~~ IDW dropped off and labeled in poly (55 gallon). Gate was open when field team arrived; field team closed it on the way out. Mobe to CH JBER field office.

1835 – Arrive at CH JBER field office; unload samples, van. Complete paperwork.

1900 – ML leaves for the day. AS follows.
End of Day.

9.28.15

FOM ✓ GW 9/28/15

JBER DA089 AVMA Groundwater Sampling 12-16-2015

0830 - Annika Seay (AS) arrives at CH field office on JBER. Kristen Stevens (KS) en route to field office with rental vehicle. AS begins prep for the day: calibrating YSI (see calibration log) and changing the bladder in the pump.
- Project Site: DA089 AVMA
- Task/Activity for the day: groundwater sampling at AP4413
- Personnel: Annika Seay (geologist, qualified sampler, logbook scribe)
  Kristen Stevens (field technician, qualified sampler)
- PN: 457958.09.LC.02
- Weather: 14.1°F, clear

0915 - KS arrives at CH field office with the rental vehicle.

0930 - AS and KS call field team lead (FTL) Jennifer Frame (JF) for daily health and safety meeting. Discuss:
- staying warm (hand warmers, layers, etc)
- be careful of area when driving
- PPE (stay warm, stay visible)
- Stay hydrated
- Keep HACH turbidity meter dry
- Slips/trips/falls
- petro-sock change out (if able to)

0945 - Continue getting ready for sampling. DO is not calibrating correctly; AS troubleshoots and contacts FTL JF. DO read correctly on a blank (DI water) test. Note is made on calibration log that DO is not calibrating within range. Some issue with fastening the rings on the new bladder. KS troubleshoots and gets it to fit.

1130 - Van is packed and crew departs for site. Brief stop before arrival.

1200 - Arrive at AVMA. Begin set up at DA089-AP4413
Take DTW and TD: (~~from~~ at FTOC)
DTW = 72.05 ft bgs
TD = 75.36 ft bgs
Retrieve flex tubing from field office.

* Late Entry * 0900 Trip Blank 15Q4DA089-TB01 for
- SW8260C

1355 - Controller is not turning on. Troubleshoot. AS retrieves AA batteries from CH field office.

1415 - AS back on site controller is working; batteries were not changed.

1420 - Start pump

1430 - Water is produced. take turbidity = 663 NTU. Will allow water to purge.

AS 12-16-15

JBER DA089 AVMA Groundwater Sampling 12.16.2015

1435 – turbidity = 118 NTU DTW = 72.11 ft bgs
hook up to ~~YSI~~ AS flow-through cell.

1525 Begin measurements on YSI (see well purge and sampling field sheet)

~~1530~~ 1535 AS – parameters stabilize

Water level ft BTOC	pH	Cond mS/cm	Turb NTU	DO mg/L	Temp °C	ORP mV
72.15	6.61	1075	2.66	0.12	4.36	10.1

1536 – collect sample 15Q4DA089-AP4413-GW-0 for analysis of:
- E300.0M (VFA)
- E310.1 E300.0 (Sulfate, Chloride, Alkalinity)
- E353.2 (Nitrate + Nitrite)
- E376.2 (Sulfide)
- RSK-175
- SW6010B-DISS (Fe and Mn) (field filtered with a 0.45 µm filter)
- SW8260C (TOC)

Collect sample 15Q4DA089-AP4413-GW-0MS and sample 15Q4DA089-AP4413-GW-0SD for same analysis as primary except no sample for RSK-175 for either MS or SD sample. Also, note that one combined sample per MS and SD sample was collected for analyses

1535 – collect sample 15Q4DA089-AP4413-GW-1 for exact same analyses as sample 15Q4DA089-AP4413-GW-0.

1740 – During sample collection (started at time listed above) the air line lost pressure and the cycle stopped on the controller (the controller numbers continued, but the sounds indicative of the cycle stopped). AS and KS troubleshoot (check connections, check lines for holes, pull plump and inspect)

1800 – FTL JF is called and informed. She gives advice on warming the tubing in case freeze has occurred. AS and KS warm tubing and pump – retry; same problem persists. FTL JF advises to shut down for the night and return tomorrow. Note: 4 unpreserved 500mL polys have not been collected, along with all unpreserved samples.

1930 AS ~~1745~~ – The site is packed up. Mobe back to CH field office. Unpack van.

2000 – Off base. End of day.

AS 12.16.2015

JBER DA089 AVMA Groundwater Sampling 12-17-2015

0815 – Annika Seay (AS) arrives at CH field office. Begins daily prep. Kristen Stevens (KS) en route.

- Project site: DA089 AVMA
- Task/Activity for the day: complete sampling at AP4413
- Personnel: Annika Seay (geologist qualified sampler, logbook scribe) Kristen Stevens (field technician, qualified sampler)
- PN: 457958.09.LC.02
- Weather: 27.8°F, clear, winds 1 mph from SSE

0845 – KS at site. Begins pump test and loading van.

0930 – AS calibrates YSI (see calibration log) KS tests pump – all elements are working correctly.

1000 – Arrive at site, hold health and safety daily meeting. Discuss:

- parking lot at site has been plowed and is very slick
- continue to use proper lifting techniques (ergonomics)
- trash bags used to place equipment on – do not step on them as they will slide out from under you
- keep good communication

Begin set up. AS takes call from field team lead (FTL) Jennifer Franz (JF) discussing today's activity schedule.

1030 – AS takes DTW and TD measurement:

DTW = 72.05 ft bgs (FTOC)
TD = 75.35 ft bgs (FTOC)

Continue set up. Will run through YSI flowthrough cell and observe measurements as soon as pumping starts and prior to sample collection.

1050 – start pump. All equipment functioning as anticipated, running well.

1200 – parameters stable

WL	pH	mS/cm Cond	NTU turb	mg/L DO	°C temp	ORP mV
72.15	6.78	1078	7.46	0.86	5.00	0.3

Sample collection continues.
Ferrous iron = 3.25 mg/L

* 1115 late entry ~~After~~ AS 2 50 Pressure issue experienced yesterday occurred today. Moved sampling equipment to well (out of vehicle) to sample

1210 – controller box is getting too cold (it is sitting inside a bag, not directly on snow). It is moved inside the vehicle to warm up AS 12.17.15

JBER DA089 AVMA Groundwater Sampling 12.17.2015

1245 – Sample collection complete. Shut off pump. Clean up. MoLE to POL yard to drop off purge & decon waters.

1315 – purge and decon water is transferred to POL yard poly drum and labeled. AS and KS make to CH field office.

1320 – Unpack van; AS completes paperwork.

1330 – collect equipment blank 15Q4DA089-EB01 for analysis of:

- E300.0M (VFA)
- E310.1, E300.0 (Sulfate, chloride, alkalinity)
- E353.2, SW9060 (Nitrate + Nitrite)(TOC)
- E376.2 (Sulfide)
- RSK 175
- SW6010B-DISS (Fe and Mn)
- SW8260C

Note: Nitrate + Nitrite and TOC are both analyzed for in one 8-oz poly

1345 – AS ~~off site~~ AK leaves base for the day. KS stays to reice, pack, and ship samples, along with cleanup.

1720 – KS departs to ship samples.

End of Day

12.17.15

Appendix A-2
Groundwater Sampling Logs

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Groundwater Sampling Record

Project Name: JBER GW LTM
Project Location: DA085 - AVMA
Project Number:
Date/Time: 10/16/13 1315
Well ID: AP-4413
Sample No.: 13Q4DA085-AP4413-GW-0
Sampler(s): M. Oakley & J. Braun
Weather: 50°F Lt. Rain, wind

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
1315	75.44 ☐ Meas. ☐ Hist.	71.69 Initial	3.75	0.61

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☒ Submersible Pump ☐ Bailer ☐ Other:
Purge Rate: ~300 mL/min
Begin Purge: Time: 1315
End Purge: Time: 1410
Total Volume Purged: ~2 gal
Well Volumes Purged: ~3
Purge Water Disposed: ☒ 55-gal Drum POL Yard ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 1410
Sample Collection Method: ☒ Pump Type: QED Bladder Dedicated ☐ Y ☒ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☒ Alconox Wash ☒ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): gray, slightly turbid, no odor, no sheen

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
2 x 4	125mL (unpres)	☐ Glass ☒ Plastic	E300.0, E310.1
1 x 4	125mL (H_2SO_4)	☐ Glass ☒ Plastic	E353.2
1 x 4	125mL ($NaOH+ZnAc$)	☐ Glass ☒ Plastic	E376.1
6 x 4	40mL (HCl)	☒ Glass ☐ Plastic	RSK-175, SW8260C
1 x 4	125mL (HNO_3)	☐ Glass ☒ Plastic	SW6010B-Diss
2 x 4	40mL	☒ Glass ☐ Plastic	SW 9060

Notes:
0.0 ppm in well & BZ
Fe = 0.0 mg/L

Collected: 13Q4DA085-AP4413-GW-0 @ 1410
also collected: 13Q4DA085-AP4413-GW-0MS
13Q4DA085-AP4413-GW-0SD
and 13Q4DA085-AP4413-GW-1 @ 1415

Sampler Signature: M. Oakley

Date: 10/16/13 Well ID: AP-4413

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	pH	ORP (mV)	Color/ Turbidity
1328	71.72	0.25	6.97	488	2.42	7.12	59.6	378.1
1331	71.72	0.50	6.70	481	1.19	7.18	58.5	208.3
1334	71.72	0.75	6.47	479	0.74	7.25	53.8	134.4
1340	71.72	1.25	6.42	479	0.63	7.27	52.7	124.7
1343	71.72	1.5	6.42	479	0.57	7.28	52.4	120.5
1346	71.72	1.75	6.41	479	0.49	7.28	51.8	116.2

Notes :

WELL PURGE AND SAMPLING FIELD SHEET

CH2MHILL

Well ID: AP-4413

Project: AVMA : DA-089

Date: 1/14/14

Project #: 457958.09.LA.02

Start Time: 1020

Field Team: Moakley + J Braun (Ahtna)

End Time: 1145

Sample ID: 14QIDA085-AP4413-GW-0 Time: 1115 primary dup other:

Sample ID: / Time: primary dup other:

Sample ID: / Time: primary dup other:

Filtered? Y/N 0.45um/1.0um

Depth to Top of Product (FTOC):	/	Depth to Water (FTOC):	72.37
Depth to Oil/Water Interface (FTOC):	/	Total Depth (FTOC):	75.41
Casing diameter: 1 in	2 in	Water Column (Ft):	3.04
gal/Ft of casing: 0.041	(0.163)	Casing Volume (gal)	0.5
Pump Intake Depth	~74'	Screen Interval	unknown
Stable DTW (FTOC):	72.42	Measured Stickup	not measured

Method of Purging (circle one)

Pump: SUB (BLDR) PERIST OTHER:	Bailer: ~~TEFLON~~ SS OTHER: N/A
Pump Type: TEFLON Flow Rate (gpm):	Required Pulls: Bailer Vol. (gals): 0.25/ 0.33
Pump Time: QED Vol. Purged (gals):	Vol Purged (gals):

Criteria for Stable Parameters

Parameter	*Working Range*	*Stability Criteria*	*Depth to Water Stabilization*
Temperature	>0.00 °C	± 1.0 °C	Time 1100 DTW 72.42
pH	0-14	± 0.1	1050 72.42
Conductivity	0-9.99 S/m	± 3%	1050 72.42
Dissolved Oxygen	0-19.99 mg/L	± 10% or 0.2 mg/L	
Turbidity	0-800 NTU	± 10% or <10 NTU	

Instrument Observations

Round	Time	Water Level (ft BTOC)	Volume Purged (gallons)	pH	Cond (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp (C)	ORP (mV)
1	1025	72.39	0.25	6.75	608	75.51	9.33	5.04	15.3
2	1030	72.42	0.5	6.86	622	59.22	7.63	5.40	11.1
3	1034	72.42	0.75	6.98	625	37.75	8.14	5.04	27.8
4	1039	72.42	1.0	7.10	623	38.35	11.00	4.87	27.1
5	1045	72.42	1.25	7.16	620	26.83	11.43	4.64	18.6
6	1050	72.42	1.50	7.16	618	18.33	10.95	4.88	19.1
7	1055	72.42	1.75	7.13	617	16.30	10.23	4.98	16.5
8	1100	72.42	2.0	7.13	617	17.27	10.33	4.97	16.6
9									

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color:	(Clear), Amber, Tan, Brown, Grey, Milky White, Other:
Odor:	(None), Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown
Turbidity:	(None), Low, Medium, High, Very Turbid, Heavy Silts

Comments:

Fe - 1.93 mg/L

PID - 0.1 ppm

WELL PURGE AND SAMPLING FIELD SHEET

CH2MHILL

Well ID: AP-4413

Project: JBER UFM

Date: 4/14/14

Project #:

Start Time: 1040

Field Team: Arthur - Bradley, L. Hess

End Time: 1200

Sample ID: 1402DA085-AP4413-GW2-C Time: 1130 primary dup other:

Sample ID: 1402DA086-AP4413-GW2-1 Time: 1136 primary dup other:

Sample ID: Time: primary dup other:

Filtered? Y/N 0.45um/1.0um

SW6010B

Depth to Top of Product (FTOC):		Depth to Water (FTOC):	72.37
Depth to Oil/Water Interface (FTOC):		Total Depth (FTOC):	75.12
Casing diameter:	1 in / 2 in.	Water Column (Ft):	2.75
gal/Ft of casing:	0.041 / 0.163	Casing Volume (gal)	0.45 gal
Pump Intake Depth	~74'	Screen Interval	
Stable DTW (FTOC):	72.46	Measured Stickup	

Method of Purging (circle one)

Pump: SUB (BLDR) PERIST OTHER:	Bailer: TEFLON SS OTHER:
Pump Type: Teflon Flow Rate (gpm):	Required Pulls: Bailer Vol. (gals): 0.25/ 0.33
Pump Time: Vol. Purged (gals):	Vol Purged (gals):

Criteria for Stable Parameters

Parameter	*Working Range*	*Stability Criteria*	*Depth to Water Stabilization*	
			Time	DTW
Temperature	>0.00 °C	± 1.0 °C	1123	72.46
pH	0-14	± 0.1	1123	"
Conductivity	0-9.99 S/m	± 3%	1123	"
Dissolved Oxygen	0-19.99 mg/L	± 10% or 0.2 mg/L		
Turbidity	0-800 NTU	± 10% or <10 NTU		

Instrument Observations

Round	*Time*	*Water Level (ft BTOC)*	*Volume Purged (gallons)*	*pH*	*Cond (mS/cm)*	*Turbidity (NTU)*	*DO (mg/L)*	*Temp (C)*	*ORP (mV)*
1	1050	72.41	0.25	6.55	0.567	51.18	5.10	6.21	44.6
2	1052	72.38	0.75	6.74	0.533	29.62	2.58	5.87	-4.2
3	1058	72.39	1.25	6.87	0.523	17.08	3.12	5.62	-31.8
4	1103	72.39	1.75	6.90	0.520	12.69	3.34	5.58	-36.2
5	1109	72.44	2.25	6.91	0.518	5.91	2.58	5.59	-39.0
6	1117	72.46	2.5	6.93	0.515	3.41	2.40	5.61	-40.2
7	1123	72.46	2.75	6.93	0.514	3.22	2.14	5.60	-39.7
8									
9									

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: (Clear), Amber, Tan, Brown, Grey, Milky White, Other:

Odor: (None), Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown

Turbidity: (None), Low, Medium, High, Very Turbid, Heavy Silts

Comments:

Fe: 3.18 mg/L

0.0 ppm in well

WELL PURGE AND SAMPLING FIELD SHEET

CH2MHILL

Well ID: AP-4413

Project: Fort Richardson Compliance Sites GW Monitoring DA089

Date: 9/15/14

Project #: 457958.09. LC.04

Start Time: 1212

Field Team: Jennifer Ulrich & Mike Landon

End Time: 1418

Sample ID: 14Q3DA089-AP4413-GW-0 Time: 1300 (prim) dup other:

Sample ID: 14Q3DA089-AP4413-GW-0 Time: 1305 primary (dup) other:

Sample ID: 14Q3DA089-AP4413-GW-0MS Time: 1300 primary dup other: MS

SampleID: 14Q3DA089-AP4413-GW-0SD Filtered? Yes 1300 0.45um 1.0um other: MSD

Time:

Depth to Top of Product (FTOC):	N/A	Depth to Water (FTOC):	71.91
Depth to Oil/Water Interface (FTOC):	N/A	Total Depth (FTOC):	76.55
Casing diameter:	2 in. (0.163) / 4 in. 0.653	Water Column (Ft)	4.64
gal/Ft of casing:		Casing Volume (gal)	0.76
Pump Intake Depth	74.00	Screen Interval	64-74
Stable DTW (FTOC):	71.94	Measured Stickup	3ft.

Method of Purging (circle one)

Pump: SUB (BLDR) PERIST OTHER:

Pump Type: QED Flow Rate (gpm): 0.06

Pump Time: ~2hrs Vol. Purged (gals): 1.7

Bailer: TEFLON SS OTHER:

Required Pulls: Bailer Vol. (gals): 0.25/ 0.33

Vol Purged (gals):

Criteria for Stable Parameters

Parameter	*Working Range*	*Stability Criteria*	*Depth to Water Stabilization* Time	DTW
Temperature	>0.00 °C	± 1.0 °C	1235	71.94
pH	0-14	± 0.2	1240	71.94
Conductivity	0-9.99 S/m	± 3%	1245	71.94
Dissolved Oxygen	0-19.99 mg/L	± 10%	1250	71.94
Turbidity	0-800 NTU	± 10% (≥10 NTU)		

Instrument Observations

Round	*Time*	*Water Level (ft BTOC)*	*Volume Purged (gallons)*	*pH*	*Cond (mS/cm)*	*Turbidity (NTU)*	*DO (mg/L)*	*Temp (C)*	*ORP (mV)*	
1	1235	71.97	~0.5	7.29	0.647	50.7	4.96	7.4	-45.4	
2	1240	71.94	~0.8	7.31	0.640	41.1	4.67	7.5	-49.8	
3	1245	71.94	~1.1	7.32	0.634	22.6	4.51	7.5	-52.6	
4	1250	71.94	~1.4	7.32	0.628	12.7	4.39	7.4	-53.6	
5	1255	71.94	~1.7	7.31	0.623	9.77	4.56	7.1	-53.2	Sample Collection
6	1300									
7										
8										
9										

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater. Minimal draw-down achieved and measured by 1) pumping at a low rate (approximately 1 liter/ 3 minutes or 1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: Clear, (Amber), Tan, Brown, Grey, Milky White, Other:

Odor: (None) Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown

Turbidity: None, Low, (Medium) High, Very Turbid, Heavy Silts

Comments: TURB 267 NTU @ initial. Wait ~~to~~ (TO) to drop prior to connecting to YSI

* Ferrous iron ~~test kit~~ (JAR) field test collected here: = 2.98 mg/L

WELL PURGE AND SAMPLING FIELD SHEET

CH2MHILL

Well ID: AP-4413

Project: Ft. Richardson Compliance Sites GW Monitoring - DA089 457958.09.LC.02

Date: 3.17.15

Start Time: 1123

End Time: 1330

Field Team: Annika Seay and Michael Landon

Sample ID: 15Q1DAØ89-AP4413-GW-0 Time: 1210 (primary) dup other:

Sample ID: 15Q1DAØ89-AP4413-GW-1 Time: 1215 primary (dup) other:

Sample ID: 15Q1DAØ89-AP4413-GW-0MS Time: 1210 primary dup (other) MS

15Q1DAØ89-AP4413-GW-0SD Filtered? (Y)/N 0.45um/1.0um

↳ Time: 1210 other: MSD

Depth to Top of Product (FTOC):		N/A	Depth to Water (FTOC):	72.49
Depth to Oil/Water Interface (FTOC):		N/A	Total Depth (FTOC):	76.6
Casing diameter:	1 in	(2 in.) 4 in.	Water Column (Ft):	4.11
gal/Ft of casing:	0.041	(0.163) 0.653	Casing Volume (gal)	0.666
Pump Intake Depth		74.60	Screen Interval	64-74
Stable DTW (FTOC):		72.61	Measured Stickup	3 ft.

Method of Purging (circle one)

Pump: SUB (BLDR) PERIST OTHER:

Pump Type: QED Flow Rate (gpm): 0.05

Pump Time: ~2 hr Vol. Purged (gals): ~1.0

Bailer: TEFLON SS OTHER:

Required Pulls: Bailer Vol. (gals): 0.25/ 0.33

Vol Purged (gals):

Criteria for Stable Parameters

Parameter	*Working Range*	*Stability Criteria*	*Depth to Water Stabilization*	
			~~Time~~ DTW ~~DTW~~	Time
Temperature	>0.00 °C	± 1.0 °C	72.61	1150
pH	0-14	± 0.2	72.61	1155
Conductivity	0-9.99 S/m	± 3%	72.61	1200
Dissolved Oxygen	0-19.99 mg/L	± 10%	72.61	1205
Turbidity	0-800 NTU	± 10% or ≤10 NTU	72.61	1205

Instrument Observations

Round	*Time*	*Water Level (ft BTOC)*	*Volume Purged (gallons)*	*pH*	*Cond (mS/cm)*	*Turbidity (NTU)*	*DO (mg/L)*	*Temp (C)*	*ORP (mV)*	
1	1145	72.6	0.05 Ats	5.89	1.517	5.56	1.25	5.88	46.3	
2	1150	72.61	~~0.10~~ 0.75	6.03	1.503	5.09	1.01	5.63	43.7	
3	1155	72.61	~~0.15~~ 0.5 Ats	6.13	1.487	5.06	0.91	5.36	33.6	
4	1200	72.61	0.75	6.15	1.481	5.04	0.87	5.42	26.3	
5	1205	72.61	1.0	6.19	1.47	4.83	0.86	5.32	25.3	
6	1210									Sample Collection
7										
8										
9										

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or 0.1 gal/min = 12.8 oz/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: (Clear), Amber, Tan, Brown, Grey, Milky White, Other:

Odor: (None), Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown

Turbidity: None, (Low) Medium, High, Very Turbid, Heavy Silts

Comments: Turb. 53.9 NTU initially; take 1 more reading 5 min later turb = 16 NTU. Hook up YSI after this reading

During sampling, a 'cooking oil' smell was observed, along with color change (yellowish) in groundwater. Some white specks were observed in some samples.

* Ferrous iron field test collected here = ~~0.91~~ Ats 0.84 mg/L

WELL PURGE AND SAMPLING FIELD SHEET

CH2MHILL

Well ID: AP4413

Project: Ft Richardson Compliance Sites GW Monitoring – DA089 457958.09.LC.02

Date: ~~6.25.15~~ AK 6.26.15

Start Time: ~~1720~~ AK 1250

Field Team: Annika Seay and Kristen Stevens

End Time: 1730

Sample ID: 15Q2DAP89-AP4413-GW-00 Time: 1355 (primary) dup other:

Sample ID: 15Q2DA089-AP4413-GW-1 Time: 1400 primary (dup) other:

Sample ID: 15Q2DA089-AP4413-GW-OMS Time: 1355 primary dup (other) MS

15Q2DA089-AP4413-GW-OSD Filtered? Y/N (0.45um/1.0um) Time: 1355 Other: MSD

Depth to Top of Product (FTOC):		N/A	Depth to Water (FTOC):	72.65	
Depth to Oil/Water Interface (FTOC):		N/A	Total Depth (FTOC):	75.50	
Casing diameter:	1 in	(2 in.) 4 in.	Water Column (Ft):	2.85	
gal/Ft of casing:	0.041	(0.163) 0.653	Casing Volume (gal)	0.46	
Pump Intake Depth		74.5' bgs	Screen Interval	64-74 ft bgs	
Stable DTW (FTOC):		72.71' bgs	Measured Stickup	3 ft.	

Method of Purging (circle one)

Pump: SUB (BLDR) PERIST OTHER:
Pump Type: QED Flow Rate (gpm): ~0.05
Pump Time: 4hr 40min Vol. Purged (gals): ~2.0

Bailer: TEFLON SS OTHER:
Required Pulls: ~~Bailer Vol. (gals): 0.25/ 0.33~~
~~Vol Purged (gals):~~

Criteria for Stable Parameters

Parameter	*Working Range*	*Stability Criteria*	*Depth to Water Stabilization* Time	DTW (BTOC)
Temperature	>0.00 °C	± 1.0 °C	1335	72.71 ft bgs
pH	0-14	± 0.2	1340	72.71 ft bgs
Conductivity	0-9.99 S/m	± 3%	1345	72.71 ft bgs
Dissolved Oxygen	0-19.99 mg/L	± 10%	1350	72.71 ft bgs
Turbidity	0-800 NTU	± 10% or ≤10 NTU		

Instrument Observations

Round	*Time*	*Water Level (ft BTOC)*	*Volume Purged (gallons)*	*pH*	*Cond (mS/cm)*	*Turbidity (NTU)*	*DO (mg/L)*	*Temp (C)*	*ORP (mV)*
1	1325	72.71	0.05	6.37	1.242	15.8	3.51	9.45	~~5.5~~ AK 30.2
2	1330	72.71	0.10	6.38	1.238	13.2	2.93	9.14	30.0
3	1335	72.71	0.15	6.38	1.232	9.0	2.68	8.91	30.4
4	1340	72.71	0.20	6.38	1.225	7.17	2.55	8.76	30.6
5	1345	72.71	0.25	6.38	1.225	5.94	2.43	8.68	28.1
6	1350	72.71	0.30	6.39	1.219	4.61	2.~~38~~ AK	8.58	28.4
7	1355								sample collection
8									
9									

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or 0.1 gal/min = 12.8 oz/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: (Clear) Amber, Tan, Brown, Grey, Milky White, Other:
Odor: (None) Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown
Turbidity: None (Low) Medium, High, Very Turbid, Heavy Silts

Comments: Initial turbidity reading = 197 NTU @ 1300
48.7 NTU @ 1315
15.8 NTU @ 1325 begin measurements

*Ferrous iron field test collected here:
3.30 mg/L

WELL PURGE AND SAMPLING FIELD SHEET

CH2MHILL

Well ID: AP4413

Project: JBER PBR DA089 AVMA

Date: 9.28.15

Start Time: 1615

End Time: 1815

Field Team: Annika Seay and Michael Landon

Sample ID: 15Q3DA089-AP4413-GW-0 Time: 1655 (primary) dup other: NA

Sample ID: 15Q3DA089-AP4413-GW-0MS Time: 1655 primary dup (other: MS)

Sample ID: 15Q3DA089-AP4413-GW-0SD Time: 1655 primary dup (other: SD)

15Q3DA089-AP4413-GW-1 Filtered? (Y/N) 0.45um/1.0um

→ Time: 1700 (dup)

Depth to Top of Product (FTOC):			NA	Depth to Water (FTOC):	72.28
Depth to Oil/Water Interface (FTOC):			NA	Total Depth (FTOC):	75.35
Casing diameter:	1 in.	(2 in.)	4 in.	Water Column (Ft):	3.07
gal/Ft of casing:	0.041	(0.163)	0.653	Casing Volume (gal)	0.50
Pump Intake Depth			74.0	Screen Interval	64-74 'bgs
Stable DTW (FTOC):			~~72.33~~ AS	Measured Stickup	~3 ft

Method of Purging (circle one)

Pump: SUB (BLDR) PERIST OTHER:

Pump Type: QED Flow Rate (gpm): 0.03

Pump Time: 2 hr Vol. Purged (gals): 0.75

~~Bailer:~~ TEFLON SS OTHER:

Required Pulls: Bailer Vol. (gals): 0.25/ 0.33

Vol Purged (gals):

Criteria for Stable Parameters

Parameter	*Working Range*	*Stability Criteria*	*Depth to Water Stabilization*	
			Time	DTW
Temperature	>0.00 °C	± 3% or min 0.2 °C	1635	72.33
pH	0-14	± 0.1	1640	72.33
Conductivity	0-9.99 S/m	± 3%	1645	72.33
Dissolved Oxygen	0-19.99 mg/L	± 10%	1650	72.33
Turbidity	0-800 NTU	± 10% (≥10 NTU)		

Instrument Observations

Round	*Time*	*Water Level (ft BTOC)*	*Volume Purged (gallons)*	*pH*	*Cond (mS/cm)*	*Turbidity (NTU)*	*DO (mg/L)*	*Temp (C)*	*ORP (mV)*	
1	1630	72.33	0.15	6.37	1.178	19.8	2.87	7.12	26.0	
2	1635	72.33	0.30	6.33	1.178	10.2	2.36	7.00	29.0	
3	1640	72.33	0.45	6.31	1.173	4.86	2.03	6.88	35.4	
4	1645	72.33	0.60	6.34	1.169	4.73	1.84	6.79	40.4	
5	1650	72.33	0.75	6.36	1.167	4.71	1.82	6.71	44.7	
6	1655	~	~	~	~	~	~	~	~	sample
7										
8										
9										

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: (Clear), Amber, Tan, Brown, Grey, Milky White, Other:

Odor: (None) Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown

Turbidity: None, (Low) Medium, High, Very Turbid, Heavy Silts

Comments:

1620 - turbidity = 38 NTU AS

Slight 'cooking oil' ~~smell~~ odor at well when purging and during sampling

WELL PURGE AND SAMPLING FIELD SHEET

CH2MHILL

Well ID: AP-4413

Project: JBER PBR LTM Treatability, DA089 AVMA

Date: 12-16-15

Start Time: 1420

Field Team: Annika Seay and Kristen Stevens

End Time: 1245 12-17-2015

Sample ID: 15Q4DA089-AP4413-GW-0 Time: 1530 (primary) dup other: —

Sample ID: 15Q4DA089-AP4413-GW-0MS Time: 1530 primary dup (other) MS

Sample ID: 15Q4DA089-AP4413-GW-0SD Time: 1530 primary dup (other) SD

15Q4DA089-AP4413-GW-1 Filtered? Y/N (0.45um/1.0um)

→ (dup) Time = 1535

Depth to Top of Product (FTOC):			NA	Depth to Water (FTOC):	72.05
Depth to Oil/Water Interface (FTOC):			NA	Total Depth (FTOC):	75.36
Casing diameter:	1 in.	(2 in.)	4 in.	Water Column (Ft):	3.31
gal/Ft of casing:	0.041	(0.163)	0.653	Casing Volume (gal)	0.54
Pump Intake Depth			74	Screen Interval	64-74 ft bgs
Stable DTW (FTOC):			72.15	Measured Stickup	~3 ft

Method of Purging (circle one)

Pump: SUB (BLDR) PERIST OTHER:	~~Bailer: TEFLON SS OTHER:~~
Pump Type: QED Flow Rate (gpm): 0.125	Required Pulls: ~~Bailer Vol. (gals):~~ 0.25/ 0.33
Pump Time: ~5 hr Vol. Purged (gals): ~5 gal	~~Vol Purged (gals):~~

Criteria for Stable Parameters

Parameter	*Working Range*	*Stability Criteria*	*Depth to Water Stabilization*	
			Time	DTW
Temperature	>0.00 °C	± 3% or min 0.2 °C	1510	72.15
pH	0-14	± 0.1	1515	72.15
Conductivity	0-9.99 S/m	± 3%	1520	72.15
Dissolved Oxygen	0-19.99 mg/L	± 10%	1525	72.15
Turbidity	0-800 NTU	± 10% (≥10 NTU)		

Instrument Observations

Round	*Time*	*Water Level (ft BTOC)*	*Volume Purged (gallons)*	*pH*	*Cond (mS/cm)*	*Turbidity (NTU)*	*DO (mg/L)* *	*Temp (C)*	*ORP (mV)*
1	1445	72.14	~~0.125~~ 0.625 AM	6.49	1109	46.7	-0.47	3.98	-13
2	1450	72.15	0.625	6.60	1105	28.3	-0.95	3.02	-8
3	1455	72.15	1.25	6.60	1088	10.8	0.65	3.23	-7.8
4	1500	72.15	1.875	6.61	1078	8.33	0.01	4.51	-1.1
5	1505	72.15	2.5	6.61	1077	6.47	-0.14	5.19	1.6
6	1510	72.15	3.125	6.61	1080	4.74	-0.09	4.86	7.4
7	1515	72.15	3.75	6.61	1086	3.12	-0.07	4.46	5.8
8	1520	72.15	4.375	6.61	1073	2.64	-0.14	4.46	7.0
9	1525	72.15	5.0	6.61	1075	2.66	0.12	4.36	10.1

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

See back →

Sensory Observations

Color: (Clear,) Amber, Tan, Brown, Grey, Milky White, Other: a little grey at first during purge

Odor: None, Low, (Medium,) High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown

Turbidity: None, Low, (Medium,) High, Very Turbid, Heavy Silts

Comments:

Water had grey tint during beginning of the purge - cleared as purging continued. Turbidity at 1430 = 6063 ~~NTU~~ ft/lbs; lowered to 118 NTU at 1435

Odor present – stale cooking oil comparison

* DO did not properly calibrate before the purging began, but read a blank DI water sample within range

CH2MHILL

WELL PURGE AND SAMPLING FIELD SHEET, cntd.

Well ID: AP4413

Instrument Observations

Round	Time	Water Level (ft BTOC)	Volume Purged (gallons)	pH	Cond (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp (C)	ORP (mV)
1	1530	~							~ sample
2									
3									
4									
5									
6									
7									
8									
9									

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis

Additional Comments: (decon procedures, purge waster disposal, other)

Appendix B
Analytical Results Table

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Summary of Chemicals Detected in Groundwater: Site OUE AVMA (DA089)

Analyte	Screening Level	Screening Level Source	Location:	AP-4413																
			Sample ID:	AP-4413-13-0830-0	AP-4413-13-0830-1	13Q4DA085-AP4413-GW-0	13Q4DA085-AP4413-GW-1	14Q1DA085-AP4413-GW-0	14Q2DA085-AP4413-GW-0	14Q2DA085-AP4413-GW-1	14Q3DA089-AP4413-GW-0	14Q3DA089-AP4413-GW-1	15Q1DA089-AP4413-GW-0	15Q1DA089-AP4413-GW-1	15Q2DA089-AP4413-GW-0	15Q2DA089-AP4413-GW-1	15Q3DA089-GW-AP4413-0	15Q3DA089-GW-AP4413-GW-1	15Q4DA089-AP4413-GW-0	15Q4DA089-AP4413-GW-1
			Sample Depth (feet):	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	70.44 to 70.44	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4
			Sample Date:	8/26/2013	8/26/2013	10/16/2013	10/16/2013	1/14/2014	4/14/2014	4/14/2014	9/15/2014	9/15/2014	3/17/2015	3/17/2015	6/26/2015	6/26/2015	9/28/2015	9/28/2015	12/16/2015	12/16/2015
Metals (mg/L)																				
Iron, dissolved	NA	NA		0.025 U	**0.0173 J**	0.025 U	**0.029 J**	**1.6**	**3.26**	**3.33**	**4.27**	**4.22 J**	**51.3**	**48.6**	**32.9**	**31.9**	**25.8**	- -	**9.32**	**9.44**
Manganese, dissolved	NA	NA		**0.000387 B**	**0.000601 B**	**0.543 B**	**0.00126 B**	**12.6**	**10.2**	**10.4**	**10.1**	**9.98 J**	**34.2**	**32.7**	**25.5**	**25**	**22**	- -	**11.2**	**11.2**
VOCs (µg/L)																				
1,1,1,2-Tetrachloroethane	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,1,1-Trichloroethane	200	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,1,2,2-Tetrachloroethane	4.3	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	**0.33 J**	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,1,2-Trichloroethane	5	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,1,2-Trichlorotrifluoroethane	1,100,000	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,1-Dichloroethane	7,300	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,1-Dichloroethene	7	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	**0.16 J**	0.3 U	- -	0.3 U	0.3 U
1,1-Dichloropropene	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,2,3-Trichlorobenzene	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,2,3-Trichloropropane	0.12	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,2,4-Trichlorobenzene	70	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,2,4-Trimethylbenzene	1,800	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,2-Dibromo-3-chloropropane	0.2	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,2-Dichlorobenzene	600	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,2-Dichloroethane	5	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,2-Dichloropropane	5	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,3,5-Trimethylbenzene	1,800	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,3-Butadiene	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,3-Dichlorobenzene	3,300	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,3-Dichloropropane	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
1,4-Dichlorobenzene	75	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
2,2-Dichloropropane	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
2-Butanone (MEK)	22,000	EPA MCL		1 U	1 U	1 U	1 U	**7.69**	3.4 U	3.4 U	3.4 U	3.4 U	**69.6**	**70.9**	**46**	**46.5**	**51.8**	- -	**17**	**17.8**
2-Chlorotoluene	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
2-Hexanone	NA	NA		1 U	1 U	1 U	1 U	**0.61 J**	1 U	1 U	1 U	1 U	**22**	**24.8**	**61.9 J**	**59.1**	**132**	- -	**50**	**50.3**
4-Chlorotoluene	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
4-Methyl-2-pentanone (MIBK)	2,900	2012 ADEC Table C GW		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**0.51 J**	1 U	1 U	- -	1 U	1 U
Acetone	33,000	2012 ADEC Table C GW		1 U	1 U	**39.8**	**38**	**32.1**	**10.3**	**10.8**	**17.9**	**16.9**	**152**	**199**	**140**	**135**	**193**	- -	**62.7 B**	**73.4 B**
Benzene	5	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	**0.29 J**	**0.31 J**	**0.25 J**	- -	**0.44 J**	**0.45 J**
Bromobenzene	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Bromochloromethane	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Bromodichloromethane	80	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Bromoform	80	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Bromomethane	51	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.5 U	0.5 U	0.5 U	0.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Carbon disulfide	3,700	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	**0.48 J**	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	**0.28 J**	**0.3 J**
Carbon tetrachloride	5	EPA MCL		**0.6**	**0.55**	**0.8**	**0.69**	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Chlorobenzene	100	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Chloroethane	290	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Chloroform	80	EPA MCL		**1.02**	**0.97**	**1.02**	**0.93**	**1.14**	**0.83**	**0.85**	**0.74**	**0.79**	**2.03**	**2.17**	**3.52**	**3.55**	**3.24**	- -	**2.34**	**2.2**
Chloromethane	66	2012 ADEC Table C GW		0.25 U	0.25 U	**0.43 J**	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
cis-1,2-Dichloroethene	70	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	**0.63**	0.3 U	0.3 U	**46.1**	**45.8**	**41.5**	**45.9**	**74.3**	**76.4**	**88.4**	- -	**45.1 J**	**43.7**
cis-1,3-Dichloropropene	8.5	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Cyclohexane	NA	NA		0.25 U	0.25 U	**0.25 J**	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Dibromochloromethane	80	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Dibromomethane	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Dichlorodifluoromethane	7,300	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Ethylbenzene	700	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Ethylene dibromide	0.05	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Hexachlorobutadiene	7.3	2012 ADEC Table C GW		0.25 U	0.25 U	**0.25 J**	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Isopropylbenzene	3,700	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
m- & p-Xylene	10,000	EPA MCL		0.5 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	- -	0.6 U	0.6 U
Methyl tert-butyl ether	470	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Methylene chloride	5	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	**0.26 J**	0.3 U	**0.61**	**0.62**	**1.21 B**	- -	**0.38 J**	**0.38 J**
n-Butylbenzene	370	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
n-Hexane	NA	NA		0.25 U	0.25 U	**0.25 J**	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
n-Propylbenzene	370	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Naphthalene	730	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
o-Xylene	10,000	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
p-Isopropyltoluene	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
sec-Butylbenzene	370	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Styrene	100	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
tert-Butylbenzene	370	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Tetrachloroethene (PCE)	5	EPA MCL		**78.8**	**75.7**	**125 J**	**135**	**130**	**169**	**171**	**52.1**	**52.8**	**4.47**	**5.56**	**7.02**	**7.13**	**14.9**	- -	**23.7**	**23.2**
Toluene	1,000	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	**0.25 J**	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Total Xylenes	10,000	EPA MCL		0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.9 U	0.9 U	- -	- -	- -	- -	- -	- -
trans-1,2-Dichloroethene	100	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
trans-1,3-Dichloropropene	8.5	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Trichloroethene (TCE)	5	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	**0.32 J**	**0.31 J**	**0.3 J**	**3.94**	**4.24**	**1.48**	**1.68**	**2**	**2.14**	**4.26**	- -	**4.86**	**4.67**
Trichlorofluoromethane	11,000	2012 ADEC Table C GW		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Vinyl acetate	37,000	2012 ADEC Table C GW		0.5 U	0.5 U	0.5 U	0.5 U	0.3 U	0.3 U	0.3 U	0.5 U	0.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	- -	0.3 U	0.3 U
Vinyl chloride	2	EPA MCL		0.25 U	0.25 U	0.25 U	0.25 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	**0.42 J**	**0.54**	**2.39**	**2.42**	**3.31**	- -	**0.85**	**0.79**

Summary of Chemicals Detected in Groundwater: Site OUE AVMA (DA089)

Analyte	Screening Level	Screening Level Source	Location:	AP-4413																
			Sample ID:	AP-4413-13-0830-0	AP-4413-13-0830-1	13Q4DA085-AP4413-GW-0	13Q4DA085-AP4413-GW-1	14Q1DA085-AP4413-GW-0	14Q2DA085-AP4413-GW-0	14Q2DA085-AP4413-GW-1	14Q3DA089-AP4413-GW-0	14Q3DA089-AP4413-GW-1	15Q1DA089-AP4413-GW-0	15Q1DA089-AP4413-GW-1	15Q2DA089-AP4413-GW-0	15Q2DA089-AP4413-GW-1	15Q3DA089-GW-AP4413-0	15Q3DA089-GW-AP4413-GW-1	15Q4DA089-AP4413-GW-0	15Q4DA089-AP4413-GW-1
			Sample Depth (feet):	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	70.44 to 70.44	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4	64.4 to 74.4
			Sample Date:	8/26/2013	8/26/2013	10/16/2013	10/16/2013	1/14/2014	4/14/2014	4/14/2014	9/15/2014	9/15/2014	3/17/2015	3/17/2015	6/26/2015	6/26/2015	9/28/2015	9/28/2015	12/16/2015	12/16/2015
Dissolved Gases (µg/L)																				
Ethane	NA	NA		0.27 U	0.27 U	0.111 U	0.107 U	0.114 U	**0.0455 J**	**0.0528 J**	0.107 U	**0.0812 J**	**0.346**	**0.441**	**0.193**	**0.126 J**	**0.0586 J**	- -	0.168 U	0.168 U
Ethene	NA	NA		0.27 U	0.27 U	0.12 U	0.116 U	0.123 U	**0.0645 J**	**0.0735 J**	0.116 U	**0.188 J**	**0.335 J**	**0.552 J**	0.106 U	**0.169 J**	**0.141 J**	- -	**0.823**	**0.985**
Methane	NA	NA		**0.136 B**	**0.184 B**	**0.0417 B**	**0.0436 B**	**0.109 J**	**0.198 B**	**0.218 B**	**0.0454 B**	**78.4**	**88.5**	**102**	**271 J**	**174 J**	**397**	- -	**302**	**367**
General Chemistry (mg/L)																				
Alkalinity, bicarb. (as $CaCO_3$)	NA	NA		**149**	**148**	**180**	**182**	**336**	**366**	**339**	**298**	- -	**646 J**	**910 J**	**500**	**495**	**459**	**453**	**378**	**367**
Alkalinity, carb. (as $CaCO_3$)	NA	NA		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	- -	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Alkalinity, bicarb. (as $CaCO_3$)	NA	NA		**149**	**148**	**180**	**182**	**336**	**366**	**339**	**298**	- -	**646 J**	**910 J**	**500**	**495**	**459**	**453**	**378**	**367**
Total alkalinity	NA	NA		**149**	**148**	**180**	**182**	**336**	**366**	**339**	**298**	- -	**646 J**	**910 J**	**500**	**495**	**459**	**453**	**378**	**367**
Chloride	NA	NA		**43.6**	**42.7**	**38.9 B**	0.05 UJ	**28.3**	**36.6**	**36.9**	- -	- -	**15.6**	**15.1**	**24.4**	**28.3**	**25.3**	**23.2**	**26.2**	**25.4**
Nitrogen, nitrate-nitrite	10	EPA MCL		**3.48 J**	**3.6**	**0.0195 B**	**0.0223 B**	**0.018**	**0.0325**	**0.0349**	**0.0375 B**	**0.0386 B**	**0.0799**	**0.0787**	**0.0901**	**0.0921**	**0.109 B**	- -	**0.0482**	**0.0445**
Sulfate	NA	NA		**24.1**	**24**	**21.8 B**	**4.09 B**	**0.449**	**0.29**	**0.217**	**2.72**	**2.69**	**1.83**	**1.94**	**2.2**	**1.95**	**1.18 B**	**1.04 B**	**1.13**	**1.05**
Sulfide	NA	NA		**0.017 J**	0.0142 UJ	**0.241 B**	0.015 UJ	**0.0187 J**	0.0193 U	0.0193 U	**0.0134 J**	- -	**0.0768**	**0.0926**	**0.0473**	**0.0531**	**0.0557**	**0.053**	**0.0331**	**0.0342**
Total organic carbon	NA	NA		**0.478 B**	**0.482 B**	**1.34 B**	**1.25 B**	**74.6**	**40.2**	**38.3**	**50.9**	- -	**839**	**875**	**518**	**515**	**350**	**355**	**270 B**	**277 B**
Organic Acids by IC (µg/L)																				
Acetic acid	NA	NA		60 U	60 U	- -	- -	**16500**	**37200**	**37500**	**46800**	- -	**176000**	**173000**	**216000**	**229000**	**227000 J**	**207000**	**109000 J**	**110000**
Butyric acid	NA	NA		120 U	120 U	- -	- -	**1410**	**540**	**521**	**3590**	- -	**24400**	**23700**	**57800**	**55500**	**53900**	**49200**	**30200**	**31000**
Butyric acid	NA	NA		120 U	120 U	- -	- -	**1410**	**540**	**521**	**3590**	- -	**24400**	**23700**	**57800**	**55500**	**53900**	**49200**	**30200**	**31000**
Formic acid	NA	NA		60 U	60 U	- -	- -	600 U	100 U	100 U	40 U	- -	2000 U	2000 U	**2810**	**2300**	**3180**	**3170**	**497 J**	**848 J**
Lactic acid	NA	NA		60 U	60 U	- -	- -	60 U	500 U	500 U	800 U	- -	**347 J**	**1050 J**	400 U	400 U	5000 U	5000 U	100 UJ	100 U
Propionic acid	NA	NA		60 U	60 U	- -	- -	**113000**	**12900**	**12900**	**4960**	- -	**202000**	**192000**	**48800**	**48100**	**39600 J**	**35100 J**	**27400 J**	**27300 J**
Pyruvic acid	NA	NA		120 U	120 U	- -	- -	200 U	200 U	200 U	80 U	- -	**4370 J**	**4310**	**4450 J**	**1820 J**	**7120 J**	**8570**	**1820 J**	**2810 J**

Notes:

NA = No screening level exists.

-- = sample not collected

B = The analyte was detected in the associated method and/or calibration blank.

J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.

U = The analyte was analyzed for, but was not detected above the limit of detection.

UJ = The analyte was below the limit of detection. However, the reported value is approximate.

mg/L = milligram(s) per liter

µg/L = microgram(s) per Liter

Bold indicates that the analyte was detected.

Shading indicates that the result exceeded screening criteria.

Appendix C
Data Quality Evaluation Reports

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JOINT BASE ELMENDORF-RICHARDSON – ARMORED VEHICLE MAINTENANCE AREA SITE DA089 AND POLELINE LINE ROAD SITE CG039 LONG-TERM MONITORING AND TREATABILITY STUDY OCTOBER 2013 – SEPTEMBER 2014 DATA QUALITY EVALUATION REPORT

Introduction

The objective of this data quality evaluation (DQE) report is to assess the data quality of analytical results for groundwater samples collected at the Joint Base Elmendorf-Richardson (JBER) Armored Vehicle Maintenance Area Site DA089 and Poleline Road Site CG039. Samples were collected and analyzed in support of the Preliminary Assessment/Site Investigation at this site. The data may also be used to support future activities such as feasibility studies, risk assessments, fate and transport modeling and remedial actions. Individual method requirements and guidelines from *the United States Air Force, Joint Base Elmendorf-Richardson, Alaska, Environmental Restoration Program, Basewide Uniform Federal Policy Quality Assurance Project Plan (March 2013) (*JBER QAPP) were used in this assessment.

This report is intended as a general data quality assessment designed to summarize data issues.

Analytical Data

This DQE report covers 33 primary samples, 6 field duplicates (FD), 4 equipment blanks (EB) and 13 trip blanks (TB). All samples were collected October 15, 2013 through September 15, 2014. A list of samples associated with this DQE is included in Attachment C1-1.

The Work Plan requires a collection frequency of 10 percent for FDs and 5 percent for MS/MSD sets and EBs; collection frequencies are outlined by method in Table C1-1 below. The required frequency was met for each method with the following exceptions:

- A FD and MS/MSD were not collected for Methods AK101 and AK102.
- The laboratory does not perform MS/MSD analysis for Methods E310.1 or RSK175.

Table C1-1: Percentage of FD, EB and MS/MSD Collected by Method

Method	Matrix	Count of Primary Samples	Count of FD	Percent of FD	Count of MS/MSD	Percent of MS/MSD	Count of EB	Percent of EB
AK101	Groundwater	1	0	0	0	0	1	100
AK102	Groundwater	1	0	0	0	0	1	100
E300.0	Groundwater	33	6	18	6	18	4	12
E300.0M	Groundwater	17	3	18	3	18	2	12
E310.1	Groundwater	18	2	11	0	0	2	11
E353.2	Groundwater	33	6	18	7	21	4	12
E376.2	Groundwater	18	4	22	5	28	3	17
RSK-175	Groundwater	33	6	18	0	0	4	12

Table C1-1: Percentage of FD, EB and MS/MSD Collected by Method

Method	Matrix	Count of Primary Samples	Count of FD	Percent of FD	Count of MS/MSD	Percent of MS/MSD	Count of EB	Percent of EB
SW6010B/C	Groundwater	33	6	18	6	18	4	12
SW8260C	Groundwater	33	6	18	5	15	4	12
SW9060	Groundwater	18	4	22	5	28	3	17

The sample results were reported as 12x sample delivery groups (SDG) presented in Table C1-2. The analyses were performed by Applied Sciences Laboratory in Corvallis, Oregon (CH2M HILL-Corvallis laboratory, UST-079).

Table C1-2: Sample Delivery Groups

M3042
M3043
N1080
N1081
N1694
N1695
N2614
N2617
N2648
N2655
N2664
N2692

Eleven methods were used to analyze the environmental samples. Samples were collected and shipped via overnight carrier to the laboratory. Selected samples were analyzed for one or more of the following analytes/methods in Table C1-3.

Table C1-3: Analytical Parameters

Parameter	Method
Gasoline Range Organics (GRO)	AK101
Diesel Range Organics (DRO)	AK102
Chloride and Sulfate	E300
Volatile Fatty Acids	E300.0M
Alkalinity	E310.1
Nitrate+Nitrite	E353.2

Table C1-3: Analytical Parameters

Parameter	Method
Sulfide	E376.2
Dissolved Gases	RSK-175
Iron and Manganese	SW6010B
Volatile Organic Compounds	SW8260C
Total Organic Carbon (TOC)	SW9060

The assessment of data includes a review of: (1) the chain-of-custody (COC) documentation; (2) holding-time compliance; (3) the required quality control (QC) samples at the specified frequencies; (4) method blanks; (5) laboratory control sample/laboratory control sample duplicates (LCS/LCSD); (6) surrogate spike recoveries; (7) matrix spike/matrix spike duplicate (MS/MSD) samples; and (8) initial and continuing calibration information and other method-specific criteria as defined by the JBER QAPP.

Field samples were also reviewed to ascertain field compliance and data quality issues. This included a review of FDs, EBs and TBs.

Data flags were assigned according to the JBER QAPP. Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will be only one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts.

The data flags are defined below:

- **J** = The analyte was positively identified, and the quantitation is an estimation because of discrepancies in meeting certain analyte-specific quality control criteria. Or the analyte was positively identified, but the associated concentration is estimated above the method detection limit and below the limit of quantitation (LOQ).

- **R** = The data are rejected because of deficiencies in meeting QC criteria and may not be used for decision making.

- **B** = The analyte was detected in the sample at a concentration less than or equal to five times (10 times for common laboratory contaminants) the blank concentration.

- **U** = The analyte was analyzed for, but the analyte was not detected.

- **UJ** = The analyte was not detected; however, the result is estimated because of discrepancies in meeting certain analyte-specific QC criteria.

Findings

The overall summaries of the data validation findings are contained in the following sections and Table C1-4.

Also included as documentation of data validation findings is the Alaska Department of Environmental Conservation Laboratory Data Review Checklist (Version 2.7, January 2010). A checklist is provided for each laboratory SDG and can be found in Attachment C1-2 to this DQE.

Holding Times

All holding-time criteria were met.

Calibration

All initial and continuing calibration criteria were met with one exception.

- The recovery of bromoform was greater than JBER QAPP criteria in a continuing calibration verification for Method SW8260C. All associated samples were not detected for bromoform and no data were qualified.

Method Blanks

Method blanks were analyzed at the required frequency and were free of contamination with the following exceptions:

- GRO was detected below the LOQ in a method blank for Method AK101. One associated sample result detected less than five times the blank concentration was qualified as estimated and flagged "B".

- Methane was detected below the LOQ in the method blanks for Method RSK-175. Sixteen associated sample results detected less than five times the blank concentrations were qualified as estimated and flagged "B". Sixteen associated results detected greater than five times the blank concentrations were not qualified.

- Hexachlorobutadiene was detected below the LOQ in the method blanks for Method SW8260C. Twenty-nine associated nondetected results were not qualified.

Calibration Blanks

Lactic acid was detected below and above the LOQ in the continuing calibration blanks (CCB) for Method E300.0M. One associated result detected greater than five times the blank concentrations, and 16 associated nondetected results, were not qualified.

TOC was detected below the LOQ in a CCB for Method SW9060. Three associated results detected greater than five times the blank concentration were not qualified.

Trip Blanks

Thirteen TBs were collected and were free of contamination with the following exceptions:

- GRO was detected below the LOQ in a TB for Method AK101. One associated sample result detected less than five times the blank concentration was qualified as estimated and flagged "B".

- Methane was detected below the LOQ in the TBs for Method RSK-175. Three associated sample results detected less than five times the blank concentrations were qualified as estimated and flagged "B". Eight associated results detected greater than five times the blank concentrations were not qualified.

- Acetone was detected below the LOQ in a TB for Method SW8260C. Four associated nondetected results were not qualified.

Equipment Blanks

Two EBs were collected and were free of contamination with the exceptions listed below.

- GRO was detected below the LOQ in an EB for Method AK101. One associated sample result detected less than five times the blank concentration was qualified as estimated and flagged "B".

- Sulfate and chloride were detected above the LOQ in the EBs for Method E300.0. Three associated sample results detected less than five times the blank concentrations were qualified as estimated and flagged "B". One associated sample result detected greater than five times the blank concentrations, and six associated nondetected results, were not qualified.

- Nitrate+nitrite was detected above the LOQ in the EBs for Method E353.2. Five associated sample results detected less than five times the blank concentrations were qualified as estimated and flagged "B". Twenty-one associated sample results detected greater than five times the blank concentrations, and one associated nondetected result, were not qualified.

- Sulfide was detected above the LOQ in an EB for Method E376.2. One associated sample result detected less than five times the blank concentration was qualified as estimated and flagged "B". One associated nondetected result was not qualified.

- Methane was detected below the LOQ in the EBs for Method RSK-175. Fifteen associated sample results detected less than five times the blank concentration were qualified as estimated and flagged "B". Twelve associated sample results detected greater than five times the blank concentrations were not qualified.

- Dissolved manganese and dissolved iron were detected below and/or above the LOQ in the EBs for Method SW6010B/C. Nine associated sample results detected less than five times the blank concentrations were qualified as estimated and flagged "B". Seventeen associated

sample results detected greater than five times the blank concentrations, and three associated nondetected results, were not qualified.

- Acetone, chloromethane, ethylbenzene, m,p-xylene, o-xylene, tetrachloroethene, total xylenes and toluene were detected below or above the LOQ in the EBs for Method SW8260C. Two associated sample results detected less than five times (10 times for acetone) the blank concentrations were qualified as estimated and flagged "B". Five associated sample results detected greater than five times (10 times for acetone) the blank concentrations, and 122 associated nondetected results, were not qualified.

- TOC was detected above and below the LOQ in the EBs for Method SW9060. Four associated sample results detected less than five times the blank concentrations were qualified as estimated and flagged "B". Six associated sample results detected greater than five times the blank concentrations were not qualified.

Field Duplicates

Six FD sets were collected. Precision was acceptable with the following exceptions:

- The relative percent differences (RPD) of 1,1-dichloroethene and chloroform were greater than JBER QAPP criteria in FD set 13Q4CG039-AP4550-GW-0/13Q4CG039-AP4550-GW-1 for Method SW8260C. Two associated detected results were qualified as estimated and flagged "J"; two associated nondetected results were qualified as estimated and flagged "UJ".

- The RPDs of chloride and sulfate were greater than JBER QAPP criteria in FD set 13Q4DA085-AP4413-GW-0/13Q4DA085-AP4413-GW-1 for Method E300.0. Three associated detected results were qualified as estimated and flagged "J"; one associated nondetected result was qualified as estimated and flagged "UJ".

- The RPD of sulfide was greater than JBER QAPP criteria in FD set 13Q4DA085-AP4413-GW-0/13Q4DA085-AP4413-GW-1 for Method E376.2. One associated detected result was qualified as estimated and flagged "J"; one associated nondetected result was qualified as estimated and flagged "UJ".

Matrix Spike Samples

The results of MS/MSD analyses provide information about the possible influence of the matrix on either accuracy or precision of the measurements. The field crew designated samples for MS/MSD analysis. All acceptance criteria were met with the following exceptions:

- The recovery dissolved iron was outside of JBER QAPP criteria in the MSs and or MSDs of samples 14Q3CG039-AP4550-GW-0, 14Q2CG039-AP4550-GW-0 and 14Q1CG039-AP3983R-GW-0 for Method SW6010B/C. The associated detected results were not qualified because the sample concentrations were greater than four times the spike concentrations.
- The recoveries of 1,1,2,2-tetrachloroethane and cis-1,2-dichloroethene were less than JBER QAPP criteria in the MS and MSD of sample 14Q3CG039-AP4550-GW-0 for

Method SW8260C. The associated detected results were not qualified because the sample concentrations were greater than four times the spike concentrations.

- The recovery of trichloroethene was less than JBER QAPP criteria in the MSD of sample 14Q3CG039-AP4550-GW-0 for Method SW8260C. The associated detected result was qualified as estimated and flagged "J".
- The RPD of chloroethane was greater than JBER QAPP criteria in the MS/MSD set of sample 14Q3DA089-AP4413-GW-0 for Method SW8260C. The associated nondetected result was not qualified.
- The recoveries of cis-1,2-dichloroethene, trichloroethene and 1,1,2,2-tetrachloroethane were outside of JBER QAPP criteria in the MS and MSD of sample 14Q1CG039-AP3983R-GW-0 for Method SW8260C. The associated detected results were not qualified because the sample concentrations were greater than four times the spike concentrations.
- The recovery of tetrachloroethene was greater than JBER QAPP criteria in the MS of sample 13Q4DA085-AP4413-GW-0 for Method SW8260C. The associated detected result was qualified as estimated and flagged "J".
- The recovery of hexachlorobutadiene was greater than JBER QAPP criteria in the MS and MSD of sample 13Q4DA085-AP4413-GW-0 for Method SW8260C. The associated nondetected result was not qualified.
- The recovery of TOC was greater than JBER QAPP criteria in the MSD of sample 14Q1CG039-AP3983R-GW-0 for Method SW9060. The associated detected result was not qualified because the sample concentration was greater than four times the spike concentration.
- The recovery of TOC was greater than JBER QAPP criteria in the MS and MSD of sample 13Q4DA085-AP4413-GW-0 for Method SW9060. The associated detected result was qualified as estimated and flagged "J".

Surrogates

Surrogates were added to all samples for the methods requiring their use. Surrogate recoveries met criteria.

Laboratory Control Samples

LCS/LCSDs were analyzed and all accuracy and precision criteria were met with the following exception:

- The recovery of chloroethane was greater than JBER QAPP criteria in a LCS for Method SW8260C. The associated nondetected results were not qualified.

Internal Standards

All internal standard acceptance criteria were met.

Tentatively Identified Compounds

Tentatively identified compounds were not reported.

Chain-of-Custody and Sample Receipt Discrepancies

- **SDG M3042.** No discrepancies noted.
- **SDG M3043.** No discrepancies noted.
- **SDG N1080.** The chain of custody requested Method E376.1 for sulfide; samples analyzed by equivalent method E376.2.
- **SDG N1081.** The chain of custody requested Method E376.1 for sulfide; samples analyzed by equivalent method E376.2.
- **SDG N1694.** The chain of custody was not relinquished.
- **SDG N1695.** The chain of custody was not relinquished.

The chain of custody requested Method E376.1 for sulfide; samples analyzed by equivalent method E376.2.

- **SDG N2614.** No discrepancies noted.
- **SDG N2617.** No discrepancies noted.
- **SDG N2648.** No discrepancies noted.
- **SDG N2655.** No discrepancies noted.
- **SDG N2664.** No discrepancies noted.
- **SDG N2692.** The containers for SW6010B for sample 14Q3DA089-AP4413-GW-1 and E353.2 for sample 14Q3DA089-AP4413-GW-0 were received frozen. The associated data were qualified as estimated and flagged "J".

Overall Assessment

The final activity in the data quality evaluation is an assessment of whether the data meet the data quality objectives. The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision making process. The precision, accuracy, representativeness, completeness and comparability are addressed in the JBER QAPP. The following summary highlights the data evaluation findings for the above defined events:

1. No data were rejected and completeness was 100 percent for all method/matrix/analyte combinations.
2. One hundred percent of the AK101 data were qualified due to low-level detections in the laboratory blank, TBs and EBs. The degree to which blank contamination was observed is within reasonable method expectations considering the small size of the dataset.

3. Approximately five percent of the E300.0 data, and five percent of the E376.2 data, were qualified due to low-level detections in the EBs. The degree to which blank contamination was observed is within reasonable method expectations considering the small size of the dataset.

4. Approximately nine percent of the E353.2 data were qualified due to low-level detections in the EBs. The degree to which blank contamination was observed suggests a contamination issue during sample collection.

5. Approximately 16 percent of the RSK-175 data were qualified due to low-level detections in the laboratory blanks, TBs and EBs. The degree to which blank contamination was observed suggests a contamination issue at the laboratory and/or during sample collection.

6. Approximately 11 percent of the SW6010B data were qualified due to low-level detections in the EBs. The degree to which blank contamination was observed suggests a contamination issue during sample collection.

7. Less than one percent of the SW8260C data were qualified due to low-level detections in the EBs. The degree to which blank contamination was observed is within reasonable method expectations.

8. Approximately 18 percent of the SW9060 data were qualified due to low-level detections in the EBs. The degree to which blank contamination was observed suggests a contamination issue during sample collection.

9. Two sample containers were received frozen; three results were qualified as estimated.

10. FD RPD exceedances were observed for Methods E300.0, E376.2 and SW8260C; 11 results were qualified as estimated.

11. MS/MSD recovery exceedances were observed for Methods SW9060 and SW8260C; three results were qualified as estimated.

12. Although data were qualified as estimated due to QC exceedances as noted, overall precision and accuracy of the data, as measured by field and laboratory QC indicators suggest that data are usable for projects objectives.

Table C1-4: Validation Flags

NativeID	Method	Analyte	Final Result	Units	Final Flag	Reason
13Q4CG039-AP3983R-GW-0	SW8260C	Acetone	7.58	µg/L	B	EB<LOQ
13Q4CG039-AP4550-GW-0	SW8260C	1,1-DCE	1.94	µg/L	J	FD>RPD
13Q4CG039-AP4550-GW-0	SW8260C	Chloroform	3.02	µg/L	J	FD>RPD
13Q4CG039-AP4550-GW-1	SW8260C	1,1-DCE	1.25	µg/L	UJ	FD>RPD
13Q4CG039-AP4550-GW-1	SW8260C	Chloroform	1.25	µg/L	UJ	FD>RPD
13Q4CG039-AP4551-GW-0	E353.2	Nitrate/Nitrite-N	0.0302	mg/L	B	EB<LOQ
13Q4CG039-AP4551-GW-0	RSK-175	Methane	0.364	µg/L	B	TB<LOQ
13Q4DA085-AP4413-GW-0	E300.0	Chloride	38.9	mg/L	B	FD>RPD
13Q4DA085-AP4413-GW-0	E300.0	Chloride	38.9	mg/L	B	EB>LOQ
13Q4DA085-AP4413-GW-0	E300.0	Sulfate	21.8	mg/L	B	EB>LOQ
13Q4DA085-AP4413-GW-0	E300.0	Sulfate	21.8	mg/L	B	FD>RPD
13Q4DA085-AP4413-GW-0	E353.2	Nitrate/Nitrite-N	0.0195	mg/L	B	EB>LOQ
13Q4DA085-AP4413-GW-0	E376.2	Sulfide	0.241	mg/L	B	FD>RPD
13Q4DA085-AP4413-GW-0	E376.2	Sulfide	0.241	mg/L	B	EB>LOQ
13Q4DA085-AP4413-GW-0	RSK-175	Methane	0.0417	µg/L	B	EB<LOQ
13Q4DA085-AP4413-GW-0	RSK-175	Methane	0.0417	µg/L	B	LB<LOQ
13Q4DA085-AP4413-GW-0	RSK-175	Methane	0.0417	µg/L	B	TB<LOQ
13Q4DA085-AP4413-GW-0	SW6010B	Manganese, dissolved	543	µg/L	B	EB>LOQ
13Q4DA085-AP4413-GW-0	SW8260C	Tetrachloroethylene	125	µg/L	J	MS>UCL
13Q4DA085-AP4413-GW-0	SW9060	Total Organic Carbon	1.34	mg/L	B	MS>UCL
13Q4DA085-AP4413-GW-0	SW9060	Total Organic Carbon	1.34	mg/L	B	SD>UCL
13Q4DA085-AP4413-GW-0	SW9060	Total Organic Carbon	1.34	mg/L	B	EB>LOQ
13Q4DA085-AP4413-GW-1	E300.0	Chloride	0.05	mg/L	UJ	FD>RPD
13Q4DA085-AP4413-GW-1	E300.0	Sulfate	4.09	mg/L	B	EB>LOQ
13Q4DA085-AP4413-GW-1	E300.0	Sulfate	4.09	mg/L	B	FD>RPD
13Q4DA085-AP4413-GW-1	E353.2	Nitrate/Nitrite-N	0.0223	mg/L	B	EB>LOQ
13Q4DA085-AP4413-GW-1	E376.2	Sulfide	0.015	mg/L	UJ	FD>RPD
13Q4DA085-AP4413-GW-1	RSK-175	Methane	0.0436	µg/L	B	TB<LOQ
13Q4DA085-AP4413-GW-1	RSK-175	Methane	0.0436	µg/L	B	LB<LOQ
13Q4DA085-AP4413-GW-1	RSK-175	Methane	0.0436	µg/L	B	EB<LOQ
13Q4DA085-AP4413-GW-1	SW6010B	Manganese, dissolved	1.26	µg/L	B	EB>LOQ
13Q4DA085-AP4413-GW-1	SW9060	Total Organic Carbon	1.25	mg/L	B	EB>LOQ
14Q2DA085-AP4413-GW-0	RSK-175	Methane	0.198	µg/L	B	LB<LOQ
14Q2DA085-AP4413-GW-1	RSK-175	Methane	0.218	µg/L	B	LB<LOQ
14Q3CG039-AP3744-GW-0	RSK-175	Methane	0.104	µg/L	B	EB<LOQ

Table C1-4: Validation Flags

NativeID	Method	Analyte	Final Result	Units	Final Flag	Reason
14Q3CG039-AP3744-GW-0	RSK-175	Methane	0.104	µg/L	B	LB<LOQ
14Q3CG039-AP3744-GW-0	SW9060	Total Organic Carbon	1.01	mg/L	B	EB<LOQ
14Q3CG039-AP3747-GW-0	RSK-175	Methane	0.0961	µg/L	B	EB<LOQ
14Q3CG039-AP3747-GW-0	RSK-175	Methane	0.0961	µg/L	B	LB<LOQ
14Q3CG039-AP3747-GW-0	SW6010B	Manganese, dissolved	0.000529	mg/L	B	EB<LOQ
14Q3CG039-AP3747-GW-0	SW9060	Total Organic Carbon	0.859	mg/L	B	EB<LOQ
14Q3CG039-AP3748-GW-0	RSK-175	Methane	0.0662	µg/L	B	LB<LOQ
14Q3CG039-AP3748-GW-0	RSK-175	Methane	0.0662	µg/L	B	EB<LOQ
14Q3CG039-AP3983R-GW-0	SW8260C	Acetone	4.21	µg/L	B	EB<LOQ
14Q3CG039-AP4344-GW-0	RSK-175	Methane	0.0356	µg/L	B	LB<LOQ
14Q3CG039-AP4344-GW-0	RSK-175	Methane	0.0356	µg/L	B	EB<LOQ
14Q3CG039-AP4550-GW-0	SW8260C	Trichloroethene (TCE)	10.2	µg/L	J	SD<LCL
14Q3CG039-AP5246-GW-0	RSK-175	Methane	0.0607	µg/L	B	EB<LOQ
14Q3CG039-AP5246-GW-0	SW6010B	Manganese, dissolved	0.00112	mg/L	B	EB<LOQ
14Q3CG039-AP5683-GW-0	RSK-175	Methane	0.0915	µg/L	B	EB<LOQ
14Q3CG039-AP5683-GW-0	SW6010B	Manganese, dissolved	0.00067	mg/L	B	EB<LOQ
14Q3DA089-AP3486-GW-0	RSK-175	Methane	0.054	µg/L	B	LB<LOQ
14Q3DA089-AP3486-GW-0	RSK-175	Methane	0.054	µg/L	B	EB<LOQ
14Q3DA089-AP3486-GW-0	SW6010B	Manganese, dissolved	0.00311	mg/L	B	EB<LOQ
14Q3DA089-AP3534-GW-0	RSK-175	Methane	0.0599	µg/L	B	EB<LOQ
14Q3DA089-AP3534-GW-0	RSK-175	Methane	0.0599	µg/L	B	LB<LOQ
14Q3DA089-AP3774-GW-0	RSK-175	Methane	0.111	µg/L	B	EB<LOQ
14Q3DA089-AP3774-GW-0	RSK-175	Methane	0.111	µg/L	B	LB<LOQ
14Q3DA089-AP3774-GW-0	SW6010B	Manganese, dissolved	0.00082	mg/L	B	EB<LOQ
14Q3DA089-AP3871-GW-0	RSK-175	Methane	0.177	µg/L	B	LB<LOQ
14Q3DA089-AP3893-GW-0	RSK-175	Methane	0.229	µg/L	B	LB<LOQ
14Q3DA089-AP3893-GW-0	RSK-175	Methane	0.229	µg/L	B	EB<LOQ
14Q3DA089-AP4341-GW-0	AK101	TPH-Gasoline	52.1	µg/L	B	EB<LOQ
14Q3DA089-AP4341-GW-0	AK101	TPH-Gasoline	52.1	µg/L	B	TB<LOQ
14Q3DA089-AP4341-GW-0	AK101	TPH-Gasoline	52.1	µg/L	B	LB<LOQ
14Q3DA089-AP4341-GW-0	RSK-175	Methane	0.0425	µg/L	B	EB<LOQ
14Q3DA089-AP4341-GW-0	RSK-175	Methane	0.0425	µg/L	B	LB<LOQ
14Q3DA089-AP4341-GW-0	SW6010B	Manganese, dissolved	0.00134	mg/L	B	EB<LOQ
14Q3DA089-AP4411-GW-0	RSK-175	Methane	0.122	µg/L	B	EB<LOQ
14Q3DA089-AP4411-GW-0	RSK-175	Methane	0.122	µg/L	B	LB<LOQ

Table C1-4: Validation Flags

NativeID	Method	Analyte	Final Result	Units	Final Flag	Reason
14Q3DA089-AP4411-GW-0	SW6010B	Manganese, dissolved	0.00122	mg/L	B	EB<LOQ
14Q3DA089-AP4413-GW-0	E353.2	Nitrate/Nitrite-N	0.0375	mg/L	B	FROZEN
14Q3DA089-AP4413-GW-0	E353.2	Nitrate/Nitrite-N	0.0375	mg/L	B	EB>LOQ
14Q3DA089-AP4413-GW-0	RSK-175	Methane	0.0454	µg/L	B	EB<LOQ
14Q3DA089-AP4413-GW-0	RSK-175	Methane	0.0454	µg/L	B	LB<LOQ
14Q3DA089-AP4413-GW-1	E353.2	Nitrate/Nitrite-N	0.0386	mg/L	B	EB>LOQ
14Q3DA089-AP4413-GW-1	SW6010B	Iron, dissolved	4.22	mg/L	J	FROZEN
14Q3DA089-AP4413-GW-1	SW6010B	Manganese, dissolved	9.98	mg/L	J	FROZEN

Notes:
mg/L = milligrams per liter
µg/L = micrograms per liter
EB<LOQ = Equipment blank concentration less than the limit of quantitation
EB>LOQ = Equipment blank concentration greater than the limit of quantitation
FD>RPD = Field duplicate relative percent difference criterion exceeded
FROZEN = Sample received frozen
LB<LOQ = Laboratory blank concentration less than the limit of quantitation
MS>UCL = Matrix spike recovery greater than the upper control limit
SD<LCL = Matrix spike duplicate recovery less than the lower control limit
SD>UCL = Matrix spike duplicate recovery greater than the upper control limit
TB<LOQ = Equipment blank concentration less than the limit of quantitation

Attachment C1-1: Samples Associated with DQE

Sample ID	Sample Type	Sample Date
13Q4CG039-GWEB01	EB	10/16/2013
13Q4DA085-EB01-GW-0	EB	10/16/2013
14Q3CG039-GWEB01	EB	9/10/2014
14Q3DA089-GWEB01	EB	9/15/2014
13Q4CG039-AP4550-GW-1	FD	10/15/2013
13Q4DA085-AP4413-GW-1	FD	10/16/2013
14Q1CG039-AP4550-GW-1	FD	1/16/2014
14Q2DA085-AP4413-GW-1	FD	4/14/2014
14Q3CG039-AP4550-GW-1	FD	9/9/2014
14Q3DA089-AP4413-GW-1	FD	9/15/2014
13Q4CG039-AP4550-GW-0	N	10/15/2013
13Q4CG039-AP3983R-GW-0	N	10/16/2013
13Q4CG039-AP4551-GW-0	N	10/16/2013
13Q4DA085-AP4413-GW-0	N	10/16/2013
14Q1DA085-AP4413-GW-0	N	1/14/2014
14Q1CG039-AP3983R-GW-0	N	1/16/2014
14Q1CG039-AP4550-GW-0	N	1/16/2014
14Q1CG039-AP4551-GW-0	N	1/16/2014
14Q2DA085-AP4413-GW-0	N	4/14/2014
14Q2CG039-AP3983R-GW-0	N	4/15/2014
14Q2CG039-AP4550-GW-0	N	4/15/2014
14Q2CG039-AP4551-GW-0	N	4/15/2014
14Q3CG039-AP5246-GW-0	N	9/4/2014
14Q3CG039-AP5683-GW-0	N	9/4/2014
14Q3CG039-AP3747-GW-0	N	9/5/2014
14Q3CG039-AP3748-GW-0	N	9/5/2014
14Q3CG039-AP4344-GW-0	N	9/5/2014
14Q3CG039-AP4353-GW-0	N	9/5/2014
14Q3DA089-AP3870-GW-0	N	9/8/2014
14Q3DA089-AP3871-GW-0	N	9/8/2014
14Q3CG039-AP3744-GW-0	N	9/9/2014
14Q3CG039-AP3983R-GW-0	N	9/9/2014
14Q3CG039-AP3989-GW-0	N	9/9/2014
14Q3CG039-AP4550-GW-0	N	9/9/2014
14Q3CG039-AP4551-GW-0	N	9/10/2014

Attachment C1-1: Samples Associated with DQE

Sample ID	Sample Type	Sample Date
14Q3DA089-AP3486-GW-0	N	9/11/2014
14Q3DA089-AP3534-GW-0	N	9/11/2014
14Q3DA089-AP3774-GW-0	N	9/11/2014
14Q3DA089-AP3893-GW-0	N	9/12/2014
14Q3DA089-AP4341-GW-0	N	9/12/2014
14Q3DA089-AP4411-GW-0	N	9/12/2014
14Q3DA089-AP4342-GW-0	N	9/15/2014
14Q3DA089-AP4413-GW-0	N	9/15/2014
13Q4CG039-TB01-GW-0	TB	10/16/2013
13Q4DA085-GWTB01	TB	10/16/2013
14Q1DA085-GWTB01	TB	1/14/2014
14Q1CG039-GWTB01	TB	1/16/2014
14Q2DA085-TB01-SO-0	TB	4/15/2014
14Q3CG039-GWTB01	TB	9/4/2014
14Q3CG039-GWTB02	TB	9/5/2014
14Q3DA089-GWTB01	TB	9/8/2014
14Q3CG039-GWTB03	TB	9/9/2014
14Q3CG039-GWTB04	TB	9/10/2014
14Q3DA089-GWTB02	TB	9/11/2014
14Q3DA089-GWTB03	TB	9/12/2014
14Q3DA089-GWTB04	TB	9/15/2014

Notes:
EB = equipment blank
FD = field duplicate
N = primary sample
TB = trip blank

Attachment C1-2 – ADEC Checklists

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Laboratory Data Review Checklist

CompletedBy	Jamie Beckett		
Title	Chemist	Date	Dec 31, 2013
CS Report Name		ReportDate	Dec 03, 2013
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	M3042
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

2.6C

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW8260C:
FD RPD exceedances.
Target analytes detected in the EB and method blank.
RSK-175:
Target analytes detected in the EB, TB and method blank.
SW6010B:
Target analytes detected in the EB.
E300.0:
Target analtyes detected in the EB.
E353.2:
Nitrate detected in the EB.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

Some data qualified as estimated;usable as qualified.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ○ No ◉ NA (Please explain.) Comments:

For details, see site-specific report.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: Methane for RSK-175.

These analytes had Method Blank detects: Hexachlorobutadiene for SW8260C.

iii. If above PQL, what samples are affected?

Comments:

No samples affected

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

v. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).
Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Trip Blank detects: Methane for RSK-175.

iv. If above PQL, what samples are affected?

Comments:

13Q4CG039-AP4551-GW-0

v. Data quality or usability affected? (Please explain.)

Comments:

Associated sample results less than five times the blank concentration were flagged "B". Associated results detected greater than five times the blank concentration were not qualified.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

○ Yes ◉ No ○ NA (Please explain.) Comments:

These samples were out of control for SW8260C: 1,1-DCE (13Q4CG039-AP4550-GW-0/13Q4CG039-AP4550-GW-1, RPD 43 vs 30), Chloroform (13Q4CG039-AP4550-GW-0/13Q4CG039-AP4550-GW-1,

RPD 83 vs 30), associated sample results were flagged J and UJ.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

Data qualified as estimated; usable as qualified.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: Chloride, Sulfate for E300.

These analytes had Equipment Blank detects: Nitrate/Nitrite-N for E353.2.

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Iron, dissolved, Manganese, dissolved for SW6010B.

These analytes had Equipment Blank detects: Acetone, Chloromethane for SW8260C.

ii. If above PQL, what samples are affected?

13Q4CG039-AP3983R-GW-0, 13Q4CG039-AP4551-GW-0

iii. Data quality or usability affected? (Please explain.)

Associated sample results less than five times (10 times for acetone) the blank concentration were flagged "B". Associated results detected greater than five times (10 times for acetone) the blank concentration were not qualified.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No other flags applied.

Laboratory Data Review Checklist

CompletedBy	Jamie Beckett		
Title	Chemist	Date	Dec 31, 2013
CS Report Name		ReportDate	Dec 03, 2013
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	M3043
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

4.2C

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW8260C:
On analysis day 10/22/13, matrix spike/spike duplicate analysis in analytical batch 102213E1 was performed on JBER sample 13Q4TU073-SB1105-SO-1ST (M302109MS/M302110MSD).
Some compounds did not meet percent recovery acceptance criteria.
SW9060:
Matrix Spike/Matrix Spike Duplicate(s):
SW9060: MS recovery of Total Organic Carbon(252%) in 13Q4DA085-AP4413-GW-0MS did not meet acceptance criteria of 85-115%.
MSD recovery of Total Organic Carbon(265%) in 13Q4DA085-AP4413-GW-0SD did not meet acceptance criteria of 85-115%.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

Some data qualified as estimated; usable as qualified.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ○ No ◉ NA (Please explain.) Comments:

For details, see site-specific report.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: Methane for RSK-175.

These analytes had Method Blank detects: Hexachlorobutadiene for SW8260C.

iii. If above PQL, what samples are affected?

Comments:

13Q4DA085-AP4413-GW-0, 13Q4DA085-AP4413-GW-1

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample detects less than five times the blank concentration were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

v. Data quality or usability affected? (Please explain)

Comments:

Some data qualified as estimated; usable as qualified.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).

Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Trip Blank detects: Methane for RSK-175.

iv. If above PQL, what samples are affected?

Comments:

13Q4DA085-AP4413-GW-0, 13Q4DA085-AP4413-GW-1

v. Data quality or usability affected? (Please explain.)

Comments:

Associated sample detects less than five times the blank concentration were flagged 'B'.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

○ Yes ◉ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

○ Yes ◉ No ○ NA (Please explain.) Comments:

These samples were out of control for E300.0: Chloride (13Q4DA085-AP4413-GW-0/3Q4DA085-AP4413-GW-1, %RPD 199.49 vs 30), Sulfate (13Q4DA085-AP4413-GW-0/13Q4DA085-AP4413-GW-1, %RPD = 136.81 vs 30), associated sample results were flagged J and UJ.

These samples were out of control for E376.2: Sulfide (13Q4DA085-AP4413-GW-0/13Q4DA085-AP4413-GW-1, %RPD = 176 vs 30), associated sample results were flagged J and UJ.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

Data qualified as estimated; usable as qualified.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: Chloride, Sulfate for E300.0.

These analytes had Equipment Blank detects: Nitrate/Nitrite-N for E353.2.

These analytes had Equipment Blank detects: Sulfide for E376.2.

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Manganese, dissolved for SW6010B.

These analytes had Equipment Blank detects: Acetone, Tetrachloroethylene for SW8260C.

These analytes had Equipment Blank detects: Total Organic Carbon for SW9060.

ii. If above PQL, what samples are affected?

13Q4DA085-AP4413-GW-0, 13Q4DA085-AP4413-GW-1

iii. Data quality or usability affected? (Please explain.)

Associated sample detects less than five times (10 times for acetone) the blank concentrations were flagged 'B'. Associated sample detects greater than five times (10 times for acetone) the blank concentrations and non-detects were not qualified.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Matrix:

These samples were flagged for Matrix spike duplicate recovery criteria greater than the upper control limit:
Total Organic Carbon (13Q4DA085-AP4413-GW-0, %R = 265 LCL=75 UCL=125) for SW9060.
Data qualified as estimated and detected result flagged J.

Hexachlorobutadiene (13Q4DA085-AP4413-GW-0, %R = 190 LCL=50 UCL=140) for SW8260C. Associated nondetected result was not qualified.

These samples were flagged for Matrix spike recovery greater than the upper control limit:
Hexachlorobutadiene (13Q4DA085-AP4413-GW-0, %R = 183 LCL=50 UCL=140) for SW8260C. Associated nondetected result was not qualified.

Tetrachloroethylene (13Q4DA085-AP4413-GW-0, %R = 207 LCL=45 UCL=150) for SW8260C. Data qualified as estimated and detected result flagged J.

Total Organic Carbon (13Q4DA085-AP4413-GW-0, %R = 252 LCL=75 UCL=125) for SW9060. Data qualified as estimated and detected result flagged J.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/19/2014
CS Report Name		ReportDate	2/18/2014
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	N1080
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

○ Yes ◉ No ○ NA (Please explain.) Comments:

COC requested Method E376.1 for sulfide; samples analyzed by equivalent method E376.2.

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 5.5C.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW8260C:
Matrix Spike/Matrix Spike Duplicate(s):
Recovery of cis-1,2-Dichloroethene (0%) in 14Q1CG039-AP3983R-GW-0MS did not meet acceptance criteria of 70-125%. Recovery of cis-1,2-Dichloroethene (0%) in 14Q1CG039-AP3983R-GW-0SD did not meet acceptance criteria of 70-125%. Recovery of 1,1,2,2-Tetrachloroethane (137%) in 14Q1CG039-AP3983R-GW-0MS did not meet acceptance criteria of 65-130%. Recovery of 1,1,2,2-Tetrachloroethane (182%) in 14Q1CG039-AP3983R-GW-0SD did not meet acceptance criteria of 65-130%.
Surrogate Standard(s):
Analytical Exception(s):
Due to high levels of analytes in the native samples, matrix spike/spike duplicate analysis in batch 012214P1 could not be performed on a JBER sample. Another client sample was selected and acceptance criteria were met.
SW6010B:
Matrix Spike/Matrix Spike Duplicate(s):
SW6010C: MS and MSD recovery of Iron in 14Q1CG039-AP3983R-GW-0MS and 14Q1CG039-AP3983R-GW-0SD did not meet acceptance criteria of 80-120% because the concentration of Iron in the sample was significantly higher than the added spike concentration.
SW9060:
Matrix Spike/Matrix Spike Duplicate(s):
SW9060A: MSD recovery of Total Organic Carbon(287%) in 14Q1CG039-AP3983R-GW-0SD did not meet acceptance criteria of 80-120%.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ◉ No ○ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. If above PQL, what samples are affected?

Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No data affected.

v. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).
Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?
Comments:

v. Data quality or usability affected? (Please explain.)
Comments:

All data are usable as reported.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

○ Yes ○ No ◉ NA (Please explain.) Comments:

Equipment blank not reported in this SDG.

i. All results less than PQL?

○ Yes ○ No ◉ NA (Please explain.) Comments:

ii. If above PQL, what samples are affected?

iii. Data quality or usability affected? (Please explain.)

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)
a. Defined and appropriate?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Matrix:

The recoveries of cis-1,2-dichloroethene, trichloroethene and 1,1,2,2-tetrachloroethane were outside of criteria in the MS and MSD of sample 14Q1CG039-AP3983R-GW-0 for Method SW8260C. The associated detected results were not qualified because concentrations were greater than four times the spike concentrations.

The recovery of dissolved iron was outside of criteria in the MS and MSD of sample 14Q1CG039-AP3983R-GW-0 for Method SW6010B. The associated detected result was not qualified because the concentration was greater than four times the spike concentration.

The recovery of total organic carbon was outside of criteria in the MSD of sample 14Q1CG039-AP3983R-GW-0 for Method SW9060. The associated detected result was not qualified because the concentration was greater than four times the spike concentration.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/19/2014
CS Report Name		ReportDate	2/18/2014
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	N1081
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

○ Yes ◉ No ○ NA (Please explain.) Comments:

COC requested sulfide by Method E376.1; samples were analyzed by equivalent method E376.2.

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 4.7C.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW8260C:
Due to high levels of analytes in the native samples, matrix spike/spike duplicate analysis in batch 012214P1 could not be performed on a JBER sample. Another client sample was selected and acceptance criteria were met.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ◉ No ○ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. If above PQL, what samples are affected?

Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No data affected.

v. Data quality or usability affected? (Please explain)

Comments:

All data are usable.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).
Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

All data are usable as reported.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD in this SDG.

ii. Submitted blind to lab?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD in this SDG.

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD in this SDG.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD in this SDG.

f. Decontamination or Equipment Blank (if applicable)

○ Yes ○ No ◉ NA (Please explain.) Comments:

Equipment blank not reported in this SDG.

i. All results less than PQL?

○ Yes ○ No ◉ NA (Please explain.) Comments:

ii. If above PQL, what samples are affected?

iii. Data quality or usability affected? (Please explain.)

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)
   a. Defined and appropriate?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No other flags applied.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/19/2014
CS Report Name		ReportDate	5/6/2014
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	N1694
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

○ Yes ◉ No ○ NA (Please explain.) Comments:

COC not relinquished.

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 3.8C.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW8260C:
Calibration Verification(s):
The %D for Bromoform (23%) in CV1-0421 exceeded acceptance criteria of 20%.
Matrix Spike/Matrix Spike Duplicate(s):
Due to high levels of compounds in the native sample, 14Q2CG039-AP4550-GW-0, client specified Matrix
Spike and Matrix Spike Duplicate samples could not be analyzed for risk of instrument contamination. MS/MSD analysis was performed on another client sample. All acceptance criteria were met.
SW6010B:
Matrix Spike/Matrix Spike Duplicate(s):
SW6010C: MS recovery of Iron(0%) in 14Q2CG039-AP4550-GW-0MS did not meet acceptance criteria of 80-120%. MSD recovery of Iron(0%) in 14Q2CG039-AP4550-GW-0SD did not meet acceptance criteria of 80-120%.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ◉ No ○ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Methane was detected in a method blank for Method RSK175.

iii. If above PQL, what samples are affected?

Comments:

No samples affected.

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

v. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).

Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

TB associated to samples in this SDG is in N1695.

iii. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Methane was detected in the TB for Method RSK175.

iv. If above PQL, what samples are affected?

Comments:

No samples affected.

v. Data quality or usability affected? (Please explain.)

Comments:

All data are usable as reported.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD in this SDG.

ii. Submitted blind to lab?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD in this SDG.

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration

R2 = Field Duplicate Concentration

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD in this SDG.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD in this SDG.

f. Decontamination or Equipment Blank (if applicable)

○ Yes ○ No ◉ NA (Please explain.) Comments:

Equipment blank not collected.

i. All results less than PQL?

○ Yes ○ No ◉ NA (Please explain.) Comments:

ii. If above PQL, what samples are affected?

iii. Data quality or usability affected? (Please explain.)

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Calibration:

The recovery of bromoform was greater than criteria in a continuing calibration verification for Method SW8260C. All associated results were not detected and were not qualified.

Total organic carbon was detected in a continuing calibration blank for Method SW9060. Associated detected results were not qualified because concentrations were greater than five times the blank concentration.

Lactic acid was detected in a continuing calibration blank for Method E300.0M. Associated results were not detected and were not qualified.

Matrix:

The recovery of dissolved iron was less than criteria in the MS and MSD of sample 14Q2CG039-AP4550-GW-0 for Method SW6010B. Associated detected results were not qualified because concentrations were greater than four times the spike concentration.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/19/2014
CS Report Name		ReportDate	5/6/2014
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	N1695
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

○ Yes ◉ No ○ NA (Please explain.) Comments:

COC not relinquished.

b. Correct analyses requested?

○ Yes ◉ No ○ NA (Please explain.) Comments:

COC requested sulfide by E376.1; samples were analyzed by equivalent method E376.2.

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 3.8C.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Sample 14Q2DA085-AP4413-GW-1 was received but not listed on COC. We received 3 VOC vials, 3 MEE vials, 2 TOC vials, 1 metals bottle, 1 nutrient bottle, 1 unpreserved bottle, and 1 sulfide bottle. Samples logged in and analyzed per containers received.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW8260C:
The %D for Bromoform (23%) in CV1-0421 exceeded acceptance criteria of 20%.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ◉ No ○ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: Methane for RSK-175.

iii. If above PQL, what samples are affected?

Comments:

14Q2DA085-AP4413-GW-0, 14Q2DA085-AP4413-GW-1

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample detects less than five times the blank concentration were flagged 'B'.

v. Data quality or usability affected? (Please explain)

Comments:

Some data qualified as estimated; usable as qualified.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).
Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Trip Blank detects: Methane for RSK-175.

iv. If above PQL, what samples are affected?

Comments:

No samples affected.

v. Data quality or usability affected? (Please explain.)

Comments:

All data are usable as reported.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

○ Yes ○ No ◉ NA (Please explain.) Comments:

Equipment blank not collected.

i. All results less than PQL?

○ Yes ○ No ◉ NA (Please explain.) Comments:

ii. If above PQL, what samples are affected?

iii. Data quality or usability affected? (Please explain.)

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)
   a. Defined and appropriate?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Calibration:

The recovery of bromoform was greater than criteria in a continuing calibration verification for Method SW8260C. All associated results were not detected and were not qualified.

Lactic acid was detected in a continuing calibration blank for Method E300.0M. Associated results were not detected and were not qualified.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/5/2014
CS Report Name		ReportDate	9/19/2014
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	N2614
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 2.0C.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

○ Yes ◉ No ○ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

○ Yes ◉ No ○ NA (Please explain.) Comments:

c. Were all corrective actions documented?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No corrective actions.

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ◉ No ○ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. If above PQL, what samples are affected?

Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

v. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).

Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

No data affected.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Manganese, dissolved for SW6010B.

These analytes had Equipment Blank detects: nitrate/nitrite for E353.2.

These analytes had Equipment Blank detects: Acetone, Ethylbenzene, hexachlorobutadiene, m,p-xylene, o-xylene, Toluene, Total Xylense for SW8260C.

ii. If above PQL, what samples are affected?

14Q3CG039-AP5246-GW-0, 14Q3CG039-AP5683-GW-0

iii. Data quality or usability affected? (Please explain.)

Associated sample results detected less than five times (10 times for acetone) the blank concentrations were qualified as estimated and flagged "B". Associated results detected greater than five times (10 times for acetone) the blank concentrations, and nondetects, were not qualified.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No other flags applied.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/5/2014
CS Report Name		ReportDate	9/24/2014
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	N2617
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 1.4C.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW8260C:
On analysis day 9/09/2014, matrix spike/spike duplicate analysis in batch 090914E1 was performed on JBER 14Q3CG039-AP5246-GW-0 (N261401MS/N261401MSD). On analysis day 9/11/2014 (batch 091114E1), a JBER sample was not available for matrix spike/spike duplicate analysis. Another client sample was selected
E300.0M:
E300.0M: Closing Blank (CCB2-0730) contained 0.101 mg/L Lactic Acid. This analyte was non detect in the sample and in the Method Blank (WB1-0919).

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ◉ No ○ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: Methane for RSK-175.

These analytes had Method Blank detects: Hexachlorobutadiene for SW8260C.

These analytes had Method Blank detects: Manganese, dissolved for SW6010B.

iii. If above PQL, what samples are affected?

Comments:

14Q3CG039-AP3747-GW-0, 14Q3CG039-AP3748-GW-0, 14Q3CG039-AP4344-GW-0

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample detects less than five times the blank concentrations were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

v. Data quality or usability affected? (Please explain)

Comments:

Some data qualified as estimated; usable as qualified.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).
Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Trip Blank detects: Acetone for SW8260C.

iv. If above PQL, what samples are affected?

Comments:

No samples affected.

v. Data quality or usability affected? (Please explain.)

Comments:

All data are usable as reported.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Manganese, dissolved for SW6010B.

These analytes had Equipment Blank detects: Total Organic Carbon for SW9060.

These analytes had Equipment Blank detects: Nitrate/nitrite for E353.2.

These analytes had Equipment Blank detects: Acetone, Ethylbenzene, m,p-Xylene, o-Xylene, Toluene, Total Xylenes for SW8260C.

ii. If above PQL, what samples are affected?

14Q3CG039-AP3747-GW-0, 14Q3CG039-AP3748-GW-0, 14Q3CG039-AP4344-GW-0

iii. Data quality or usability affected? (Please explain.)

Associated sample results detected less than five times (10 times for acetone) the blank concentrations were qualified as estimated and flagged "B". Associated sample results detected greater than five times (10 times for acetone) the blank concentrations, and nondetects, were not qualified.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Lactic acid was detected below the LOQ in a continuing calibration blank for Method E300.0M. No samples were affected.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/5/2014
CS Report Name		ReportDate	9/25/2014
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	N2648
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 3.0C.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW8260C:
Matrix Spike/Matrix Spike Duplicate(s):
Some compounds did not meet acceptance criteria.
SW6010B:
Matrix Spike/Matrix Spike Duplicate(s):
SW6010C: The matrix spike recovery for iron in client sample "14Q3CG039-AP4550-GW-0MS" was outside acceptance criteria because the analyte concentration in the sample was significantly higher than the added spike concentrations.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ◉ No ○ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: Methane for RSK-175.

These analytes had Method Blank detects: Hexachlorobutadiene for SW8260C.

iii. If above PQL, what samples are affected?

Comments:

14Q3CG039-AP3744-GW-0, 14Q3DA089-AP3871-GW-0

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample detects less than five times the blank concentrations were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

v. Data quality or usability affected? (Please explain)

Comments:

Some data qualified as estimated; usable as qualified.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).
Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

All data are usable as reported.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Acetone, Ethylbenzene, m,p-Xylene, o-Xylene, Toluene, Total Xylenes for SW8260C.

These analytes had Equipment Blank detects: Total Organic Carbon for SW9060.

These analytes had Equipment Blank detects: Nitrate/nitrite for E353.2.

These analytes had Equipment Blank detects: Dissolved Manganese for SW6010B.

ii. If above PQL, what samples are affected?

14Q3CG039-AP3744-GW-0, 14Q3CG039-AP3983R-GW-0,

iii. Data quality or usability affected? (Please explain.)

Associated sample detects less than five times (10 times for acetone) the blank concentrations were flagged 'B'. Associated sample detects greater than five times (10 times for acetone) the blank concentration and non-detects were not qualified.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Calibration:
Lactic acid was detected below the LOQ in a continuing calibration blank for Method E300.0M. No data were affected.

Matrix:

These samples were flagged for Matrix spike duplicate recovery criteria less than the lower control limit: Trichloroethene (TCE) (14Q3CG039-AP4550-GW-0, %R = 69 LCL=70 UCL=125) for SW8260C. Associated detected result was qualified as estimated and flagged "J".

The recovery dissolved iron was less than criteria in the MS of sample 14Q3CG039-AP4550-GW-0 for Method SW6010B. The associated detected result was not qualified because the sample concentration was greater than four times the spike concentration.

The recoveries of 1,1,2,2-tetrachloroethane and cis-1,2-dichloroethene were less than criteria in the MS and MSD of sample 14Q3CG039-AP4550-GW-0 for Method SW8260C. The associated detected results were not qualified because the sample concentrations were greater than four times the spike concentrations.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/5/2014
CS Report Name		ReportDate	9/26/2014
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	N2655
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 1.6C

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW6010B:
The native results for iron and manganese in client sample "14Q3DA089-AP3534-GW-0" were less than 50 times the LOQ, so a post digestion spike was performed. All acceptance criteria were met.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ◉ No ○ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: Methane for RSK-175.

These analytes had Method Blank detects: Hexachlorobutadiene for SW8260C.

iii. If above PQL, what samples are affected?

Comments:

14Q3DA089-AP3486-GW-0, 14Q3DA089-AP3534-GW-0, 14Q3DA089-AP3774-GW-0

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample detects less than five times the blank concentrations were flagged 'B'. Associated non-detects were not qualified.

v. Data quality or usability affected? (Please explain)

Comments:

Some data qualified as estimated; usable as qualified.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)

Comments:

All data are usable.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).

Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

No data affected.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Manganese, dissolved for SW6010B.

These analytes had Equipment Blank detects: Nitrate/nitrite for E353.2.

These analytes had Equipment Blank detects: Ethylbenzene, m,p-Xylene, o-Xylene, Toluene, Total Xylenes for SW8260C.

ii. If above PQL, what samples are affected?

14Q3DA089-AP3486-GW-0, 14Q3DA089-AP3534-GW-0, 14Q3DA089-AP3774-GW-0

iii. Data quality or usability affected? (Please explain.)

Associated sample detects less than five times the blank concentrations were flagged 'B'. Associated sample results detected greater than five times the blank concentrations and non-detects were not qualified.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No other flags applied.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/5/2014
CS Report Name		ReportDate	11/4/2014
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	N2664
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 2.1C.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW6010B:
The native results for iron and manganese in client sample "14Q3DA089-AP4341-GW-0" were less than 50 times the LOQ, so a post digestion spike was performed. All acceptance criteria were met.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ◉ No ○ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: TPH-Gasoline for AK101.

These analytes had Method Blank detects: Methane for RSK-175.

These analytes had Method Blank detects: Hexachlorobutadiene for SW8260C.

iii. If above PQL, what samples are affected?

Comments:

14Q3DA089-AP3893-GW-0, 14Q3DA089-AP4341-GW-0, 14Q3DA089-AP4411-GW-0

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample detects less than five times the blank concentrations were flagged 'B'. Associated non-detects were not qualified.

v. Data quality or usability affected? (Please explain)

Comments:

Some data qualified as estimated; usable as qualified.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).

Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Trip Blank detects: TPH-Gasoline for AK101.

iv. If above PQL, what samples are affected?

Comments:

14Q3DA089-AP4341-GW-0

v. Data quality or usability affected? (Please explain.)

Comments:

Associated sample detects less than five times the blank concentrations were flagged 'B'.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: TPH-Gasoline for AK101.

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Manganese, dissolved for SW6010B.

These analytes had Equipment Blank detects: Nitrate/nitrite for E353.2.

These analytes had Equipment Blank detects: Ethylbenzene, m,p-Xylene, o-Xylene, Toluene, Total Xylenes for SW8260C.

ii. If above PQL, what samples are affected?

14Q3DA089-AP3893-GW-0, 14Q3DA089-AP4341-GW-0, 14Q3DA089-AP4411-GW-0

iii. Data quality or usability affected? (Please explain.)

Associated sample detects less than five times the blank concentrations were flagged 'B'. Associated sample results detected greater than five times the blank concentrations and non-detects were not qualified.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No other flags applied.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/5/2014
CS Report Name		ReportDate	10/7/2014
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	N2692
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 2.4C.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

○ Yes ○ No ◉ NA (Please explain.) Comments:

The containers for SW6010B for sample 14Q3DA089-AP4413-GW-1 and E353.2 for sample 14Q3DA089-AP4413-GW-0 were received frozen. The associated data were qualified as estimated and flagged "J".

e. Data quality or usability affected? (Please explain)

Comments:

Some data qualified as estimated; usable as qualified.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No discrepancies.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ◉ No ○ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes were detected in the method blank: Hexachlorobutadiene for Method SW8260C.

These analytes were detected in the method blank: Methane for RSK175.

iii. If above PQL, what samples are affected?

Comments:

14Q3DA089-AP4413-GW-0

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample results less than five times the blank concentrations were qualified as estimated and flagged "B". Associated sample results detected greater than five times the blank concentrations and nondetects were not qualified.

v. Data quality or usability affected? (Please explain)

Comments:

Some data qualified as estimated; usable as qualified.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

○ Yes ◉ No ○ NA (Please explain.) Comments:

The recovery of chloromethane was greater than the upper control limit in a LCS for Method SW8260C.

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

No samples affected; all associated results not detected.

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ◉ No ○ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).

Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

No data affected.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes were detected in the Equipment Blank: Nitrate/nitrite for E353.2.

These analytes were detected in the Equipment Blank: Methane for RSK175.

These analytes were detected in the Equipment Blank: Dissolved Manganese for SW6010B.

These analytes were detected in the Equipment Blank: Ethylbenzene, m,p-Xylene, o-Xylene, Toluene, Total Xylenes for SW8260C.

These analytes were detected in the Equipment Blank: Total Organic Carbon for SW9060.

ii. If above PQL, what samples are affected?

14Q3DA089-AP4413-GW-1, 14Q3DA089-AP4413-GW-0

iii. Data quality or usability affected? (Please explain.)

Associated sample results less than five times the blank concentrations were qualified as estimated and flagged "B". Associated sample results detected greater than five times the blank concentrations and nondetects were not qualified.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Calibration:
Lactic acid was detected below the LOQ in a continuing calibration blank. No samples were affected.

Matrix:
The RPD of chloroethane was greater than criteria in the MS/MSD set of sample 14Q3DA089-AP4413-GW-0 for Method SW8260C. The associated nondetected result was not qualified.

JOINT BASE ELMENDORF-RICHARDSON – ARMORED VEHICLE MAINTENANCE AREA SITE DA089 TREATABILITY STUDY 2015
DATA QUALITY EVALUATION REPORT

Introduction

The objective of this data quality evaluation (DQE) report is to assess the data quality of analytical results for groundwater samples collected at the Joint Base Elmendorf-Richardson (JBER) Armored Vehicle Maintenance Area Site DA089. Samples were collected and analyzed in support of the Preliminary Assessment/Site Investigation at this site. The data may also be used to support future activities such as feasibility studies, risk assessments, fate and transport modeling and remedial actions. Individual method requirements and guidelines from *the United States Air Force, Joint Base Elmendorf-Richardson, Alaska, Environmental Restoration Program, Basewide Uniform Federal Policy Quality Assurance Project Plan (March 2013) (*JBER QAPP) were used in this assessment.

This report is intended as a general data quality assessment designed to summarize data issues.

Analytical Data

This DQE report covers four primary samples, four field duplicates (FD), two equipment blanks (EB) and four trip blanks (TB). All samples were collected March 17, 2015 through December 17, 2015. A list of samples associated with this DQE is included in Attachment C2-1.

The Work Plan requires a collection frequency of 10 percent for FDs and 5 percent for MS/MSD sets and EBs; collection frequencies are outlined by method in Table C2-1 below. The required frequency was met for each method for 2015 as whole, although a FD and MS/MSD was not collected for each method during each quarter of sampling.

Table C2-1: Percentage of FD, EB and MS/MSD Collected by Method

Method	Matrix	Count of Primary Samples	Count of FD	Percent of FD	Count of MS/MSD	Percent of MS/MSD	Count of EB	Percent of EB
E300.0	Groundwater	4	4	100	4	100	2	50
E300.0M	Groundwater	4	4	100	4	100	2	50
E310.1	Groundwater	4	4	100	2	50	2	50
E353.2	Groundwater	4	3	75	3	75	2	50
E376.2	Groundwater	4	4	100	4	100	2	50
RSK-175	Groundwater	4	3	75	1	25	2	50
SW6010B	Groundwater	4	3	75	3	75	2	50
SW8260C	Groundwater	4	3	75	3	75	2	50
SW9060	Groundwater	4	4	100	4	100	2	50

The sample results were reported as four sample delivery groups (SDG) presented in Table C2-2. The analyses were performed by Applied Sciences Laboratory in Corvallis, Oregon.

Table C2-2: Sample Delivery Groups

P1595
P2473
P3271
P3868

Nine methods were used to analyze the environmental samples. Samples were collected and shipped via overnight carrier to the laboratory. Selected samples were analyzed for one or more of the following analytes/methods in Table C2-3.

Table C2-3: Analytical Parameters

Parameter	Method
Chloride and Sulfate	E300
Volatile Fatty Acids	E300.0M
Alkalinity	E310.1
Nitrate+Nitrite	E353.2
Sulfide	E376.2
Dissolved Gases	RSK-175
Iron and Manganese	SW6010B
Volatile Organic Compounds	SW8260C
Total Organic Carbon (TOC)	SW9060

The assessment of data includes a review of: (1) the chain-of-custody (COC) documentation; (2) holding-time compliance; (3) the required quality control (QC) samples at the specified frequencies; (4) method blanks; (5) laboratory control sample/laboratory control sample duplicates (LCS/LCSD); (6) surrogate spike recoveries; (7) matrix spike/matrix spike duplicate (MS/MSD) samples; and (8) initial and continuing calibration information and other method-specific criteria as defined by the JBER QAPP.

Field samples were also reviewed to ascertain field compliance and data quality issues. This included a review of FDs, EBs and TBs.

Data flags were assigned according to the JBER QAPP. Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will be only one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts.

The data flags are defined below:

- **J** = The analyte was positively identified, and the quantitation is an estimation because of discrepancies in meeting certain analyte-specific quality control criteria. Or the analyte was positively identified, but the associated concentration is estimated above the method detection limit and below the limit of quantitation (LOQ).

- **R** = The data are rejected because of deficiencies in meeting QC criteria and may not be used for decision making.

- **B** = The analyte was detected in the sample at a concentration less than or equal to five times (10 times for common laboratory contaminants) the blank concentration.

- **U** = The analyte was analyzed for, but the analyte was not detected.

- **UJ** = The analyte was not detected; however, the result is estimated because of discrepancies in meeting certain analyte-specific QC criteria.

Findings

The overall summaries of the data validation findings are contained in the following sections and Table C2-4.

Also included as documentation of data validation findings is the Alaska Department of Environmental Conservation Laboratory Data Review Checklist (Version 2.7, January 2010). A checklist is provided for each laboratory SDG and can be found in Attachment C2-2 to this DQE.

Holding Times

All holding-time criteria were met.

Calibration

All initial and continuing calibration criteria were met with one exception.

- The recovery of propionic acid was greater than JBER QAPP criteria in a continuing calibration verification (CCV) for Method RSK-175. Four associated detected results were qualified as estimated and flagged "J".

Method Blanks

Method blanks were analyzed at the required frequency and were free of contamination that would affect the sample results.

Trip Blanks

Four TBs were collected and were free of contamination that would affect the sample results.

Equipment Blanks

Two EBs were collected and were free of contamination with the exceptions listed below. EBs were not collected in the March and June 2015 events.

- Sulfate was detected above the LOQ in one EB for Method E300.0. Two associated sample results detected less than five times the blank concentrations were qualified as estimated and flagged "B".

- Nitrate+nitrite was detected above the LOQ in one EB for Method E353.2. One associated sample result detected less than five times the blank concentration was qualified as estimated and flagged "B".

- Acetone was detected above the LOQ, and methylene chloride was detected below the LOQ, LOQ in the EBs for Method SW8260C. Three associated sample results detected less than 10 times the blank concentrations were qualified as estimated and flagged "B".

- TOC was detected above and below the LOQ in one EB for Method SW9060. Two associated sample results detected less than five times the blank concentration were qualified as estimated and flagged "B".

Field Duplicates

Four FD sets were collected. Precision was acceptable with the following exceptions:

- The relative percent difference (RPD) of lactic acid was greater than JBER QAPP criteria in FD set 15Q1DA089-AP4413-GW-0/15Q1DA089-AP4413-GW-1 for Method E300.0M. Two associated detected results were qualified as estimated and flagged "J".

- The RPD of pyruvic acid was greater than JBER QAPP criteria in FD set 15Q2DA089-AP4413-GW-0/15Q2DA089-AP4413-GW-1 for Method E300.0M. Two associated detected results were qualified as estimated and flagged "J".

- The RPDs of pyruvic acid and formic acid were greater than JBER QAPP criteria in FD set 15Q4DA089-AP4413-GW-0/15Q4DA089-AP4413-GW-1 for Method E300.0M. Four associated detected results were qualified as estimated and flagged "J".

- The RPDs of bicarbonate alkalinity and total alkalinity were greater than JBER QAPP criteria in FD set 15Q1DA089-AP4413-GW-0/15Q1DA089-AP4413-GW-1 for Method E310.1. Four associated detected results were qualified as estimated and flagged "J".

- The RPD of ethene was greater than JBER QAPP criteria in FD set 15Q1DA089-AP4413-GW-0/15Q1DA089-AP4413-GW-1 for Method RSK-175. Two associated detected results were qualified as estimated and flagged "J".

- The RPD of methane was greater than JBER QAPP criteria in FD set 15Q2DA089-AP4413-GW-0/15Q2DA089-AP4413-GW-1 for Method RSK-175. Two associated detected results were qualified as estimated and flagged "J".

Matrix Spike Samples

The results of MS/MSD analyses provide information about the possible influence of the matrix on either accuracy or precision of the measurements. The field crew designated samples for MS/MSD analysis. All acceptance criteria were met with the following exceptions:

- The recoveries of lactic acid and pyruvic acid were less than JBER QAPP criteria in the MS and MSD of sample 15Q1DA089-AP4413-GW-0 for Method E300.0M. Additionally, the RPD of lactic acid was greater than JBER QAPP criteria in the MS/MSD of this same sample. The associated detected results were qualified as estimated and flagged "J".

- The recovery of acetic acid was less than JBER QAPP criteria in the MS of sample 15Q3DA089-GW-AP4413-0 for Method E300.0M. The associated detected result was qualified as estimated and flagged "J".

- The recovery of pyruvic acid was greater than JBER QAPP criteria in the MS and MSD of sample 15Q3DA089-GW-AP4413-0 for Method E300.0M. The associated detected result was qualified as estimated and flagged "J".

- The recoveries of lactic acid and acetic acid were less than JBER QAPP criteria in the MS and/or MSD of sample 15Q4DA089-AP4413-GW-0 for Method E300.0M. One associated detected result was qualified as estimated and flagged "J"; one associated nondetected result was qualified as estimated and flagged "UJ".

- The recovery of cis-1,2-dichloroethene was less than JBER QAPP criteria in the MS and MSD of sample 15Q4DA089-AP4413-GW-0 for Method SW8260C. The associated detected result was qualified as estimated and flagged "J".

- The recovery of 2-hexanone was less than JBER QAPP criteria in the MS and MSD of sample 15Q2DA089-AP4413-GW-0 for Method SW8260C. The associated detected result was qualified as estimated and flagged "J".

Surrogates

Surrogates were added to all samples for the methods requiring their use. Surrogate recoveries met criteria.

Laboratory Control Samples

LCS/LCSDs were analyzed and all accuracy and precision criteria were met.

Internal Standards

All internal standard acceptance criteria were met.

Tentatively Identified Compounds

Tentatively identified compounds were not reported.

Chain-of-Custody and Sample Receipt Discrepancies

- **SDG P1595.** Samples received at 0.7 degrees Celsius. There was no evidence of freezing so no data were qualified.

  All SW8260C and RSK-175 vials were received in preserved vials but did not meet the pH<2 requirement. Samples were analyzed within the holding time for unpreserved samples so no data were qualified.

  Only two SW8260C vials received for sample 15Q1DA089-AP4413-GW-1, pH could not be verified.

- **SDG P2473.** Some SW8260C vials received with air bubbles. Sufficient volume remained to perform analysis from vials without air bubbles.

  The metals container for 15Q2DA089-AP4413-GW-0 was received with pH greater than 2, additional acid was added upon receipt at the laboratory.

- **SDG P3271.** No discrepancies noted.

- **SDG P3868.** Samples received at 0.1 degrees Celsius. There was no evidence of freezing so no data were qualified.

  The TB received was methanol instead of water, analysis of TB was canceled.

Overall Assessment

The final activity in the data quality evaluation is an assessment of whether the data meet the data quality objectives. The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision making process. The precision, accuracy, representativeness, completeness and comparability are addressed in the JBER QAPP. The following summary highlights the data evaluation findings for the above defined events:

1. No data were rejected and completeness was 100 percent for all method/matrix/analyte combinations.
2. Approximately 12.5 percent of the E300.0 data, 14 percent of the E353.2 data, and 25 percent of the SW9060 data, were qualified due to low-level detections in the EBs. The degree to which blank contamination was observed is within reasonable method expectations considering the small size of the dataset.
3. Less than one percent of the SW8260C data were qualified due to low-level detections in the EBs. The degree to which blank contamination was observed is within reasonable method expectations.
4. A CCV recovery exceedance was observed for Method E300.0M; four results were qualified as estimated.

5. FD RPD exceedances were observed for Methods E300.0M, E310.1 and RSK-175; 16 results were qualified as estimated.
6. MS/MSD recovery exceedances were observed for Methods E300.0M and SW8260C; eight results were qualified as estimated.
7. Although data were qualified as estimated due to QC exceedances as noted, overall precision and accuracy of the data, as measured by field and laboratory QC indicators suggest that data are usable for projects objectives.

Table C2-4: Validation Flags

Native ID	Method	Analyte	Final Result	Units	Final Flag	Reason	Comment
15Q1DA089-AP4413-GW-0	E300.0M	Lactic Acid	0.347	mg/L	J	FD>RPD	%RPD = 100 vs 30
15Q1DA089-AP4413-GW-0	E300.0M	Lactic Acid	0.347	mg/L	J	MS<LCL	%R = 9 LCL=75 UCL=125
15Q1DA089-AP4413-GW-0	E300.0M	Lactic Acid	0.347	mg/L	J	MSRPD	MSRPD = 41.15 Limit =20
15Q1DA089-AP4413-GW-0	E300.0M	Lactic Acid	0.347	mg/L	J	SD<LCL	%R = 22 LCL=75 UCL=125
15Q1DA089-AP4413-GW-0	E300.0M	Pyruvic acid	4.37	mg/L	J	MS<LCL	%R = 28 LCL=75 UCL=125
15Q1DA089-AP4413-GW-0	E300.0M	Pyruvic acid	4.37	mg/L	J	SD<LCL	%R = 25 LCL=75 UCL=125
15Q1DA089-AP4413-GW-0	E310.1	Alkalinity, Bicarbonate	646	mg/L	J	FD>RPD	%RPD = 33.93 vs 30
15Q1DA089-AP4413-GW-0	E310.1	Alkalinity, Total	646	mg/L	J	FD>RPD	%RPD = 33.93 vs 30
15Q1DA089-AP4413-GW-0	RSK-175	Ethene	0.335	µg/L	J	FD>RPD	%RPD = 48.93 vs 30
15Q1DA089-AP4413-GW-1	E300.0M	Lactic Acid	1.05	mg/L	J	FD>RPD	%RPD = 100 vs 30
15Q1DA089-AP4413-GW-1	E310.1	Alkalinity, Bicarbonate	910	mg/L	J	FD>RPD	%RPD = 33.93 vs 30
15Q1DA089-AP4413-GW-1	E310.1	Alkalinity, Total	910	mg/L	J	FD>RPD	%RPD = 33.93 vs 30
15Q1DA089-AP4413-GW-1	RSK-175	Ethene	0.552	µg/L	J	FD>RPD	%RPD = 48.93 vs 30
15Q2DA089-AP4413-GW-0	E300.0M	Pyruvic acid	4.45	mg/L	J	FD>RPD	%RPD = 84 vs 30
15Q2DA089-AP4413-GW-0	RSK-175	Methane	271	µg/L	J	FD>RPD	%RPD = 43.6 vs 30
15Q2DA089-AP4413-GW-0	SW8260C	2-Hexanone	61.9	µg/L	J	MS<LCL	%R = 29 LCL=55 UCL=130
15Q2DA089-AP4413-GW-0	SW8260C	2-Hexanone	61.9	µg/L	J	SD<LCL	%R = 34 LCL=55 UCL=130
15Q2DA089-AP4413-GW-1	E300.0M	Pyruvic acid	1.82	mg/L	J	FD>RPD	%RPD = 84 vs 30
15Q2DA089-AP4413-GW-1	RSK-175	Methane	174	µg/L	J	FD>RPD	%RPD = 43.6 vs 30
15Q3DA089-GW-AP4413-0	E300.0	Sulfate	1.18	mg/L	B	EB>LOQ	blank target = 0.509MG/L
15Q3DA089-GW-AP4413-0	E300.0M	Acetic Acid	227	mg/L	J	MS<LCL	%R = 74 LCL=75 UCL=125
15Q3DA089-GW-AP4413-0	E300.0M	Propionic Acid	39.6	mg/L	J	CCV>UCL	Propionic Acid %D +22 vs. 20
15Q3DA089-GW-AP4413-0	E300.0M	Pyruvic acid	7.12	mg/L	J	SD>UCL	%R = 128 LCL=75 UCL=125
15Q3DA089-GW-AP4413-0	E300.0M	Pyruvic acid	7.12	mg/L	J	MS>UCL	%R = 126 LCL=75 UCL=125
15Q3DA089-GW-AP4413-0	E353.2	Nitrate/Nitrite-N	0.109	mg/L	B	EB>LOQ	blank target = 0.0424MG/L
15Q3DA089-GW-AP4413-0	SW8260C	Methylene chloride	1.21	µg/L	B	EB<LOQ	blank target = 0.39UG/L
15Q3DA089-GW-AP4413-GW-1	E300.0	Sulfate	1.04	mg/L	B	EB>LOQ	blank target = 0.509MG/L

Table C2-4: Validation Flags

Native ID	Method	Analyte	Final Result	Units	Final Flag	Reason	Comment
15Q3DA089-GW-AP4413-GW-1	E300.0M	Propionic Acid	35.1	mg/L	J	CCV>UCL	Propionic Acid %D +22 vs. 20
15Q4DA089-AP4413-GW-0	E300.0M	Acetic Acid	109	mg/L	J	MS<LCL	%R = 70 LCL=75 UCL=125
15Q4DA089-AP4413-GW-0	E300.0M	Formic Acid	0.497	mg/L	J	FD>RPD	%RPD = 52.19 vs 30
15Q4DA089-AP4413-GW-0	E300.0M	Lactic Acid	0.1	mg/L	UJ	SD<LCL	%R = 33 LCL=75 UCL=125
15Q4DA089-AP4413-GW-0	E300.0M	Lactic Acid	0.1	mg/L	UJ	MS<LCL	%R = 36 LCL=75 UCL=125
15Q4DA089-AP4413-GW-0	E300.0M	Propionic Acid	27.4	mg/L	J	CCV>UCL	Propionic Acid %D +14 vs. 10
15Q4DA089-AP4413-GW-0	E300.0M	Pyruvic acid	1.82	mg/L	J	FD>RPD	%RPD = 42.76 vs 30
15Q4DA089-AP4413-GW-0	SW8260C	Acetone	62.7	µg/L	B	EB>LOQ	blank target = 149UG/L
15Q4DA089-AP4413-GW-0	SW8260C	cis-1,2-Dichloroethene	45.1	µg/L	J	SD<LCL	%R = 67 LCL=70 UCL=125
15Q4DA089-AP4413-GW-0	SW8260C	cis-1,2-Dichloroethene	45.1	µg/L	J	MS<LCL	%R = 69 LCL=70 UCL=125
15Q4DA089-AP4413-GW-0	SW9060	Total Organic Carbon	270	mg/L	B	EB>LOQ	blank target = 3.37MG/L
15Q4DA089-AP4413-GW-1	E300.0M	Formic Acid	0.848	mg/L	J	FD>RPD	%RPD = 52.19 vs 30
15Q4DA089-AP4413-GW-1	E300.0M	Propionic Acid	27.3	mg/L	J	CCV>UCL	Propionic Acid %D +14 vs. 10
15Q4DA089-AP4413-GW-1	E300.0M	Pyruvic acid	2.81	mg/L	J	FD>RPD	%RPD = 42.76 vs 30
15Q4DA089-AP4413-GW-1	SW8260C	Acetone	73.4	µg/L	B	EB>LOQ	blank target = 149UG/L
15Q4DA089-AP4413-GW-1	SW9060	Total Organic Carbon	277	mg/L	B	EB>LOQ	blank target = 3.37MG/L

Notes:
mg/L = milligrams per liter
µg/L = micrograms per liter
CCV>UCL = Continuing calibration verification recovery greater than the upper control limit
EB<LOQ = Equipment blank concentration less than the limit of quantitation
EB>LOQ = Equipment blank concentration greater than the limit of quantitation
FD>RPD = Field duplicate relative percent difference criterion exceeded
MS<LCL = Matrix spike recovery less than the lower control limit
MS>UCL = Matrix spike recovery greater than the upper control limit
MSRPD = Relative percent difference of matrix spike/matrix spike duplicate greater than the upper control limit
SD<LCL = Matrix spike duplicate recovery less than the lower control limit
SD>UCL = Matrix spike duplicate recovery greater than the upper control limit

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Attachment C2-1: Samples Associated with DQE

Sample ID	Sample Date	Sample Type	TB Associations	EB Associations
15Q4DA089-EB01	17-Dec-15	EB		17121501
15Q3DA089-GW-EB01	28-Sep-15	EB		28091501
15Q4DA089-AP4413-GW-1	16-Dec-15	FD	16121501	17121501
15Q3DA089-GW-AP4413-GW-1	28-Sep-15	FD	28091501	28091501
15Q2DA089-AP4413-GW-1	26-Jun-15	FD	15062301	
15Q1DA089-AP4413-GW-1	17-Mar-15	FD	17031501	
15Q4DA089-AP4413-GW-0	16-Dec-15	N	16121501	17121501
15Q3DA089-GW-AP4413-0	28-Sep-15	N	28091501	28091501
15Q2DA089-AP4413-GW-0	26-Jun-15	N	15062301	
15Q1DA089-AP4413-GW-0	17-Mar-15	N	17031501	
15Q4DA089-TB01	16-Dec-15	TB	16121501	
15Q3DA089-GW-TB04	28-Sep-15	TB	28091501	
15Q2DA089-GW-TB01	26-Jun-15	TB	15062301	
15Q1DA089-GW-TB01	17-Mar-15	TB	17031501	

Notes:
EB = equipment blank
FD= field duplicate
N = primary sample
TB = trip blank

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Attachment C2-2 – ADEC Checklists

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Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	12/8/2015
CS Report Name		ReportDate	4/7/2015
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	P1595
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

0.7C. Cooler was less than 2C, there was no evidence of freezing so no data were qualified.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

All VOC and RSK175 vials were received in preserved containers but did not meet pH<2 requirement.
Holding times were met for unpreserved samples.
Only two vials were received for sample 15Q1DA089-AP4413-GW-1 VOC, pH could not be verified.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW8260C:
The MS/SD exceeded acceptance criteria for Acetone.
RSK-175:
There were no items of concern.
SW6010B:
There were no items of concern.
E300.0M:
The MS/SD exceeded acceptance criteria for multiple analytes.
E300.0:
There were no items of concern.
E353.2:
There wee no items of concern.
SW9060:
There were no items of concern.
E310.1:
There were no items of concern.
E376.2:
There were no items of concern.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

Some data qualified as estimated.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ○ No ◉ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. If above PQL, what samples are affected?

Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

v. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).
Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?
Comments:

v. Data quality or usability affected? (Please explain.)
Comments:

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

○ Yes ◉ No ○ NA (Please explain.) Comments:

These samples were out of control for FD set 15Q1DA089-AP4413-GW-0/15Q1DA089-AP4413-GW-1 for method E300.0M: Lactic Acid (%RPD = 100 vs 30), associated sample results were flagged J.

These samples were out of control for FD set 15Q1DA089-AP4413-GW-0/15Q1DA089-AP4413-GW-1 for method E310.1: Alkalinity, Bicarbonate as CaCO3 (%RPD = 33.93 vs 30), Alkalinity, Total as CaCO3 (%RPD = 33.93 vs 30), associated sample results were flagged J.

These samples were out of control for FD set 15Q1DA089-AP4413-GW-0/15Q1DA089-AP4413-GW-1 for method RSK-175: Ethene (%RPD = 48.93 vs 30), associated sample results were flagged J.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

Data qualified as estimated.

f. Decontamination or Equipment Blank (if applicable)

○ Yes ○ No ◉ NA (Please explain.) Comments:

Equipment blank not collected.

i. All results less than PQL?

○ Yes ○ No ◉ NA (Please explain.) Comments:

ii. If above PQL, what samples are affected?

iii. Data quality or usability affected? (Please explain.)

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Matrix:

These samples were flagged for Matrix spike duplicate recovery criteria less than the lower control limit: Lactic Acid (15Q1DA089-AP4413-GW-0, %R = 22 LCL=75 UCL=125), Pyruvic acid (15Q1DA089-AP4413-GW-0, %R = 25 LCL=75 UCL=125) for E300.0M. The associated detected results were qualified as estimated and flagged "J".

These samples were flagged for Matrix spike recovery less than the lower control limit:

Lactic Acid (15Q1DA089-AP4413-GW-0, %R = 9 LCL=75 UCL=125), Pyruvic acid (15Q1DA089-AP4413-GW-0, %R = 28 LCL=75 UCL=125) for E300.0M. The associated detected results were qualified as estimated and flagged "J".

These samples were flagged for Matrix spike RPD criteria exceeded:
Lactic Acid (15Q1DA089-AP4413-GW-0, MSRPD = 41.15 Limit =20) for E300.0M. The associated detected result was qualified as estimated and flagged "J".

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	12/9/2015
CS Report Name		ReportDate	7/20/2015
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	P2473
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3.8C

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

No sample received for 14Q3AT035-SBGWTB02.
Sample 15Q2DA089AP4413-GW-1 received with bubbles in one of three VOA vials. Sufficient volume remained to perform analysis from vial with no air bubbles.
Sample 15Q2DA089AP4413-GW-0 metals arrived with pH>2, additional acid preservative added upon login.
Samples were received on a Saturday, Temp was taking but the documentation where it was recorded has come up
missing. Analyst who received samples made note they were in range and <3.0C.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

MS/MSD exceedances

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

Some data qualified as estimated.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ○ No ◉ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. If above PQL, what samples are affected?

Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

v. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).

Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

No data affected.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes were out of control in FD set 15Q2DA089-AP4413-GW-0/15Q2DA089-AP4413-GW-1 for Method RSK-175: Methane (%RPD 43.6 vs 30). Associated detected results were flagged "J".

These analytes were out of control in FD set 15Q2DA089-AP4413-GW-0/15Q2DA089-AP4413-GW-1 for Method E300.0M: Pyruvic Acid (%RPD 84 vs 30). Associated detected results were flagged "J".

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

Some data qualified as estimated.

f. Decontamination or Equipment Blank (if applicable)

○ Yes ○ No ◉ NA (Please explain.) Comments:

An EB was not collected.

i. All results less than PQL?

○ Yes ○ No ◉ NA (Please explain.) Comments:

ii. If above PQL, what samples are affected?

iii. Data quality or usability affected? (Please explain.)

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Matrix Spike:
The recovery of 2-Hexanone was less than the lower control limit in the MS (%R = 29 LCL=55 UCL=130) and MSD (%R = 34 LCL=55 UCL=130) of sample 15Q2DA089-AP4413-GW-0 for Method SW8260C. The associated detected result in the parent sample was qualified as estimated and flagged "J".

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	12/9/2015
CS Report Name		ReportDate	10/29/2015
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	P3271
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

2.5C

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

No discrepancies.

c. Were all corrective actions documented?

○ Yes ○ No ◉ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ○ No ◉ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. If above PQL, what samples are affected?

Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

v. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).

Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

No data affected.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: Sulfate for E300.0.

These analytes had Equipment Blank detects: Nitrate/Nitrite-N for E353.2.

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Methylene chloride for SW8260C.

ii. If above PQL, what samples are affected?

15Q3DA089-GW-AP4342-0, 15Q3DA089-GW-AP4413-0, 15Q3DA089-GW-AP4413-GW-1

iii. Data quality or usability affected? (Please explain.)

Associated sample results less than five times the blank concentrations were qualified as estimated and flagged "B".

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Calibration:

These samples were flagged for Continuing calibration recovery greater than the upper control limit: Propionic Acid (15Q3DA089-GW-AP4413-0, Propionic Acid %D +22 vs. 20), Propionic Acid (15Q3DA089-GW-AP4413-GW-1, Propionic Acid %D +22 vs. 20) for E300.0M. The associated detected results were flagged "J".

Matrix:

These samples were flagged for Matrix spike duplicate recovery criteria greater than the upper control limit:
Pyruvic acid (15Q3DA089-GW-AP4413-0, %R = 128 LCL=75 UCL=125) for E300.0M. The associated detected result was flagged "J".

These samples were flagged for Matrix spike recovery greater than the upper control limit:
Pyruvic acid (15Q3DA089-GW-AP4413-0, %R = 126 LCL=75 UCL=125) for E300.0M. The associated detected result was flagged "J".

These samples were flagged for Matrix spike recovery less than the lower control limit:
Acetic Acid (15Q3DA089-GW-AP4413-0, %R = 74 LCL=75 UCL=125) for E300.0M. The associated detected result was flagged "J".

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	1/19/2016
CS Report Name		ReportDate	1/8/2016
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	P3868
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Temperature 0.1C, there was no evidence of freezing so no data were qualified.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

The TB received was a methanol TB instead of water, TB analysis was canceled.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

MS/MSD exceedances.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

Some data qualified as estimated.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ◉ No ○ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: Total Organic Carbon for SW9060.

iii. If above PQL, what samples are affected?

Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

v. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

iv. Data quality or usability affected? (Use the comment box to explain.).
Comments:

All data are usable as reported.

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

The TB received was a methanol TB instead of water, TB analysis was canceled. Sample results are within historical ranges so no data were qualified.

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

○ Yes ○ No ◉ NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ○ No ◉ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

All data are usable as reported.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

○ Yes ◉ No ○ NA (Please explain.) Comments:

These samples were out of control for E300.0M for FD set 15Q4DA089-AP4413-GW-0/15Q4DA089-AP4413-GW-1: Formic Acid (%RPD = 52.19 vs 30), Pyruvic acid (%RPD = 42.76 vs 30), associated sample results were flagged J.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

Data qualified as estimated.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: Acetone for SW8260C.

These analytes had Equipment Blank detects: Total Organic Carbon for SW9060.

ii. If above PQL, what samples are affected?

15Q4DA089-AP4413-GW-0, 15Q4DA089-AP4413-GW-1

iii. Data quality or usability affected? (Please explain.)

Associated sample results less than five times (10 times for acetone) the blank concentrations were qualified as estimated and flagged "B".

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Calibration:

These samples were flagged for Continuing calibration recovery greater than the upper control limit: Propionic Acid (15Q4DA089-AP4413-GW-0, Propionic Acid %D +14 vs. 10), Propionic Acid (15Q4DA089-AP4413-GW-1, Propionic Acid %D +14 vs. 10) for E300.0M. Associated detected results were qualified as estimated and flagged "J".

Matrix:

These samples were flagged for Matrix spike duplicate recovery criteria less than the lower control limit: Lactic Acid (15Q4DA089-AP4413-GW-0, %R = 33 LCL=75 UCL=125) for E300.0M. Associated nondetected result was qualified as estimated and flagged "UJ".

cis-1,2-Dichloroethene (15Q4DA089-AP4413-GW-0, %R = 67 LCL=70 UCL=125) for SW8260C. Associated detected result was qualified as estimated and flagged "J".

These samples were flagged for Matrix spike recovery less than the lower control limit: Acetic Acid (15Q4DA089-AP4413-GW-0, %R = 70 LCL=75 UCL=125), Lactic Acid (15Q4DA089-AP4413-GW-0, %R = 36 LCL=75 UCL=125) for E300.0M. Associated nondetected result was qualified as estimated and flagged "UJ", associated detected result was qualified as estimated and flagged "J".

cis-1,2-Dichloroethene (15Q4DA089-AP4413-GW-0, %R = 69 LCL=70 UCL=125) for SW8260C. Associated detected result was qualified as estimated and flagged "J".

Appendix D
Laboratory Analytical Reports (electronic only)

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