



**UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON
ALASKA**

ENVIRONMENTAL RESTORATION PROGRAM

**SITE CHARACTERIZATION REPORT ADDENDUM
DP009 – BUILDING 986 DRY WELL**

FINAL

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SITE CHARACTERIZATION REPORT ADDENDUM
DP009 – BUILDING 986 DRY WELL
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

Prepared for
Air Force Civil Engineer Center

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TABLE OF CONTENTS

Section	Page
LIST OF ACRONYMS AND ABBREVIATIONS	iii
TITLE AND APPROVAL PAGE	v
1.0 INTRODUCTION.....	1
2.0 SITE LOCATION AND DESCRIPTION	1
3.0 INVESTIGATION AND REMEDIAL ACTION HISTORY.....	2
4.0 2014 FIELD ACTIVITIES.....	4
4.1 Soil Gas Screening and Sampling.....	4
4.2 Building Survey	5
5.0 RESULTS	5
5.1 Soil Gas Screening Results	6
5.2 Soil Gas Analytical Results	6
5.3 Building Survey Results	7
5.4 Data Quality Evaluation.....	7
6.0 CONCLUSIONS AND RECOMMENDATIONS.....	8
6.1 Conclusions.....	8
6.2 Recommendations.....	9
7.0 REFERENCES.....	10

Tables

- 1 DP009 Analytical Sample Summary
- 2 DP009 Soil Gas Screening Results
- 3 TO-15 Soil Gas Sample Results at DP009

Figures

- 1 Site DP009 Location
- 2 Previous Soil Sample Results
- 3 Soil Gas Results

Appendixes

A Field Logs and Data Collection Forms

- A-1 Field Documentation
- A-2 Soil Gas Probe Completion Diagrams
- A-3 Soil Gas Sampling Logs
- A-4 Building Survey
- A-5 Chain-of-Custody Forms
- A-6 Photo Log
- A-7 Survey Elevation Measurements and Coordinates

B Laboratory Reports and Data Quality Review

- B-1 FROG-4000 Output Log Files (electronic only)
- B-2 Data Quality Evaluation Report (includes ADEC Checklists)
- B-3 Laboratory Data Packages (electronic only)

LIST OF ACRONYMS AND ABBREVIATIONS

$\mu\text{g}/\text{m}^3$	microgram(s) per cubic meter
1,1-DCE	1,1-dichloroethene
AAC	<i>Alaska Administrative Code</i>
ABS	acrylonitrile butadiene styrene
ADEC	Alaska Department of Environmental Conservation
AFCEC	Air Force Civil Engineer Center
Army	United States Army
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
COPC	contaminant of potential concern
DQE	data quality evaluation
DRO	diesel-range organics
EPA	United States Environmental Protection Agency
FFA	Federal Facility Agreement
GC	gas chromatograph
GRO	gasoline-range organics
HVAC	heating, ventilating, and air conditioning
IC	institutional control
ITRC	Interstate Technology and Regulatory Council
JBER	Joint Base Elmendorf-Richardson
JBER-R	JBER-Richardson
JP-4	jet propulsion fuel, grade 4
mg/kg	milligram(s) per kilogram
NFA	no further action
OUA	Operable Unit A
PBR	Performance-Based Remediation
PCE	tetrachloroethene
PID	photoionization detector
POL	petroleum, oil, and lubricant

QC	quality control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SOP	standard operating procedure
SVE	soil vapor extraction
SWMU	Solid Waste Management Unit
TCE	trichloroethene
TO	task order
trans-1,2-DCE	trans-1,2-dichloroethene
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USAF	United States Air Force
VOC	volatile organic compound
WESTON	Weston Solutions, Inc.

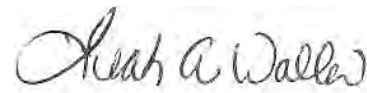
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This *DP009 Site Characterization Report Addendum* was prepared by qualified persons, as required by 18 *Alaska Administrative Code* (AAC) 75.355(c)(1) and 18 AAC 75.380(a) and defined in 18 AAC 75.990(100).

Reporting Organization’s Project Manager:

Signature: _____



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1.0 INTRODUCTION

This document is an addendum to the *Joint Base Elmendorf-Richardson, Alaska, Site Characterization Report, DP009 – Building 986 Dry Well* (Site Characterization Report) (United States Air Force [USAF], 2014a) and presents the results of the soil gas screening and sampling that was recommended in that report. DP009 is located within Joint Base Elmendorf-Richardson (JBER)-Richardson (JBER-R) (the former Fort Richardson Army Post) in Anchorage, Alaska.

Soil gas screening and sampling conducted between June 2 and August 13, 2014, was performed in accordance with the *Joint Base Elmendorf-Richardson, Basewide Uniform Federal Policy-Quality Assurance Project Plan Addendum – Additional Site Characterization Work Plan, DP009 – Building 986 Dry Well* (Site Characterization Work Plan Addendum) (USAF, 2014b), and in accordance with the standard operating procedures (SOPs) provided in the *Soil Gas Sampling Work Plan Addendum* (USAF, 2013a) to the *Joint Base Elmendorf-Richardson, Basewide Uniform Federal Policy-Quality Assurance Project Plan* (Basewide UFP-QAPP) (USAF, 2013b), which were approved by the Alaska Department of Environmental Conservation (ADEC) in May 2014, October 2013, and August 2013, respectively. The activities were conducted as a follow-on investigation to the 2013 fieldwork. The objective was to further characterize the volatile organic compounds (VOCs) detected in soil during the 2013 investigation, evaluate whether it is widespread and/or indicative of a separate source area, and to collect soil gas samples to further assess the vapor intrusion pathway.

Work was conducted by CH2M HILL under subcontract to Weston Solutions, Inc. (WESTON) for the JBER and Clear Air Force Station Performance-Based Remediation (PBR) project. This work has been authorized by the Air Force Civil Engineer Center (AFCEC) under Contract Number FA8903-09-D-8589, Task Order (TO) No. 0016.

2.0 SITE LOCATION AND DESCRIPTION

DP009 is located on the southeast corner of Otter Lake Road and Warehouse Street at JBER-R (Figure 1). DP009 consists of a former dry well located near Building 986 (petroleum, oil, and lubricant [POL] laboratory). The 15-foot-deep dry well was approximately 4 feet in diameter, and was located south of Building 986. The dry well was used from the 1950s to the 1990s for the disposal of drain and sink water from the adjacent POL laboratory. Numerous chemicals were used in the POL laboratory during quality testing of fuels used at Fort Richardson, including motor gas; aviation fuel; jet propulsion fuel, grade 4 (JP-4); arctic-grade diesel; spent reagents; solvents; heavy metals, including mercury, lead, silver, and barium; and waste solutions. The dry well was connected to a pipe that led from the laboratory sink. The dry well was removed in 1998, along with piping and sludge waste found at the bottom of the well. In addition, the laboratory sink was removed along with its associated subsurface piping, fixtures, and plumbing (United States Army [Army], 2000).

Building 986 is currently in use as a POL laboratory. Three full-time (40-hour-per-week) workers, both male and female, occupy Building 986 from Monday to Friday. Additional information regarding Building 986 can be found in Section 5.3, Building Survey Results.

The nearest surface water body to DP009 is Ship Creek, which is approximately 1.3 miles south of the site. Additional information on location, regional hydrology, hydrogeology, climate, and site history is presented in the Site Characterization Report (USAF, 2014a).

Regulatory oversight for DP009 is currently conducted by ADEC, and DP009 is listed under State of Alaska Contaminated Sites Database Hazard Identification number 943 as Cleanup Complete with Institutional Controls (ICs). Because petroleum hydrocarbons have historically been the primary contaminants of potential concern (COPCs) at DP009, the USAF has been managing investigation and remediation of contamination at the site under the State-Fort Richardson Environmental Restoration Agreement (Two-Party Agreement) in accordance with the ADEC Contaminated Sites Program (18 AAC 75).

3.0 INVESTIGATION AND REMEDIAL ACTION HISTORY

Prior to regulation under the Two-Party Agreement, DP009 was investigated under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) with Operable Unit A (OUA). DP009 was also referred to as Solid Waste Management Unit (SWMU) 60. Under the Three-Party Agreement (regulated by both the United States Environmental Protection Agency [EPA] and ADEC), the Army was also required to support closure of the site under the Resource Conservation and Recovery Act (RCRA) (Army, 2006).

Investigations and cleanup actions were conducted at DP009 from 1992 through 2003. In 1992, prior to regulation under the Two-Party Agreement, DP009 was investigated under CERCLA with OUA. The Army sampled the dry well in 1992 to determine the presence and extent of contaminants in the well. Eighteen inches of water and 6 to 8 inches of sludge were observed in the well at 15 feet below ground surface (bgs). Samples taken from the sludge and water revealed that petroleum hydrocarbons and heavy metals (including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) and VOCs (1,2-dichlorobenzene, 1,4-dichlorobenzene, and 1,3,5-trimethylbenzene) were present (Army, 1997).

In 1995, as part of the OUA remedial investigation (RI), eight soil borings were advanced and five monitoring wells were installed (Ecology and Environment, 1996). Groundwater samples were collected from five monitoring wells (AP-3650/AP-3651 – upgradient wells; AP-3648 – source area well; AP-3649/AP-3652 – downgradient wells). Diesel-range organics (DRO) and gasoline-range organics (GRO) were detected in soil samples from boring locations within a 40-foot radius of the former dry well with the highest concentrations detected at a depth of 15 feet bgs. Site-related contaminants were not detected in groundwater samples collected from the monitoring wells at DP009 (Ecology and Environment, 1996). The baseline risk assessment for the site indicated that contamination did not pose unacceptable risk to human health or the environment under CERCLA (Army, 1997).

Following completion of the RI for DP009 in 1995, no further action (NFA) was selected in the *Record of Decision for Operable Units A and B* (Army, 1997), and the site was closed under CERCLA and transferred to the Two-Party Agreement to address remaining petroleum hydrocarbon contaminated soil. In 1998, the dry well, associated piping, and sludge waste found at the bottom of the well were removed, along with the laboratory sink and its associated subsurface piping, fixtures, and plumbing. Under the Two-Party Agreement, a soil vapor extraction (SVE) system was installed in 1998 consisting of three vapor extraction wells

(EMCON, 1999). The SVE system operated until reduced removal rates were reported in July 1999, and the system was converted to a bioventing system consisting of 14 bioventing wells. The bioventing system operated from October 1999 to December 2003. The SVE/bioventing system significantly reduced DRO, GRO, and benzene, toluene, ethylbenzene, and total xylenes (BTEX) concentrations in soil at the site (AGVIQ, 2004).

From 1999 through 2003, a total of 15 soil borings were advanced to support remediation monitoring of the SVE/bioventing system and the ultimate shutdown and decommissioning of the system in May 2004 (AGVIQ, 2004). Soil samples were analyzed for GRO, DRO, and BTEX. The historical data at DP009 show that releases from the dry well resulted in DRO, GRO, benzene, and ethylbenzene soil contamination in the vadose zone within a 40-foot radius of the former dry well, ranging in depth from 10 to 35 feet bgs. In 2003, DRO and benzene were detected above the ADEC Table B1 cleanup levels of 250 and 0.025 milligrams per kilogram (mg/kg), respectively. The maximum concentration of DRO in soil was 746 mg/kg at CB-13 (15 feet bgs), and the maximum concentration of benzene was 0.0862 mg/kg at CB-15 (15 feet bgs) (Figure 2). All other analytes were detected below ADEC Table B1 and B2 cleanup levels. No impacts to groundwater were observed.

The Army implemented ICs to restrict site access to petroleum-contaminated soils. As a result, ADEC approved closure of the site with ICs in 2004, and the site is assigned a “Cleanup Complete with Institutional Controls” status.

In 2006, SWMU 60 was recommended for closure under RCRA because all tanks and containers had been removed, the dry well was closed, and site cleanup was conducted in accordance with the Federal Facility Agreement (FFA) and the Two-Party Agreement (Army, 2006).

In 2013, additional site characterization activities were conducted to further characterize the nature of residual COPCs in soil at DP009 and to evaluate potential risks to human health and the environment. Two soil borings were installed and sampled to depths of 40 feet bgs. DRO and GRO concentrations, although above project screening levels, were sufficiently delineated laterally and vertically within the source area for the purposes of evaluating current and future site risk related to petroleum. The highest concentration of DRO detected in 2013 (413 mg/kg) was in the source area at boring DP009-SB02 from 15 to 20 feet bgs, adjacent to the former dry well. This concentration is significantly less than the 746 mg/kg of DRO detected in this area in 2003. GRO was also detected at DP009-SB01 above the project screening level (300 mg/kg) at a concentration of 339 mg/kg from 15 to 20 feet bgs (USAF, 2014a).

During the 2013 field investigation, benzene, trichloroethene (TCE), and tetrachloroethene (PCE) were detected in soil at concentrations an order of magnitude higher than historical data. The highest historical concentration of benzene was 0.0862 mg/kg (at 15 feet bgs in 2003). In 2013, benzene was detected at concentrations up to 0.46 mg/kg (20 to 25 feet bgs), and with concentrations of 0.0561 mg/kg in surface soil (0 to 5 feet bgs). TCE and PCE had not been historically detected. In 2013, TCE was detected at concentrations up to 0.028 mg/kg (20 to 25 feet bgs), and PCE was detected at concentrations up to 0.0397 mg/kg (15 to 20 feet bgs). The lateral extent of TCE and PCE in soil has not been defined (USAF, 2014a).

A human health risk evaluation was completed for DP009 using the hydrocarbon risk calculator and the 2003 and 2013 data (USAF, 2014a). Two exposure areas were considered at the site, the DRO/GRO source area (including co-located VOCs) and the VOC-only source area.

Cumulative cancer risks for the DRO/GRO source area current industrial and hypothetical residential exposure scenarios are above the regulatory risk standard of 1E-05 for the DRO/GRO source area. The primary contributors to carcinogenic risk for the industrial scenario are benzene and PCE in indoor air; the primary contributor to carcinogenic risk for the residential scenario is benzene in indoor air (USAF, 2014a).

Cumulative cancer risks for the VOC-only source area current industrial and hypothetical residential exposure scenarios for the direct contact, outdoor inhalation, and groundwater ingestion pathways are below the regulatory risk standard of 1E-05 for the benzene and TCE contamination in the VOC-only source area. For the vapor intrusion pathway, benzene and TCE concentrations exceed 18 AAC 75.345 Table B1 cleanup levels, indicating that further evaluation is necessary to assess possible vapor intrusion risk (USAF, 2014a).

4.0 2014 FIELD ACTIVITIES

Field activities at DP009 consisted of the installation of six soil gas probes (DP009-SV01 through DP009-SV06), soil gas screening at five locations, soil gas sampling for laboratory analysis at two locations, and a building survey. Fieldwork was conducted between June 2 and August 13, 2014. Surveying of the soil gas probes locations was completed by The Boutet Company, an Alaska-licensed surveyor, on June 24, 2014.

Installation, screening and sampling of soil gas probes was supervised by Annika Seay and Jennifer Ulrich (Frame) of CH2M HILL who are “qualified persons” as defined in 18 AAC 75.990 (100) and whose resumes are provided in Appendix F of the Basewide UFP-QAPP (USAF, 2013a) and the Site Characterization Report (USAF, 2014a), respectively.

The following documents are provided in Appendix A: Field documentation (Appendix A-1), soil gas probe completion diagrams (Appendix A-2), soil gas sampling logs (Appendix A-3), building survey (Appendix A-4), chain-of-custody forms (Appendix A-5), a photo log (Appendix A-6), and survey elevation measurements and coordinates (Appendix A-7).

4.1 Soil Gas Screening and Sampling

Five soil gas probes, DP009-SV01 through DP009-SV05, were installed on June 2, 2014, and one soil gas probe, DP009-SV06, was installed on July 31, 2014 (Figure 3). All soil gas probes were installed to a depth of 8 feet bgs by GeoTek Alaska, Inc., in accordance with SOP-5b, using a Geoprobe 8040DT drill rig. A six-inch stainless steel 0.0057-inch mesh screen with a 7/16-inch outer diameter was connected to one-eighth inch inner diameter Teflon tubing and installed from 7.5 to 8.0 feet bgs. The screen was surrounded by a 10/20 Colorado silica sand filter pack starting approximately 3 inches below the screen, and extending to approximately 6 inches above the screen. Hydrated 3/8-inch bentonite chips were used to seal the annular space above the sand pack. A temporary flush mount completion including a quick-connect stainless steel cap for the tubing and a 4-inch acrylonitrile butadiene styrene (ABS) cleanout adaptor fitting with a screw cap was constructed. The soil gas probes were left in place at the conclusion of the sampling effort to allow

for additional future sampling, if necessary. Probe construction details can be found on the soil gas probe completion diagrams in Appendix A-2.

On June 4, 2014, soil gas screening samples were collected from five soil gas probes (DP009-SV01 through DP009-SV05) and screened with a portable gas chromatograph (GC) with a photoionization detector (PID) (FROG-4000 by Defiant Technologies, Inc.) for PCE and TCE and with a GEM2000 landfill gas meter for oxygen, carbon dioxide, and methane concentrations. Soil gas screening for PCE and TCE and measurement of oxygen, carbon dioxide, and methane were conducted in accordance with methods outlined in SOP-5f.

A physical leak check of the sampling manifold and a helium leak check of the soil gas probe (using helium with a 99.999 percent purity rating) were performed prior to sampling, in accordance with SOP-5f of the Soil Gas Work Plan Addendum. For the helium-leak check, the helium concentration beneath the enclosure was verified to be greater than 10 percent prior to and while purging the probe. During the last 5 minutes of the purge, a gas sampling bag (i.e., a Tedlar bag) was attached to the sample exhaust port; this bag/sample was used for analysis of helium with a helium detector. The helium concentration measured in the leak-check sample at each location was 0.0 percent helium (Appendix A-3). Soil gas was then collected from each location in a gas sampling bag for field screening with a GEM2000 gas meter and a photoionization detector (both calibrated on a daily basis). Soil gas screening and sampling logs are presented in Appendix A-3.

On August 13, 2014, soil gas samples for laboratory analysis were collected from DP009-SV03 and DP009-SV06 (Figure 3) using the procedures outlined in SOP-05c. One primary soil gas sample was collected from soil gas probe DP009-SV06, and one primary soil gas sample and one duplicate soil gas sample were collected from soil gas probe DP009-SV03. Prior to sampling, leak check procedures were performed at both probes as described above. All soil gas samples were assigned a unique identification number in the field and were submitted to Applied Sciences Laboratory (CH2M HILL Corvallis Laboratory, UST-079) for analysis of BTEX, PCE, TCE, 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), and vinyl chloride by EPA Method TO-15 (Table 1).

4.2 Building Survey

A survey of Building 986 was completed on June 10, 2014; the completed ADEC Building Inventory and Indoor Air Sampling Questionnaire is included in Appendix A-4.

Differential pressure of the Building 986 indoor air relative to the outdoor air was measured from June 16 to 25, 2014, using an Omniguard 4 differential pressure transducer/data logger. The differential pressure transducer was placed in the office located in the southwestern corner of the building. Tubing was extended from the differential pressure transducer through the office window to the outside of the building. The pressure differential between the indoor and outdoor atmospheres was recorded by the electronic data logger at 5-minute intervals for 9 days.

5.0 RESULTS

This section describes the results of soil gas screening, analytical soil gas samples, and the differential pressure monitoring. Soil gas screening results are not compared to screening levels. The results were used to determine presence or absence and a rough order of magnitude to assess

the distribution of PCE and TCE in the subsurface. Soil gas analytical results were compared to ADEC’s residential shallow soil gas target levels (ADEC, 2012). ADEC’s target levels for shallow soil gas “are conservative, risk-based screening levels” that are one line of evidence in a phased approach for evaluating vapor intrusion, and “exceeding a target level does not automatically imply that receptors are at risk or the pathway is complete” (ADEC, 2012).

5.1 Soil Gas Screening Results

A summary of the soil gas screening results is presented in Table 2. TCE and PCE were detected in soil gas at concentrations above the calibrated detection limit (137 and 172 micrograms per cubic meter [$\mu\text{g}/\text{m}^3$], respectively) in both the primary and field duplicate sample from location DP009-SV03. TCE was detected at concentration of 14,265 $\mu\text{g}/\text{m}^3$ in the primary sample and 18,457 $\mu\text{g}/\text{m}^3$ in the duplicate sample, and PCE was detected at a concentration of 1,787 $\mu\text{g}/\text{m}^3$ in the primary sample and 2,566 $\mu\text{g}/\text{m}^3$ in the duplicate sample at location DP009-SV03. Location DP009-SV03 is near the former dry well (Figure 3). PCE was observed at concentrations below the calibrated detection limits at two other locations: DP009-SV01 and DP009-SV05. TCE and PCE were not detected at locations DP009-SV02 and DP009-SV04. These soil gas screening results indicate that the former dry well is the source of TCE and PCE in soil and that the contamination is likely confined to the area around the former dry well.

Field screening of oxygen, carbon dioxide, and methane in soil gas from each location indicated that the soil is well oxygenated (18.4 to 21.3 percent) with relatively low concentrations of carbon dioxide (0.1 to 2.4 percent) and no methane detections. Concentrations of oxygen, carbon dioxide, and methane detected using the GEM2000 landfill gas meter are provided in Table 2. Soil gas sampling logs are presented in Appendix A-3. FROG-4000 output log files are presented in Appendix B-1.

5.2 Soil Gas Analytical Results

Results of the TO-15 analysis of the two primary and one field duplicate soil gas samples collected from 7.5 to 8 feet bgs are presented in Table 3, and shown on Figure 3. PCE, TCE, ethylbenzene, toluene, and xylenes were detected in soil gas at DP009-SV03 and DP009-SV06. However, none of the analyte concentrations exceeded ADEC’s residential or commercial/industrial target levels for shallow soil gas. No PCE or TCE degradation compounds (1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, or vinyl chloride) were detected in soil gas samples from DP009-SV03 or DP009-SV06, indicating that degradation of PCE and TCE is not likely occurring.

PCE was detected at concentrations ranging from 5.93 J $\mu\text{g}/\text{m}^3$ to 45.3 $\mu\text{g}/\text{m}^3$, and TCE was detected at concentrations ranging from 2.84 J $\mu\text{g}/\text{m}^3$ to 4.21 J $\mu\text{g}/\text{m}^3$. The analytical soil gas concentrations at DP009-SV03 are several orders of magnitude lower than the soil gas screening results from the same location (see Section 5.1). Benzene was not detected in soil gas at location DP009-SV06 even though soil samples collected in 2013 at the same location contained benzene concentrations of 0.039 and 0.145 mg/kg at 0 to 5 feet bgs and 10 to 15 feet bgs, respectively, and 0.46 mg/kg at 20 to 25 feet bgs. Examination of the field documentation (field notes, soil gas probe completion logs, and soil gas sampling logs) for locations DP009-SV03 and DP009-SV06 and discussions with the field team provide no indication of soil gas sample collection error. The discrepancy between the soil gas screening results and the soil gas analytical results could be

due to the inherent temporal variability related to shallow soil gas sampling (Interstate Technology and Regulatory Council [ITRC], 2007).

5.3 Building Survey Results

Building 986 is one level slab-on-grade with a sealed concrete floor and painted concrete block foundation. Building 986 consists of the main laboratory surrounded by two offices, a break room, and three storage rooms. There are two floor drains and one cleanout located in the building. A commercial heating, ventilating, and air conditioning (HVAC) system was installed in 2012, which provides multiple air exchanges per hour to meet code for a POL laboratory. The commercial HVAC consists of multiple roof air intakes and multiple air exhausts. Windows nearest the suspected source area are only opened occasionally in the summer. Onsite workers include three full-time (40-hour) workers from Monday to Friday. Two exterior doors are present on the northern side of the building, and one exterior door is located on the eastern side of the building.

The results of the differential pressure monitoring indicate that there is a constant positive pressure between the office space in the building and the outdoor air. These results are consistent with the use of a commercial HVAC system to maintain compliance with the POL laboratory code requirements. The large positive spike shown on the plot of pressure monitoring data (Appendix A-4) is likely the result of personnel at Building 986 attempting to close the window in the office through which the differential pressure transducer tubing was run. The constant positive pressure in this area of the building and the multiple air exchanges per hour suggest that there is little potential for vapor intrusion and that current exposure to 40-hour-per-week workers via the vapor intrusion pathway is insignificant.

5.4 Data Quality Evaluation

Sample receipt forms, laboratory data review checklists, and a comprehensive data quality evaluation (DQE) report are included in Appendix B-2. The goal of the DQE is to demonstrate that a sufficient number of representative samples were collected, and that the resulting analytical data can be used to support the decision making process. The following summary highlights the DQE findings:

1. No data were rejected, and completeness was 100 percent for all method/matrix/analyte combinations.
2. No data were qualified because of low-level blank detections.
3. Although data were qualified as estimated because of quality control (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.

The complete laboratory data package is included in Appendix B-3.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This section presents the conclusions for additional sampling activities conducted from June to August 2014 and provides recommendations for further actions at the site.

6.1 Conclusions

The following conclusions were made regarding DP009:

- TCE and PCE were detected in soil gas screening samples at concentrations up to 18,457 and 2,566 $\mu\text{g}/\text{m}^3$, respectively (DP009-SV03 located near the former dry well). Soil gas screening results indicate that the former dry well at DP009 is the source of PCE and TCE contamination at the site. PCE and TCE contamination, while not laterally defined with definitive soil data, appears to be limited to the area surrounding the former dry well. The vertical extent of PCE and TCE contamination was delineated during the 2013 Site Characterization to a maximum depth of 25 feet bgs.
- The risk evaluation completed in 2013 indicated that the vapor intrusion pathway was complete for current industrial and potential future residents at DP009, and, based on modeling of soil concentrations, there was potential risk from exposure to benzene, PCE, and TCE concentrations within indoor air. Soil gas samples were collected in 2014, and PCE and TCE were detected at concentrations up to 45.3 $\mu\text{g}/\text{m}^3$ and 4.21 $\mu\text{g}/\text{m}^3$, below ADEC's residential or commercial/industrial target levels for shallow soil gas. No PCE or TCE degradation compounds (1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, or vinyl chloride) were detected in soil gas samples.
- Comparison of soil gas screening concentrations to soil gas analytical concentrations indicated a discrepancy of up to several orders of magnitude between the results. A reason for the discrepancy was not determined. Given the difference, the results of these soil gas analytical samples should not be used for decision making.
- Soil gas sample results provide no evidence that PCE and TCE are being degraded within the vadose zone at DP009.
- The results of the differential pressure monitoring indicate that there is a constant positive pressure between the office space in the building and the outdoor air. The constant positive pressure in this area of the building and the multiple air exchanges per hour suggest that there is little potential for vapor intrusion and that current exposure to 40-hour-per-week workers via the vapor intrusion pathway is insignificant.

6.2 Recommendations

The following are recommended for DP009:

- Based on concentrations of VOCs detected in soil in 2013 and soil gas screening results in 2014, further investigation of the lateral extent of TCE and PCE in soil is necessary.
- The results of the 2014 analytical soil gas samples should not be used for decision making purposes. Further investigation of soil gas may be necessary to support evaluation of potential future site risk and risk management decisions.

7.0 REFERENCES

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Appendix A
Field Logs and Data Collection Forms

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Appendix A-1
Field Documentation

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SOP-04 Attachment 1: Organic Vapor and Air Monitoring

Field Calibration Sheet

CH2MHILL

Project Number: 457958 09-HE-02

Page of

Calibration Event	1	2	3	4
Date and Time:	6-2-14	6-4-14	6-11-14	6-12-14
Instrument				
Instrument Type:	Mini Rae 2000	Mini ^{AT} PID	PID	PID
Instrument Name:	PID	Mini Rae 3000	Mini Rae 3000	Mini Rae 3000
Serial Number:	C102431	C102560	C102560	C102560
Owner of Instrument:	CH2MHILL	CH2MHILL	CH2MHILL	CH2MHILL
Lamp Type (PID only):	10.6eV	10.6eV	10.6eV	10.6eV
Type of Regulator:	Model 713 0.5 LPM OM	Model 713 0.5 LPM OM	Model 713 0.5 LPM OM	Model 713 0.5 LPM OM
Type of Tubing:	T-connection	T-connection	T-connection	T-connection
Calibration Gas				
Gas Type:	Isobutylene	Isobutylene	Isobutylene	Isobutylene
Canister Lot Number:	14-4896	14-4896	14-4896	14-4896
Canister Expiration Date:	11/7/2015	11/7/2015	11/7/2015	11/7/2015
Observations				
Zero Gas Reading:	0.1	0.0	0.0	0.0
Calibration Reading:	103	100.0	100	100.0
Ambient Weather Conditions:	high 40s, light rain cloudy	high 60s, clear, light breeze	high 50s, clear light breeze	high 50s, cloudy, light breeze
Operators Initials:	ATS	ATS	ATS	ATS
Notes/Comments:				

FQM ✓
Jennita frame 6/6/14



SOP-04 Attachment 1: Organic Vapor and Air Monitoring

Field Calibration Sheet

CH2MHILL

Project Number:

Page of

Calibration Event	1	2	3	4
Date and Time:	7/28/14 0745	7/29/14 0730	7/30/14 0730	7/31/14 0745

Instrument				
Instrument Type:	PID	PID	PID	PID
Instrument Name:	Mini Rae 3000	Mini Rae 3000	Mini Rae 3000	Mini Rae 3000
Serial Number:	C102548	C102548	C102548	C102548
Owner of Instrument:	CH2MHILL	CH2M HILL	CH2MHILL	CH2M HILL
Lamp Type (PID only):	10.6eV	10.6eV	10.6eV	10.6eV
Type of Regulator:	Model 713 0.5 LPM OM	Model 713 0.5 LPM OM	Model 713 0.5 LPM OM	Model 713 0.5 LPM OM
Type of Tubing:	M-connection	T-connection	T-connection	T-connection

Calibration Gas				
Gas Type:	Isobutylene	Isobutylene	Isobutylene	Isobutylene
Canister Lot Number:	13-4712	13-4712	13-4712	13-4712
Canister Expiration Date:	02-13-15	02-13-15	02-13-15	02-13-15

Observations				
Zero Gas Reading:	0.0	0.1	0	0.0
Calibration Reading:	100.0	100.0	100.0	100.0
Ambient Weather Conditions:	50s, clear	50s, overcast, fog	50s, overcast	50s, clear
Operators Initials:	AS	AS	AS	AS
Notes/Comments:				

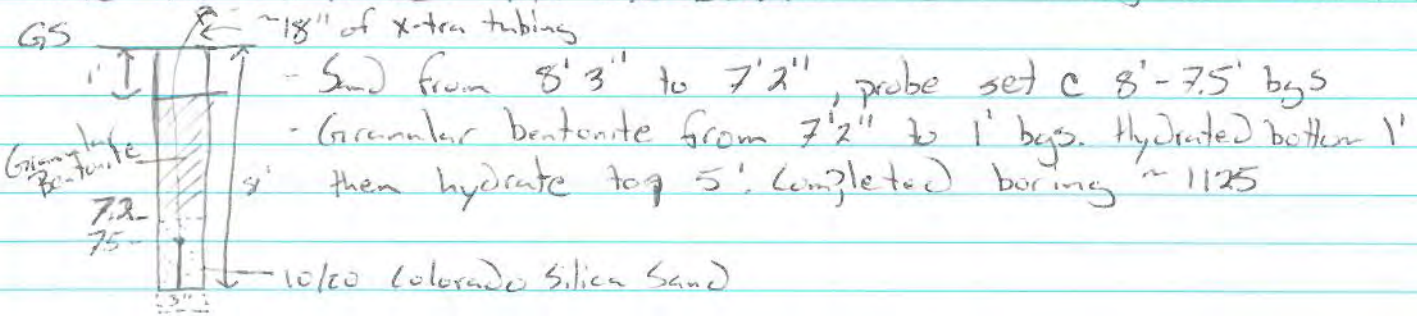
FQM ✓
Jennifer Welch
7/31/14

1000 - Arrive @ site DP009, behind Bldg. 986. Plan is to install SV probes in 5 locations @ a depth of 8 ft. bgs.

Driller preps rig with rod + decon water, probes + tubing.

1015 - Set-up on DP009-SV1 (NW corner of grid)

1030 - Begin drilling DP009-SV1, move ~12-18" away from building to allow for clearance. PID = 0.0 BZ. Push to 8' using 2.25" OD rod.



1130 - Move to DP009-SV2 (SW corner) location of grid. Begin drilling PID = 0.0 BZ. Sand from 8'3" to 7'. Placed 1' of granular + hydrated

1200 - Finish installing DP009-SV2, take lunch

1235 - Back onsite.

1240 - Set-up @ DP009-SV3 (middle of grid). PID = 0.0 BZ.

Sand 8'3" to 7'2", screen from 8' to 7'6". Granular Bentonite 7'2" to 1' bgs.

1325 - Setup @ DP009-SV05 (South East corner of grid). PID = 0.0 BZ

Sand 8'3" to 7'1", screen 8' - 7'6". Granular Bentonite from 7'1" to 1' bgs

1400 - Move to DP009-SV04 (Northeast corner of grid) next to bldg 986

Moving SV location ~18 to 24" south to allow access. PID = 0.0 BZ

Sand from 8'3" to 7'. Screen from 8' - 7.5'. Bentonite from 7' to 1' bgs.

1450 - Finish implants @ DP009, start building monuments. Set top of cap @ grade.

1515 - Finish setting monument caps clean-up area, pack-up to demob.

1530 - Go back to office trailer + complete paperwork and inspect test SV monitoring equipment.

- Finish paperwork + site prep for tomorrow. Plan to calibrate FROG + begin screening DP009.

[Handwritten signature] 6/2/2014

Calibration

Analyte Name Tetrachloroethene Analyte Alias PCE

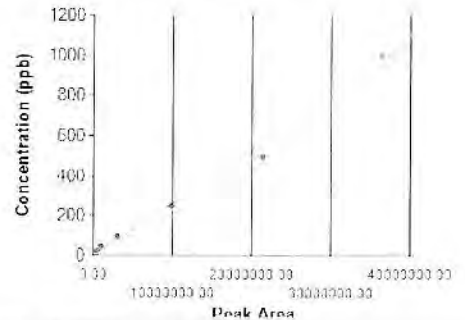
- Analytes
- Inchloroethene
 - Tetrachloroethene**

Peak	Time	Height	Area	Width	Concentration	FileName
7	190.25	47439	455033	0	25	C:\Users\bjonesst\AppData\Roaming\Defiant\20140603\1517.LOG
2	190.08	87248	913111	0	50	C:\Users\bjonesst\AppData\Roaming\Defiant\20140603\1508.LOG
3	189.5	268676	2978193	0	100	C:\Users\bjonesst\AppData\Roaming\Defiant\20140603\1558.LOG
4	189.08	759607	9772110	0	250	C:\Users\bjonesst\AppData\Roaming\Defiant\20140603\1546.LOG
5	188.75	1556915	21314262	0	500	C:\Users\bjonesst\AppData\Roaming\Defiant\20140603\1531.LOG
6	188.92	2752900	36383004	0	1000	C:\Users\bjonesst\AppData\Roaming\Defiant\20140603\1514.LOG

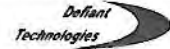
Analyte Window 10.00 Retention Time Use Average Manually set 188 seconds

Solve Using: Area Quadratic
 Force Through Zero

Area
 EQ $Y=1.4979E-013X^2 + 2.1797E-005X + 0.0000E+000$
 QUAD R² 0.99445
 EQ $Y=2.6471E-005X + 0.0000E+000$
 LINE R² 0.99028



*EQM ✓
Jennifer Frame
6/4/14*



Calibration

Analyte Name Trichloroethene Analyte Alias TCE

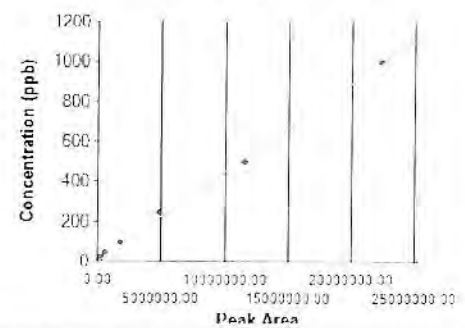
- Analytes
- Trichloroethene
 - Tetrachloroethene

Peak	Time	Height	Area	Width	Concentration	FileName
7	80.58	31070	223723	0	25	C:\Users\bionest\AppData\Roaming\Defiant\20140603\1617.LOG
▶	80.83	65521	520650	0	50	C:\Users\bionest\AppData\Roaming\Defiant\20140603\1608.LOG
3	80.75	201903	1754367	0	100	C:\Users\bionest\AppData\Roaming\Defiant\20140603\1558.LOG
4	80.58	528885	4819372	0	250	C:\Users\bionest\AppData\Roaming\Defiant\20140603\1546.LOG
5	80.67	1134126	11553518	0	500	C:\Users\bionest\AppData\Roaming\Defiant\20140603\1531.LOG
6	80.67	2074940	22305223	0	1000	C:\Users\bionest\AppData\Roaming\Defiant\20140603\1514.LOG

Analyte Window 10.00 Retention Time Use Average Manually set 80 seconds

Solve Using: Area Linear
 Force Through Zero

Area
 EQ $Y = 9.4685E-014X^2 + 4.6684E-005X + 0.0000E+000$
 QUAD R² 0.99619
 EQ $Y = 4.4847E-005X + 0.0000E+000$
 LINE R² 0.99595



DISCONNECTED NO PARAMS X: 37.00 Y: 1.2843586.60 ANALYZE: 37.00 0.0

FQM ✓
Jennifer Kame
9/4/14

0800 Brandon Jones - Stanley (BJS) meets Annika Seay (ATS) and Field Team Lead (FTL) Morgan Bruno (MB) at CH Field office. BJS begins checking Frog calibration for screening today. ATS calibrates PID meter.
Fresh air calibration = 0.0 ppm, Isobutylene calibration = 102.0 ppm

0835 Frog calibration check complete.

0935 Leave field office for DP009 (BJS and ATS)

0940 ATS checks in with building. No one answers door and it is locked. A vehicle is parked out front and lights are on in the building. Begin set up for SV Probe screening.

Project Site: DP009

Task / Activity for the day: Soil Vapor screening at 5 SV probe locations

Personnel: Brandon Jones - Stanley, Annika Seay (field logbook)

Project Number: 457958.09.HR.04

Hold Health and Safety ~~briefing~~ tailgate meeting. Topics include:

- Pinch points when working with hand tools
- awkward positioning / ergonomics
- biological hazards (mosquitoes, potential for wildlife on base)
- muster area / evacuation plan
- hydration, work / rest regime

1000 Begin set up SV01 [DP009-SV01] leak check (manifold leak check) passed

1005 Begin purge for helium check.

1010 Helium check passed.

1015 Prepare to collect sample. HQZDP009-SV01-01-SG-0. Will run for 5 min. to collect sample

1020 Pull sample bag. Small sample pulled - will use Frog first to see if additional sample is needed. Hook up to Frog for sample.

1030 Pull another 5 minute sample; did not recover PCE or TCE during first try. The bag was not as full as expected during first try; the seals are checked before trying for second sample.

1035 Second sample attempt much better. Hook sample bag to Frog.

1050 MB on site to take us back to field trailer to meet with drill crew to move to new site.

1100 ATS leaves site. Jennifer Frame (JF) will spell her.

1116 - Collect screening sample @ SV02. Analyze on Frog.

1130 - Jenn on-site. Get set-up @ SV03. Helium detector dies (Jenn to shop to get charger).

1200 - Plug in detector, says it is charged ~5 minutes later. On plus turn on @ des. Appears to have a bad battery. Call TTT to get replacement.

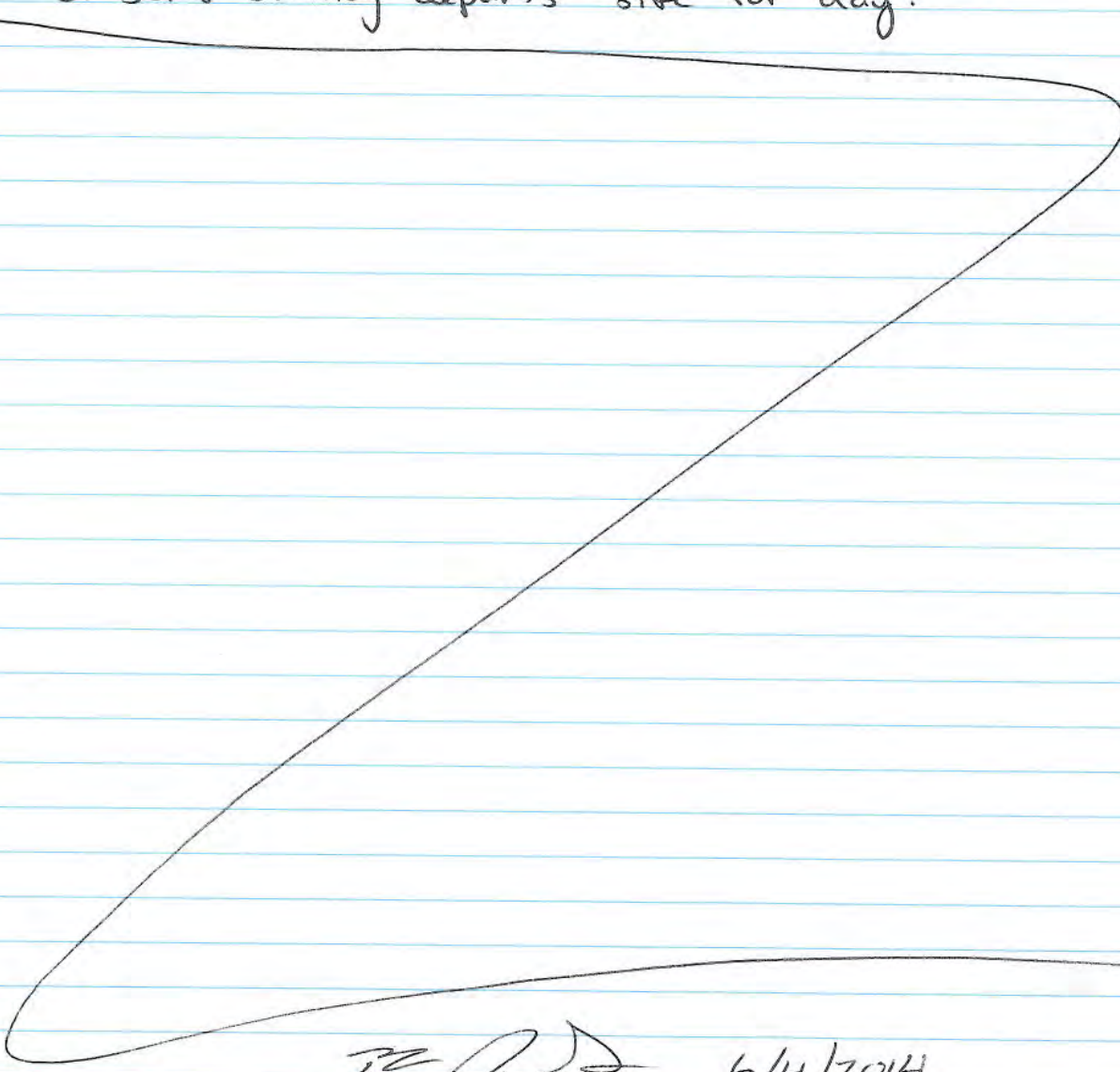
1245 - Jenn off-site to get new detector. Will send other back to Pine

6/4/14

DP009

5BER-R

- 1245 - Return to field office/lunch. Inspect TO-17 tubes. Need to order union to connect to pump & place tubes in series. Contact Swagelok NW, will pick-up tomorrow morning ~ 7 AM along with Teflon tubing.
- 1400 - Mob back to DP009 to finish screening last 3 SV probes.
- 1420 - Begin purge/sampling SV03 - Refer to sampling log for this location.
- 1518 - Start collecting duplicate sample for this location.
- 1535 - Move to SV05 - SE corner.
- 1540 - Begin purging / sample screening - See sampling log for this location.
- 1555 - Collect 14Q2DP009-SV0501-S6-0 Screening sample.
- 1620 - Setup C SV04. Located in NE corner.
- 1635 - Collect 14Q2DP009-SV0401-S6-0, screening samples analyzed using FROG, GEM 2000, & PID
- 1700 - Return to office to run cal check on FROG & complete paperwork.
- 1845 - B. Jones - Stanley departs site for day.



je [signature]

6/4/2014

FQM / JUP

FTL mb 6/4/14

Scale: 1 square =

Return to the Rain

Site: DP-009, Building 986

CH2M Staff: Brandon Jones, Stanley, Jennifer Frame

Purpose: Conduct building survey @ 986 (POL laboratory)
at site DP009

0845: Arrive on-site. Check temp of TU-17 cooler ~ 32°F
refresh ice

0905: Arrive @ Building 986. Conduct Daily H+S briefing, Discuss
potential hazards within the laboratory

0910 - Meet Steve Kelly (Lab Manager) to conduct building survey.
See ADEC survey form. Building 986 is a POL laboratory
to test the quality of fuels. This includes multiple jet fuels
and ground fuels. Noticeable petroleum odor when entering
the building.

0950 - Complete survey, if pressure monitoring required will be staged
in main lab office, with tubing exiting through a window

1000 - Return to field office, complete paperwork

1400 - Depart site for day

6/10/14

EQM/dwp

PTL md
6/10/14

JBER

TU101 / AT029 / DP009

6/16/14

TASK: Return to TU101 to turn ~~off~~ ^{on} collect data @ TU101, from air pressure monitor & remove from site. Air pressure monitoring is part of the building survey that was conducted at this site last week. Air pressure monitoring will begin conducted ~~at~~ ^{at} DP009 also ~~to~~ ^{on} today. Head to AT029 to re-test helium leak check & methane at per SM / FTL / C. Schwabenlander.

Personnel: J. Frame

1230 - onsite [TU101] ~~break~~ ^{on} Setup computer & download data log & report from 1 week monitoring effort

1400 - Mob to [DP009]

1430 - check in w/ staff at Bldg. Place system & setup for 1 wk. collection. Provide contact # & info in-case of questions

1530 - back to field office. Send report / log to C Schwabenlander & B. Jones-Stanley.

1630 - gather needs for [AT029], head to site

1650 - onsite AT029-SV01. Setup on SV probe.

• conduct manifold leak check → Pass • $O_2 = 1.2\%$

• conduct helium leak check → fail > 100,000 ppm

• measure methane → hi = 17.2%. • $CO_2 = 11.8\%$

1710 - contact SV pro B. Jones-Stanley. He will confer w/ Ben Thompson to determine whether to move forward w/ sampling.

1725 - FTL contacts SM. No word from B. Thompson. will pack up & return based on SM's conversation w/ B. Thompson

1800 - Back to field office

Jennifer Frame 6/16/14

0800 - AS member to site SS044 with field team lead (FTL) Morgan Bruno (MB)

0815 - Arrive at site and meet Geotek drillers. Soldier arrives at building to make sure radio towers are off. M. Bruno leaves site

0830 - Hold health and safety tailgate meeting. Discuss:

- yesterday's events (site evac, bear at site) and how our responses to the issues were timely and appropriate. Continue with good communication today.
- hydration and work/rest regime. Continue to take breaks as needed, and stay hydrated
- proper PPE; working on a flush mount in asphalt. Concrete pieces may fly up.
- communicate any changing conditions

0845 ^{AS} Begin

0845 - Begin set up at AP-3920

- Site: SS044
- Task/Activity for the day: decommission
1 flush mount well in parking lot, decommission
1 stick up well behind fence of abandoned building (if able)
- Personnel: Annika Seay (qualified sampler and logbook scribe)
- Subcontractors: Mick McHaney (driller) and Chris Bucht (helper) of Geotek Alaska, Inc. (MM)
- PN: 457958 09. JM. 02.

0900 - Begin breaking up concrete around flush mount AP-3920.

0915 - Young male moose walks up to ^{within} near site in brush and trees. Does not retreat when hearing horn sound. Driller MM makes noise and the moose runs off. CH Van is positioned near rig; AS has drillers move their work truck to position near rig in case they need to get in and away from curious moose.

0930 - Driller MM has added sand to well before beginning to pull flush mount. Added a little more than anticipated (sand is to 8 ft bags). Note the bottom of the well was knocked out before adding sand. MM attaches PVC puller to begin to pull up on well casing to add more sand. ~~MM~~

0935 - MM pulls ~ 2-ft of casing up and GB adds more sand. MM attempts to pull more casing and the PVC snaps. MM tags sand at 7.8 ft bags.

plate entry * 0845 - AS takes WL and TD of AP-392

- DTW = 12.2 ft bgs

- TD = 17.7 ft bgs

0945 - Drillers need to chisel around flush mount metal ring to remove the ring. Asphalt/concrete is about 4-5" thick.

Attempt to pull with rig; it is still stuck. Drillers chisel more around it. Bentonite is pulled out from inside the ring. Some has sloughed in to the hole. After ring removal, MM will lower rod in to open hole back up for more sand and bentonite.

1000 - Drillers attempt to drill around metal ring to extract it; drill ~ 2' down

1010 - Chain is wrapped around ^{ring} and extracted with rig. Attempt to photograph the hole after the ring is extracted; the hole has a 'swollen' appearance (lifted above level surface of parking lot) that was not caused by drillers' actions during decommissioning.

Sloughed from 7.8 to 3' bgs with bentonite from the previous well. Driller had lowered rod in before this second sloughing to reopen the hole. Sloughing is anticipated to continue. Fresh bentonite is added from 3' to 1.5' bgs. Sand from 1.5' to 0.5' bgs.

Asphalt patch to top. Make flush with ground surface.

Elliot Wilson is supposed to be bring asphalt to complete patch, as the drillers do not have enough on site to complete.

1045 - Drillers clean up as much as they can; Elliot Wilson will be taking most of the trash. Drillers attempt to stay busy while waiting for Elliott. AS calls M. Bruno to inquire about key to fence.

1100 - MM finds asphalt while cleaning out truck. Almost complete patch. Will still need more.

1105 - Elliot Wilson and Morgan Bruno arrive on site. Morgan calls about key.

~~1115 - Mobe to site DP009. Key not available at this time. Drillers continue to pack up site.~~

1145 - Mobe to DP009. Stake out location for SV-06. It will be located near ~~SV-01~~ SB01.

1205 - Hold health and safety, tailgate briefing. Discuss:

- general procedures for installing SV probes. Main concern on rig is pinch points.
- uneven ground, slips/tips/falls.
- do not touch tubing for probe; use new nitrile gloves for handling
- no smoking within 50 ft of storage tanks along building; no smoking near the rig

MB and AS have checked for any utility markings - all clear. MB has checked in with building.

1225 - Set rig at probe installation location.

- Project site: DP009
- Task/Activity for day: install 1 SV probe to 8' bgs
- Personnel: Annika Seay (qualified sampler and logbook scribe)
- Subcontractors: Elliot Wilson (driller) Mick McHaney (driller) Chris Buchta (helper)
- PN 457958 09

- 1235 - Begin drilling DP009 - SV06
- 1255 - Drill to 8' bgs. Screen from 7.5 to 8' bgs, sand from 8' 3" to 6" bgs. Bentonite from 6' to 1' bgs. Sand from 1' to ground surface. 1/2 bag sand, 1/2 bag bentonite
- 1255 - installation complete, AS caps tubing
- 1305 - MB arrives with plastic monument cover for tubing. Drillers clean up site. A.S. ^{attempts to} check ⁱⁿ with building - no one is there. Sign on door says they will return at 2 PM
- 1325 - Move to TU074. Check utility markings. 3rd party locate found a metal anomaly and SV probe spot has been adjusted to account for that. Set up rig.
- 1345 - Hold health and safety tailgate briefing. Discuss:
- pinch points on rig
 - uneven ground, with slips/trips, falls
 - bees flying in area
 - wildlife has been previously seen by railroad tracks, be mindful

- Project Site: TU074
- Task/Activity for day: install 1 SV probe to 8' bgs
- Personnel: Annika Seay (qualified sampler/logbook scribe)
- Subcontractors: Elliot Wilson (driller), Mick McHaney (driller) Chris Buchta (helper)

- 1350 - Begin drilling TU074 - SV01
- 1355 - hole sloughed when pulling rod - redrilling in same hole. Sand from 8' 3" to 7". Screen is from 7.5' to 8' bgs
- 1415 - Bentonite from 7" to 1" bgs
- 1415 - ~~Complete~~ complete SV probe installation. EW leaves site. BE AS and CB secure monument. Drillers clean up site.
- 1430 - A.S. completes paperwork in office. Meets with Jennifer Frame about boring logs
- 1610 - End of day.

Annika Seay 7-31-14

0830 - Annika Seay (AS) and Jennifer Frame (JF) meet at the CH field office. Begin prep. for the day's sampling.

- Project Site: TU074

- Task / Activity for the day: Sample 1
Soil Vapor probe

- Personnel: Jennifer Frame (qualified sampler)
Annika Seay (qualified sampler and logbook scribe)

- Project Number: 457958. 09. KT. 06

1115 - Set up for SVP sampling at TU074-SV011

1130 - manifold check passes; helium check also passes. ^{AS} Begin

1132 - field measurements taken; pre-sample checks complete.

1139 - Sampler ^{collection} begins - flow rate = 194.73 (end flow rate = 193.62)

collect sample 1403TU074-SV0101-SG-0-A and sample

1403TU074-SV0101-SG-0-B for analysis of:

- TO-17 (PMN only)

1150 - begin DUP sample collection. flow rate = 199.11

collect sample 1403TU074-SV0101-SG-1-A and sample

1403TU074-SV0101-SG-1-B for analysis of:

- TO-17 (2-MN only)

1200 - collect TU074 BLANK (outdoor air)

1403TU074-BLANK-SG-0-A

1403TU074-BLANK-SG-0-B

1202 - demobe from site. Prepare for next site.

1300 - mobe to DP009.

1310 - arrive at site. JF checks in with the building.

- Project Site: DP009

- Task / Activity for the day: Sample 1 SV probe

- Personnel: Annika Seay (qualified sampler and logbook scribe) Jennifer Frame (qualified sampler)

- Project Number: 457958 09. HR. 04

1315 - set up at DP009-SV061. See sampling log for canister / flow controller data

1330 - begin manifold leak check.

1335 - begin purge. All checks pass.

1347 - begin collecting sample 1403DP009-SV0601-SG-0 for analysis of:

- TO15 (limited suite)

1352 - sample collected

mobe to DP009-SV031.

1420 - Begin manifold check. Pass.

1420 - Begin purge (4 minute purge) (Helium check)

JBER

TU037

8-13-14

~~1428~~ ^{ATs} ~~begin~~ collecting sample 14Q3DP009-SV0301-SG-0 for analysis of:
- TO-15

~~1444~~ ^{ATs} ~~begin~~ collecting ^{DUP} sample 14Q3DP009-SV0301-SG-1 for analysis of:
- TO-15

1455 - DUP sample pressure < 2; will resample.

~~1520~~ - pack up and move back to CH field office after completing sample collection ^{DUP}

1458 - Setup new canister & flow controller. See sample log for details.

1503 - begin re-sample of DP009-SV03 DUP sample TO-15

1508 - stop sample, check final pressure. Final pressure = 5.77 Hg.
Run sample for an additional 45 seconds. Final pressure ^{DUP}

1509 - -3.24 Hg @ 1509 ^{DUP} Final pressure -3.24 Hg.

1520 - pack up & demob to CH field office after completing sample collection.
Samples will be shipped via FedEx tomorrow.

1700 - end of day

Amelia [Signature]
8-13-14