

2015 ANNUAL REPORT

Groundwater Monitoring and Whole House Filter Program for Moses Lake Wellfield Superfund Site (Former Larson Air Force Base)

Moses Lake, Washington

CERCLIS Site No. WAD988466355

Prepared by

U.S. ARMY CORPS OF ENGINEERS

Seattle District



Prepared for

U.S. EPA Region 10



U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, WA 98101

FINAL

May 19, 2016

This page is left intentionally blank

Contents

EXECUTIVE SUMMARY	I
1. INTRODUCTION	1
1.1. 2015 SAMPLING PROGRAM SCOPE OF WORK.....	1
1.2. SITE BACKGROUND	2
1.3. GEOLOGIC SETTING.....	4
1.4. PREVIOUS INVESTIGATIONS.....	5
1.5. USACE INVESTIGATION STRATEGY.....	6
1.5.1. <i>Groundwater Monitoring Wells and Extraction Wells</i>	6
1.5.2. <i>Private Wells</i>	7
2. SAMPLING AND FIELD ACTIVITIES FOR 2015	8
2.1. EVENT 1 (NOVEMBER 2014).....	8
2.1.1. <i>Groundwater Monitoring Wells</i>	8
2.1.2. <i>Private Wells</i>	8
2.2. EVENT 2 (FEBRUARY 2015)	9
2.2.1. <i>Groundwater Monitoring Wells</i>	9
2.2.2. <i>Private Wells</i>	9
2.3. EVENT 3 (MAY 2015).....	9
2.3.1. <i>Groundwater Monitoring Wells</i>	9
2.3.2. <i>Private Wells</i>	9
2.4. EVENT 4 (AUGUST 2015)	10
2.4.1. <i>Groundwater Monitoring Wells</i>	10
2.4.2. <i>Private Wells</i>	10
2.5. EVENT 5 (NOVEMBER 2015).....	10
2.5.1. <i>Groundwater Monitoring Wells</i>	10
2.5.2. <i>Private Wells</i>	11
2.6. RIGHT OF ENTRY (ROE) ACQUISITION	11
3. ANALYSIS, DATA VALIDATION, AND RESULTS	12
3.1. ANALYTICAL AND DATA VALIDATION PROCEDURES.....	12
3.2. MONITORING WELLS - RESULTS	12
3.2.1. <i>Groundwater Elevations</i>	12
3.2.2. <i>Analytical Results</i>	13
3.3. PRIVATE WELLS WITHOUT WHFS– RESULTS	13
3.3.1. <i>Analytical Results</i>	13
3.4. PRIVATE WELLS WITH WHFS – RESULTS.....	14
3.4.1. <i>Analytical Results</i>	14
3.4.2. <i>Whole House Filter Efficiency Analysis</i>	14
3.5. TIME-SERIES GRAPHS.....	15
3.6. TOP OF BASALT AND TOP OF RINGOLD FORMATION DATA	15
3.7. CUSTOMER NOTIFICATION OF 2014 AND 2015 RESULTS	15
4. STATE WELL INVENTORY DATABASE SEARCH.....	16

5. SUMMARY AND DISCUSSION	17
5.1. SITE TCE PLUME DISCUSSION	17
5.2. WHOLE HOUSE FILTERS	18
6. RECOMMENDATIONS	19
6.1. GROUNDWATER MONITORING WELLS	19
6.2. PRIVATE WELLS.....	19
6.3. WHOLE HOUSE FILTER SYSTEMS.....	20
APPENDIX A - FIELD SAMPLING REPORTS.....	50
APPENDIX B – COMPREHENSIVE 2015 ANALYTICAL RESULTS	51
APPENDIX C – 2015 WHOLE HOUSE FILTER EFFICIENCY MEMORANDUM	66
APPENDIX D – TCE TIME-SERIES GRAPHS	67
APPENDIX E - LABORATORY DATA PACKAGES (CD ONLY)	68
APPENDIX F - QUALITY CONTROL SUMMARY REPORT	69
APPENDIX G – DATA VALIDATION REPORT(CD ONLY).....	70
APPENDIX H – WASHINGTON DEPARTMENT OF ECOLOGY - NEW WELL QUERY	71

Figures (located after text)

Figure 1. General Location Map for Moses Lake Wellfield Superfund Site (EPA 2008).	23
Figure 2. Contaminant Boundaries from the Interim Record of Decision (EPA 2008).	24
Figure 3. Hydrogeologic Conceptual Model (EPA 2008)	25
Figure 4. Map of Wells and Sampling Status for 2015.....	26
Figure 5. Map of Wells - Cascade Valley Inset.....	26
Figure 6. Cascade Valley Inset with TCE Contours and Results (Highest Value Shown)	26
Figure 7. Priest Rapids-Roza 1 Monitoring Wells (BW series) with Groundwater Elevations (May 2015 Results)....	26
Figure 8. Roza 2 Monitoring Wells (CW series) with Groundwater Elevations (May 2015 Results)	26
Figure 9. Priest Rapids-Roza 1 Monitoring Wells (BW series) with TCE Contours and Results (Highest Value Shown)	26
Figure 10. Roza 2 Monitoring Wells (CW series) with TCE Contours and Results (Highest Value Shown)	26

Tables (located after text)

Table 1. Wells Sampled during 2015 Sampling Year	28
Table 2. Private Wells with Whole-House Filter Systems.....	32
Table 3. Monitoring Wells – Groundwater Elevations	33
Table 4. Monitoring and Extraction Wells – Sampling Results	36
Table 5. Perchlorate and PFCs in Select Monitoring Wells	43
Table 6. Private Wells without WHFs – Sampling Results	44
Table 7. Private Wells with WHFs- Analytical Results	47
Table 8. Whole House Filters – Purge and Totalizer Volume Summary.....	49

ACRONYMS

1,1-DCE	1,1-Dichloroethene
ADR	Automated Data Review
AFB	Air Force Base
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-DCE	cis-1,2-Dichloroethene
CSM	Conceptual site model
COC	Contaminant of concern
1,2-DCA	1,2-Dichloroethane
1,1-DCA	1,1-Dichloroethane
DERP-FUDS	Defense Environmental Restoration Program - Formerly Used Defense Sites
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives
DoD QSM	Department of Defense Quality Systems Manual for Environmental Laboratories
DSHS	(Washington) Department of Social and Health Services
GAC	Granular Activated Carbon
IA	Interagency Agreement
IROD	Interim Record of Decision
MCL	Maximum Contaminant Level
MWH	Montgomery Watson Harza
NC	Not calculated
µg/L	Micrograms per liter
PDB	Passive diffusion bag
PE	Performance Evaluation
PFBS	Perfluorobutanesulfonic acid
PFC	Perfluorinated compound
PFHpA	Perfluoroheptanoic acid
PFHxS	Perfluorohexanesulfonic Acid
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
QC	Quality Control
QAPP	Quality Assurance Project Plan
QCSR	Quality Control Summary Report
RI	Remedial Investigation
RL	Reporting Limit
ROE	Right-of-Entry
SEDD	Staged Electronic Data Deliverable
TCE	Trichloroethene
trans-DCE	trans-1,2-Dichloroethene
1,1,1-TCA	1,1,1-Trichloroethane
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

VC	Vinyl Chloride
VOC	Volatile Organic Compounds
WDOE	Washington (State) Department of Ecology
WDOH	Washington (State) Department of Health
WHF	Whole House Filter

EXECUTIVE SUMMARY

The purpose of this Annual Report is to summarize findings from the 2015 Moses Lake Wellfield Superfund Site (Site) sampling program completed by the U.S. Army Corps of Engineers (USACE) on behalf of the U.S. Environmental Protection Agency (EPA), Region 10, and pursuant to the 2008 Interim Record of Decision (IROD) for the Site (EPA 2008). The objectives of this sampling program are 1) to ensure protection of human health by sampling groundwater and comparing contaminant concentrations to the Federal drinking water Maximum Contaminant Level (MCL) for Site contaminants such as trichloroethene (TCE), and 2) to gather baseline data prior to implementation of groundwater pump and treat system. As part of the sampling program, USACE also installs and maintains Whole House Filter (WHF) treatment systems at private properties to prevent human exposure to TCE and related contaminants of concern (COCs) at levels that exceed the MCLs.

The 2015 sampling program consisted of five sampling events:

- Event 1 (November 2014);
- Event 2 (February 2015);
- Event 3 (May 2015);
- Event 4 (August 2015); and
- Event 5 (November 2015)

During the 2015 sampling program, the TCE MCL (5.0 µg/L) was exceeded in approximately 30% of the monitoring and extraction wells. Neither the TCE MCL nor the cis-1,2-dichloroethene (cis-DCE) MCL was exceeded in the private wells. However, the TCE MCL was exceeded in WP-04, the well that services Granite Construction for industrial purposes.

USACE sampled approximately 69 private wells and 83 monitoring or extraction wells over the course of the year, and also replaced granular activated carbon (GAC) annually for the private wells with WHFs. There are currently ten homes with WHFs. There have been no detections of TCE or cis-DCE in the mid and effluent samples (the latter leads into the homes), which confirmed that the WHFs are protecting human health.

An action threshold of 2 µg/L TCE has been used to place private wells on quarterly sampling (as opposed to annual sampling), and an action threshold of 3.5 µg/L TCE has been used to determine which private wells would receive a WHF. The 3.5 µg/L value accounts for analytical uncertainty of the method used for TCE quantitation to ensure human exposure above the MCL does not occur. Results from quarterly sampling during the 2015 sampling program identified one private residential well (WP-125) with TCE concentrations that exceeded the TCE action threshold of 3.5 µg/L. Based on these findings, USACE coordinated with EPA and the residents, and installed a WHF on private well WP-125 in April 2015.

Recommendations from the 2015 sampling program are provided below.

Groundwater Monitoring Wells

- Evaluate historical groundwater elevation data and TCE concentrations for evidence of seasonal fluctuations to ensure conservative timing of future optimized annual sampling events in the groundwater monitoring program.
- Evaluate recent groundwater elevation data collected in support of the anticipated south plume pump and treatment system in parallel with historic groundwater information to ensure sufficient baseline data are available to support pump and treat system optimization analysis following start-up of the south plume pump and treat system.
- There are currently only two monitoring wells located in Cascade Valley. The monitoring well pair is located just south of Dick Road, which is approximately one mile south of the main plume. Installation of additional monitoring wells in the northern part of Cascade Valley is recommended to refine the conceptual site model and determine the source of the TCE impacting the private wells.
- Installation of six monitoring wells in the Roza 1 basalt aquifer upgradient of Cascade Valley (generally upgradient of WP-04) and downgradient of 04BW06 is planned for summer 2016 to better define the origin of contaminant concentrations in the private wells of Cascade Valley. Presently, it is unclear whether contamination impacting the north Cascade Valley is coming from the distal portion of the main plume, or another unidentified TCE source.
- Enter monitoring well boring logs and Washington Department of Ecology (Ecology) driller logs (when deemed suitable for interpretation) into a geologic database so that subsurface cross-sections can be readily generated through the main and south plumes and into Cascade Valley.

Private Wells

- Sample newly installed private well, BHW096, identified through WDOE records search. It appears to be drawing groundwater from the Roza I aquifer. Groundwater from this formation has historically had VOC contamination in some areas. Prior to sampling, USACE will obtain an ROE from homeowner.
- Continue collecting annual groundwater samples from all private wells with any historic COC detections to document plume migration.
- Continue updating the sampling program by adding new private wells, small public water systems (and monitoring wells) with high likelihood of COC detections as they are identified through Ecology's well log database.
- For private wells that exceed 2.0 µg/L TCE, continue collecting quarterly groundwater samples for at least four quarters to evaluate patterns in seasonal and temporal system variability that support future sampling frequency and timing recommendations.
- Continue to communicate with residents who have not agreed to groundwater monitoring but are located in areas anticipated to have elevated TCE concentrations. Document attempted communication with residents, that the residents have declined to participate in the monitoring program, and that the Government has informed residents of the risks associated with exposure to water exceeding the MCL for TCE.
- Conduct a comprehensive review of Ecology's drillers' logs versus assigned private well numbers (WP series) and evaluate which private wells may be suitable for incorporation into a geologic database.
- Purchase signs stating "Non-potable water, do not drink" water for Granite Construction (WP-04) due to exceedances of the TCE MCL during 2014, 2015 (and Feb 2016). Mail letter to Granite

Construction informing them that they should not drink the water due to health risks. [Note: these actions occurred in April 2016]. Provide signs to Granite Construction in May 2016 and continue to remind them that the water is not suitable for drinking.

Whole House Filter Systems

- Continue to install and maintain WHF systems at private wells that exceed the action threshold of 3.5 µg/L TCE.
- Continue to monitor the efficiency of WHF systems by tracking if TCE exceeds its action level of 3.5 µg/L at the mid or effluent ports, and take steps to correct any issues.
- Use information from the WHF totalizing flow meters, which measure the volume of water treated by the WHF systems, to monitor and evaluate the efficiency of the treatment systems.
- Over time, if concentrations at the influent ports to WHFs decline, work with EPA to determine which WHFs can be removed from residential wells.

This page is left intentionally blank

1. INTRODUCTION

Under an Interagency Agreement (IA) with U.S. Environmental Protection Agency (EPA), Region 10, the Seattle District U.S. Army Corps of Engineers (USACE) provides ongoing technical assistance focused on groundwater sampling and Whole House Filter (WHF) maintenance as required to protect human health at the Moses Lake Superfund Site (Site). The purpose of this Annual Report is to summarize findings from the 2015 annual sampling program completed by USACE on behalf of EPA to support requirements within the Interim Record of Decision (IROD; EPA 2008) for the Moses Lake Superfund Site (Site). This report is organized as follows:

- Section 1: Introduction
- Section 2: Sampling and Field Activities for 2015
- Section 3: Analysis, Data Validation, and Results
- Section 4: State Well Inventory Database Search
- Section 5: Summary and Discussion
- Section 6: Recommendations

1.1. 2015 Sampling Program Scope of Work

The scope of work for the USACE 2015 sampling program included the following:

- Obtaining and updating Rights of Entry (ROEs) for site access;
- Installation, replacement, and maintenance of whole house filter (WHF) systems;
- Preparing a WHF efficiency memo;
- Collection, analysis, and evaluation of contaminant of concern (COC) data and groundwater elevation data in groundwater monitoring wells;
- Collection, analysis, and evaluation of COC data in untreated private wells and private wells with WHF systems;
- One-time sampling of perfluorinated compounds and perchlorate in a subset of monitoring wells;
- Coordination and contracting with laboratories and subcontractors for data analysis and data validation.
- Updating the project database (EQuIS™) with sampling results; updating an Excel spreadsheet with sampling results.
- Review of the Washington State Department of Ecology (WDOE) Well Inventory Database for newly constructed private wells that may be at risk for COCs;
- Preparation of a Work Plan-Quality Assurance Project Plan for the 2015 work, and an Annual report summarizing activities, analytical results, and recommendations (this document); and
- Notification of residents of annual sampling results.

1.2. Site Background

The Site is located within and beyond the northwestern region of the City of Moses Lake, Washington (see Figure 1 for Site location and Figure 2 for contaminant boundaries at time of IROD). The Site encompasses approximately 15 square miles and includes the Grant County International Airport and surrounding area (formerly the Larson Air Force Base (LAFB)), commercial facilities, and residences.

Previous environmental investigations conducted at the Site identified contamination of soil and groundwater resulting from historic operation of the former LAFB and industrial activities associated with the aircraft industry. Potential source areas are scattered throughout the Site and approximately 1000 acres of groundwater have been identified as contaminated to date.

Previous investigations focused primarily on the former LAFB. The former LAFB occupied approximately 9607 acres and was active from 1942 until 1966. In 1988, three municipal wells operated by the City of Moses Lake were found to be contaminated with trichloroethene (TCE). Additionally, TCE was historically detected in two domestic wells operated by the Skyline Water System, Inc., a private water provider located in unincorporated Grant County south of the former LAFB property. Domestic (residential) and commercial (light or heavy industrial) private wells locations outside the former base have also had detections of TCE. TCE concentrations associated with the Site have been found to exceed EPA's National Primary Drinking Water Standards (the Maximum Contaminant Level (MCL)) under the Federal Safe Drinking Water Act. The MCL represents the maximum level (i.e., concentration) of the contaminant allowed in drinking water, and is set at 5 µg/L for TCE.

Based on the TCE detections described above, between 1989 and 1993 the City chose to fix the three contaminated City water-supply wells south of the Airport by extending the casings down to the lower basalt aquifers. In addition, the Skyline community, which was dependent on the Skyline water system, received an alternative water source (bottled water) between 1997 and 2003. In 2003, USACE completed construction of a replacement water-supply well, which draws water from a deeper, uncontaminated groundwater aquifer, and currently provides drinking water to the Skyline community.

Following findings of contaminated domestic (private) wells and upon request from Region 10 EPA, USACE began a private well groundwater sampling program in 2001. The groundwater sampling program has been used to ensure that humans are not exposed to contaminant concentrations above the MCL, and to monitor TCE plume migration. Under this program, drinking water from private wells¹ and small drinking water systems (Group A and B systems)² were sampled (with some gaps between sampling events) for TCE related compounds. Recently, USACE has also been sampling monitoring wells at least annually and those data are presented with the results from private wells and small drinking water systems in an annual report (this document). City of Moses Lake wells are routinely sampled for VOCs per WA State Dept. of Health

¹ Private wells consist of wells used for drinking and other domestic uses, and industrial process wells.

² A "Group A" public water system is defined in RCW 70.119A.020 as a public water system with at least 15 service connections regardless of the number of people; or a system serving an average of 25 or more people per day for at least 60 days per year, regardless of number of service connections; or a system serving 1,000 or more people on two or more consecutive days. A "Group B" public water system is any public water system that does not meet the definition of a Group A system. For ease of reporting, small drinking water systems are reported as part of private wells.

(WDOH) requirements, and the results are posted on WDOH's website. However, since the wells that WDOH samples are all screened below the contaminated aquifers, those data are not included in this report.

For ease of reporting, small drinking water systems are reported as part of private wells. The majority of private wells sampled are located in the Cascade Valley area immediately downgradient of the main (north) and south plumes (see Figure 4 through Figure 12). In 2002, following two private well monitoring events, a whole house filter (WHF) system was designed and installed at five residential sites where it was determined that TCE contamination could potentially exceed the drinking water standard for TCE (5 µg/L).

Groundwater monitoring wells have been installed over the last 22 years in order to monitor contamination at the Site. Groundwater elevation data are collected where available to evaluate groundwater flow direction and are also used to evaluate plume migration at groundwater monitoring wells.

An IROD was signed in September 2008 (EPA 2008) for cleanup actions in areas with soil and groundwater contamination that exceed risk-based concentrations. The IROD required groundwater pump and treat systems to be installed for two of five identified TCE plumes. The IROD further specified that cleanup levels will be attained throughout all the plumes, but active remediation may be discontinued if it can be demonstrated that natural attenuation (through dilution) can remediate the remnant plumes in a reasonable timeframe (within the estimated 30 years for cleanup).

The IROD specifies that information gathered during groundwater monitoring, as well as design and operation of the selected groundwater pump and treat system, be used to determine the need for refinement of the selected groundwater remedy to meet groundwater restoration goals. Currently, EPA is designing a pump and treat system for the south plume that is anticipated to be operational in 2018 (the south plume as defined in the IROD is illustrated in Figure 2). Information from operation of the south plume treatment system will be used to make decisions on a second pump and treat system that is planned to be installed for the main plume.

The COCs monitored in the groundwater sampling program are as follows:

- trichloroethene (TCE)
- cis-1,2-dichloroethene (cis-DCE)
- trans-1,2-dichloroethene (trans-DCE)
- vinyl chloride (VC)
- 1,1-dichloroethene (1,1-DCE)
- 1,2-dichloroethane (DCA)
- 1,1,1-trichloroethane (TCA)
- 1,1-dichloroethane (1,1-DCA)

Only TCE, however, has a cleanup level established in the IROD, and the other VOCs have either never been detected or have been detected only at levels far below any established MCL or risk-based cleanup level.

1.3. Geologic Setting

The Site occupies a nearly flat fluvial terrace bounded to the east by Crab Creek and to the south and west by Moses Lake. The geologic units affected by contamination include, with increasing depth and from youngest to oldest: sand and coarse gravel deposited by huge glacial floods (Hanford formation), silt and sand deposited in lakes and rivers (Ringold Formation, locally eroded away to the north and east), and several extensive basalt flows of the Wanapum Basalt Formation. The Wanapum Basalt at the Site is divided into three members as follows, from geologically youngest to oldest: the Priest Rapids Member, the Roza Member, and the Frenchman Springs Member. At the Site, the Roza Member consists of three basalt flows, of which Roza 1 is the youngest and always the first encountered. The Priest Rapids Member overlies the Roza Member in the central portions of the Site, but is mostly highly weathered and has been eroded away entirely along the east and west margins. The basalt flows typically have a vesiculated, fractured, and sometimes brecciated flowtop overlying a dense flow interior characterized by vertical cooling fractures. The deeper and less weathered the basalt flows are, the more likely these fractures are to be completely filled by secondary minerals (EPA 2008).

Figure 3 illustrates the Hydrogeologic Conceptual Model, which shows the geological members as defined in the IROD. The hydrostratigraphic units relevant to the Site are as follows:

- Hanford Formation (aquifer in areas, but unsaturated beneath a substantial portion of the Site)
- Ringold Formation (locally semi-confining, locally water-bearing, absent in areas)
- Priest Rapids and flow-top of Roza 1 (aquifer)
- Dense flow interior of Roza 1
- Roza 2 flow top (aquifer) Dense flow interior of Roza 2 (aquitard)

TCE has been detected in all three aquifers described above, indicating that there is some connectivity between aquifers. The highest concentrations of TCE are found in the Priest Rapids and flow-top of Roza 1 aquifer. The TCE occurrence and migration pathways are also illustrated on Figure 3, showing the complexity of contaminant flow through the fractured basalts.

Monitoring well nomenclature is based on the Hydrogeologic Conceptual Model. The Hanford Formation aquifer is generally associated with the “AW” series monitoring wells; the Priest Rapids and Roza 1 aquifer is associated with “BW” series monitoring wells; and the Roza 2 basalt flow is associated with the “CW” series monitoring wells. An example of monitoring well nomenclature is 12BW05, which represents a well drilled in 2012 (12), screened within the Priest Rapids and Roza 1 aquifer (BW), and fifth in the BW monitoring well installation series (05) for that year.

TCE contamination is found primarily in the upper basalt aquifers (Priest Rapids and Roza 1, and Roza 2). Some of the private wells may be drawing water from the overlying alluvium, but driller logs suggest that the majority of the private wells are open only in basalt. Some draw from several basalt flows, but rarely from below Roza 2.

1.4. Previous Investigations

On February 16, 1988, groundwater samples were collected by the Washington Department of Social and Health Services (DSHS) from eight wells serving the City of Moses Lake municipal water supply system. Analytical results indicated that three wells contained elevated concentrations of TCE. Additional sampling by DSHS in both September and December of 1988 found TCE in several City of Moses Lake and Skyline Water Company wells.

Based on these preliminary sampling results, EPA requested that Ecology and Environment, Inc. (E&E) outline possible approaches to identify the potential source or sources of TCE groundwater contamination in the Moses Lake area. E&E identified a number of potential source areas for the TCE contamination. In response to the detection of TCE in the municipal wells, USACE, the Department of Defense representative for deactivated armed forces bases, conducted interviews with former LAFB employees in 1989. These interviews identified four potential chemical waste disposal areas and thirteen other potential areas where TCE may have been handled, as source areas for groundwater contamination. Additional relevant investigations and actions since 1989 have been as follows:

- October 14, 1992 – Site listed on the National Priority List (NPL).
- 1993 – Dames & Moore completed a Phase I Remedial Investigation (RI) Report, documenting TCE in the Hanford Formation and Priest Rapids-Roza 1 aquifer. The investigation did not include the lower basalt (Roza 2) aquifer. The boundary of the TCE plume was partially defined to the north and east, but the south and west were not clearly delineated.
- 1995 - Dames & Moore completed an addendum to the 1993 Phase I RI, confirming TCE in the central and southern portion of the former LAFB in the Hanford Formation and upper Priest Rapids-Roza 1 groundwater.
- 1998 - URS Greiner sampled private water wells and other wells for Class A and Class B water systems east, south, and southwest of the previously known TCE plume. There were eight detections of TCE during this study.
- 1999 - USACE retained Montgomery Watson to perform an RI at the Site. During the course of the RI, several private wells were tested and found to be contaminated with TCE. Four wells that were previously outside of the TCE plume were found to be above the detection limit (MWH 1999).
- 2001 - USACE contracted with MSC Environmental to install single stage WHF carbon filtration units at five of the wells.
- 2003 – USACE completed a replacement well for the Skyline Water Supply system to replace the two contaminated original Skyline wells. During construction of the replacement well, TCE contamination was unexpectedly found in the Roza 2 aquifer, so drilling continued to the Frenchmen Spring Member basalt aquifer, and the well was screened at 661 to 722 ft bgs.
- 2004 - USACE confirmed TCE contamination in the Roza 2 aquifer as part of the Nature and Extent Investigation completed to support the FS.
- 2007 - CALIBRE began replacing the original single filter units with lead-lag systems. In June 2008, filters were replaced at private wells known as WP-14, WP-70, WP-82, WP-83, and WP-86.

- 2009-2012, four rounds of monitoring and filter replacement occurred at WP-14, WP-82, WP-83, and WP-86 (EHS 2009a; EHS 2009b).
- Since 2012, field work has been performed by USACE staff, analytical work by Analytical Resources, Inc (ARI), and data validation by Laboratory Data Consultants, Inc (LDC). Since 2013, WHF work has been done by McMullen Water Systems.

1.5. USACE Investigation Strategy

The USACE investigation strategy, with input from EPA, includes sampling groundwater monitoring wells and private wells to ensure protection of human health by comparing the results to the federal drinking water MCL for Site contaminants such as TCE that resulted from historic Site activities. The investigation strategy for monitoring wells and private wells is provided below, and is based on the USACE Work Plan-QAPP developed or adjusted each year for the sampling program.

1.5.1. Groundwater Monitoring Wells and Extraction Wells

Between 1991 and 2005, approximately 82 groundwater monitoring wells were installed on the Site by licensed drillers contracted by USACE. An additional 21 monitoring wells have been installed since that time for a total of approximately 103 monitoring wells installed across the site within multiple aquifers. Of those 103 monitoring wells, at least 40 wells are known to have been fitted with dedicated bladder pumps, and 35 others had never had dedicated sampling pumps installed and were designated for passive diffusion bag (PDB) sampling when USACE resumed Site groundwater monitoring in 2013. EPA and USACE agreed to implement PDB sample collection at the remaining 35 monitoring wells based on cost effectiveness, close correlation between PDB sampler and bladder pump sampling results at most wells evaluated during the Nature and Extent Investigation (NEI) conducted by USACE in 2004-2005, and PDB case studies and investigations conducted by the US Geological Survey and the US Air Force.

Groundwater monitoring well sampling has been focused on identifying TCE concentrations and tracking plume extent and migration and included collection of groundwater elevation data to evaluate groundwater flow direction. Samples were obtained from dedicated bladder pumps installed in monitoring wells or from passive diffusion bags (PDBs). The majority of the monitoring wells are located northeast of the Cascade Valley area (see Figure 4).

Groundwater analytical data will be used to assess plume migration both before and after the groundwater pump and treat system is operational, and will support groundwater contour modeling. Monitoring data will be used to assess the effectiveness of the future groundwater pump and treat system in restoring groundwater to Federal drinking water standards and State cleanup levels.

Five extraction wells (12EX01, 12EX02, 14EX03, 14EX04 and 14EX05) have been installed in the Roza 1 aquifer as part of a future pump and treat remedy for the south plume. The treatment system is anticipated to be operational in 2018. The extraction wells to date have been treated like monitoring wells, and have been sampled using PDBs following the same procedures as the monitoring wells.

1.5.2. Private Wells

The Moses Lake IROD requires preventing human exposure to COCs in groundwater that are above their MCLs. TCE is the focus for interim groundwater monitoring activities, since it is the only COC that historically has exceeded its MCL (5 µg/L). In fact, it is the only groundwater COC listed in the IROD. The investigation strategy for the private well sampling program historically began with a list of existing private wells within the 5 µg/L TCE plume boundary or near the leading edge of the plume boundary. Some well owners were recruited for the private groundwater sampling program in the 1990s and early 2000s. Other residents have asked to be included in the sampling program over the years. USACE successfully recruited many additional home owners in 2012/2013, and the private well network was also optimized in 2013 to remove a number of non-detect wells that were outside of the plume area. As more information has become available that helps identify private wells that may be impacted, well owners have been and will continue to be recruited for evaluation.

Sampling of private wells prior to 2013 consisted of selecting up to 53 private (domestic) wells per year to assess TCE concentrations within the Site. The majority of private wells sampled are located in the Cascade Valley area immediately downgradient of the main and south plumes (see Figure 5). Information regarding private well depth and screen length is typically limited, but can be available in WDOE installation records or based on the well owner's personal knowledge. It is believed that groundwater collected from private wells in the Moses Lake area is primarily from the upper basalt aquifers (Roza 1 and Roza 2). While information on groundwater monitoring wells is more complete in the Moses Lake area overall, there are only two groundwater monitoring wells located within the Cascade Valley and none immediately upgradient of Cascade Valley. Therefore, it is unclear whether the TCE contamination detected in private wells originates from the main plume to the northeast, the south plume to the east, or from an unidentified source to the north of Cascade Valley. Addressing this data gap is critical for refining the conceptual site model (CSM).

Historically, a Site action threshold of 3.5 µg/L of TCE has been used as the groundwater concentration at which cautionary engineering controls such as WHFs are implemented. The action threshold accounts for analytical uncertainty of the method used for TCE quantitation to ensure human exposure above the MCL does not occur. This value is based on the analytical laboratory lower recovery limit of 30 percent, applied to the TCE MCL of 5 µg/L ($5.0 \mu\text{g/L} - [0.30\% * 5.0] = 3.5 \mu\text{g/L}$). Wells with existing WHFs are sampled initially quarterly (influent, mid, and effluent ports) to determine contaminant loading to the activated carbon filters for calculation of potential contaminant breakthrough (i.e., concentrations that exceed the action threshold). After a year of sampling, a WHF efficiency analysis is performed to verify that the WHF filters are preventing exposure to TCE, and to determine if sampling frequency can be reduced.

The 2015 (and continuing) sampling strategy for private wells is to sample annually the entire suite of wells, and quarterly those with either WHFs or TCE detections that have historically been greater than 2.0 µg/L. Groundwater elevation data are not obtained from the private wells due to the potential for entangling the water level indicator cable with pump plumbing and/or cables present in the private wells. Additionally, many of the well heads are not equipped with sounding ports. Consequently, well head elevations have not been surveyed.

2. SAMPLING AND FIELD ACTIVITIES FOR 2015

The 2015 sampling program consisted of five events described below. A detailed report for each sampling event can be found in Appendix A (Field Sampling Reports). Table 1 lists the wells that were sampled for each event, and Appendix B includes comprehensive analytical results for all 2015 events.

A summary of each sampling event is provided below for groundwater monitoring wells and private wells. USACE only sampled properties where the well is located and for which we had Rights-of-Entry (ROEs). No sampling was conducted at homes that are supplied by neighboring wells; however, in many cases ROEs have previously been obtained to facilitate sending sampling results.

Private wells with WHF systems (see Table 2) were sampled (before and after GAC replacement) upstream of the filtration system (the influent sample), between the lead and lag filter units (the mid sample), and downstream of the lag filter unit (the effluent sample, which is the post-filtration sample prior to water entering the residence). WHF systems were inspected every six months to ensure all parts were working properly and to replace the fines filters; both GAC vessels of each system were replaced annually.

Private wells without WHF systems were sampled from a water tap as close to the well head as possible.

2.1. Event 1 (November 2014)

2.1.1. Groundwater Monitoring Wells

During Event 1, 69 groundwater monitoring wells consisting of 34 bladder pump wells and 35 PDB wells were sampled for VOCs in accordance with the 2015 Work Plan-QAPP. Groundwater elevation data were collected from all sampled monitoring wells. After samples were collected, PDBs were deployed in wells without dedicated bladder pumps.

2.1.2. Private Wells

During Event 1, seven private wells with WHFs were sampled for VOCs. WP-14, WP-70, WP-83, and WP-86 were sampled at the influent port only to document incoming TCE concentrations. WP-121, WP-123, and WP-124 were sampled from the influent, mid, and effluent sampling ports to document the presence of TCE in the influent port and efficiency of the filters based on the results from the effluent port. Before sample collection, totalizer flow meter readings were recorded.

Six private wells without WHFs (WP-04, WP-27, WP-125, WP-131, WP-167, and WP-168) were also sampled for VOCs in November 2014 because TCE concentrations between 2 and 3.5 µg/L had been detected at those locations during the June 2013 sampling event. Data collected from these wells will be used for seasonal trend analysis.

2.2. Event 2 (February 2015)

2.2.1. Groundwater Monitoring Wells

During Event 2, 47 groundwater monitoring wells consisting of 17 bladder pump wells and 30 PDB wells were sampled for VOCs in accordance with the 2015 Work Plan-QAPP. Groundwater elevation data were collected from all sampled monitoring wells. After samples were collected, PDBs were deployed in wells without dedicated bladder pumps.

For the 2015 sampling program, EPA requested a one-time sampling of perfluorinated compounds at monitoring wells 91AW13 and 00BW06, and a one-time sampling of perchlorate at monitoring wells 91AW01, 91BW01, 91AW15, 91AW07, 99BW01, 00BW16, 00BW11, and 00AW13.

During the February sampling event, the lead sampler (Marsh) accidentally removed pumps at MW2 and MW4 because he thought they were old due to similar pumps being removed from other Moses Lake wells in the 1990s. However, they were active City wells, so EPA approval was requested and received to install bladder pumps. Installation was done by Corps on 3/19/15 (Marsh) and included training of city personnel, who were very happy with results. The EPA RPM was also on site and satisfied with work.

2.2.2. Private Wells

During Event 2, seven private wells with WHFs were sampled for VOCs. WP-14, WP-70, WP-83, WP-86, WP-121, and WP-124 were sampled at the influent port only to document incoming TCE concentrations. WP-123 was sampled from the influent, mid, and effluent sampling ports to document the presence of TCE in the influent port and efficiency of the filters based on the results from the effluent port. Before sample collection, totalizer flow meter readings were recorded.

Six private wells without WHFs (WP-04, WP-27, WP-125, WP-131, WP-167, and WP-168) were also sampled for VOCs in February 2015 because TCE concentrations between 2 and 3.5 µg/L had been detected at those locations during the June 2013 sampling event. Data collected from these wells will be used for seasonal trend analysis. Based on Event 2 results, a WHF was recommended for WP-125 and installed in April 2015.

2.3. Event 3 (May 2015)

2.3.1. Groundwater Monitoring Wells

During Event 3, 82 groundwater monitoring wells consisting of 43 bladder pump wells and 39 PDB wells were sampled for VOCs in accordance with the 2015 Work Plan-QAPP. Groundwater elevation data were collected from all sampled monitoring wells. After samples were collected, PDBs were deployed in wells without dedicated bladder pumps. There was insufficient water in 99AW10 to collect a sample.

2.3.2. Private Wells

In May 2015, GAC vessels were replaced at four WHF wells (WP-14, WP-70, WP-83 and WP-86). Before sample collection, totalizer flow meter readings were recorded. After the filters were replaced, the mid and

effluent ports were sampled for VOCs to ensure the filter systems were working properly. All systems were verified to be reducing effluent concentrations to below the TCE action threshold.

Three WHF wells (WP-121, WP-124, and WP-129) were sampled at the influent port only to document incoming TCE concentrations. Two WHF wells (WP-123 and WP-125) were sampled from the influent, mid, and effluent sampling ports to document the presence of TCE in the influent port and efficiency of the filters based on the results from the effluent port. Before sample collection, totalizer flow meter readings were recorded.

In May 2015, 60 private wells without WHFs were also sampled for VOCs. However, several additional wells could not be sampled: the owner at WP-118 did not answer (b) (6); the owners at WP-65 refused to let USACE sample this year; the owner at WP-154 (b) (6); and the samplers were unable to obtain the key to sample at WP-71B.

2.4. Event 4 (August 2015)

2.4.1. Groundwater Monitoring Wells

During Event 4, 29 groundwater monitoring wells consisting of four bladder pump wells and 25 PDB wells were sampled for VOCs in accordance with the 2015 Work Plan-QAPP. Groundwater elevation data were collected from all sampled monitoring wells. After samples were collected, PDBs were deployed in wells without dedicated bladder pumps.

2.4.2. Private Wells

During Event 4, nine private wells with WHFs were sampled for VOCs. WP-14, WP-70, WP-83, WP-86, WP-121, WP-124, and WP-129 were sampled at the influent port only to document incoming TCE concentrations. WP-123 and WP-125 were sampled from the influent, mid, and effluent sampling ports to document the presence of TCE in the influent port and efficiency of the filters based on the results from the effluent port. Before sample collection, totalizer flow meter readings were recorded.

Five private wells without WHFs (WP-04, WP-27, WP-131, WP-167, and WP-168) were also sampled for VOCs in August 2015. These wells were sampled because TCE concentrations between 2 and 3.5 µg/L were detected at those locations during the June 2013 sampling event. Data collected from these wells will be used for seasonal trend analysis.

2.5. Event 5 (November 2015)

2.5.1. Groundwater Monitoring Wells

During Event 5, 29 groundwater monitoring wells consisting of four bladder pump wells and 25 PDB wells were sampled for VOCs in accordance with the 2015 Work Plan-QAPP. Groundwater elevation data were collected from all sampled monitoring wells. After samples were collected, PDBs were deployed in wells without dedicated bladder pumps.

2.5.2. Private Wells

In November 2015, GAC vessels were replaced at five WHF wells (WP-119, WP-121, WP-123, WP-124 and WP-129). Before sample collection, totalizer flow meter readings were recorded. After the filters were replaced, the mid and effluent ports were sampled to ensure the filter systems were working properly. All systems were verified to be reducing effluent concentrations to below the TCE action threshold.

Four WHF wells (WP-14, WP-70, WP-83 and WP-86) were sampled at the influent port only to document incoming TCE concentrations. One WHF well (WP-125) was sampled from the influent, mid, and effluent sampling ports to document the presence of TCE in the influent port and efficiency of the filters based on the results from the effluent port. Before sample collection, totalizing flow meter readings were recorded.

Four private wells without WHFs (WP-27, WP-131, WP-167, and WP-168) were also sampled for VOCs in November 2015. These wells were sampled because TCE concentrations between 2 and 3.5 µg/L had been detected at those locations during the June 2013 sampling event. Data collected from these wells will be used for seasonal trend analysis.

WP-116 was sampled in November 2015 at the request of the homeowner because the well intake was raised approximately 20 feet after replacing a pipe. The sample results were similar to previous sampling events, indicating that raising the well did not affect concentrations in the groundwater.

WP-04 (Granite Construction) was not sampled as intended because there was no one at the office to give the samplers the key. Previously, gravel pit staff had always been at the office, and thus prior arrangements had never been necessary. However, the gravel pit now apparently has reduced winter hours. Thus, in the future, sampling appointments will be made ahead of time like they are for other private wells.

2.6. Right of Entry (ROE) Acquisition

Right-of-Entry (ROE) forms are used to obtain permission to enter onto property to conduct water sampling. In general, USACE only obtained ROEs from property owners (and tenants, if applicable) where a well is located. During 2015 sampling year, USACE was unable to acquire ROEs for the following wells:

- WP-11: (b) (6), the owner, indicated (b) (6) did not want the Government involved with (b) (6) property (b) (6) s on well water.
- WP-77: (b) (6), the owner, is now on city water. (b) (6) has a broken pump and does not have the means to fix it.
- WP-15W: This system has not been sampled by USACE because it is apparently a back-up system. (b) (6) unwilling to meet with USACE to sign ROEs for this system. The well house is also (b) (6). Due to lack of an ROE and for safety reasons, this well was not sampled.
- WP-25W: The Hillcrest Water Users Association POC (John Freitag) has agreed to sign an ROE annually; he is unwilling to sign an ROE for a longer period.

USACE will continue to make an attempt at least annually (anticipated during the annual May event) to acquire an ROE.

3. ANALYSIS, DATA VALIDATION, AND RESULTS

The sections below discuss analytical and data validation procedures, and then groundwater elevations and analytical results for monitoring/extraction wells and analytical results for private wells. A comprehensive table of all analytical results is provided in Appendix B.

3.1. Analytical and Data Validation Procedures

All sampling and analytical activities were executed in compliance with project data quality objectives (DQOs), and results are considered acceptable for use.

The analytical laboratory used for this project was Analytical Resources, Inc. (ARI) of Tukwila, WA. Samples were analyzed by EPA Method 524.3 for VOCs, by SW-846 Method 6850 for perchlorate, and by EPA Method 537 for perfluorinated compounds. These methods produce data with the analytical sensitivity required to evaluate whether drinking water meets the Federal MCLs for applicable analytes. A Quality Control Summary Report (QCSR) summarizing analytical performance expressed in terms of data quality indicators (DQIs) can be found in Appendix F.

Laboratory Data Consultants, Inc. (LDC) of Carlsbad, CA, performed the data validation task. The Data Validation Report (DVR) presents Stage 2a and Stage 4 data validation results for samples collected. Data validation was performed in accordance with the requirements outlined in LDC's SOW for services; the USACE-prepared 2015 Work Plan-QAPP (USACE 2015a); the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (DOD 2013); and the Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (CLPNFG 2008). A full chemical Data Validation Report is provided in Appendix G. Based on the data quality assessment presented in the QCSR and the DVR, the overall quality of data is known and acceptable for the intended use.

Water samples and associated quality control (QC) samples were collected from groundwater monitoring wells and private wells in accordance with the 2015 USACE Work Plan-QAPP. Field QC samples included field duplicates, field blanks, trip blanks, matrix spikes (MS), and matrix spike duplicates (MSDs). A performance evaluation (PE) sample, provided by Environmental Resource Associates of Arvada, CO, was submitted for VOC analysis during the November 2015 sampling event.

3.2. Monitoring Wells - Results

3.2.1. Groundwater Elevations

Groundwater elevations, summarized in Table 3, were collected from 88 monitoring wells during Event 3. Golden Software's Surfer® program, with Kriging selected as the interpolation method, was used to produce groundwater elevation contours of the BW and CW monitoring wells (Priest Rapids-Roza 1 aquifer and Roza 2 aquifer, respectively). The general flow direction in the Priest Rapids-Roza 1 aquifer in the northern portion of the Site is to the southwest (see Figure 7), which is consistent with previous groundwater elevation data. The groundwater flow direction within the south plume is southerly, which is consistent with previous groundwater elevation data.

The flow direction in the Roza 2 aquifer radiates to the northwest and south from well 12CW03; well 12CW03 is located in the northern portion of the south plume (see Figure 8). The contours were blanked between 12CW04 and the other CW monitoring wells to the north due to lack of data. The exact location of the peak elevation of the groundwater in the Roza 2 aquifer is not known due to this lack of data.

The software-generated groundwater contours were reviewed by a hydrogeologist and deemed to be accurate. The data for the groundwater elevation figures are based on Event 3 (May 2015) only.

Groundwater elevation data were not collected from private wells, due to the risk of entangling the water level indicator cord with private well pumps. In addition, unless the residents' and neighbors' use of water could be controlled, the elevations collected would not be indicative of natural contours.

3.2.2. Analytical Results

Analytical results for the groundwater monitoring and extraction wells are provided in Table 4 and shown in Figure 9 (Priest Rapids-Roza 1) and Figure 10 (Roza 2). The May 2015 TCE results were used to generate the figures. Of the 83 monitoring and extraction wells sampled, 34 wells had no detections above the reporting limits for VOCs, 49 wells had TCE detections above 0.2 µg/L, and a subset (six) also had cis-DCE detections. Twenty-five of those 49 wells exceeded the MCL (5.0 µg/L) for TCE. The maximum TCE detection in the Priest Rapids-Roza 1 aquifer was 106 µg/L in well 12BW05 in November 2014 (an increase from 88.2 µg/L in June 2014). The maximum cis-DCE detection in the Priest Rapids-Roza 1 aquifer was 8.82 µg/L at well 04BW06 in November 2014. The maximum TCE detection in the Roza 2 aquifer was 7.16 µg/L at well 04CW07 in February 2015 (an increase from 5.73 µg/L in 2014). Well 04CW07 is the only Roza 2 monitoring well that exceeded the TCE MCL; it is located below the southern portion of the south plume. There were no cis-DCE detections in the Roza 2 aquifer.

EPA recommended a one-time sampling of perchlorate and perfluorinated compounds (PFCs) at select monitoring wells. Perchlorate was sampled at eight wells and was non-detect in all wells. PFCs were sampled at two monitoring wells located near the Site 10-Fire Training Pit Area. Of the six PFCs reported, only four analytes were detected: perfluoroheptanoic acid, perfluorohexanesulfonic acid (PFHXS), perfluorononanoic acid (PFNA), and perfluorooctanoic acid (PFOA). The results are presented in Table 5.

3.3. Private Wells without WHFs– Results

This section summarizes results for private wells without WHFs.

3.3.1. Analytical Results

Analytical results for the private wells without WHFs are provided in Table 6. TCE and cis-DCE were the only analytes detected out of the eight analytes evaluated in 2015. Of the 60 private non-WHF well locations sampled, TCE results can be summarized as follows: 13 had no detections (i.e., results were < 0.2 µg/L), and 47 had TCE detections at or above 0.2 µg/L. Of those 47, WP-04, WP-131, WP-167, and WP-168 had TCE concentrations above 2.0 µg/L for at least one event and were sampled quarterly. WP-27 was also sampled quarterly during the 2015 sampling year because it had historical detections greater than 2.0 µg/L; however, none of the 2015 results were above 2.0 µg/L. WP-04 exceeded the TCE MCL (5.0 µg/L); however, this well is not used for drinking water.

The maximum TCE detection was 5.45 µg/L at WP-04 in August 2015. Well WP-04 is used for industrial process water and has had TCE concentrations that fluctuate around the MCL. Between November 2014 and August 2015 the TCE concentrations ranged from 4.80-5.45 µg/L, and the graph in Appendix D shows a rising trend. No WHF is needed at this location because the water is not being used for consumption. The business associated with WP-04 has previously been informed of the elevated risk associated with TCE and has been asked to provide signage stating that well water should not be used for human or animal consumption. To the Corps' knowledge, no signs have been placed yet; see recommendations in Executive Summary and Section 6.

A TCE concentration of 3.58 µg/L was recorded at WP-125 during February 2015 sampling event. Because this value exceeded the 3.5 µg/L TCE action threshold to protect human health, a WHF was installed in April 2015, prior to the May 2015 Sampling Event.

Six private wells had cis-DCE detections. The maximum detection was 1.85 µg/L at well WP-04 in August 2015, which is considerably lower than the cis-DCE MCL (70 µg/L).

3.4. Private Wells with WHFs – Results

The analytical results and the efficiency of the WHFs are discussed below.

3.4.1. Analytical Results

Table 7 provides the TCE and cis-DCE analytical results for the private wells with WHFs. Table 8 summarizes purge volumes collected prior to sampling at WHF wells. For the 2015 sampling year, the WHFs were successful in reducing TCE and cis-DCE to undetected concentrations in the effluent ports, which lead into the homes, indicating that the WHFs are working effectively.

During Event 2 (February 2015), WP-125 (at that time without a WHF) had influent TCE concentrations that exceeded the action threshold of 3.5 µg/L. Consequently, a WHF was installed in April 2015, prior to Event 3 (May 2015). Sampling results from Event 3 showed that the WHF at WP-125 was working effectively because results were non-detect in the mid and effluent samples.

Contractor-analyzed spent GAC did not exceed any Toxicity Characteristic Leaching Procedure (TCLP) thresholds in 2015.

3.4.2. Whole House Filter Efficiency Analysis

A memorandum (memo) to evaluate the efficiency of the Siemens AWC-1230 WHF systems installed in August and October 2013 at Moses Lake private wells WP-119, WP-121, WP-124, and WP-129 was completed in July 2015 (covering events in November 2013, and February, June, and October 2014). The 2015 Whole House Filter Efficiency Memo is located in Appendix C. The memo evaluated whether the filters worked sufficiently for a year to protect residents from exposure to TCE concentrations greater than the MCL. In addition, this memo evaluated whether there was sufficient evidence to reduce filter sampling frequency from quarterly to something less frequent.

The memo summarized that the WHFs are working sufficiently to ensure protection of human health. The technical team recommends continuing to sample the WHF influent ports quarterly at WP-119, WP-121, WP-124 and WP-129 to evaluate seasonal trends. The team recommend that sampling frequency for the mid and effluent ports can be reduced to annual sampling and still protect human health based on the current flow rates, TCE concentrations, and assumption of annual replacement of WHFs. Additionally, a WHF system was installed at WP-123 in September 2014 and was sampled at all three ports. After the February 2015 sampling event, it was determined that WP-125 needed a WHF system. The WHF system at WP-125 was installed in April 2015 and sampled in May 2015. Efficiency evaluations for WP-123 and WP-125 will be made after the February 2016 sampling event. See also Section 5.2.

3.5. Time-Series Graphs

Time-series graphs were created for 2015 TCE data. These graphs are located in Appendix D and include monitoring well and private wells with four or more previous detections for TCE.

3.6. Top of Basalt and Top of Ringold Formation Data

In 2014, EPA requested that USACE produce figures showing the top of basalt and the top of Ringold formation data. These figures were Figure 11 and Figure 12, respectively in the 2014 Annual Report (USACE 2015b) and have not been reproduced in this 2015 Annual Report.

3.7. Customer Notification of 2014 and 2015 Results

The results from the 2014 Sampling Program (i.e., the focus of the 2014 Annual Report) were mailed to the Moses Lake residents on February 6, 2015. The results from the 2015 Sampling Program (the content of this 2015 Annual Report) were mailed February 18, 2016.

4. State Well Inventory Database Search

To determine whether additional private wells were installed within or near the VOC plume, information from the Washington State Department of Ecology (WDOE) Well Logs database (<https://fortress.wa.gov/ecy/waterresources/map/WCLWebMap/textsearch.aspx>) was queried. The results of the query are provided in Appendix H. Well logs can be found in Appendix I.

The database was searched for wells constructed or well logs received between December 15, 2014 and February 1, 2016 and screened or open to the upper basalt flows in Priest Rapids-Roza 1 and Roza 2 geologic members (see Figure 3). Following the Groundwater Institutional Control Boundary (see Figure 2), all or portions of the following Township, Range, and Sections were queried: T19N, R28E, Sections 4, 5, 6, 7, 8, 9, 16, 17, 18 and T20N, R28E, Sections 16, 17, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32, 33, 34.

Two private wells were installed (USACE/EPA not involved) between December 15, 2014 and February 1, 2016. The two wells (BHW096 and BHW097) are located in Cascade Valley. BHW097 is located approximately 2000 feet south of Dick Road on Shorecrest Drive, far from any historic contaminant detections and is not recommended for sampling. BHW096 is located southwest of WP-18N and WP-18S but on Ottmar Road (see Figure 6) and is recommended for annual sampling. It appears to be drawing groundwater from the Roza 1 aquifer. Groundwater from these formations has historically had VOC contamination in some areas.

5. Summary and Discussion

Summary and discussion of the TCE plume and WHF work for the five sampling events in the 2015 sampling program is provided below.

5.1. Site TCE Plume Discussion

During the 2015 sampling program, the TCE MCL of 5.0 µg/L was exceeded in approximately 30% of the monitoring and extractions wells, primarily in the BW monitoring wells. Regarding the private wells, approximately 58 of the 71 private wells (including WHFs) located in the Cascade Valley had detections of TCE (> 0.20 µg/L) during the 2015 sampling program; however, only WP-04 (Granite Construction) exceeded the TCE MCL of 5.0 µg/L.

TCE plume contours of the 5.0 µg/L TCE MCL, the action threshold of 3.5 µg/L TCE, and the recommended quarterly sampling level 2.0 µg/L were developed based on the May 2015 data and are summarized in Figure 6, Figure 9, and Figure 10. For well locations where two or more data points were available in 2015 (e.g., duplicates), the highest value was used for contouring. The contours were initially generated using the Kriging gridding method in Golden Software's Surfer® program Version 8, which numerically estimates plume boundaries based on input data. The Surfer® Kriging method was used on log-transformed concentration data to produce more systematic and repeatable contouring compared to manually only developed contouring methods historically used for the Site. Where deemed appropriate, the computer generated contours were adjusted based on professional judgment (e.g. open ended contours where there are data gaps). The main plume is open-ended to the southwest due to lack of monitoring well data in the downgradient direction. The northeast plume is only defined by one monitoring well (99BW15) and two private wells (WP-14 and WP-83). The northeast plume contours are open to the northeast due to lack of data in the upgradient direction. The south plume is more continuous, with the highest concentration of 106 µg/L (November 2014) at well 12BW05 (an increase from 88.2 µg/L in June 2014).

It is anticipated that private wells, including those in the Cascade Valley, draw water from the upper basalt aquifers (Priest Rapids-Roza 1 and Roza 2) and potentially the overlying alluvium. However, limited private well construction information makes it difficult to correlate individual private wells with a specific aquifer. In addition, there are only two groundwater monitoring wells located within the Cascade Valley, and they are too distant from the other clusters of monitoring wells to help delineate the origin of groundwater contamination occurring in the Cascade Valley. The majority of private wells in Cascade Valley are downgradient from or near the leading edge of the contaminant plume. Several of the wells sampled in the Cascade Valley area are immediately downgradient of the main (north) and/or south plumes. Until additional monitoring wells become available to track the plume, data from private wells is being used to help understand plume migration. Additional monitoring wells upgradient of Cascade Valley are needed to refine the CSM, help predict TCE concentrations at residential wells, and delineate the extent of TCE contamination in the Roza 1 versus Roza 2 aquifers.

TCE results from WP-04 have shown contaminant concentrations above or near the TCE MCL over the last two years (4.7 µg/L in 2012, 5.48 µg/L in 2013, 4.89 µg/L in 2014, and 5.45 µg/L in 2015). Four WHF systems are clustered near WP-04 and are likely drawing contaminated groundwater associated with the main plume. Contours around WP-04 are open to the northeast due to lack of data in the upgradient

direction. Current data suggest that the private wells downgradient of WP-04 (generally southwest, see Figure 6) without WHF systems are the most at risk of exceeding the TCE MCL. Based on the groundwater elevation contours for BW monitoring wells (Figure 7) and the 2015 TCE contours (Figure 9), the source of TCE contamination in the northern Cascade Valley could be from the main TCE plume or an unidentified source.

Following the June 2013 sampling event, a value of 2.0 µg/L TCE was recommended by USACE and agreed to by EPA as the lower threshold value above which private wells would be monitored quarterly for a minimum of one year given the limited amount of available historic data for private wells. This recommendation was made to evaluate groundwater fluctuations based on seasonal changes (i.e., change in irrigation activities, decrease in precipitation, etc.) and determine whether fluctuations would necessitate action to prevent ingestion of contaminated drinking water. This recommendation for quarterly sampling of private wells continued in 2015 to generate data for trend analyses.

Due to the presence of multiple contaminant plumes and uncertainty of private well construction, all other private wells within the Moses Lake area with any historic COC detections are recommended for annual sampling until a better understanding of plume migration has been documented. Additional houses may be added based on their proximity to wells with elevated concentrations.

5.2. Whole House Filters

In summary, the WHFs are working as intended and reducing cis-DCE and TCE concentrations in effluent samples (i.e., in the water that is supplied to the homes) below both the MCLs and the detection limits for each. The WHF GAC vessels were exchanged annually; the fines filters were replaced every six months, and the WHF systems were also inspected for general functionality at that time. Only one new WHF was installed during the 2015 sampling year at WP-125 in April 2015. The results of the WHF efficiency analysis confirmed that the WHFs are working as intended. Based on discussion with EPA in September 2014, the frequency of WHF port sampling continued in 2015 as follows:

- In the first year after installation, all ports (influent, mid, effluent) will be sampled quarterly.
- At end of first year, an efficiency analysis will be performed.
- In the second year (assuming all is well based on the analysis), the influent port will be sampled quarterly, and the mid and effluent ports annually.
- At end of the second year, a seasonal analysis will be done to decide which quarter is best for annual sampling, with the preference of having the majority of the WHFs on the same schedule.
- In the third year and beyond, all three ports would be sampled only annually.
- USACE will strive to put the WHFs on the same schedule for annual sampling.

6. Recommendations

Recommendations from the 2015 sampling program are provided below.

6.1. Groundwater Monitoring Wells

- Evaluate historical groundwater elevation data and TCE concentrations for evidence of seasonal fluctuations to ensure conservative timing of future optimized annual sampling events in the groundwater monitoring program.
- Evaluate recent groundwater elevation data collected in support of the anticipated south plume pump and treat system in parallel with historic groundwater information to ensure sufficient baseline data are available to support pump and treat system optimization analysis following start-up of the south plume pump and treat system.
- There are currently only two monitoring wells located in Cascade Valley. The monitoring well pair is located just south of Dick Road, which is approximately one mile south of the main plume. Installation of additional monitoring wells in the northern part of Cascade Valley is recommended to refine the conceptual site model and determine the source of the TCE impacting the private wells.
- Installation of six monitoring wells in the Roza 1 basalt aquifer upgradient of Cascade Valley (generally upgradient of WP-04) and downgradient of 04BW06 is planned for summer 2016 to define the origin of contaminant concentrations in the private wells of Cascade Valley. Presently, it is unclear whether contamination impacting north Cascade Valley is coming from the distal portion of the main plume, or another unidentified TCE source.
- Enter monitoring well boring logs and WDOE driller logs (when deemed suitable for interpretation) into a geologic database so that subsurface cross-sections can be readily generated through the main and south plumes and into Cascade Valley.

6.2. Private Wells

- Sample newly installed private well, BHW096, identified through WDOE records search. It appears to be drawing groundwater from the Roza I aquifer. Groundwater from this formation has historically had VOC contamination in some areas. Prior to sampling, USACE will obtain an ROE from homeowner.
- Continue collecting annual groundwater samples from all private wells with any historic COC detections to document plume migration.
- Continue updating the sampling program by adding new private wells, small public water systems (and monitoring wells) with high likelihood of COC detections as they are identified through Department of Ecology's well log database.
- For private wells that exceed 2.0 µg/L TCE, continue collecting quarterly groundwater samples for at least four quarters to evaluate patterns in seasonal and temporal system variability that support future sampling frequency and timing recommendations.
- Continue to communicate with residents who have not agreed to groundwater monitoring but are located in areas anticipated to have elevated TCE concentrations. Document attempted communication with residents, that the residents have declined to participate in the monitoring

program, and that the Government has informed residents of the risks associated with exposure to water exceeding the MCL for TCE.

- Conduct a comprehensive review of WDOE drillers' logs versus assigned private well numbers (WP series) and evaluate which private wells may be suitable for incorporation into a geologic database.
- Purchase signs stating "Non-potable water, do not drink" water for Granite Construction (WP-04) due to exceedances of the TCE MCL during 2014, 2015 (and Feb 2016). Mail letter to Granite Construction informing them that they should not drink the water due to health risks. [Note: these actions occurred in April 2016]. Provide signs to Granite Construction in May 2016 and continue to remind them that the water is not suitable for drinking.

6.3. Whole House Filter Systems

- Continue to install and maintain WHF systems at private wells that exceed the action threshold of 3.5 µg/L TCE.
- Continue to monitor the efficiency of WHF systems by tracking if TCE exceeds its action level of 3.5 µg/L at the mid or effluent ports, and take steps to correct any issues.
- Use information from the WHF totalizing flow meters, which measure the volume of water treated by the WHF systems, to monitor and evaluate the efficiency of the treatment systems.
- Over time, if concentrations at the influent ports to WHFs decline, work with EPA to determine which WHFs can be removed from residential wells.

References

CALIBRE, Inc. 2008. Draft Sampling Event Summary Report prepared for the Domestic Well Whole-House Filter Program for Moses Lake Wellfield Superfund Site (Former Larson Air Force Base), Moses Lake, Washington. August 2008.

CLNFG. 2008. USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (SOM01.2). June 2008.

DoD. 2013. DoD/DOE Quality Systems Manual (QSM) for Environmental Laboratories. Version 5.0. July 13, 2013.

EHS-International, Inc. 2009a. Final Management Plan, Domestic Well Whole-House Filter Program for Moses Lake Wellfield Superfund Site (Former Larson AFB), Moses Lake, Washington. Updated June 2009.

EHS-International, Inc. 2009b. Sampling Event Summary Report, Domestic Well Whole-House Filter Program for Moses Lake Wellfield Superfund Site (Former Larson Air Field Base), Moses Lake, Washington, FINAL. November 2009.

EPA. 2008. U.S. Environmental Protection Agency (EPA). Interim Record of Decision, Moses Lake Wellfield Superfund Site. September 30, 2008.

Montgomery Watson (MWH). 1999. Management Plan Volume II - Part 1, Field Sampling Plan Remedial Investigation/Feasibility Study Moses Lake Wellfield Superfund Site – FINAL. September 1999.

MWH. 2003. Supplemental Management Plan. January 13, 2003.

USACE. 2015a. Final 2015 Work Plan with Quality Assurance Project Plan. Groundwater Monitoring and Whole-House Filter Program for Moses Lake Wellfield Superfund Site. Former Larson AFB. Moses Lake, Washington. February 19, 2015.

USACE. 2015b. 2014 Annual Report. Groundwater Monitoring and Whole House Filter Program for Moses Lake Wellfield Superfund Site (Former Larson Air Force Base). Moses Lake, Washington. June 2, 2015.

Figures

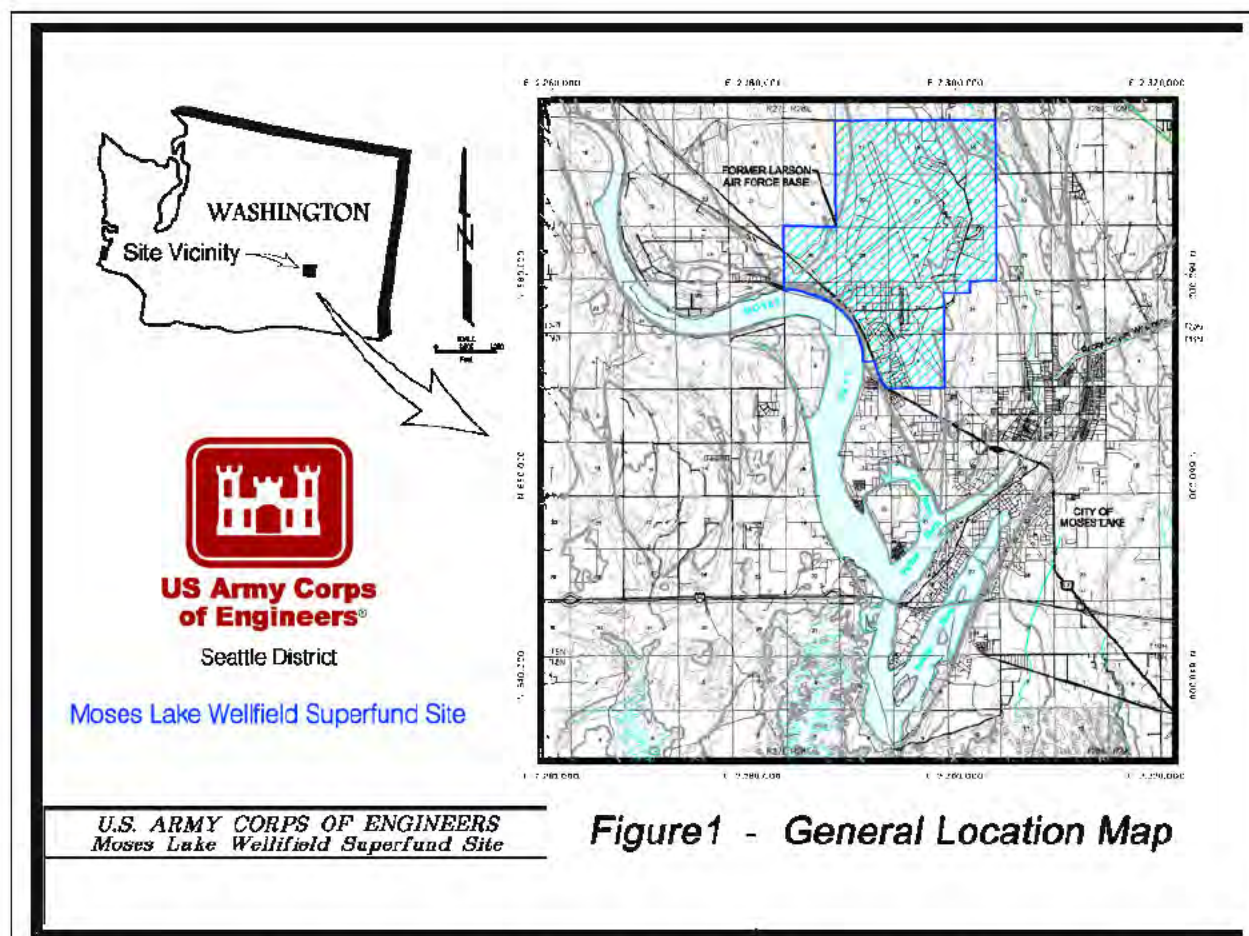


Figure 1. General Location Map for Moses Lake Wellfield Superfund Site (EPA 2008).



Figure 2. Contaminant Boundaries from the Interim Record of Decision (EPA 2008).

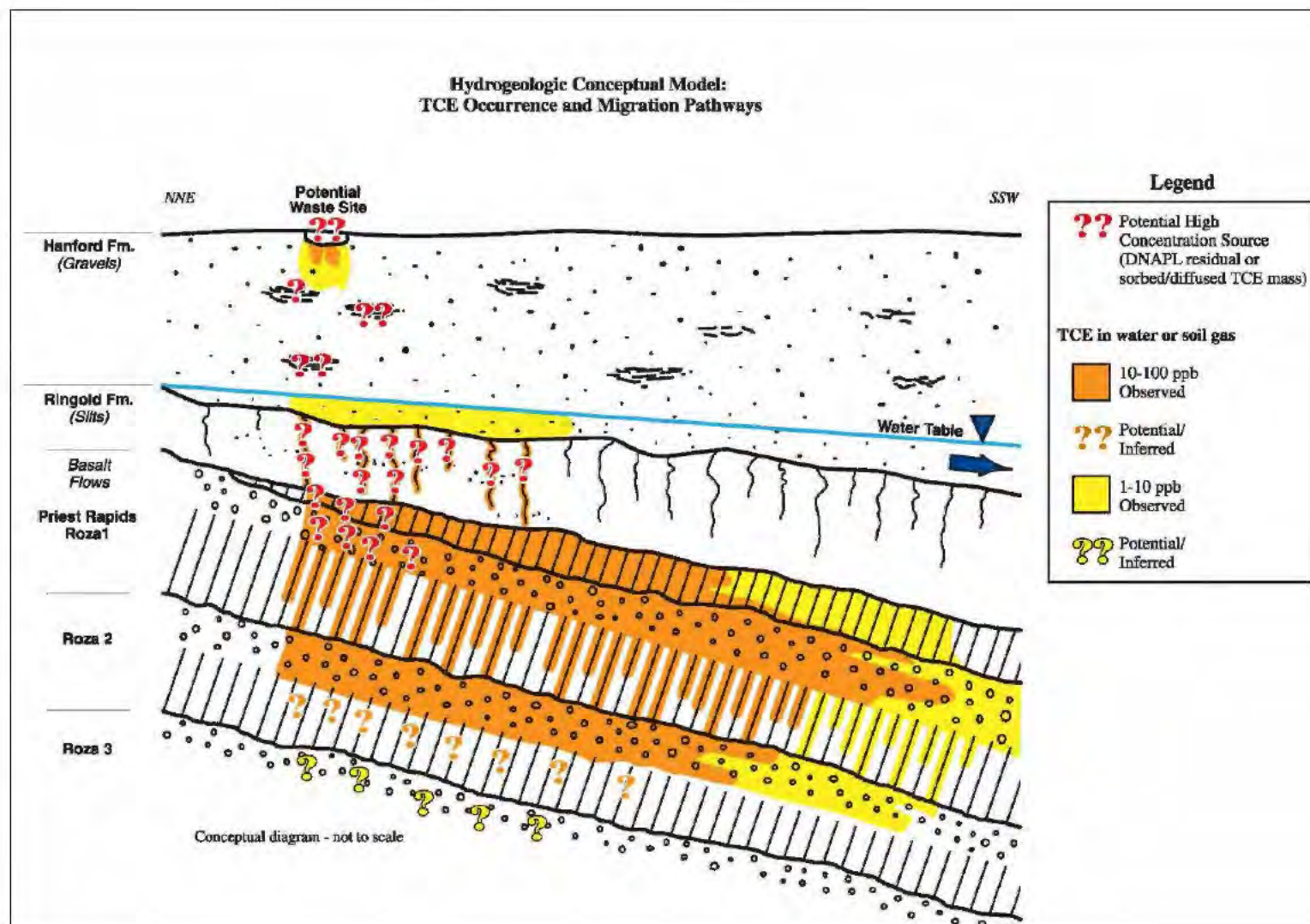


Figure 3. Hydrogeologic Conceptual Model (EPA 2008)

91AW01
91AW03
91AW02
91BW01



99BW04

99BW05
99BW17

99AW10

04BW01
00BW09
01BW01
00BW05
91BW02
00AW08
91AW05
91AW04
91AW06
00BW08
91AW15
00BW11
00BW07
00BW04
00BW14
00BW01
91AW13
00BW06
91AW14
99BW16
04BW04
04CW01
04CW02
91AW18
04BW05
91AW17
91AW08
91AW07
99AW01
99BW01
04CW03
91BW03
91AW09
04BW06
00BW12
91AW16
00BW03
00AW03
99 (b) (6)
WP-83
99BW
92BW01
92BW03
02BW02
00BW02
00AW11
WP-50
00BW15
00AW12
99AW05
99BW12
99BW06

Figure 5

(b) (6)

91AW12
91AW11
91BW04
91AW10
99BW13
99AW06
12BW01
WP-01
(b) (6)
99AW07
99BW14
14EX05
14BW03
04BW09
00AW14
04CW04
12CW03
12BW04
00BW13
04BW07
12BW07
12EX01
91AW19
14EX03
04CW05
12BW05
14BW02
14BW01
12CW04
12CW02
14EX04
99AW09
99BW18
12BW06
12CW05
(b) (6)
12EX02
12BW08
04CW07
12CW01
99BW10
02BW01
12BW02
99AW03
(b) (6)
BHP602
99AW02
99BW09
00AW10
00BW10
04CW08
WP-21
(b) (6)

BCE483

BCE482

Legend

- Monitoring Well, Detect
 - Monitoring Well, Not Sampled
 - Monitoring Well, No Detection
 - Private Well, Detect
 - Private Well, Not Sampled
 - Private Well, No Detection
- Cascade Valley Area

99BW08

0 0.25 0.5

1
Miles

Wellfield Superfund Site
Moses Lake, Washington
Locations of Wells Sampled in 2015



Shorecrest Drive

Dick Road

Ottmar Road

Legend

- Monitoring Well, Detect
- Monitoring Well, Not Sampled
- Monitoring Well, No Detection
- Private Well, Detect
- Private Well, Not Sampled
- Private Well, No Detection
- Cascade Valley Area

Wellfield Superfund Site
Moses Lake, Washington

Locations of Wells Sampled in 2015

Cascade Valley Inset

Date: 23 December 2015

0 0.125 0.25

0.5
Miles

(b) (6)



00BW16
0.2U
00AW13



Shorecrest Drive

(b) (6)

(b) (6)

(b) (6)

(b) (6)

(b) (6)

99BW11
0.2U
9AW04



Dick Road

(b) (6)

(b) (6)

W

Ottmar Road

(b) (6)

(b) (6)

Legend

- Monitoring Well, Detect
- Monitoring Well, Not Sampled
- Monitoring Well, No Detection
- Private Well, Detect
- Private Well, Not Sampled
- Private Well, No Detection

Cascade Valley Area

2 ug/L TCE Contours

3.5 ug/L TCE Contours

5 ug/L TCE Contours

Wellfield Superfund Site
Moses Lake, Washington
TCE Concentration Inset Map
Cascade Valley
(May 2015 Results)
Date: 02 February 2016

0

0.125

0.25

(b) (6)

0.5

Miles



Legend

- Groundwater Elevation (feet)
- Monitoring Well, Detect
- Monitoring Well, Not Sampled
- Monitoring Well, No Detection
- Cascade Valley Area

0 0.25 0.5 1 Miles

Wellfield Superfund Site
Moses Lake, Washington
Priest Rapids/Roza 1 Monitoring
Wells (BW series) with Groundwater
Elevations (May 2015 Results)
Date: 23 December 2015



04CW01
1031.64 ft

04CW02
1031.74 ft

1020

04CW03
1016.14 ft

1025

1030

1035

04CW04
1055.57 ft

12CW03
1059.78 ft

1055

04CW05
1055.74 ft

12CW04
1058.52 ft

1050

1045

1040

1035

1025

12CW01
1029.21 ft

1020

04CW07
1015.95 ft

12CW02
1030.12 ft

1030

12CW05
1029.62 ft

04CW08
1023.76 ft

Legend

- Groundwater Elevation (feet)
- Monitoring Well, Detect
- Monitoring Well, No Detection
- Cascade Valley Area

0

0.25

0.5

1

Miles

Wellfield Superfund Site
Moses Lake, Washington
Roza 2 Monitoring Wells (CW series)
with Groundwater Elevations
(May 2015 Results)
Date: 23 December 2015



Figure 6

Main Plume

Northeast Plume

South Plume

- Legend**
- Monitoring Well, Detect
 - Monitoring Well, No Detection
 - Private Well, Detect
 - Private Well, No Detection
 - Excluded from Contouring
 - Cascade Valley Area
 - 2 ug/L TCE Contours
 - 3.5 ug/L TCE Contours
 - 5 ug/L TCE Contours

Wellfield Superfund Site
Moses Lake, Washington
Priest Rapids-Roza 1 Monitoring Wells
(BW series), with TCE Contours and Results
(May 2015 Results)
Date: 07 January 2016

0 0.25 0.5 1 Miles



04CW01
0.62

04CW02
0.2U

04CW03
2.37

04CW04
0.38

12CW03
0.32

04CW05
2.17

12CW04
0.58

12CW02
0.27

12CW05
0.82

12CW01
3.29

04CW07
5.29

04CW08
0.2U

Legend

- Monitoring Well, No Detection
- Monitoring Well, Detect

Cascade Valley Area

2 ug/L TCE Contours

3.5 ug/L TCE Contours

5 ug/L TCE Contours

Wellfield Superfund Site Moses Lake, Washington

Roza 2 Monitoring Wells (CW series)
with TCE Contours and Results
(May 2015 Results)

Date: 07 January 2016

0

0.25

0.5

1

Miles

Tables

Table 1. Wells Sampled during 2015 Sampling Year

Well ID	November 2014		February 2015		May 2015		August 2015		November 2015	
	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation
00AW11	v	x	v	x	v	x				x
00AW12		x		x	v	x		x		
00AW13	v	x	Perchlorate	x	v	x		x		
00AW14		x		x	v	x		x		
00BW01	v	x		x	v	x		x		x
00BW02	v	x	v	x	v	x		x		x
00BW03	v	x		x	v	x		x		x
00BW04				x	v	x		x		x
00BW05	v	x		x	v	x		x		x
00BW06	v	x	PFC	x	v	x		x		x
00BW07	v	x		x	v	x		x		x
00BW08		x		x	v	x		x		x
00BW09	v	x		x	v	x		x		x
00BW10	v	x		x	v	x		x		x
00BW11	v	x	Perchlorate	x	v	x		x		x
00BW12	v	x	v	x	v	x		x		x
00BW13	v	x		x	v	x		x		x
00BW14	v	x		x	v	x		x		x
00BW15	v	x	v	x	v	x		x		x
00BW16	v	x	Perchlorate	x	v	x		x		x
01BW01	v	x		x	v	x		x		x
02BW01	v	x	v	x	v	x	v	x	v	x
02BW02	v	x		x	v	x		x		x
04BW01	v	x		x	v	x		x		x
04BW04	v	x	v	x	v	x		x		x
04BW05	v	x	v	x	v	x		x		x
04BW06	v	x	v	x	v	x				x
04BW07	v	x		x	v	x		x		x
04BW09	v	x	v	x	v	x	v	x	v	x
04CW01	v	x	v	x	v	x		x		x
04CW02	v	x		x	v	x		x		x
04CW03	v	x	v	x	v	x		x		x
04CW04	v	x	v	x	v	x		x		x
04CW05	v	x	v	x	v	x	v	x	v	x
04CW07A	v	x	v	x	v	x	v	x	v	x
04CW07B	v	x	v	x	v	x	v	x	v	x
04CW08	v	x		x	v	x		x		x
12BW01	v	x		x	v	x		x		
12BW02	v	x	v	x	v	x	v	x	v	x
12BW03A	v	x	v	x	v	x	v	x	v	x
12BW03B	v	x	v	x	v	x	v	x	v	x
12BW04A	v	x	v	x	v	x	v	x	v	x

Well ID	November 2014		February 2015		May 2015		August 2015		November 2015	
	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation
12BW04B	v	x	v	x	v	x	v	x	v	x
12BW05	v	x	v	x	v	x	v	x	v	x
12BW06	v	x	v	x	v	x	v	x	v	x
12BW07	v	x	v	x	v	x	v	x	v	x
12BW08	v	x	v	x	v	x	v	x	v	x
12CW01	v	x	v	x	v	x	v	x	v	x
12CW02	v	x	v	x	v	x	v	x	v	x
12CW03	v	x	v	x	v	x	v	x	v	x
12CW04	v	x	v	x	v	x	v	x	v	x
12CW05	v	x	v	x	v	x	v	x	v	x
12EX01	v	x	v	x	v	x	v	x	v	x
12EX02	v	x	v	x	v	x	v	x	v	x
14BW01	v	x	v	x	v	x	v	x	v	x
14BW02	v	x	v	x	v	x	v	x	v	x
14BW03	v	x	v	x	v	x	v	x	v	x
14EX03	v	x	v	x	v	x	v	x	v	x
14EX04	v	x	v	x	v	x	v	x	v	x
14EX05	v	x	v	x	v	x	v	x	v	x
91AW01		x	Perchlorate	x		x				
91AW07		x	Perchlorate	x	v	x		x		x
91AW09				x	v	x		x		
91AW13			PFC	x		x				
91AW14		x		x	v	x		x		x
91AW15		x	Perchlorate	x	v	x		x		
91AW16		x		x	v	x		x		
91AW17		x			v	x		x		x
91BW01		x	Perchlorate	x		x				
91BW02	v	x		x	v	x		x		x
91BW03	v	x	v	x	v	x		x		x
91BW04	v	x	v	x	v	x	v	x	v	x
92BW01	v	x	v	x	v	x	v	x	v	x
92BW02	v	x	v	x	v	x		x		x
99AW01	v	x	v	x	v	x		x		x
99AW04	v	x	v	x		x		x		
99AW08		x		x	v	x		x		x
99AW09	v	x	v	x	v	x		x		x
99AW10		x		x		x				
99BW01	v	x	v+ Perchlorate	x	v	x		x		x
99BW09	v	x		x	v	x		x		x
99BW10	v	x	v	x	v	x	v	x	v	x
99BW11	v	x		x	v	x		x		x
99BW12	v	x	v	x	v	x		x		x
99BW13		x								

Well ID	November 2014		February 2015		May 2015		August 2015		November 2015	
	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation
99BW14	v	x		x	v	x		x		x
99BW15	v	x	v	x	v	x		x		x
99BW16		x	v	x	v	x		x		x
99BW18	v	x	v	x	v	x	v	x	v	x
MW-2				x	v	x		x		
MW-4				x	v	x		x		
WP-03					v					
WP-04	v		v		v		v			
WP-09					v					
WP-10					v					
WP-105					v					
WP-111					v					
WP-116					v				v	
WP-119									v	
WP-120					v					
WP-121	v		v		v		v		v	
WP-122					v					
WP-123	v		v		v		v		v	
WP-124	v		v		v		v		v	
WP-125	v		v		v		v		v	
WP-126					v					
WP-127					v					
WP-128					v					
WP-129					v		v		v	
WP-130					v					
WP-131	v		v		v		v		v	
WP-136					v					
WP-137					v					
WP-138					v					
WP-139					v					
WP-13E					v					
WP-14	v		v		v		v		v	
WP-143					v					
WP-144					v					
WP-145					v					
WP-147					v					
WP-148					v					
WP-149					v					
WP-150					v					
WP-151					v					
WP-152					v					
WP-153					v					
WP-154					v					
WP-155					v					

Well ID	November 2014		February 2015		May 2015		August 2015		November 2015	
	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation
WP-156					v					
WP-164					v					
WP-165					v					
WP-167	v		v		v		v		v	
WP-168	v		v		v		v		v	
WP-169					v					
WP-172					v					
WP-175					v					
WP-177					v					
WP-178					v					
WP-179					v					
WP-180					v					
WP-18N					v					
WP-18S					v					
WP-25W					v					
WP-27	v		v		v		v		v	
WP-28					v					
WP-33					v					
WP-45					v					
WP-50					v					
WP-52					v					
WP-54					v					
WP-57					v					
WP-66					v					
WP-68					v					
WP-69					v					
WP-70	v		v		v		v		v	
WP-71A					v					
WP-74					v					
WP-82					v					
WP-83	v		v		v		v		v	
WP-86	v		v		v		v		v	

v – Samples were analyzed for VOCs via EPA Method 524.3

PFC – Samples were analyzed for Perfluorinated Compounds via EPA Method 537

Perchlorate – Samples were analyzed for Perchlorate via EPA Method 6850

Table 2. Private Wells with Whole-House Filter Systems

WELL ID	Date WHF System Installed/Replaced	Comment
WP-14	May 2013	Replaced WHF from mid-2000s
WP-70	May 2013	Replaced WHF from mid-2000s
WP-82	Removed	Was installed in early 2000s though no detections exceeded action threshold; was removed in 2013 because results continued to be less than action threshold.
WP-83	May 2013	Replaced WHF from mid-2000s
WP-86	May 2013	Replaced WHF from mid-2000s
WP-119	Aug 2013	Newly installed
WP-121	Aug 2013	Newly installed
WP-129	Sep 2013	Newly installed
WP-124	Oct 2013	Newly installed
WP-123	Sep 2014	Newly installed
WP-125	Apr 2015	Newly installed

Table 3. Monitoring Wells – Groundwater Elevations

Well ID	Water Level Elevation Nov 2014	Water Level Elevation Feb 2015	Water Level Elevation May 2015	Water Level Elevation August 2015	Water Level Elevation Nov 2015	Screen Interval	Bladder Pump Installed?	Stick Up or Flush Mount	NAD 83 Coordinates	
00AW11	1073.88	1072.71	1071.93		1073.68	81-91	Yes	Stick Up	47.180903	-119.30661
00AW12	1074.23	1072.30	1073.38	1075.84		86.6-96.6	No	Stick Up	47.177623	-119.299624
00AW13	1058.53	1056.43	1056.45	1058.53		127.5-137.5	Yes	Flush Mount	47.160381	-119.319088
00AW14	1070.34	1068.41	1069.57	1071.57		81-91	No	Stick Up	47.165828	-119.301585
00BW01	1082.51	1081.47	1082.16	1082.88	1082.28	68-78	Yes	Stick Up	47.190079	-119.28616
00BW02	1075.69	1075.17	1074.04	1075.17	1075.29	87-97	Yes	Stick Up	47.182638	-119.306417
00BW03	1075.85	1074.81	1073.80	1074.70	1075.20	85-95	Yes	Stick Up	47.185409	-119.303345
00BW04		1085.18	1084.48	1084.20	1085.82	70-80	Yes	Stick Up	47.192445	-119.298192
00BW05	1086.09	1085.36	1084.65	1084.42	1086.14	80-90	Yes	Stick Up	47.195435	-119.294518
00BW06	1050.24	1052.53	1051.06	1047.53	1049.90	180-190	Yes	Stick Up	47.189802	-119.338849
00BW07	1080.52	1079.99	1079.34	1079.11	1080.52	75-85	Yes	Stick Up	47.192043	-119.301497
00BW08	1075.55	1076.06	1076.27	1075.97	1075.61	92-102	Yes	Stick Up	47.192293	-119.316264
00BW09	1085.41	1084.67	1083.85	1083.56	1085.47	79.5-89.5	Yes	Stick Up	47.196831	-119.301469
00BW10	1032.74	1034.91	1021.39	1014.32	1030.66	186.2-196.2	Yes	Stick Up	47.147826	-119.307873
00BW11	1071.57	1072.24	1071.64	1070.90	1071.58	107-117	Yes	Flush Mount	47.188424	-119.317939
00BW12	1075.56	1074.70	1073.35	1073.74	1075.00	101-111	Yes	Stick Up	47.188245	-119.304851
00BW13	1070.00	1069.62	1069.23	1071.27	1069.62	133-143	Yes	Stick Up	47.165764	-119.301631
00BW14	1083.78	1082.99	1083.41	1084.21	1085.74	62-72	Yes	Flush Mount	47.191362	-119.288309
00BW15	1074.61	1072.63	1073.44	1076.16	1073.76	105.6-115.6	Yes	Stick Up	47.177595	-119.299711
00BW16	1044.52	1047.72	1041.87	1036.93	1043.81	186.4-196.4	Yes	Stick Up	47.160398	-119.319182
01BW01	1086.53	1085.77	1085.04	1084.83	1086.59	85-95	Yes	Flush Mount	47.196578	-119.295897
02BW01	1045.05	1044.89	1039.63	1036.44	1044.84	188-192.5	Removed	Flush Mount	47.154543	-119.309278
02BW02	1076.22	1074.12	1075.35	1077.93	1075.53	109-118.5	Yes	Flush Mount	47.182746	-119.295425
04BW01	1086.38	1085.48	1084.74	1084.59	1086.35	96-116	No	Stick Up	47.196733	-119.295632
04BW04	1056.57	1061.33	1057.26	1055.66	1056.14	190-210	No	Stick Up	47.186124	-119.331118
04BW05	1061.50	1061.95	1061.29	1060.22	1061.05	176-196	No	Stick Up	47.179966	-119.328492
04BW06	1065.29	1065.42	1064.65		1065.13	174-194	No	Stick Up	47.178499	-119.316265
04BW07	1058.57	1057.27	1055.35	1055.91	1057.98	195-215	No	Stick Up	47.164316	-119.313303

Well ID	Water Level Elevation Nov 2014	Water Level Elevation Feb 2015	Water Level Elevation May 2015	Water Level Elevation August 2015	Water Level Elevation Nov 2015	Screen Interval	Bladder Pump Installed?	Stick Up or Flush Mount	NAD 83 Coordinates	
04BW09	1070.07	1068.09	1069.13	1071.33	1069.65	139.5-149.5	No	Flush Mount	47.16529	-119.303267
04CW01	1030.86	1037.85	1031.64	1020.25	1029.19	298-308	No	Stick Up	47.186125	-119.330888
04CW02	1026.78	1034.50	1031.74	1016.21	1025.48	297-307	No	Stick Up	47.180036	-119.328547
04CW03	1019.91	1029.60	1016.14	1000.02	1017.44	264-284	No	Stick Up	47.180214	-119.311653
04CW04	1056.92	1057.41	1055.57	1053.88	1056.33	303-313	No	Stick Up	47.16437	-119.313331
04CW05	1056.97	1057.10	1055.74	1053.91	1056.45	260-280	No	Stick Up	47.163731	-119.304417
04CW07	1031.16	1035.60	1015.95	1015.03	1028.78	283-293/ 303-309	No	Stick Up	47.155184	-119.309159
04CW08	1032.60	1035.61	1023.76	1011.21	1030.00	294-314	No	Flush Mount	47.146414	-119.310925
12BW01	1073.88	1072.13	1073.37	1075.30		162 - 172	No	Stick Up	47.168105	-119.301971
12BW02	1055.22	1052.77	1049.52	1050.10	1054.87	174 - 194	No	Flush Mount	47.156722	-119.305516
12BW03	1060.84	1058.99	1056.69	1057.91	1060.30	179-189/ 199-219	No	Stick Up	47.160178	-119.312552
12BW04	1070.19	1068.66	1068.50	1069.99	1069.74	158-168/178-188	No	Stick Up	47.165106	-119.307067
12BW05	1071.96	1069.59	1070.38	1072.77	1071.44	167 - 187	No	Stick Up	47.162973	-119.303437
12BW06	1059.51	1057.42	1055.32	1056.23	1059.22	170 - 200	No	Flush Mount	47.158669	-119.309139
12BW07	1073.05	1065.16	1072.18	1074.25	1072.86	160 - 180	No	Stick Up	47.16467	-119.303665
12BW08	1055.97	1053.79	1050.70	1051.11	1055.47	178 - 198	No	Flush Mount	47.156729	-119.307772
12CW01	1034.67	1039.04	1029.21	1063.71	1033.18	274 - 294	No	Flush Mount	47.156724	-119.30559
12CW02	1033.95	1039.90	1030.12	1018.32	1032.41	300 - 320	No	Stick Up	47.16022	-119.312575
12CW03	1061.08	1061.60	1059.78	1058.13	1060.49	288-298	No	Stick Up	47.165098	-119.306996
12CW04	1059.96	1060.52	1058.52	1056.60	1059.36	255 - 265	No	Stick Up	47.16294	-119.303394
12CW05	1034.64	1039.29	1029.62	1019.27	1033.07	287 - 307	No	Flush Mount	47.158672	-119.309
12EX01	1073.40	1071.30	1072.26	1074.30	1072.95	160 - 180	No	Stick Up	47.16465	-119.30358
12EX02	1055.93	1053.73	1050.68	1051.05	1055.46	180 - 198	No	Flush Mount	47.156733	-119.307692
14BW01	1071.59	1069.68	1070.09	1071.89	1071.08	160-180	No	Stick Up	47.163858	-119.305713
14BW02	1063.57	1061.48	1060.38	1062.07	1063.37	157-187	No	Stick Up	47.162105	-119.306092
14BW03	1073.46	1071.68	1072.51	1074.33	1072.99	143-173	No	Stick Up	47.166044	-119.304279
14EX03	1071.35	1069.56	1069.87	1071.61	1070.86	160-180	No	Stick Up	47.163859	-119.305689
14EX04	1063.60	1061.57	1060.44	1062.17	1062.27	157-187	No	Stick Up	47.162104	-119.306073
14EX05	1073.55	1072.52	1072.48	1074.25	1072.96	143-173	No	Stick Up	47.166044	-119.304263
91AW01	1092.49	1092.62	1092.39			118-138	No	Stick Up	47.227185	-119.341427
91AW07	1073.50	1072.42	1071.31	1072.36	1073.07	81-101	No	Stick Up	47.180598	-119.311535

Well ID	Water Level Elevation Nov 2014	Water Level Elevation Feb 2015	Water Level Elevation May 2015	Water Level Elevation August 2015	Water Level Elevation Nov 2015	Screen Interval	Bladder Pump Installed?	Stick Up or Flush Mount	NAD 83 Coordinates	
91AW09		1072.24	1071.19	1072.30		81-101	Yes	Stick Up	47.179826	-119.31241
91AW13		1051.82	1051.72			138-158	Yes	Stick Up	47.189741	-119.338937
91AW14	1063.17	1063.68	1063.59	1062.29	1062.80	116-136	No	Stick Up	47.188512	-119.327511
91AW15	1081.07	1072.70	1072.13	1071.33		89-109	Yes	Flush Mount	47.188513	-119.317936
91AW16	1077.66	1076.75	1075.45	1075.44		69-89	No	Stick Up	47.186224	-119.303338
91AW17	1070.47		1069.13	1069.64	1069.82	108-128	Yes	Stick Up	47.179675	-119.326143
91BW01	1092.95	1092.50	1092.20			193-203	No	Stick Up	47.226823	-119.341512
91BW02	1075.81	1076.65	1076.82	1076.54	1076.25	137-147	Yes	Stick Up	47.192871	-119.315772
91BW03	1072.71	1071.75	1070.99	1072.16	1072.46	170-180	Yes	Stick Up	47.180218	-119.312071
91BW04	1067.78	1066.58	1066.83	1067.89	1067.55	178-188	Yes	Stick Up	47.171379	-119.307337
92BW01	1074.09	1072.70	1072.03	1071.42	1074.66	143-153	Yes	Stick Up	47.18096	-119.306561
92BW02	1073.97	1072.52	1072.00	1080.85	1073.80	147-157	Yes	Stick Up	47.179523	-119.305986
99AW01	1073.35	1072.41	1071.40	1072.36	1073.07	101-111	Yes	Stick Up	47.180311	-119.311651
99AW04	1044.22	1043.22	1045.85	1046.17		48-58	Yes	Flush Mount	47.153002	-119.325386
99AW08	1075.72	1073.91	1075.26	1077.64	1075.42	70-80	Yes	Flush Mount	47.182757	-119.295516
99AW09	1064.10	1061.79	1063.35	1065.31	1063.89	97.5-107.5	Yes	Stick Up	47.160705	-119.304635
99AW10	1079.74	1079.88	1080.07			120-130	Yes	Stick Up	47.207212	-119.341389
99BW01	1072.77	1071.72	1071.00	1072.11	1072.50	141.5-151.5	Yes	Stick Up	47.180311	-119.311651
99BW09	1034.46	1035.25	1027.72	1020.50	1020.91	110-120	Yes	Stick Up	47.150603	-119.293789
99BW10	1044.77	1044.97	1038.70	1036.44	1101.82	175-185	Yes	Flush Mount	47.15475	-119.3095
99BW11	1033.85	1042.97	1028.20	1020.66	1032.07	102-112	Yes	Flush Mount	47.153011	-119.325283
99BW12	1064.96	1065.16	1064.21	1063.79	1064.64	162-172	Yes	Flush Mount	47.174589	-119.319677
99BW14	1057.27	1066.44	1069.89	1072.24	1068.91	85-95	Yes	Stick Up	47.16798	-119.294074
99BW15	1020.70	1073.81	1075.05	1077.54	1075.11	90-100	Yes	Flush Mount	47.182758	-119.295615
99BW16	1084.29	1063.69	1063.56	1062.27	1062.75	146-156	Yes	Stick Up	47.188514	-119.327413
99BW17		167 - 187	1169.50			120-140	No	Stick Up	47.220362	-119.314865
99BW18	1058.52	170 - 200	1054.85	1056.65	1058.33	143-153	Yes	Stick Up	47.160705	-119.304635
MW-2		160 - 180	1080.68	1082.38		64.5-74.5	Yes	Stick Up	47.186583	-119.289051
MW-4		178 - 198	1082.33	1084.15		66-76	Yes	Stick Up	47.189081	-119.289433

Table 4. Monitoring and Extraction Wells – Sampling Results

MONITORING AND EXTRACTION WELL RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70)	Results µg /L (MCL 5)
HANFORD FORMATION AQUIFER WELLS					
00AW11	14MLW1119N00AW11	11/19/2014	N	< 0.20 R	1.70 R
00AW11	15MLW0225N00AW11	2/25/2015	N	< 0.20 U	1.33
00AW11	15MLW0509N00AW11	5/9/2015	N	< 0.20 U	1.17
00AW12	15MLW0505N00AW12	5/5/2015	N	< 0.20 U	< 0.20 U
00AW13	14MLW1120N00AW13	11/20/2014	N	< 0.20 U	< 0.20 U
00AW13	15MLW0510N00AW13	5/10/2015	N	< 0.20 U	< 0.20 U
00AW14	15MLW0505N00AW14	5/5/2015	N	< 0.20 U	< 0.20 U
91AW07	15MLW0505D91AW07	5/5/2015	FD	< 0.20 U	0.43
91AW07	15MLW0505N91AW07	5/5/2015	N	< 0.20 U	0.43
91AW09	15MLW0508N91AW09	5/8/2015	N	< 0.20 U	0.27
91AW14	15MLW0504N91AW14	5/4/2015	N	< 0.20 U	1.30
91AW15	15MLW0506N91AW15	5/6/2015	N	< 0.20 U	< 0.20 U
91AW16	15MLW0506N91AW16	5/6/2015	N	< 0.20 U	< 0.20 U
91AW17	15MLW0505N91AW17	5/5/2015	N	< 0.20 U	0.15 J
99AW01	14MLW1119N99AW01	11/19/2014	N	< 0.20 U	0.85
99AW01	15MLW0225N99AW01	2/25/2015	N	< 0.20 U	0.55
99AW01	15MLW0508N99AW01	5/8/2015	N	< 0.20 U	0.51
99AW04	14MLW1121N99AW04	11/21/2014	N	< 0.20 U	< 0.20 U
99AW04	15MLW0227N99AW04	2/27/2015	N	< 0.20 U	< 0.20 U
99AW08	15MLW0508N99AW08	5/8/2015	N	< 0.20 U	< 0.20 U
99AW09	14MLW1120N99AW09	11/20/2014	N	0.33 R	4.09 R
99AW09	15MLW0226D99AW09	2/26/2015	FD	< 0.20 U	2.20
99AW09	15MLW0226N99AW09	2/26/2015	N	< 0.20 U	2.22
99AW09	15MLW0510N99AW09	5/10/2015	N	< 0.20 U	1.89
MW-2	15MLW0505NMW2	5/5/2015	N	< 0.20 U	< 0.20 U
MW-4	15MLW0505NMW4	5/5/2015	N	< 0.20 U	< 0.20 U
PRIEST RAPIDS AND ROZA 1 AQUIFER WELLS					
00BW01	14MLW1116N00BW01	11/16/2014	N	< 0.20 U	< 0.20 U
00BW01	15MLW0505N00BW01	5/5/2015	N	< 0.20 U	< 0.20 U
00BW01	15MLW0505D00BW01	5/5/2015	FD	< 0.20 U	< 0.20 U
00BW02	14MLW1118N00BW02	11/18/2014	N	< 0.20 U	0.24
00BW02	15MLW0224N00BW02	2/24/2015	N	< 0.20 U	0.22
00BW02	15MLW0506N00BW02	5/6/2015	N	< 0.20 U	0.27
00BW03	14MLW1118N00BW03	11/18/2014	N	< 0.20 U	< 0.20 U
00BW03	15MLW0506N00BW03	5/6/2015	N	< 0.20 U	< 0.20 U
00BW04	15MLW0504N00BW04	5/4/2015	N	< 0.20 U	< 0.20 U
00BW05	14MLW1116N00BW05	11/16/2014	N	< 0.20 U	< 0.20 U
00BW05	15MLW0505N00BW05	5/5/2015	N	< 0.20 U	< 0.20 U
00BW06	14MLW1118N00BW06	11/18/2014	N	< 0.20 U	< 0.20 U
00BW06	15MLW0507N00BW06	5/7/2015	N	< 0.20 U	0.11 J
00BW07	14MLW1116N00BW07	11/16/2014	N	< 0.20 U	< 0.20 U
00BW07	15MLW0504N00BW07	5/4/2015	N	< 0.20 U	< 0.20 U

MONITORING AND EXTRACTION WELL RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70)	Results µg /L (MCL 5)
00BW08	15MLW0507N00BW08	5/7/2015	N	< 0.20 U	< 0.20 U
00BW09	14MLW1117N00BW09	11/17/2014	N	< 0.20 U	< 0.20 U
00BW09	15MLW0504N00BW09	5/4/2015	N	< 0.20 U	< 0.20 U
00BW10	14MLW1119N00BW10	11/19/2014	N	< 0.20 R	< 0.20 R
00BW10	15MLW0511N00BW10	5/11/2015	N	< 0.20 U	< 0.20 U
00BW11	14MLW1118N00BW11	11/18/2014	N	< 0.20 U	< 0.20 U
00BW11	15MLW0506N00BW11	5/6/2015	N	< 0.20 U	< 0.20 U
00BW12	14MLW1118N00BW12	11/18/2014	N	< 0.20 U	19.1
00BW12	15MLW0224N00BW12	2/24/2015	N	< 0.20 U	18.5
00BW12	15MLW0506N00BW12	5/6/2015	N	< 0.20 U	17.1
00BW12	15MLW0506D00BW12	5/6/2015	FD	< 0.20 U	15.6
00BW13	14MLW1120N00BW13	11/20/2014	N	< 0.20 R	< 0.20 R
00BW13	15MLW0509N00BW13	5/9/2015	N	< 0.20 U	< 0.20 U
00BW14	14MLW1117N00BW14	11/17/2014	N	< 0.20 U	< 0.20 U
00BW14	15MLW0505N00BW14	5/5/2015	N	< 0.20 U	< 0.20 U
00BW15	14MLW1119N00BW15	11/19/2014	N	0.27 R	1.82 R
00BW15	15MLW0225N00BW15	2/25/2015	N	0.33	1.97
00BW15	15MLW0509N00BW15	5/9/2015	N	0.32	1.84
00BW16	14MLW1120N00BW16	11/20/2014	N	< 0.20 U	< 0.20 U
00BW16	15MLW0510N00BW16	5/10/2015	N	< 0.20 U	< 0.20 U
01BW01	14MLW1116N01BW01	11/16/2014	N	< 0.20 U	< 0.20 U
01BW01	15MLW0505N01BW01	5/4/2015	N	< 0.20 U	< 0.20 U
02BW01	14MLW1119N02BW01	11/19/2014	N	< 0.20 U	11.2
02BW01	15MLW0225N02BW01	2/25/2015	N	< 0.20 U	12.2
02BW01	15MLW0506N02BW01	5/6/2015	N	< 0.20 U	10.9
02BW01	15MLW0817N02BW01	8/17/2015	N	< 0.20 U	11.2
02BW01	15MLW0817D02BW01	8/17/2015	FD	< 0.20 U	11.0
02BW01	15MLW1116N02BW01	11/16/2015	N	< 0.20 U	11.5
02BW02	14MLW1117N02BW02	11/17/2014	N	< 0.20 U	< 0.20 U
02BW02	14MLW1117D02BW02	11/17/2014	FD	< 0.20 U	< 0.20 U
02BW02	15MLW0508N02BW02	5/8/2015	N	< 0.20 U	< 0.20 U
04BW01	14MLW1121N04BW01	11/21/2014	N	< 0.20 U	< 0.20 U
04BW01	15MLW0504N04BW01	5/4/2015	N	< 0.20 U	< 0.20 U
04BW01	15MLW0504D04BW01	5/4/2015	FD	< 0.20 U	< 0.20 U
04BW04	14MLW1117N04BW04	11/17/2014	N	< 0.20 U	0.44
04BW04	15MLW0223N04BW04	2/23/2015	N	< 0.20 U	0.43
04BW04	15MLW0504N04BW04	5/4/2015	N	< 0.20 U	0.35
04BW05	14MLW1117N04BW05	11/17/2014	N	< 0.20 U	1.53
04BW05	15MLW0223N04BW05	2/23/2015	N	< 0.20 U	1.69
04BW05	15MLW0504N04BW05	5/4/2015	N	< 0.20 U	1.24
04BW06	14MLW1117N04BW06	11/17/2014	N	2.82	14.5
04BW06	15MLW0223N04BW06	2/23/2015	N	2.72	13.4
04BW06	15MLW0504N04BW06	5/4/2015	N	2.51	11.8
04BW07	14MLW1117N04BW07	11/17/2014	N	< 0.20 U	< 0.20 U
04BW07	15MLW0504N04BW07	5/4/2015	N	< 0.20 U	< 0.20 U

MONITORING AND EXTRACTION WELL RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70)	Results µg /L (MCL 5)
04BW09	14MLW1119N04BW09	11/19/2014	N	< 0.20 U	35.6
04BW09	15MLW0225N04BW09	2/25/2015	N	< 0.20 U	32.6
04BW09	15MLW0505N04BW09	5/5/2015	N	< 0.20 U	21.6
04BW09	15MLW0819N04BW09	8/19/2015	N	< 0.20 U	25.1
04BW09	15MLW1118N04BW09	11/18/2015	N	< 0.20 U	29.0
12BW01	14MLW1121N12BW01	11/21/2014	N	< 0.20 U	< 0.20 U
12BW01	15MLW0505N12BW01	5/5/2015	N	< 0.20 U	< 0.20 U
12BW02	14MLW1118N12BW02	11/18/2014	N	< 0.20 U	9.57
12BW02	15MLW0224N12BW02	2/24/2015	N	< 0.20 U	9.02
12BW02	15MLW0506N12BW02	5/6/2015	N	< 0.20 U	7.99
12BW02	15MLW0817N12BW02	8/17/2015	N	< 0.20 U	9.02
12BW02	15MLW1117N12BW02	11/17/2015	N	< 0.20 U	8.93
12BW03	14MLW1118N12BW03A	11/18/2014	N	< 0.20 U	0.94
12BW03	14MLW1118N12BW03B	11/18/2014	N	< 0.20 U	0.64
12BW03	14MLW1118D12BW03B	11/18/2014	FD	< 0.20 U	0.60
12BW03	15MLW0223N12BW03A	2/23/2015	N	< 0.20 U	0.86
12BW03	15MLW0223N12BW03B	2/23/2015	N	< 0.20 U	0.66
12BW03	15MLW0504N12BW03A	5/4/2015	N	< 0.20 U	1.07
12BW03	15MLW0504N12BW03B	5/4/2015	N	< 0.20 U	0.45
12BW03	15MLW0818N12BW03A	8/18/2015	N	< 0.20 U	1.21
12BW03	15MLW0818N12BW03B	8/18/2015	N	< 0.20 U	0.56
12BW03	15MLW1118N12BW03A	11/18/2015	N	< 0.20 U	0.62
12BW03	15MLW1118N12BW03B	11/18/2015	N	< 0.20 U	0.55
12BW04	14MLW1118N12BW04A	11/18/2014	N	< 0.20 U	20.8
12BW04	14MLW1118D12BW04A	11/18/2014	FD	< 0.20 U	20.3
12BW04	14MLW1118N12BW04B	11/18/2014	N	< 0.20 U	21.4
12BW04	15MLW0224N12BW04A	2/24/2015	N	< 0.20 U	19.9
12BW04	15MLW0224N12BW04B	2/24/2015	N	< 0.20 U	21.2
12BW04	15MLW0505N12BW04A	5/5/2015	N	< 0.20 U	16.5
12BW04	15MLW0505N12BW04B	5/5/2015	N	< 0.20 U	17.0
12BW04	15MLW0819N12BW04A	8/19/2015	N	< 0.20 U	18.6
12BW04	15MLW0819N12BW04B	8/19/2015	N	< 0.20 U	18.0
12BW04	15MLW1118N12BW04A	11/18/2015	N	< 0.20 U	24.0
12BW04	15MLW1118N12BW04B	11/18/2015	N	< 0.20 U	21.5
12BW05	14MLW1119N12BW05	11/19/2014	N	< 0.20 U	106
12BW05	15MLW0224N12BW05	2/24/2015	N	< 0.20 U	98.3
12BW05	15MLW0506N12BW05	5/6/2015	N	< 0.20 U	68.7
12BW05	15MLW0819N12BW05	8/19/2015	N	< 0.20 U	77.0
12BW05	15MLW1118N12BW05	11/18/2015	N	< 0.20 U	89.3
12BW06	14MLW1118N12BW06	11/18/2014	N	< 0.20 U	5.14
12BW06	15MLW0223N12BW06	2/23/2015	N	< 0.20 U	5.97
12BW06	15MLW0506N12BW06	5/6/2015	N	< 0.20 U	5.67
12BW06	15MLW0818N12BW06	8/18/2015	N	< 0.20 U	5.56
12BW06	15MLW1117N12BW06	11/17/2015	N	< 0.20 U	5.23
12BW07	14MLW1119N12BW07	11/19/2014	N	< 0.20 U	71.2

MONITORING AND EXTRACTION WELL RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70)	Results µg /L (MCL 5)
12BW07	15MLW0225N12BW07	2/25/2015	N	< 0.20 U	65.0
12BW07	15MLW0505N12BW07	5/5/2015	N	< 0.20 U	51.4
12BW07	15MLW0819N12BW07	8/19/2015	N	< 0.20 U	54.0
12BW07	15MLW0819D12BW07	8/19/2015	FD	< 0.20 U	65.5
12BW07	15MLW1118N12BW07	11/18/2015	N	< 0.20 U	69.7
12BW08	14MLW1118N12BW08	11/18/2014	N	< 0.20 U	9.49
12BW08	15MLW0224N12BW08	2/24/2015	N	< 0.20 U	9.78
12BW08	15MLW0506N12BW08	5/6/2015	N	< 0.20 U	8.00
12BW08	15MLW0817N12BW08	8/17/2015	N	< 0.20 U	8.34
12BW08	15MLW1116N12BW08	11/16/2015	N	< 0.20 U	9.77 J+
12BW08	15MLW1116D12BW08	11/16/2015	FD	< 0.20 U	10.5
14BW01	14MLW1119N14BW01	11/19/2014	N	< 0.20 U	58.4
14BW01	15MLW0225N14BW01	2/25/2015	N	< 0.20 U	58.8
14BW01	15MLW0506N14BW01	5/6/2015	N	< 0.20 U	44.3
14BW01	15MLW0819N14BW01	8/19/2015	N	< 0.20 U	63.6
14BW01	15MLW1118N14BW01	11/18/2015	N	< 0.20 U	56.3
14BW02	14MLW1118N14BW02	11/18/2014	N	< 0.20 U	23.3
14BW02	15MLW0224N14BW02	2/24/2015	N	< 0.20 U	22.0
14BW02	15MLW0506N14BW02	5/6/2015	N	< 0.20 U	20.5
14BW02	15MLW0817N14BW02	8/17/2015	N	< 0.20 U	19.5
14BW02	15MLW1118N14BW02	11/18/2015	N	< 0.20 U	22.8
14BW03	14MLW1119N14BW03	11/19/2014	N	< 0.20 U	10.7
14BW03	15MLW0225N14BW03	2/25/2015	N	< 0.20 U	11.3
14BW03	15MLW0505N14BW03	5/5/2015	N	< 0.20 U	8.73
14BW03	15MLW0819N14BW03	8/19/2015	N	< 0.20 U	9.05
14BW03	15MLW1118N14BW03	11/18/2015	N	< 0.20 U	12.1
91BW02	14MLW1118N91BW02	11/18/2014	N	< 0.20 U	< 0.20 U
91BW02	15MLW0507N91BW02	5/7/2015	N	< 0.20 U	< 0.20 U
91BW02	15MLW0507D91BW02	5/7/2015	FD	< 0.20 U	< 0.20 U
91BW03	14MLW1119N91BW03	11/19/2014	N	< 0.20 U	35.0
91BW03	15MLW0225N91BW03	2/25/2015	N	< 0.20 U	31.3
91BW03	15MLW0508N91BW03	5/8/2015	N	< 0.20 U	27.9
91BW04	14MLW1120N91BW04	11/20/2014	N	< 0.20 R	0.17 R
91BW04	15MLW0226N91BW04	2/26/2015	N	< 0.20 U	0.19 J
91BW04	15MLW0509N91BW04	5/9/2015	N	< 0.20 U	< 0.20 U
91BW04	15MLW0818N91BW04	8/18/2015	N	< 0.20 U	0.20
91BW04	15MLW1117N91BW04	11/17/2015	N	< 0.20 U	0.20
91BW04	15MLW1117D91BW04	11/17/2015	FD	< 0.20 U	0.19 J
92BW01	14MLW1119N92BW01	11/19/2014	N	< 0.20 U	23.2
92BW01	14MLW1119D92BW01	11/19/2014	FD	< 0.20 U	21.5
92BW01	15MLW0225N92BW01	2/25/2015	N	< 0.20 U	21.4
92BW01	15MLW0509N92BW01	5/9/2015	N	< 0.20 U	19.1
92BW01	15MLW0818N92BW01	8/18/2015	N	< 0.20 U	18.8
92BW01	15MLW1117N92BW01	11/17/2015	N	0.12 J	22.2
92BW02	14MLW1119N92BW02	11/19/2014	N	0.68 R	7.07 R

MONITORING AND EXTRACTION WELL RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70)	Results µg /L (MCL 5)
92BW02	15MLW0225N92BW02	2/25/2015	N	0.92	7.88
92BW02	15MLW0225D92BW02	2/25/2015	N	0.81	7.67
92BW02	15MLW0509N92BW02	5/9/2015	N	0.83	7.06
99BW01	14MLW1119N99BW01	11/19/2014	N	< 0.20 U	32.6
99BW01	15MLW0225N99BW01	2/25/2015	N	< 0.20 U	33.2
99BW01	15MLW0225D99BW01	2/25/2015	N	< 0.20 U	31.4
99BW01	15MLW0508N99BW01	5/8/2015	N	< 0.20 U	29.4
99BW09	14MLW1118N99BW09	11/18/2014	N	< 0.20 U	< 0.20 U
99BW09	15MLW0507N99BW09	5/7/2015	N	< 0.20 U	< 0.20 U
99BW09	15MLW0507D99BW09	5/7/2015	FD	< 0.20 U	< 0.20 U
99BW10	14MLW1120N99BW10	11/20/2014	N	< 0.20 U	13.5
99BW10	15MLW0226N99BW10	2/26/2015	N	< 0.20 U	13.4
99BW10	15MLW0511N99BW10	5/11/2015	N	< 0.20 U	11.4
99BW10	15MLW0818N99BW10	8/18/2015	N	< 0.20 U	11.2 J+
99BW10	15MLW0818D99BW10	8/18/2015	FD	< 0.20 U	11.5
99BW10	15MLW1117N99BW10	11/17/2015	N	< 0.20 U	14.1
99BW11	14MLW1121N99BW11	11/21/2014	N	< 0.20 U	< 0.20 U
99BW11	15MLW0511N99BW11	5/11/2015	N	< 0.20 U	< 0.20 U
99BW12	14MLW1117N99BW12	11/17/2014	N	< 0.20 U	0.39
99BW12	14MLW1117D99BW12	11/17/2014	FD	< 0.20 U	0.34
99BW12	15MLW0223N99BW12	2/23/2015	N	< 0.20 U	0.33
99BW12	15MLW0507N99BW12	5/7/2015	N	< 0.20 U	0.33
99BW14	14MLW1117N99BW14	11/17/2014	N	< 0.20 U	< 0.20 U
99BW14	14MLW1117D99BW14	11/17/2014	FD	< 0.20 U	< 0.20 U
99BW14	15MLW0507N99BW14	5/7/2015	N	< 0.20 U	< 0.20 U
99BW15	14MLW1117N99BW15	11/17/2014	N	1.98	7.87
99BW15	15MLW0223N99BW15	2/23/2015	N	1.97	8.06
99BW15	15MLW0223D99BW15	2/23/2015	FD	1.93	7.89
99BW15	15MLW0508N99BW15	5/8/2015	N	1.85	7.18
99BW16	15MLW0223N99BW16	2/23/2015	N	< 0.20 U	1.41
99BW16	15MLW0504N99BW16	5/4/2015	N	< 0.20 U	1.37
99BW18	14MLW1120N99BW18	11/20/2014	N	< 0.20 R	36.6 R
99BW18	15MLW0226N99BW18	2/26/2015	N	< 0.20 U	8.99
99BW18	15MLW0510N99BW18	5/10/2015	N	< 0.20 U	8.02
99BW18	15MLW0818N99BW18	8/18/2015	N	< 0.20 U	6.75
99BW18	15MLW1117N99BW18	11/17/2015	N	< 0.20 U	8.42
ROZA 2 AQUIFER WELLS					
04CW01	14MLW1117N04CW01	11/17/2014	N	< 0.20 U	0.56
04CW01	15MLW0223N04CW01	2/23/2015	N	< 0.20 U	0.61
04CW01	15MLW0504N04CW01	5/4/2015	N	< 0.20 U	0.62
04CW02	14MLW1117N04CW02	11/17/2014	N	< 0.20 U	< 0.20 U
04CW02	15MLW0504N04CW02	5/4/2015	N	< 0.20 U	< 0.20 U
04CW03	14MLW1117N04CW03	11/17/2014	N	< 0.20 U	3.19
04CW03	15MLW0223N04CW03	2/23/2015	N	< 0.20 U	2.90
04CW03	15MLW0504N04CW03	5/4/2015	N	0.15 J	2.37

MONITORING AND EXTRACTION WELL RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70)	Results µg /L (MCL 5)
04CW04	14MLW1117N04CW04	11/17/2014	N	< 0.20 U	0.41
04CW04	15MLW0223N04CW04	2/23/2015	N	< 0.20 U	0.42
04CW04	15MLW0223D04CW04	2/23/2015	FD	< 0.20 U	0.49
04CW04	15MLW0504N04CW04	5/4/2015	N	< 0.20 U	0.38
04CW05	14MLW1119N04CW05	11/19/2014	N	< 0.20 U	3.07
04CW05	15MLW0224N04CW05	2/24/2015	N	< 0.20 U	2.79
04CW05	15MLW0505N04CW05	5/5/2015	N	< 0.20 U	2.17
04CW05	15MLW0819N04CW05	8/19/2015	N	< 0.20 U	2.37
04CW05	15MLW1118N04CW05	11/18/2015	N	< 0.20 U	2.29
04CW05	15MLW1118D04CW05	11/18/2015	FD	< 0.20 U	2.83
04CW07	14MLW1119N04CW07A	11/19/2014	N	< 0.20 U	6.27
04CW07	14MLW1119N04CW07B	11/19/2014	N	< 0.20 U	5.20
04CW07	15MLW0225N04CW07A	2/25/2015	N	< 0.20 U	7.16
04CW07	15MLW0225N04CW07B	2/25/2015	N	< 0.20 U	5.82
04CW07	15MLW0506N04CW07A	5/6/2015	N	< 0.20 U	5.14
04CW07	15MLW0506N04CW07B	5/6/2015	N	< 0.20 U	5.29
04CW07	15MLW0817N04CW07A	8/17/2015	N	< 0.20 U	5.46
04CW07	15MLW0817N04CW07B	8/17/2015	N	< 0.20 U	5.60
04CW07	15MLW1116N04CW07A	11/16/2015	N	< 0.20 U	6.47
04CW07	15MLW1116N04CW07B	11/16/2015	N	< 0.20 U	6.79
04CW08	14MLW1120N04CW08	11/20/2014	N	< 0.20 U	< 0.20 U
04CW08	15MLW0506N04CW08	5/6/2015	N	< 0.20 U	< 0.20 U
04CW08	15MLW0506D04CW08	5/6/2015	FD	< 0.20 U	< 0.20 U
12CW01	14MLW1118N12CW01	11/18/2014	N	< 0.20 U	3.58
12CW01	15MLW0224N12CW01	2/24/2015	N	< 0.20 U	3.70
12CW01	15MLW0506N12CW01	5/6/2015	N	< 0.20 U	3.29
12CW01	15MLW0817N12CW01	8/17/2015	N	< 0.20 U	3.24
12CW01	15MLW1117N12CW01	11/17/2015	N	< 0.20 U	3.43
12CW02	14MLW1118N12CW02	11/18/2014	N	< 0.20 U	0.27
12CW02	15MLW0223N12CW02	2/23/2015	N	< 0.20 U	0.36
12CW02	15MLW0504N12CW02	5/4/2015	N	< 0.20 U	0.27
12CW02	15MLW0818N12CW02	8/18/2015	N	< 0.20 U	0.25
12CW02	15MLW1117N12CW02	11/17/2015	N	< 0.20 U	0.39
12CW03	14MLW1118N12CW03	11/18/2014	N	< 0.20 U	0.32
12CW03	15MLW022N12CW03	2/24/2015	N	< 0.20 U	0.37
12CW03	15MLW0505N12CW03	5/5/2015	N	< 0.20 U	0.32
12CW03	15MLW0819N12CW03	8/19/2015	N	< 0.20 U	0.32
12CW03	15MLW1118N12CW03	11/18/2015	N	< 0.20 U	0.42
12CW04	14MLW1119N12CW04	11/19/2014	N	< 0.20 U	0.68
12CW04	14MLW1119D12CW04	11/19/2014	FD	< 0.20 U	0.70
12CW04	15MLW0224N12CW04	2/24/2015	N	< 0.20 U	0.62
12CW04	15MLW0224D12CW04	2/24/2015	FD	< 0.20 U	0.67
12CW04	15MLW0506N12CW04	5/6/2015	N	< 0.20 U	0.58
12CW04	15MLW0818N12CW04	8/18/2015	N	< 0.20 U	0.49
12CW04	15MLW1118N12CW04	11/18/2015	N	< 0.20 U	0.50

MONITORING AND EXTRACTION WELL RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70)	Results µg /L (MCL 5)
12CW05	14MLW1118N12CW05	11/18/2014	N	< 0.20 U	0.81
12CW05	15MLW0223N12CW05	2/23/2015	N	< 0.20 U	0.88
12CW05	15MLW0506N12CW05	5/6/2015	N	< 0.20 U	0.82
12CW05	15MLW0818N12CW05	8/18/2015	N	< 0.20 U	0.74
12CW05	15MLW1117N12CW05	11/17/2015	N	< 0.20 U	0.71
EXTRACTION WELLS					
12EX01	14MLW1119N12EX01	11/19/2014	N	0.34	4.01
12EX01	15MLW0225N12EX01	2/25/2015	N	0.47	7.99
12EX01	15MLW0505N12EX01	5/5/2015	N	0.48	7.37
12EX01	15MLW0819N12EX01	8/19/2015	N	0.27	3.14
12EX01	15MLW0819D12EX01	8/19/2015	FD	0.26	3.02
12EX01	15MLW1118N12EX01	11/18/2015	N	0.23	3.86
12EX02	14MLW1118N12EX02	11/18/2014	N	< 0.20 U	5.33
12EX02	15MLW0224N12EX02	2/24/2015	N	< 0.20 U	4.24
12EX02	15MLW0506N12EX02	5/6/2015	N	< 0.20 U	4.40
12EX02	15MLW0506D12EX02	5/6/2015	FD	< 0.20 U	4.01
12EX02	15MLW0817N12EX02	8/17/2015	N	< 0.20 U	5.23
12EX02	15MLW1116N12EX02	11/16/2015	N	< 0.20 U	4.68
12EX02	15MLW1116D12EX02	11/16/2015	FD	< 0.20 U	4.68
14EX03	14MLW1119N14EX03	11/19/2014	N	0.23	41.2
14EX03	15MLW022N14EX03	2/24/2015	N	0.29	39.5
14EX03	15MLW0506N14EX03	5/6/2015	N	< 0.20 U	36.4
14EX03	15MLW0819N14EX03	8/19/2015	N	0.30	34.3
14EX03	15MLW1118N14EX03	11/18/2015	N	0.41	38.8
14EX04	14MLW1118N14EX04	11/18/2014	N	< 0.20 U	20.1
14EX04	14MLW1118D14EX04	11/18/2014	FD	< 0.20 U	18.8
14EX04	15MLW0224N14EX04	2/24/2015	N	< 0.20 U	18.8
14EX04	15MLW0224D14EX04	2/24/2015	FD	< 0.20 U	17.8
14EX04	15MLW0506N14EX04	5/6/2015	N	< 0.20 U	15.4
14EX04	15MLW0817N14EX04	8/17/2015	N	< 0.20 U	18.7
14EX04	15MLW1118N14EX04	11/18/2015	N	< 0.20 U	19.8
14EX05	14MLW1119N14EX05	11/19/2014	N	< 0.20 U	4.19
14EX05	15MLW0225N14EX05	2/25/2015	N	< 0.20 U	3.33
14EX05	15MLW0505N14EX05	5/5/2015	N	< 0.20 U	3.06
14EX05	15MLW0819N14EX05	8/19/2015	N	< 0.20 U	3.77
14EX05	15MLW1118N14EX05	11/18/2015	N	0.13 J	4.15

Cells shaded red exceed 5.0 µg/L TCE MCL risk level.

N -Normal Sample

FD -Field Duplicate

U -

Undetected

R-Rejected

J -Estimated

J+

MCL-Maximum Contaminant Level

Table 5. Perchlorate and PFCs in Select Monitoring Wells

Well ID	Sample Name	Sample Date	Sample Type	Perchlorate 15 µg/L	PFBS ¹ 380 µg/L (MCL)	PFHpA	PFHxS	PFNA 0.013 µg/L (New Jersey Dept of Health value requested as MCL)	PFOS 0.2 µg/L (provisional health advisory)	PFOA 0.4 µg/L (provisional health advisory)
00AW13	15MLW0226N00AW13	2/26/2015	N	1.0 U						
00BW06	15MLW0224D00BW06	2/24/2015	FD		0.0300 U	0.00396 J	0.0439	0.0404	0.0100 U	0.0101 J
00BW06	15MLW0224N00BW06	2/24/2015	N		0.0300 U	0.00332 J	0.0412	0.0384	0.0100 U	0.00897 J
00BW11	15MLW0224N00BW11	2/24/2015	N	1.0 U						
00BW16	15MLW0226N00BW16	2/26/2015	N	1.0 U						
91AW01	15MLW0223N91AW01	2/23/2015	N	1.0 U						
91AW07	15MLW0225N91AW07	2/25/2015	N	1.0 U						
91AW13	15MLW0224N91AW13	2/24/2015	N		0.0300 U	0.00300 U	0.0100 U	0.0488	0.0100 U	0.00700 U
91AW15	15MLW0224D91AW15	2/24/2015	FD	1.0 U						
91AW15	15MLW0224N91AW15	2/24/2015	N	1.0 U						
91BW01	15MLW0223N91BW01	2/23/2015	N	1.0 U						
99BW01	15MLW0225N99BW01	2/25/2015	N	1.0 U						

PFBS Perfluorobutanesulfonic Acid

PFHpA Perfluoroheptanoic Acid

PFHxS Perfluorohexanesulfonic Acid

PFNA Perfluorononanoic Acid

PFOS Perfluorooctanesulfonic Acid

PFOA Perfluorooctanoic Acid

Table 6. Private Wells without WHFs – Sampling Results

PRIVATE WELL WITHOUT WHF - RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70)	Results µg/L (MCL 5)
WP-03	15MLW0507NWP03	5/7/2015	N	< 0.20 U	1.19
WP-03	15MLW0507DWP03	5/7/2015	FD	0.26	1.00
WP-04	14MLW1120NWP04	11/20/2014	N	1.67	5.44
WP-04	15MLW0227NWP04	2/27/2015	N	1.67	5.19
WP-04	15MLW0507NWP04	5/7/2015	N	1.58	4.80
WP-04	15MLW0818NWP04	8/18/2015	N	1.85	5.45
WP-09	15MLW0504NWP09	5/4/2015	N	< 0.20 U	< 0.20 U
WP-10	15MLW0505NWP10	5/5/2015	N	< 0.20 U	< 0.20 U
WP-105	15MLW0507NWP105	5/7/2015	N	< 0.20 U	0.26
WP-111	15MLW0507NWP111	5/7/2015	N	< 0.20 U	0.27
WP-116	15MLW0507NWP116	5/7/2015	N	0.45	1.72
WP-116	15MLW1117NWP116	11/17/2015	N	0.44	1.71
WP-120	15MLW0507NWP120	5/7/2015	N	< 0.20 U	0.30
WP-122	15MLW0504NWP122	5/4/2015	N	< 0.20 U	0.70
WP-126	15MLW0507NWP126	5/7/2015	N	0.12 J	0.94
WP-127	15MLW0504NWP127	5/4/2015	N	< 0.20 U	0.89
WP-128	15MLW0507NWP128	5/7/2015	N	< 0.20 U	0.40
WP-130	15MLW0506NWP130	5/6/2015	N	< 0.20 U	0.31
WP-131	14MLW1121NWP131	11/21/2014	N	< 0.20 U	0.94
WP-131	15MLW0226NWP131	2/25/2015	N	< 0.20 U	0.96
WP-131	15MLW0506NWP131	5/6/2015	N	0.13 J	2.92
WP-131	15MLW0506DWP131	5/6/2015	FD	< 0.20 U	3.15
WP-131	15MLW0818NWP131	8/18/2015	N	< 0.20 U	1.60
WP-131	15MLW1119NWP131	11/19/2015	N	< 0.20 U	0.89
WP-136	15MLW0507NWP136	5/7/2015	N	< 0.20 U	1.15
WP-137	15MLW0507NWP137	5/7/2015	N	< 0.20 U	1.22
WP-138	15MLW0505NWP138	5/5/2015	N	< 0.20 U	0.30
WP-139	15MLW0505NWP139	5/5/2015	N	< 0.20 U	0.69
WP-13E	15MLW0504NWP13E	5/4/2015	N	< 0.20 U	< 0.20 U
WP-143	15MLW0505NWP143	5/5/2015	N	< 0.20 U	0.75
WP-144	15MLW0505NWP144	5/5/2015	N	< 0.20 U	0.32
WP-145	15MLW0505NWP145	5/5/2015	N	< 0.20 U	0.38
WP-147	15MLW0506NWP147	5/6/2015	N	< 0.20 U	0.27
WP-148	15MLW0506NWP148	5/6/2015	N	< 0.20 U	0.17 J
WP-149	15MLW0504NWP149	5/4/2015	N	< 0.20 U	0.12 J
WP-150	15MLW0504NWP150	5/4/2015	N	< 0.20 U	< 0.20 U
WP-150	15MLW0504DWP150	5/4/2015	FD	< 0.20 U	0.11 J
WP-151	15MLW0506NWP151	5/6/2015	N	< 0.20 U	1.61
WP-152	15MLW0507NWP152	5/7/2015	N	< 0.20 U	0.22
WP-153	15MLW0507NWP153	5/7/2015	N	< 0.20 U	0.33

PRIVATE WELL WITHOUT WHF - RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70)	Results µg/L (MCL 5)
WP-154	15MLW0505NWP154	5/5/2015	N	< 0.20 U	0.32
WP-155	15MLW0507NWP155	5/7/2015	N	< 0.20 U	0.40
WP-156	15MLW0506NWP156	5/6/2015	N	< 0.20 U	0.47
WP-164	15MLW0504NWP164	5/4/2015	N	< 0.20 U	0.32
WP-165	15MLW0507NWP165	5/7/2015	N	< 0.20 U	0.24
WP-167	14MLW1120NWP167	11/20/2014	N	< 0.20 U	2.29
WP-167	15MLW0227NWP167	2/27/2015	N	< 0.20 U	1.60
WP-167	15MLW0505NWP167	5/5/2015	N	< 0.20 U	2.37
WP-167	15MLW0819NWP167	8/19/2015	N	< 0.20 U	2.63
WP-167	15MLW0819DWP167	8/19/2015	FD	< 0.20 U	2.57
WP-167	15MLW1118NWP167	11/18/2015	N	< 0.20 U	1.45
WP-168	14MLW1120NWP168	11/20/2014	N	< 0.20 U	2.93
WP-168	15MLW0227NWP168	2/27/2015	N	< 0.20 U	2.83
WP-168	15MLW0505NWP168	5/5/2015	N	< 0.20 U	2.27
WP-168	15MLW0819NWP168	8/19/2015	N	< 0.20 U	2.07
WP-168	15MLW1118NWP168	11/18/2015	N	< 0.20 U	2.26
WP-169	15MLW0504NWP169	5/4/2015	N	< 0.20 U	1.88
WP-172	15MLW0507NWP172	5/7/2015	N	< 0.20 U	0.35
WP-175	15MLW0504NWP175	5/4/2015	N	< 0.20 U	0.42
WP-177	15MLW0505NWP177	5/5/2015	N	< 0.20 U	< 0.20 U
WP-178	15MLW0505NWP178	5/5/2015	N	< 0.20 U	0.21
WP-179	15MLW0507NWP179	5/7/2015	N	< 0.20 U	0.13 J
WP-180	15MLW0507NWP180	5/7/2015	N	< 0.20 U	0.10 J
WP-18N	15MLW0506NWP18N	5/6/2015	N	< 0.20 U	0.23
WP-18S	15MLW0506NWP18S	5/6/2015	N	< 0.20 U	0.17 J
WP-18S	15MLW0506DWP18S	5/6/2015	FD	< 0.20 U	0.16 J
WP-25W	15MLW0504NWP25W	5/4/2015	N	< 0.20 U	0.55
WP-25W	15MLW0504DWP25W	5/4/2015	FD	< 0.20 U	0.52
WP-27	14MLW1120NWP27	11/20/2014	N	< 0.20 U	0.87
WP-27	15MLW0225NWP27	2/25/2015	N	< 0.20 U	1.67
WP-27	15MLW0506NWP27	5/6/2015	N	< 0.20 U	1.73
WP-27	15MLW0818NWP27	8/18/2015	N	< 0.20 U	1.61
WP-27	15MLW1117NWP27	11/17/2015	N	< 0.20 U	1.17
WP-28	15MLW0506NWP28	5/6/2015	N	< 0.20 U	0.73
WP-33	15MLW0506NWP33	5/6/2015	N	< 0.20 U	0.69
WP-45	15MLW0505NWP45	5/5/2015	N	< 0.20 U	1.12
WP-50	15MLW0503NWP50	5/3/2015	N	< 0.20 U	< 0.20 U
WP-52	15MLW0504NWP52	5/4/2015	N	< 0.20 U	0.35
WP-54	15MLW0506NWP54	5/6/2015	N	< 0.20 U	0.10 J
WP-57	15MLW0505DWP57	5/5/2015	FD	< 0.20 U	0.44
WP-57	15MLW0505NWP57	5/5/2015	N	< 0.20 U	0.44
WP-66	15MLW0507NWP66	5/7/2015	N	0.33	1.20

PRIVATE WELL WITHOUT WHF - RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70)	Results µg/L (MCL 5)
WP-66	15MLW0507DWP66	5/7/2015	FD	0.32	1.34
WP-68	15MLW0507NWP68	5/7/2015	N	< 0.20 U	0.69
WP-69	15MLW0507NWP69	5/7/2015	N	0.24	1.72
WP-71A	15MLW0507NWP71A	5/7/2015	N	< 0.20 U	0.28
WP-74	15MLW0507NWP74	5/7/2015	N	0.22	1.30
WP-82	15MLW0503NWP82	5/3/2015	N	< 0.20 U	0.12 J

	Cell shaded yellow exceeded 2.0 µg/L TCE in 2013 and was sampled quarterly in 2015
	Cells shaded red exceeded 5.0 µg/L TCE MCL risk level. This well does not have a WHF system because water is used for industrial purposes only.

N -Normal Sample

FD -Field Duplicate

U -Undetected

J -Estimated

MCL-Maximum Contaminant Level

Table 7. Private Wells with WHFs- Analytical Results**NOTE:** Mid and effluent results in all cases were <0.20 µg/L for cis-DCE and TCE and therefore are not shown.

PRIVATE WHF WELL RESULTS					CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Sample Location	Results µg/L (MCL 70)	Results µg/L (MCL 5)
WP-14	14MLW1121DWP14A1	11/21/2014	FD	Influent	1.00	4.21
WP-14	14MLW1121NWP14A1	11/21/2014	N	Influent	0.95	3.53
WP-14	15MLW0226NWP14A1	2/25/2015	N	Influent	0.89	3.27
WP-14	15MLW0503NWP14A1	5/3/2015	N	Influent	0.93	3.42
WP-14	15MLW0819NWP14A1	8/19/2015	N	Influent	0.93	3.65
WP-14	15MLW1118NWP14A1	11/18/2015	N	Influent	0.92	3.55
WP-14	15MLW1118DWP14A1	11/18/2015	FD	Influent	0.88	3.44
WP-70	14MLW1120NWP70A2	11/20/2014	N	Influent	0.19 J	4.54
WP-70	15MLW0226NWP70A1	2/25/2015	N	Influent	0.18 J	3.55
WP-70	15MLW0504NWP70A1	5/4/2015	N	Influent	0.20	3.40
WP-70	15MLW0818NWP70A1	8/18/2015	N	Influent	0.16 J	3.90
WP-70	15MLW1118NWP70A1	11/18/2015	N	Influent	0.18 J	3.52
WP-83	14MLW1120DWP83A1	11/20/2014	FD	Influent	0.29	1.25
WP-83	14MLW1120NWP83A1	11/20/2014	N	Influent	0.25	1.08
WP-83	15MLW0226NWP83A1	2/25/2015	N	Influent	0.24	1.27
WP-83	15MLW0503NWP83A1	5/3/2015	N	Influent	0.26	1.75
WP-83	15MLW0819NWP83A1	8/19/2015	N	Influent	0.27	1.03
WP-83	15MLW1118NWP83A1	11/18/2015	N	Influent	0.29	1.13
WP-86	14MLW1120NWP86A1	11/20/2014	N	Influent	< 0.20 U	2.81
WP-86	15MLW0227DWP86A1	2/27/2015	FD	Influent	< 0.20 U	2.89
WP-86	15MLW0227NWP86A1	2/27/2015	N	Influent	< 0.20 U	2.89
WP-86	15MLW0505DWP86A1	5/5/2015	FD	Influent	< 0.20 U	2.26
WP-86	15MLW0505NWP86A1	5/5/2015	N	Influent	< 0.20 U	2.19
WP-86	15MLW0818NWP86A1	8/18/2015	N	Influent	< 0.20 U	1.01
WP-86	15MLW1117NWP86A1	11/17/2015	N	Influent	< 0.20 U	2.22
WP-119	15MLW1117NWP119A1	11/17/2015	N	Influent	0.16 J	3.54
WP-121	14MLW1120NWP121A1	11/20/2014	N	Influent	< 0.20 U	4.06
WP-121	15MLW0226NWP121A1	2/25/2015	N	Influent	0.14 J	3.54
WP-121	15MLW0504NWP121A1	5/4/2015	N	Influent	< 0.20 U	3.85
WP-121	15MLW0818NWP121A1	8/18/2015	N	Influent	0.13 J	4.40
WP-121	15MLW1119NWP121A1	11/19/2015	N	Influent	0.13 J	3.43
WP-123	14MLW1120NWP123A1	11/20/2014	N	Influent	0.31	2.70
WP-123	15MLW0226NWP123A1	2/25/2015	N	Influent	0.43	2.57
WP-123	15MLW0507NWP123A1	5/7/2015	N	Influent	0.25	2.77
WP-123	15MLW0818NWP123A1	8/18/2015	N	Influent	0.13 J	3.01
WP-123	15MLW1117NWP123A1	11/17/2015	N	Influent	0.40	3.19
WP-124	14MLW1120NWP124A1	11/20/2014	N	Influent	1.05	4.25
WP-124	15MLW0226NWP124A1	2/25/2015	N	Influent	1.09	3.78
WP-124	15MLW0506NWP124A1	5/6/2015	N	Influent	0.74	3.49
WP-124	15MLW0818DWP124A1	8/18/2015	FD	Influent	0.75	3.12

PRIVATE WHF WELL RESULTS					CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Sample Location	Results µg/L (MCL 70)	Results µg/L (MCL 5)
WP-124	15MLW0818NWP124A1	8/18/2015	N	Influent	0.72	3.25
WP-124	15MLW1117NWP124A1	11/17/2015	N	Influent	1.04	4.36
WP-125	14MLW1121NWP125	11/21/2014	N	No WHF	0.83	3.52
WP-125	15MLW0226DWP125	2/25/2015	FD	No WHF	0.76	3.27
WP-125	15MLW0226NWP125	2/25/2015	N	No WHF	0.77	3.58
WP-125	15MLW0507DWP125A1	5/7/2015	FD	Influent	0.61	2.42
WP-125	15MLW0507NWP125A1	5/7/2015	N	Influent	0.62	2.68
WP-125	15MLW0818NWP125A1	8/18/2015	N	Influent	0.57	2.85
WP-125	15MLW1117NWP125A1	11/17/2015	N	Influent	1.02	3.72
WP-129	15MLW0506NWP129A1	5/6/2015	N	Influent	< 0.20 U	3.14
WP-129	15MLW0818NWP129A1	8/18/2015	N	Influent	< 0.20 U	2.09
WP-129	15MLW1117NWP129A1	11/17/2015	N	Influent	< 0.20 U	3.34

Sample ID locations are as follows:

A-influent before lead, B- in between lead and lag filter (mid), C - effluent after lag

Those without an A, B, or C did not yet have a WHF installed (WP-125)

N -Normal Sample

FD -Field Duplicate

U -Undetected

J -Estimated

Table 8. Whole House Filters – Purge and Totalizer Volume Summary

Date	Well System	Flow Meter Initial (Gal)	Flow Meter Final (Gal)
November 2014 Sampling Event			
11/20/2014	WP-70	132,254	132,259
11/20/2014	WP-86	325,858	325,863
11/20/2014	WP-83	1,240,522	1,240,527
11/21/2014	WP-14	816,689	816,696
11/20/2014	WP-121	10,299	10,299
11/20/2014	WP-124	149,922	149,927
11/20/2014	WP-123	14,888	14,898
February 2015 Sampling Event			
2/26/2015	WP-70	152,630	152,635
2/27/2015	WP-86	343,529	343,536
2/26/2015	WP-83	1,277,150	1,277,717
2/26/2015	WP-14	860,080	860,091
2/26/2015	WP-121	60	70
2/26/2015	WP-124	175,861	175,867
2/26/2015	WP-123	22,565	22,570
May 2015 Sampling Event			
5/4/2015	WP-70	166,159	166,161
5/5/2015	WP-86	355,476	355,486
5/3/2015	WP-83	1,346,019	1,346,029
5/3/2015	WP-14	943,599	943,609
5/4/2015	WP-121	1,375	1,381
5/6/2015	WP-124	194,176	194,181
5/6/2015	WP-129	41,765	41,770
5/7/2015	WP-123	35,632	35,640
5/7/2015	WP-125	15,591	15,596
August 2015 Sampling Event			
8/18/2015	WP-70	186,147	186,152
8/18/2015	WP-86	496,419	496,429
8/19/2015	WP-83	1,653,496	1,653,500
8/19/2015	WP-14	1,277,992	1,277,992
8/18/2015	WP-121	43,252	43,258
8/18/2015	WP-124	217,219	217,224
8/18/2015	WP-129	69,631	69,636
8/18/2015	WP-123	151,681	151,696
8/18/2015	WP-125	85,415	85,420
November 2015 Sampling Event			
11/18/2015	WP-70	205,250	205,253
11/17/2015	WP-86	521,982	521,989
11/18/2015	WP-83	1,790,436	1,790,440
11/18/2015	WP-14	1,459,538	1,459,544
11/17/2015	WP-119	167,767	167,767
11/19/2015	WP-121	57,441	57,446
11/17/2015	WP-124	237,056	237,066
11/17/2015	WP-129	85,444	85,450
11/17/2015	WP-123	186,157	186,172
11/17/2015	WP-125	198,061	198,065

APPENDIX A - Field Sampling Reports

Private Wells and Monitoring Wells Groundwater Sampling Field Report November 2014 Field Sampling Event

**Moses Lake Wellfield Superfund Site
Moses Lake, Washington**



**Field Investigation:
16-21 November 2014
Report Prepared:
January 2015**

By: Technical Services Branch



**US Army Corps
of Engineers** ®
Seattle District

TABLE OF CONTENTS

1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION 1

1.1 BACKGROUND 1

1.2 GROUNDWATER SAMPLING EVENT SUMMARY AND OBJECTIVES 2

2.0 DESCRIPTION OF WORK 2

2.1 ACTIVITIES PRIOR TO THE NOVEMBER 2014 GROUNDWATER SAMPLING EVENT 2

2.2 PRIVATE WELL SAMPLING PROCEDURES 3

2.3 WHOLE HOUSE FILTER SAMPLING PROCEDURES 4

2.4 MONITORING WELL SAMPLING PROCEDURES 5

2.4.1 Monitoring Well Sampling Using Dedicated Bladder Pumps 5

2.4.2 Monitoring Well Sampling Using Passive Diffusion Bags 7

2.5 SAMPLING EVENT ACTIVITIES AND OBSERVATIONS 8

2.5.1 Team 1 Monitoring Well Bladder Pump Sampling 8

2.5.2 Team 2 Private Well System Sampling 10

2.5.3 Team 2 Passive Diffusion Bag Sampling and Deployment 13

3.0 INVESTIGATION-DERIVED WASTE 15

4.0 PACKAGING AND SHIPMENT 15

5.0 LABORATORY ANALYSIS 15

6.0 DECONTAMINATION PROCEDURES 16

7.0 PROTECTION LEVEL 16

TABLE 1: PRIVATE WELL STABILIZED WATER TEMPERATURES AND PURGE TIMES 11

APPENDICES

APPENDIX A – SITE AND WELL LOCATION MAP

APPENDIX B – FIELD SAMPLING PHOTOS

APPENDIX C – FIELD NOTES, ACKNOWLEDGEMENT FORM, PRIVATE WELL SOP, MICROPURGE LOGS

1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION

1.1 BACKGROUND

The Moses Lake Wellfield Superfund Site is located between the Grant County Airport and the City of Moses Lake, Washington. The Site includes the former Larson Air Force Base (LAFB) property, Port of Moses Lake property and adjacent private properties affected by Site groundwater contamination. The Site is listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 National Priorities List (NPL) for Uncontrolled Hazardous Waste Sites.

The Moses Lake Wellfield Superfund Site is an area of approximately 15 square miles, which includes the former LAFB, commercial facilities, and residences. The former LAFB occupied approximately 9,607 acres three miles northwest of the City of Moses Lake. The United States Air Force was active at the site from 1942 until 1966. During 1988 and 1989, the Washington State Department of Health confirmed the presence of trichloroethylene (TCE) above the Federal Maximum Contaminant Level (MCL) in three City of Moses Lake municipal wells and two Skyline community wells. The Seattle District, US Army Corps of Engineers (USACE) completed a Remedial Investigation (RI) phase in 2003. Appendix A of this report shows the general location map and a site map.

During the course of the RI, several private wells were tested and found to be contaminated with TCE. In 2001, the USACE contracted installation of carbon filtration units – known as whole house filter systems (WHF) – at five of those wells. Several years of groundwater monitoring data has been evaluated since the original WHF systems were installed.

The final results of the Phase I RI released in a report in March 1993 indicated that TCE was consistently found in shallow alluvial and upper basalt (α -basalt) groundwater in the central area of the former base.

On October 14, 1992, the affected areas of the former LAFB and off-site down gradient areas, termed the "Moses Lake Wellfield Contamination", were listed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 for Uncontrolled Hazardous Waste Sites. The former LAFB property is one part of the Moses Lake Wellfield Superfund Site; the site also includes the contaminant plume.

Chemical results from 1993 and 1994 combined with historical data indicated that TCE occurred in the central and southern portion of the former LAFB in alluvial and α -basalt groundwater. In 2004, USACE confirmed TCE contamination in the next lower basalt aquifer (c-basalt). As of 1995, the data suggest that more than one source may have contributed TCE to the alluvial and α -basalt groundwater in the central portion of the former LAFB.

In 1998, URS Greiner completed a sampling round of private water wells and wells for Class A and Class B water systems east, south and southwest of the previously known TCE plume. There were eight detections of TCE during this study. Four wells that were previously outside the plume extent were found to be above the detection limit.

1.2 GROUNDWATER SAMPLING EVENT SUMMARY AND OBJECTIVES

In coordination with the US Environmental Protection Agency (USEPA) Region 10, two USACE environmental field teams deployed to conduct the November 2014 Moses Lake Wellfield groundwater sampling event during a single mobilization. The events described in this report involve USACE field teams verifying sample point locations; discussion of sampling techniques; recording groundwater observations; collecting groundwater samples; and shipping those samples by overnight delivery for laboratory analysis. Environmental sampling team members responsible for the November 2014 field event were Joseph Marsh, Jonathan Moen, Karah Haskins, and Rebecca Weiss.

All of the work described in this report was accomplished in accordance with the Moses Lake Wellfield Superfund Site Quality Assurance Project Plan. In addition, the teams followed the guidance presented in: the Seattle District, USACE Safety and Health Plan; USACE Safety Manual EM 385-1-1; Seattle District, USACE, Sampling Standard Operating Procedures (SOP).

The private wells and monitoring wells designated for sampling is displayed on a map found at Appendix A. These wells have been selected based on their down-gradient locations relative to the inferred flow direction of TCE-contaminated groundwater and validated sampling analytical data from previous monitoring events.

Two environmental field teams deployed to the Site and collected groundwater samples from 13 private well systems, and 69 monitoring wells during the November 2014 sampling event as summarized below:

Team 1: Joseph Marsh and Jonathan Moen collected groundwater samples from 34 monitoring wells fitted with dedicated bladder pumps between 16 and 21 November 2014.

Team 2: Karah Haskins and Rebecca Weiss collected groundwater samples from 13 private well systems and 35 passive diffusion bag monitoring wells between 17 and 21 November 2014.

The objectives of groundwater sampling at Moses Lake are to: 1) collect representative samples from designated private well systems and monitoring wells yielding data of known and sufficient quality to evaluate TCE concentrations and define existing TCE plumes; 2) to assure compliance with the requirements of USEPA; and 3) to make critical project - specific decisions based on the evaluated data.

2.0 DESCRIPTION OF WORK

2.1 ACTIVITIES PRIOR TO THE NOVEMBER 2014 GROUNDWATER SAMPLING EVENT

The USACE project team worked to collect signatures on Department of the Army Right of Entry forms as required before conducting the well sampling on private, city or county government property. For most properties, previously signed Right of Entry forms were still valid. For all

properties designated for sample collection, owners (and renters if applicable) were contacted to coordinate sample collection times during the scheduled field sampling week. Many of the owners allowed the sampling teams to work on their property while they were not at home. At some of the properties, home owners or well system managers had to unlock pump houses and open valves for the sampling teams – requiring prior coordination.

Prior to conducting sampling activities at each location, both teams verified the address or well location and map location matched, and that the Right of Entry form had been signed prior to arriving at each sampling location.

Each team was responsible for identifying potential health and safety hazards at each sampling location. If a hazard is verified at a private well sampling location, an alternate hose bib connected to the same water source may be selected in a safer area of the subject property. In the case of hazardous monitoring well conditions, the well may be situated in a construction zone (as with bladder pump well 00BW04 adjacent to new road construction on the Genie Industries property) requiring the cancellation of sampling at that well until the next scheduled sampling event.

Also for private well sampling, the field team was tasked with determining the most appropriate cold-water tap or other sample port as close to each wellhead as practical, while comparing notes on sample points collected during previous sampling events. The team was briefed that groundwater samples would not be collected from taps delivering chlorinated, aerated, softened or filtered water.

2.2 PRIVATE WELL SAMPLING PROCEDURES

During the November 2014 groundwater sampling event, samples were collected from a total of 13 private wells consisting of: six private well system hose bibs (WP-04, WP-27, WP-125, WP-131, WP-167, and WP-168), and seven WHF systems (WP-14, WP-70, WP-83, WP-86, WP-121, WP-123, and WP-124).

The USACE Environmental Center of Expertise assisted with a revision of existing standard operating procedures for WHF systems and private well sampling with the intent of increasing reliability and repeatability in analytical data quality. Beginning with the November 2014 sampling event described in this field report, USACE has determined private well and WHF groundwater purging shall to consist of: allowing water flow at the sampling port at a rate of approximately 0.5 to 1 gallon per minute (gpm), while measuring the temperature of the water stream with a digital thermometer every two minutes until stabilization is achieved. These procedures follow the general principles of the New Hampshire private well system water sampling guidance.

During purging, the flow rate at each location was verified by graduated cylinder. While purging continued, the field team monitored the surrounding area and flowing water for unusual observations and odors as purge water was captured in a five gallon bucket. They

recorded the start time of the purging in the field logbook immediately after opening each hose bib sample point and establishing the flow rate. While one team member used the digital thermometer to measure water temperatures, the other recorded the temperatures every two minutes until the parameters stabilized.

Upon reaching stabilization, the approximate total purged volume was recorded in the project field book along with any other significant observations. The team then conducted the sample collection activities.

Prior to collecting a water sample, the team reduced the flow rate at each tap to approximately 150 to 200 ml/min. to minimize sample water turbulence and aeration. Prior to sample collection at each private well system, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of each plumbing system were noted to assist in data interpretation. A photographic record of each sample point was made by the team. In addition, each team placed handle tags (indicating that water samples were taken by USACE on that date and time) on the front doors of homes sampled if nobody was home during sample collection. A photo was taken of the handle tag and front of house in that case for the project files.

After the sample containers are filled, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time are placed on the containers. The samples are then packaged in bubble wrap bags and plastic zipper type bags, placed into pre-iced sample shipping coolers and prepared for shipment as described in Section 3.0. All sampling teams worked to ensure each property was left just as they found it with no damage done, and any doors or gates closed as required.

2.3 WHOLE HOUSE FILTER SAMPLING PROCEDURES

In coordination with USEPA and affected Moses Lake area homeowners, granular activated carbon (GAC) water filters have been installed in private well systems showing TCE results of 3.5 µg/l or greater. Each GAC filter system consists of two lightweight composite GAC filter tanks (acting as lead and lag filters), associated piping, bag filters (to prevent GAC particles from entering the household plumbing system), pressure gauges and valved/regulated sample collection ports.

Groundwater samples were collected from seven WHF systems (WP-14, WP-70, WP-83, WP-86, WP-121, WP-123, and WP-124) during the November 2014 sampling event. Each system was purged according to the revised private well sampling SOP consisting of allowing water flow at a hose bib nearest the wellhead at a rate of approximately 0.5 to 1 gpm, while measuring the temperature of the water stream with a digital thermometer every two minutes until

stabilization is achieved. Purge flow rates averaged approximately 0.5 gpm as measured with graduated cylinder, and purged water at each location was captured in a five gallon bucket to verify purged volumes. During purging, continuous temperature readings were recorded using a digital thermometer until water temperature stabilization was achieved. Once water temperature had stabilized, the hose bib was closed, and the field team prepared to collect samples from the pre-determined WHF sample ports (labeled "A" for the lead inlet port, "B" for the lead outlet port, and "C" for the lag outlet port).

WHF sample collection consists of opening each designated sample port valve fully to allow the maximum restricted flow rate of approximately 150 to 200 ml/min to flow into a capture bucket for a few seconds to ensure organic matter or air bubbles have been flushed out of the system. Restrictors have been placed on the sampling lines to provide a smooth, non-turbulent stream at a low-flow rate to minimize loss of volatiles that may be present in the water stream. Next, the sampling team immediately fills three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface away from the shed or pump house GAC filter location after the samples were collected.

2.4 MONITORING WELL SAMPLING PROCEDURES

2.4.1 MONITORING WELL SAMPLING USING DEDICATED BLADDER PUMPS

Moses Lake monitoring well groundwater purging and sampling was performed in accordance with the Seattle District's Low-Flow Ground Water Purging and Sampling SOP, prepared in March 1999 and revised on 1 Sep 2009. Data generated during purging were recorded on the MicroPurge/Low-Flow Sampling Log forms (Appendix C).

The team verified each monitoring well location and identification number with project maps and tables. They verified work can proceed safely in the vicinity of moving vehicular traffic, heavy industry, and other hazards as required. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard "stick-up" well completions. Prior to purging each well, the depth to static water level in each well was measured and checked periodically to monitor draw down as a guide to flow rate adjustment (no greater than 0.4 foot drawdown is permitted to prevent sampling stagnant casing water).

Purging operations at each well commenced once the following equipment was prepared: the MP20 MicroPurge[®] Controller equipped with an adjustable pressure regulator was connected to the Well Wizard[®] bladder pumps via air line and quick connect fittings. Another air line was quick-connected to a pressurized CO₂ cylinder to drive the pump. Pump flow rates were then adjusted during a "pre-purge" period to maximize withdrawal rates and minimize excessive drawdown in each well. The evacuated pre-purge volume at each well was intended to flush out a bladder pump and tubing volume prior to monitoring stabilization parameters. Finally, a QED MicroPurge[®] basics MP20 Flow Cell was connected to the pump's discharge line at ground

surface to measure established stabilization parameters (pH, specific conductivity, temperature, DO, ORP, and turbidity).

Depth to water measurements during purging were monitored and recorded to verify that minimal drawdown occurred. A graduated measuring cup was used to determine the volume purged. Generally, acceptable low-flow rates are no greater than 500 milliliters per minute (ml/min.), and are typically closer to 400 ml/min. for the Well Wizard® bladder pump systems, depending upon the amount of water level drawdown detected during pumping at each well. Purge data was recorded on the micropurge logs every two minutes.

Low-flow purging continued until three consecutive measurements of the stabilization parameters met stabilization requirements.

Stabilization parameter requirements for all private well and bladder pump monitoring wells are as follows:

Temperature	+/- 0.2 °C
Specific Conductivity	+/- 0.020 millisiemens/centimeter (mS/cm)
DO	+/- 0.2 milligrams/liter (mg/l)
pH	+/- 0.2 units
ORP	+/- 20 millivolts (mV)

At each monitoring well, groundwater sample collection would begin immediately after achieving stabilization of water quality parameters during low flow purging.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled immediately following purging by disconnecting the flow-through cell from the pump tubing system, and capturing water directly from the discharge end of the tubing. All sample containers were carefully filled at a low-flow rate to minimize agitation. During sample collection, significant physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms and project field book as needed.

After filling the sample containers, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time were placed on each container and the container was placed in a plastic zipper bag. The bagged sample vials were placed into bubble wrap bags. Finally, the filled sample containers were placed into pre-iced shipping coolers to begin sample cooling to the required 4° centigrade sample preservation temperature prior to shipment to the analytical laboratory. One set of trip blanks were required and included per sample shipping cooler.

At the conclusion of groundwater sampling at each well, the flush mount well covers were bolted closed and stick up well caps padlocked.

2.4.2 MONITORING WELL SAMPLING USING PASSIVE DIFFUSION BAGS

Passive diffusion bags (PDBs) were been selected by the Moses lake Project Delivery Team as the most appropriate, cost-effective method for groundwater sample collection from Moses Lake monitoring wells lacking dedicated bladder pumps. The PDBs were purchased from ALS Environmental laboratory under license by the US Geological Survey and The General Electric Company, both co patent-holders. The 1 ¼" diameter low-density polyethylene PDBs were pre-filled with 220 ml or 330 ml of ASTM Type II certified, laboratory-grade, deionized water. Each filled PDB was then heat sealed by the laboratory prior to shipment to USACE via overnight delivery in hermetically sealed pouches.

The environmental field team allowed a minimum of 14 days to elapse before returning to the Moses Lake site for groundwater sample collection per PDB guidance. PDB retrieval and sampling consisted of the following procedures:

1. The team verified each monitoring well location and identification number with project maps and the sample matrix. They verified work can proceed safely in the vicinity of moving vehicular traffic as required. The PDBs were prepared over clean sheets of aluminum foil prior to being placed into each well. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard "stick-up" well completions. The team donned new Nitrile gloves for groundwater sample collection.
2. The team carefully hauled each weighted PDB to the surface using the nylon suspension line. The sampling team carefully cut the top corner off each PDB and filled each sample vial. The team filled each vial just to overflowing and maintained a reverse meniscus. There was no down time once the PDB has been brought to the surface until sample collection was complete at each well. Any residual sample water in the used PDBs was discharged to ground surface.
3. Each PDB represented a unique sample ID number based on the well ID (and sample interval if two PDBs are deployed into one well). With the exception of the MS/MSD, all QC samples were submitted "blind" to the laboratory using a separate unique sample ID number not labeled as duplicate or trip blank per USACE standard sampling procedure. One set of trip blanks were required and included per sample shipping cooler. An extra laboratory- prepared PDB was shipped to the site and was used for collection of the trip and field blanks at the direction of the USACE project chemist.
4. Once recovered and sampled the PDBs and suspension lines were be discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials were disposed of as municipal waste. The PDBs and other solid waste material were

placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and returned to the Seattle District, USACE office.

5. Finally, the team securely capped and locked each monitoring well riser and cover plate when finished.

2.5 SAMPLING EVENT ACTIVITIES AND OBSERVATIONS

2.5.1 TEAM 1 MONITORING WELL BLADDER PUMP SAMPLING

Groundwater sample collection commenced immediately after achieving stabilization of water quality parameters during low flow purging at each well using dedicated bladder pump systems as described previously. As with the PDB sampling, the sampling team worked from the far north end of the Site, moving to the far south end sampling each designated well as it was encountered. The project well maps and sample matrix were used to ensure samples were collected at the correct locations. The team used 15 lb. (and occasionally 5 lb.) compressed CO₂ cylinders acquired from Oxarc in Moses Lake to drive the pump systems, airlines, pump controllers, and flow cells to conduct the sampling of dedicated bladder pumps.

During the November 2014 sampling event, Team 1 collected groundwater samples from 34 of a planned set of 36 monitoring wells fitted with dedicated bladder pumps. Bladder pump well 00BW04 could not be sampled due to construction on the well and at the well location. Bladder pump well 99BW16 sample tubing was completely filled with ice and could not be thawed out to permit purging and sampling. The bladder pump wells designated for sample collection were: 91BW02; 91BW03; 91BW04; 92BW01; 92BW02; 99AW01; 99AW04; 99AW09; 99BW01; 99BW09; 99BW10; 99BW11; 99BW12; 99BW14, 99BW15, 99BW16; 99BW18; 00AW11; 00AW13; 00BW01; 00BW02; 00BW03; 00BW04; 00BW05; 00BW06; 00BW07; 00BW09; 00BW10; 00BW11; 00BW12; 00BW13; 00BW14; 00BW15; 00BW16; 01BW01; and 02BW02.

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated monitoring well, the sampling team always attempted to contact the property owner for each monitoring well location before beginning the field sampling activities. This was essential to conduct groundwater sampling, water level measurement, or inspection of ten designated monitoring wells located within the restricted area of the Grant County Airport (Port of Moses Lake property). A Port of Moses Lake escort must be assigned (arranged in advance of the field sampling) to accompany the sampling team to any location on the airfield. Airport monitoring wells designated for sampling, water level measurement, or inspection for future sampling consisted of: 00BW12, 91AW16, 00BW03, 00BW02, 00BW11, 91AW15, 91BW02, 00BW08, 00BW06, and 91AW13. During this sampling event, Port Security Manager Greg Becken acted as escort during airport property sampling on 18 November 2014. Work was completed as planned on that day. However, monitoring well 91AW13 could not be located for inspection during this event.

Other than property owner notifications, no special access procedures were required for any of the other bladder pump monitoring wells sampled during the November 2014 event.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All sample containers were filled immediately following low-flow purging by disconnecting the flow-through cell from the pump tubing system, and capturing pumped groundwater directly from the discharge end of the pump tubing. During sample collection, physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms.

Stabilization of water quality parameters during purging occurred within three to seven readings (6 to 12 minutes) during this event. Measured temperatures ranged from 11.99°C at well 00BW03 to 15.17°C at well 91BW02. Specific conductivity ranged from 0.24 mS/cm (well 99BW09) to 0.53 ms/cm (well 00BW10). Dissolved oxygen measurements ranged from 1.35 ppm (well 00BW11) to 10.13 ppm (well 00BW12). PH ranged from 5.93 units (well 00BW13) to 7.08 units (well 00AW11). Oxygen reduction potential ranged from 206 mV (well 99BW12) to 649 mV (well 91BW04).

Significant Observations Made During Team 1 Bladder Pump Sampling

Bladder pump monitoring well 00BW04 could not be accessed for groundwater sampling during the November 2014 sampling event. Monitoring well 00BW04 is situated in an active road construction zone and is being converted from stick-up casing to flush mount vault. This new access road has been installed for Genie Industries adjacent to the Grant County Airport. The dedicated bladder pump system was removed by USACE during the October 2014 sampling event to permit construction of the well conversion by drilling contractor, and will be adjusted and re-installed in well 00BW04 during the February 2015 sampling event.

Due to unusually cold temperatures during this sampling event, twenty out of 34 dedicated bladder pump wells were found to contain from two to three feet of ice filled pump discharge tubing. The environmental field team managed to pull the pump cap and tubing assembly out of the well risers and thaw the tubing out within 10 minutes using the heated cab of their sampling truck. The pump assemblies were then replaced in each well, and sampling activities could resume. At well 99BW16, the frozen pump tubing assembly could not be removed for thawing in the heated vehicle, resulting in no sample collection at that well.

Earlier in 2014, a deep, narrow void was observed in soils adjacent to the north side of the PVC riser in flush mount well 99BW12. At the direction of the project geologist, four bags of bentonite chips were added in September 2014, but a void remained. During the November 2014 sampling event, the team added one bag of bentonite chips to the void space resulting in completely filling it to the top. Recommend continued inspections of this area in future sampling events.

Monitoring well 00BW14 is situated in a deep vault approximately two feet below the asphalt pavement of the CDSI Transfer and Recycling Center. Sampling teams must spend considerable

time and effort to clean out several inches of water and debris over the sealed well cover plate that has passed through the numerous openings in the manhole cover. During the September-October 2014 sampling event, the team filled the manhole cover holes with expanding foam to keep water and debris out. During the November 2014 sampling event, the team discovered three inches of standing water in the vault that had been infiltrating from under the asphalt pavement, but the plugged manhole voids are keeping surface water and debris out.

Significant drawdown was observed during purging at well 02BW02. Reducing the flow rate halted the drawdown- and partial recovery was observed prior to sample collection. Minor drawdown was observed at well 00BW03, but did not exceed the 0.4 ft. limitation of the low-flow SOP.

The specific conductivity probe failed during purging at well 00BW05, but resumed normal operation after departing this location.

Well 99-BW16 shows bentonite heaved in the well casing – no corrective action recommended at this time.

Monitoring well 91-BW01 can now be safely accessed without restriction for water level measurements and future groundwater sampling. Well 99-BW17 is designated for water level measurements, but US Air Force aircraft operations near this well made access unsafe during the November 2014 sampling event.

For sampling Genie Industries bladder pump well 00BW09 – this well is no longer accessible from the airport side. The field team was required to check in with Genie personnel to obtain visitor badges, then drive around the south and west perimeters of the facility to reach the monitoring well. In addition, the vicinity of 00BW09 is being used for testing new mobile boom vehicles, so the team had to protect themselves from noise and constantly monitor moving equipment near the sampling zone.

Between 17 and 20 November 2014, groundwater samples for the November 2014 monitoring well sampling event were shipped under chain of custody via the Grant County Airport Fedex Station priority overnight to the contract laboratory - Analytical Resources, Inc. in Tukwila, WA. Environmental field team 1 departed the Site on the morning of 21 November 2014. They hand-delivered the last cooler containing groundwater samples under chain of custody to the contract laboratory and returned to the USACE District Office in Seattle.

2.5.2 TEAM 2 PRIVATE WELL SYSTEM SAMPLING

USACE environmental field team 2 consisted of Karah Haskins and Rebecca Weiss. While environmental field team 1 worked independently on their set of bladder pump monitoring wells, Team 2 collected samples at their own pre-assigned set of seven whole house filter well system sample ports, six private well system hose bibs, and 38 PDB monitoring wells requiring sampling and/or PDB installation for the next sampling event.

During the period of 17-21 November 2014, Team 2 collected groundwater samples from the following private well systems with whole house filters installed: WP-14, WP-70, WP-83, WP-86, WP-121, WP-123, and WP-124. During that same time period, Team 2 collected groundwater samples from the following private well systems: WP-04, WP-27, WP-125, WP-131, WP-168, and WP-169.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

Trip blanks were sent inside each sample shipping cooler delivered to the analytical lab.

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated location, the sampling team always attempted to contact the owner or resident at each private well location before beginning the field sampling activities. Upon arrival at each private well property designated for sample collection, the team verified they were at the correct address using maps, notes, and the sampling matrix, and verified through field documentation they were ready to collect samples at the correct sampling point (hose bib, or suitable water discharge port nearest to the wellhead).

Per modified SOP, sampling point valves were opened, and water allowed to flow at approximately 0.5 gpm into a capture bucket. Next, water temperature readings were measured every two minutes until stabilization was achieved. During the November sampling event, water temperature stabilization averaged approximately eight minutes elapsed purging time with most locations reaching stabilization within six minutes as shown in Table 1 below.

TABLE 1: PRIVATE WELL STABILIZED WATER TEMPERATURES AND PURGE TIMES

Well Location ID	Stable Temp. °C	Total Purge Time (Minutes)
WP-04	15.7	6
WP-14	19.8	6
WP-27	14.6	6
WP-70	12.9	6
WP-83	9.6	6
WP-86	10.2	6
WP-121	8.7	6
WP-123	8.4	12

WP-124	11.1	8
WP-125	12.2	6
WP-131	13.8	16
WP-167	13.2	12
WP-168	15.5	6

Upon achieving stabilization, the final stabilized readings were entered into the project field book. Prior to collecting a water sample, the flow rate at each tap was reduced to approximately 100 to 200 ml/min. to minimize sample aeration and turbulence. The sampling team donned new Nitrile gloves prior to sample collection at each residence. In the case of the WHF sample ports, restrictors on the sample ports provided a stream of sample water at approximately 150 to 200 ml./min. All sample containers were be filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. A photographic record of each sample point was made by the team.

Significant observations made during Private Well/WHF Sampling

Door handle tags were attached to the front doors of the following three residences where private wells were sampled by Team 2, but the resident was not at home during sample collection activities: WP-86, WP-123, and WP-125. As mentioned previously, the door handle tags are intended to inform the residents that a sample had been collected by the USACE team while they were away from home, and provide them with a point of contact and phone number if they had any questions or concerns. Photos of the handle tags are maintained in USACE project files and are found at Appendix B.

Due to the presence of containerized chemicals near the sample point, one field blank sample was collected at WP-14 using reagent-grade water.

Teflon sample tubing was attached to the hose bib at WP-125 and WP-131 to mitigate turbulent water flow. After decontamination, reagent grade water was passed through the tubing and collected as an equipment blank sample. Also at WP-131, the primary sample point water system was shut off and the field team had to use an alternate hose bib located on the northeast corner of the house.

Between 17 and 21 November 2014, all Team 2 groundwater samples were shipped priority overnight to Analytical Resources, Inc. via the Grant County Airport Fedex Station. Sampling Team 2 departed project site on 21 November 2014 and returned to the USACE District Office in Seattle.

2.5.3 TEAM 2 PASSIVE DIFFUSION BAG SAMPLING AND DEPLOYMENT

USACE environmental field team 2 collected samples from a pre-installed set of 35 PDB wells, and deployed new PDBs into a pre-assigned set of 38 PDB monitoring wells during the November 2014 mobilization.

The team generally worked from the north end of the Site and moved to the far south end sampling each designated well as it was encountered. A total of 35 monitoring wells were fitted with new PDBs during the September-October 2014 sampling event in preparation for the November 2014 event. The PDB wells were: 02-BW01; 04-BW01; 04-BW04; 04-BW05; 04-BW06; 04-BW07; 04-BW09; 04-CW01; 04-CW02; 04-CW03; 04-CW04; 04-CW05; 04-CW07; 04-CW08; 12-BW01; 12-BW02; 12-BW03; 12-BW04; 12-BW05; 12-BW06; 12-BW07; 12-BW08; 12-CW01; 12-CW02; 12-CW03; 12-CW04; 12-CW05; 12-EX01; 12-EX02; 14BW01, 14BW02, 14BW03, 14EX03, 14EX04, and 14EX05.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

The team first verified each monitoring well location and identification number with project maps and the sample matrix. The team also verified that work could proceed safely in the vicinity of moving vehicular traffic or other physical, biological, or environmental hazards that may have been present near each monitoring well.

Each team member donned new Nitrile gloves for groundwater sample collection at each well. Once the wells were unlocked and opened, one team member lifted the well riser plug and began hauling the PDB vertically to the surface.

Once each PDB was raised to the surface, the sampling team worked together to carefully cut the top corner off each bag using decontaminated steel scissors. Next, one person held the open sample vials and the other carefully and slowly tilted the bags - open side down - toward each open sample vial. The pre-preserved vials were filled just to overflowing to maintain a reverse meniscus. Then the vials were immediately capped making sure there were no bubbles or headspace per standard VOC sampling procedure. This entire sampling process can be completed within one minute to minimize loss of volatiles while preventing introduction of contaminants into the water from surface sources. After all required vials were filled; any residual sample water remaining in the used PDBs was discharged to ground surface. Therefore, no Investigation-derived waste (IDW) water was generated during this sampling event.

The sampling team recommends continued use of protective mesh PDB sleeves in wells with steel risers due to a greater potential for damage to the PDB membranes (monitoring wells 12EX01, 12EX02, 14EX03, 14EX04, and 14EX05).

Once recovered and sample water removed, the PDBs and suspension lines were discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste

materials were disposed of as municipal waste. The PDBs and other solid waste material were placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and returned to the Seattle District, USACE office for future reuse.

Finally, the sampling team closed and locked each monitoring well casing cover or secured the flush mount well cover plates when sample collection was completed at each location.

After collecting water samples from the PDBs, team 2 deployed PDB assemblies into 38 monitoring wells selected for groundwater sampling.

Two sizes of PDBs were ordered: The bags consisted of the standard 220 ml size, and a larger 330 ml bag selected to accommodate primary and field duplicate samples where required. In some wells, two 330 ml PDBs were connected in tandem and lowered to the mid-screen depth to accommodate primary, field duplicate, and MS/MSD sample volumes as required. Two PDBs were installed at two mid-screen depths if a designated well had two screened intervals (as found in wells 04CW07, 12BW03, and 12BW04). All PDBs and stainless steel anchor weights were purchased from ALS Environmental, and shipped to the District office by UPS overnight delivery.

Following the established PDB deployment procedures, both environmental team members worked together using a table of Moses Lake monitoring well logs to determine the number of required weights, length of nylon suspension line, and number of PDBs required at each designated well. Wells deeper than 200 feet generally required two steel weights to allow proper PDB positioning. Each team member donned a new pair of Nitrile gloves prior to working on PDB assemblies at each well. Steel weights, suspension lines, and PDBs were quickly assembled on a strip of clean aluminum foil on the tailgate of the sampling vehicle. The prepared assembly of PDB, suspension lines, and weights was lowered into place at each well within 10 to 15 minutes to reduce the possibility of contaminants entering the diffusion bags during deployment.

At each specific well, the team lowered the weight into the well first, followed by the suspension line and PDB. The team worked to keep the assembly centered within the well casing as they slowly lower it to the well bottom. When the team felt the weight hit well bottom, they pulled up the line approximately one inch and tied it off securely to the casing plug or well cap. This method ensured the PDB would always be centered at the mid-well screen depth. Finally, the well cap was locked, or the cover plate secured with locking bolts depending on type of well encountered – stick up or flush mount.

All laboratory-filled PDBs arrived at the USACE office in good condition prior to field deployment. Each PDB was packed in groups of 10 into sealed foil pouches to prevent inadvertent contamination until deployment into the designated monitoring wells. No specific difficulties or problems were noted during PDB deployment.

Significant Observations Made During Passive Diffusion Bag Sampling

Team 2 detected an unusual oil-like residue on the PDB and suspension line at well 04CW02 not seen previously. Padlocks had to be cut off due to being seized up at wells 91AW07, 91SW14, and 91AW17 (scheduled to be replaced with new locks in February 2015). A rusty residue was observed on the PDB and PDB suspension line installed in well 14EX03.

For future sampling events involving well 91AW17, the City of Moses lake water department must be contacted to open the gate for access to this well near a city well and water tower.

3.0 INVESTIGATION-DERIVED WASTE

No investigation-derived waste was generated during this sampling event. All residual PDB water or purged well water was transferred directly to ground surface on each property away from the sample collection point.

4.0 PACKAGING AND SHIPMENT

As mentioned in the narrative of each sampling event, groundwater samples were packaged in shipping coolers on ice and under chain of custody for priority overnight shipping to the USACE contract laboratory Analytical Resources, Inc. via the Grant County Airport Fedex Station. Team 1 hand delivered one cooler directly to the laboratory at the conclusion of the sampling event.

All sample shipping coolers were prepared for laboratory delivery in the following manner: Each cooler was lined (sides and bottom) with plastic "bubble-wrap" sheets for shock absorption. A large 30-gallon plastic garbage bag was then placed into the cooler to contain the sample water in the event of container breakage during shipment to the laboratories. The glass sample vials were labeled, placed into plastic zip-seal bags, and placed into foam shipping blocks or bubble-wrap bags for shock protection. All the samples were placed in the shipping coolers as indicated on the corresponding chain of custody forms. Gallon size plastic zipper bags of cubed ice bags were placed between and on top of the samples in each cooler to ensure maintenance of the required four degrees centigrade (plus/minus two degrees) sample preservation temperature. The completed chain of custody (COC) forms were placed in gallon size plastic zipper bags and taped to the inside of each cooler lid. Two custody seals were affixed to the outside of each cooler. The custody seals were placed so that the coolers could not be opened without breaking the seals. Each cooler was then securely sealed with fiber tape. The field team ensured drain plugs were securely taped inside and out to prevent possible water leakage.

The laboratory was informed of the sample delivery and ensured the samples were properly accepted and checked in upon receipt the following morning after the sample containers were shipped. All sample coolers and sample containers were accounted for at the contract laboratory following each shipment.

5.0 LABORATORY ANALYSIS

Chemical analyses performed on the samples were as follows: VOCs (Method 524.3).

6.0 DECONTAMINATION PROCEDURES

PDB weights, flow cells and associated tubing, water level indicator meters, and water volume measurement containers used by each team were decontaminated at the end of the project with an Alconox®-water solution followed by triple rinsing using distilled water in the USACE Geology Laboratory.

7.0 PROTECTION LEVEL

All sampling activities were conducted under Worker Protection Level D. For this project, personnel protective equipment included reflective safety vests, safety splash protection glasses, Nitrile gloves, and safety steel toe boots. New pairs of Nitrile gloves were donned prior to handling acid-preserved sample containers and between each unique private well sample point or monitoring well.

End of Field Sampling Report

APPENDIX A

Site and Well Location Maps
(Available in USACE Files)

APPENDIX B

Field Sampling Photos

Figure 1



Figure 2



Figure 1: Due to barbed wire fences, the field team hand-carried equipment across a field to sample well 00BW01. Figure 2: Jonathan Moen monitoring low flow purging at well 01BW01.

Figure 3



Figure 4



Figure 3: Jonathan Moen recording flow cell data at well 00BW05.

Figure 4: Water level measurements being taken at well 02BW02.



Figure 5



Figure 6



Figures 5 and 6: Most of the dedicated bladder pumps selected for November 2014 sampling contained up to three feet of ice in the sample discharge tubing, and had to be thawed out using the sampling vehicle heater prior to conducting sampling activities.

Figure 7



Figure 8



Figure 7: Well 00BW14 – Jonathan Moen removes standing water from the manhole vault. Even with plugged holes in the cover plate, water still seeped into the vault from under the pavement. Figure 8: Well 00BW14 – bolts being removed on the standard flush mount vault installed two feet below ground surface.



Figure 9



Figure 9: Recording water quality indicator parameters during purging of well 00BW09 on the Genie Industries property.

Figure 10



Figure 10: Opening cover plate to access well 99BW12 for groundwater sampling.

Figure 11



Figure 11: 99BW12 well vault floor after filling the narrow void adjacent to the PVC riser with bentonite chips.



Figure 12



Figure 13



Figures 12 and 13: Jonathan Moen inspects airport well 91AW16 and measures static water level. The team was unaware the well contained a dedicated bladder pump. This well will be sampled in February 2015.

Figure 14



Figure 15



**Figure 14: Jonathan Moen opens airport well 00BW11 for groundwater sample collection.
Figure 15: Bladder pump well 91AW15 was located approximately 25 feet north of 00BW11, and will also be sampled in February 2015.**



Figure 16



Figure 17



Figure 16: Well 91AW15 can be seen at arrow as Jonathan Moen works on 00BW11.

Figure 17: The sampling team located bladder pump 99AW10 (first time USACE has opened the well in 15 years for water level measurement). This well will be sampled in February 2015.

Figure 18



Figure 19



Figure 18: Inside casing view of monitoring well 91AW01 found to contain sample tubing for a submersible pump presumably used by contractors.

Figure 19: Inside casing view of monitoring well 91BW01 found to contain a dedicated bladder pump. This was first time USACE has visited these wells since 1999.



Figure 20

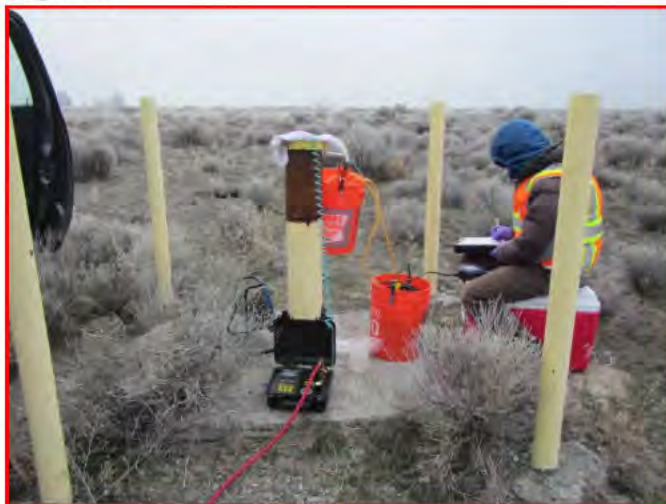


Figure 21



Figure 20: Jonathan Moen recording purge readings in sub-freezing temperatures at well 92BW02.

Figure 21: Detail photo of purging operation at well 92BW02

Figure 22



Figure 23



Figure 22: Attaching tubing, air lines, and cables required to sample well 99BW18.

Figure 23: Ice can be seen sliding out of the Teflon sample discharge tubing at well 00BW13. Less than one foot of ice was found at the end of this tubing, and it was easily dislodged to permit purging and sampling.



Figure 24



Figure 25



Figure 24: Pump tubing being thawed out in frozen truck cab (bladder pump well 00BW16).

Figure 25: Purging activities prior to sampling at well 99BW10.

Figure 26

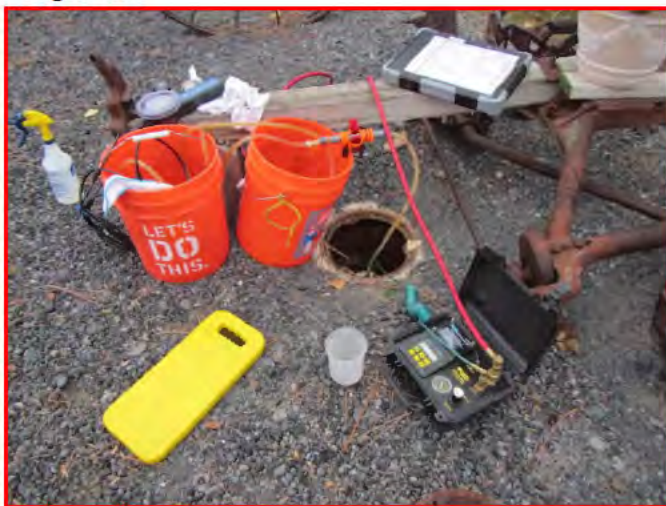


Figure 27



Figure 26: Low flow purging underway at bladder pump well 99BW11.

Figure 27: Jonathan Moen records field data during purging at bladder pump well 99AW04.



Figure 28



Figure 29



Figure 28: A typical passive diffusion bag recovered from well 04BW05 prior to being cut open for immediate VOC sample collection. A new PDB was then reinstalled in the well.

Figure 29: Labeled well casing at PDB well 04CW03.

Figure 31



Figure 30



Figures 30 and 31: Rust residue on suspension line and bottom of PDB from steel well casing at well 14EX03.



Figure 32



Figure 33

(b) (6)

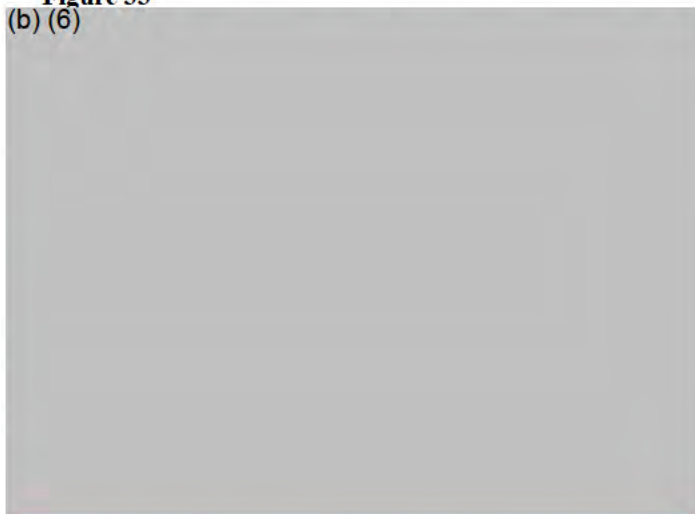


Figure 32: Sample point photo within WP-27 pump house.

Figure 33: Rebecca Weiss preparing hose bib for purging at WP-86.

Figure 34



(b) (6)



Figure 34: Flow meter/totalizer as seen at WP-86 during field activities. Figure 35: Sampling handle tag left on door at vacant WP-86 after sample collection.



Figure 36
(b) (6)



Figure 37
(b) (6)

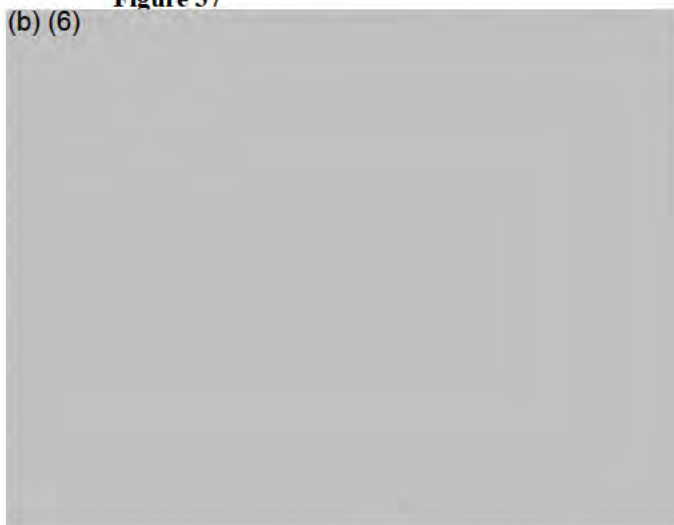


Figure 36: Yard hydrant sampling point prior to sample collection at WP-167.

Figure 37: Preparations for sample collection at WP-168.

Figure 38
(b) (6)

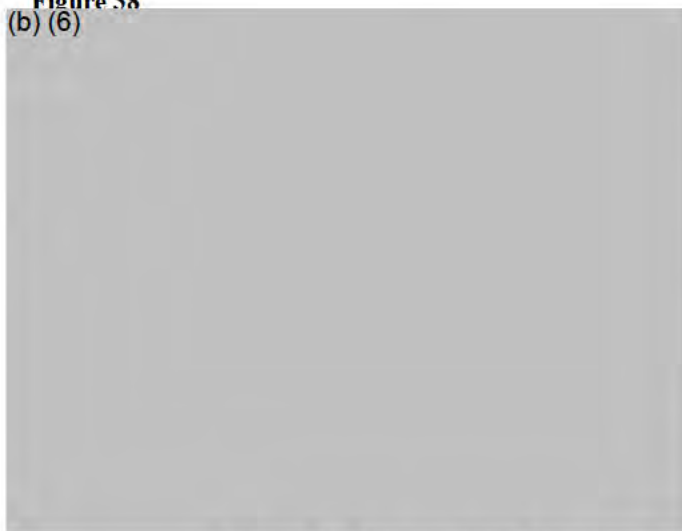


Figure 39
(b) (6)



Figure 38: Preparations for purging from the hose bib at WP-121.

Figure 39: Handle tag left after sampling at WP-123.



Figure 40



Figure 41



Figure 40: Groundwater purging activities at WP-121.

Figure 41: Rebecca Weiss prepares to measure water temperature during purging from the yard hydrant at WP-83.

Figure 42

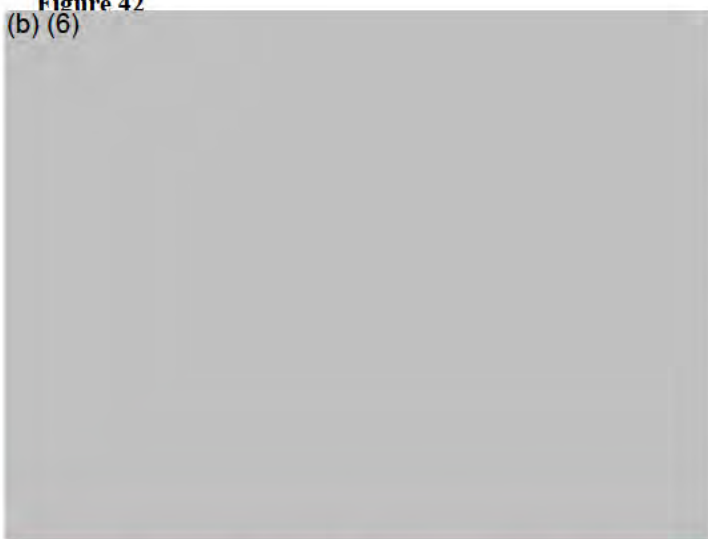


Figure 43



Figure 42: Rebecca Weiss uses the yard hydrant next to the well house for purging at WP-14.

Figure 43: Handle tag left after sample collection at WP-125.



Figure 44



Figure 45
(b) (6)



Figure 44: Sampling with Teflon tubing due to low-to-floor hose bib sample point at WP-125.

Figure 45: Rebecca Weiss measures water temperature during purging at WP-131.



APPENDIX C

Field Notes

(Acknowledgement Form, Private Well SOP, Micropurge Logs
Available in USACE Files)

SEATTLE DISTRICT, USACE
ENVIRONMENTAL SAMPLING
FIELD LOG BOOK
Project: MOSES LAKE WELLFIELDS
MONITORING WELL SAMPLING

Book 5



FY14-
FY15

Rite in the Rain®
ALL-WEATHER
**ENVIRONMENTAL
FIELD BOOK**

Nº 550F

NOV. 2014
EVENT

Location Moses Lake, WA

Date 11-16-14 → 11-21-14

Project / Client Moses Lake Wellfield

November Sampling event
Bladder pump wellsField
Notes on
Pg. 60

Groundwater Sampling Table

Team: Maugh, Mosen

SAMPLE ID	DATE	TIME	VOC 524.3	NOTES
14MLW1116N01BW01	11-16	1501	3	
" 1116N00BW05	11-16	1539 1420	3	
" 1116N00BW01	11-16	1420	3	
" 1116N00BW07	11-16	1610	3	
14MLW1117N00BW14	11-17	1154	3	
" 1117N99BW15	11-17	0922	3	
" 1117N02BW02	← 11-17	1020	9	MS MSD
" 1117N02BW02	← 11-17	1042	3	F.D.
" 1117N99BW12	* 11-17	1515	3	
" 1117N99BW14	← 11-17	1420	9	MS MSD
" 1117D99BW14	← 11-17	1443	3	F.D.
" 1117N99BW16	NO sample 11-17	—	3	iced up
" 1117N00BW09	11-17	1340	3	
14MLW1117TB01	11-17	0820	2	Trip Blank 1
14MLW1117D99BW12	* 11-17	1530	3	Field Duplicate of 99BW12

This table represents samples sent in cooler
on COC No. 1

* 2 Vials Submitted for Trip Blanks

Field Notes
Begin on
Pg. 60

Location Moses Lake, WA

Project / Client Moses Lake Wellfield

Groundwater Sampling Table cont.
Team 1

SAMPLE ID	DATE	TIME	VOC 524.3	NOTES
14MLW1118N00BW12	11-18	0920	3	
" 1118N00BW02	11-18	1101	3	
" 1118N00BW03	11-18	1010	3	
" 1118N00BW11	11-18	1138	3	
" 1118N91BW02	11-18	1231	3	
" 1118N00BW06	11-18	1320	3	
" 1118N99BW09	11-18	1555	3	
14MLW1119N91BW03	11-19	1312	3	
1119N99BW01	11-19	1333	3	
1119N99AW01	11-19	1406	3	
1119N92BW01	← 11-19	1035	89	MS MSD
1119D92BW01	← 11-19	1048	3	F.D.
14MLW1119EB019BW03	11-19	—	3	Field Blank
14MLW1119TB02	11-19	0900	2	Trip Blank 2

This table represents samples sent in cooler
on COC No. 2

* 2 Vials Submitted for Trip Blanks

* No field blank!
No odors detected near
fuel storage areas

Location Moses Lake, WA

Date _____

Field Notes
on page
60Project / Client Moses Lake WellfieldGroundwater Sample Table cont.

TEAM 1

SAMPLE ID	2014 DATE	TIME	VOC 5243	NOTES
14MLW1119N00AW11	11-19	0958	3	
" 1119N92BW02	11-19	0927	3	
" 1119N00BW15	11-19	0853	3	
" 1119N00BW10	11-19	1513	3	
14MLW1120N91BW04	11-20	0845	3	
" 1120N00BW13	11-20	0930	3	
" 1120N99AW09	11-20	1044	3	
" 1120N99BW18	11-20	1013	3	
14MLW1120N91TB03	11-19 11-20	0930	2	Trip Blank 3

Cooler 3

Coc 3

EVENT
NOV-2014Location Moses Lake, WA

Date _____

Field Notes on
Page 60Project / Client Moses Lake WellfieldGroundwater Sampling Table cont.

TEAM 1

SAMPLE ID	2014 DATE	TIME	VOC 5243	NOTES
14MLW1120N00BW16	11-20	1127	3	
" 1120N00AW13	11-20	1132	3	
" 1120N99BW10	11-20	1134	3	
14MLW1121N99AW04	11-21	0902	3	
" 1121N99BW11	11-21	0846	3	
14MLW1121TB04	11-21	0840	2	Trip Blank 4

COC 4

Cooler 4

Location Moses Lake Date 11-16-14

Project / Client Wellfield
Nov-14 Sampling

Field Notes - calibrated flow cell

1350 Setup at 00BW01 upon arrival
walked in to site with all
equipment - purged to stabilization

1420 = Sample time - Close + lock well

1445 Setup at 01BW01

cold weather - purging to stabilization

1501 = Sample collection time, closed well.

1517 = 00BW05 setup - purging to
stabilization - Spc Probe not working
1539 = sample time, close + lock well1551 = Mob to 00BW07 Spc probe working
Normally Now, Purge to stability1610 Sample time - outside temp
Now 32°F samples transferred
to cooler - well closed + locked.

1630 - End of day

Mob. to Hotel - samples kept
in Refrigerator in hotel room.

J. R. W.

EVENT
NOV-2014

Location Moses Lake Date 11-17-14

Project / Client Wellfield Nov-14 Sampling

Field Notes

0730 → Calibrated flow cell - mob. to
Safeway to buy ice. Mob. to
= First well - checked in with Jay
@ CDST well 00BW11 amMob. to 02BW02 water tubing frozen
can't sample until we thaw it
out with truck0900 - Mob. to 99BW15 purged to
stability -

0922 = Sample time, close up well

0956 = Defrosted 02BW02 tubing
SWL = 68.52 - Purging to stability
Low PH + drawdown noted

1020 (P) sample time + m/s/m

1042 (FD) sample time

close up well + Mob. to another well.

00BW14 - checked in with Jay
at Recycle center (CDST) open vault
- well vault has 3" water from
under pavement - No debris sofoam filler in cover holes worked.
opening well - purging to stability

1154 Sample time @ 00BW14

Lunch

1318 Setup at 00BW09

Top 3' Tubing frozen - used truck heater →
Thawed out, purged to stability1340 = Sample time - close - Lock well
- return to Genie office to return

Badges.

Setup at 99BW14

purging to stabilization

1420 = (P) Time + MS/LWD

1443 = (FD) Time close - Lock well

(New Lock installed)

Mob. to 99BW12 - purging to
Stability

1515 = Sample time (P)

1530 = Sample time (FD)

Adding 18 Bags of bentonite chips
(filled) to void on N. side of riser
close well -

1538 - Mob to 99BW16

pump tubing Frozen - no sampler
here today. Cannot pull tubing to thaw out.

Mob. to FedEx at airport

1600 → samples from yesterday + tomorrow shipped

in cooler [NWS503]

1630 - end of day, Quince

Field Notes

Picked up 15lb. CO₂ at OXARC

8830 - Calibrated flow cell, meet

Greg Beehen at Port of Moses Lake

office. He escorts us on Airport property,

0900 - Set up at well 00BW12

Frozen tubing - Thawed out

purged to stability

0920 - Sample time - close-lock well

Mob. to PDB well 91AW16

SWL = 80.42' B_g Pump installed!

PDB not needed. (Lock cut off)

0941 = Setup at 00BW03 Bladder pump.

Tubing frozen (water in tubing) -

Top 3 ft. - Thawed out

1010 = Sample time after purging to stability

close-lock well - Mob to 00BW02

1021 = at 00BW02 - discharge tubing

frozen - using truck defroster

to thaw out, - OK

purged to stability

1101 Sample time

Close + lock well Mob. to snowplow

shed area.

EVENT
NOV 19 14

1112 - OOBW11 - flush mount - opening
Near PDB well 91AW15

- Marsh opens 91AW15
- Moen opens OOBW11 - Not frozen

SWL @ 91AW15 = 83.51'
Bladder Pump installed!
No PDB Needed.

Moen purging OOBW11 to stability

1138 - Sample time OOBW11
well closed. (Air used to
blow out water from sample discharge
tubing - Co₂ pressure thru freeze protection
kits). Recommend removing water each round.
- Break -

1200 - Mob. to 91BW02 Tubing frozen

1214 - SWL @ 0013W08 = 91.88

thawing tubing
91BW02 SWL = 93.64'
purging to stability

1231 = Sample time - close well

mob. to OOBW06 - Frozen tubing!

Water level measured, thawing tubing
SWL = 148.68" (91AW13 location not confirmed)

1320 - Sample time, close + lock well
Depart Secure Airport Facility - property.

EVENT
NOV-5011

* Northwest Airport wells open for unrestricted Access.

1422 - 91AW10 SWL 129.90'

Bladder Pump installed!
No PDB Needed.

North end accessed for first time

91AW01 SWL = 129.15'

91BW01 SWL = 129.25'

1520 - Mob. to 91BW09 BP well
purged to stability (Frozen tubing
thawed out first)

1555 - Sample time
close + lock well.

1620 - cutting lock + replace with new
at well 91AW07 for PDB sampling.

1630 end of Day

In Run

11-19-14

Moses Lake Wellfield

FIELD NOTES

0730 Flow Cell calibrated, Truck defrosted

0800 - ~~Flow cell calibrated~~, Bought ice
at Safeway0830 - Setup at 00BW15 - tubing
~~FROZEN~~ - thawing in truck per
new ICE S&P - Thawed purging
to Stabilization0853 = Sample collection time - Mob. to
92BW02 after locking well
Tubing not frozen - purging
to stabilization.0927 = Sample time close & lock well
Mob. to 00AW11 - well tubing
appears frozen, but is ok after
clearing by hand, purging to
stabilization0958 = Sample time, close - lock well
Mob. over to 92BW01
CSWL 84.38' @ 92BW01
water tube frozen - upper 2"
thawed out in truck.

purging to Stabilization

1035 = Sample time R

1048 = Sample time FD

EVENT
NOV-2014

11-19-14

Moses Lake Wellfield

Field Notes

Packed up 15Lb CO₂ @ OXARC

Lunch

1230 - Mobilize to 91BW03 - Tubing Frozen -
purging to Stabilization Truck Thawing
S&P followed
- No Field blanks here - no odors detected
from tank farm or airport1312 - Sample time, close lock well
Mob. to 91BW01

SWL = 89.78' No ice visible

SWL @ 91AW01 = 89.29'
purging to stabilization1333 = Sample time - close/lock well
Mob. to 91AW01 tubing frozen
thawing out in heated truck
Purging to stability1406 = Sample time, close - lock well
after flushing out tubing water
Delivering samples from yesterday
+ today to Fedex in cooler
INWS-504, Fedex number 805512271834.1456 = arrive @ 00BW10 - using cooler 3 now -
purging to stabilization - no ice1513 = Sample time
close up well - end of Day

Jan 11/14

Field Notes

0730

calibrated flow cell
mobilize to Safeway to buy ice
Mob. to first well - 91BW04
purged to stability - some ice
in discharge tube - OK

0845 =

sample time, close - lock well
Mob. to 00BW13 - purging to
stabilization - minor ice in tubing
(Discharge sample tubing).

0930 =

sample time - close - lock wells

0951 =

Mobilize to 99BW18

some ice in tubing to thaw out - OK

($\times$ SWL @ 99AW09 = 97.52')

→ purged to stability

1013 - sample time

Mob. to adjacent well 99AW09

Thawing out frozen tubing

- purging to stabilization

1044

= sample time, close - lock well

1100

Fedex - airport location to drop off
cooler 3 to ARI - priority overnight delivery
Lunch on site.

1120-

1150

continued...

1206 - 00BW06

Begin setup for purging
iced tubing - Thawed purged to stability

1237 =

sample time - close up well

 $\times$

00AW13 SWL = 121.45'

1300 =

tubing thawed out
purged to stabilization

1312 =

sample time, close up well

Mob. to

99BW10

purging to stabilization - No ice

1344 =

sample time, closing well.

1400-1600 =

completing paperwork, organizing
supplies, buying supplies for tomorrow

1600 - end of day. Gravel

11-21-14

0800 =

Bought ice - calibrated flow cell
went to "Windmill Farm"

Setup on

99BW11 - talked to Home
owner.

purging to stabilization

($\times$ SWL 99AW04 42.26')

0846

sample time - close up well

Mob. went on property to 99AW04

purging to stabilization

0902 =

sample time, close up well

Location

Date:

11-21-74

Project / Client

Project / Client Moses Lake Wellfield

1000- bagging ice + prepping shipping cooler for hand delivery to ARE today.

1100- Depart Moses Lake

- Arrive @ ARI, Tukwila, to drop off final sample cooler (Cooler 4) directly to Sample Custodian

1200 - Return to District, unload supplies
- equipment - turn in truck.

- equipment - turn in truck.

1600 Mission complete.

John R. Smith

Location

Date _____

Project / Client

Location: Moses Lake Date: 11/17/2014
 Project / Client: Moses Lake wellfield 11/21/2014
 superfund site NOV sampling 2014

Groundwater Sampling Table

Sampling Team: Haskins, Weiss
 Culler 1 Tracking number 805512271775

SAMPLE ID	Date	Time	VOC 5243	Notes
14MLW1117N04CW02	11-17	1133	3	
" N04BW05	11-17	1157	3	
" N04BW06	11-17	1237	3	
" N04CW03	11-17	1326	3	MSD Field pur
" N04CW03	11-17		3	
" N04BW04	11-17	1423	3	
" N04CW01	11-17	1402	3	
" N04BW07	11-17	1544	3	
" N04CW04	11-17	1521	3	
" N12CW02	11-17		3	
" D04CW01	11-17	NOT	NEED	
" D04BW04	11-17	1430	3	duplicate
PDTB01	11/17	1437	3	rough blank
D04CW04	11/17			
FB				
" TB05	11/17	1552	3	
14MLW1118N12CW02	11/18	0830	3	
14MLW1118N12BW03A	11/18	0918	3	
" N12BW03B	11/18	0923	3	Broke one MSD
D12BW03B	11/18	0930	3	
N12BW06	11/18	1011	3	

Location: Moses Lake Date: 11/18-11/19 95
 Project / Client: NOV 2014 sampling

SAMPLE ID	Date	Time	VOC 5243	Notes
14MLW1118N12CW05	11/18	1025	3	Broke one
" N12BW02	11/18	1403	3	
" N12CW01	11/18	1348	3	
" N12EX02	11/18	1245	3	
" N12BW08	11/18	1315	3	
" N12EX04	11/18	1450	9	✓
" D12EX04	11/18	1455	3	
" N14BW02	11/18	1430	3	
" N12BW04A	11/18	1501	3	
" D12BW04A	11/18	1603	3	
" N12BW04B	11/18	1608	3	
" N12CW03	11/18	1536	3	
" PDTB02	11/18	1519	3	move to cooler
14MLW1119N14BW01	11/19	0812	3	
N14EX03	11/19	0835	3	
TB06	11/19	0839	3	

Culler 2

Tracking 805512271786

Location Moses Lake Date 11/19
 Project / Client NOV 2014 Sampling
Cooler 3

Cooler 3

sample ID	Date	Time	VOL 524.3	Notes
PDTB				
14MLW1118PDTB02	11/18	1519	3	
14MLW1119N12BW05	11/19	0904	3	
" "N12CW04	11/19	0924	3	NO MSY MSD
" "D12CW04	11/19	0930	3	
" "N04CW05	11/19	0944	3	
" "N12BW07	11/19	1008	3	
N12EX01	11/19	1031	3	
N04BW01	11/19	1129	3	
N14BW03	11/19	1147	3	
N14EX05	11/19	1228	3	
N12BW01	11/19	1520	3	Cooler 4
N02BW01	11/19	1535	3	
N04BW01	11/19			Cooler 4
N04CW07A	11/19	1539	3	
N04CW07B	11/19	1547	3	
N04CW08	11/20	0847	3	
TB07	11/20	1339	3	

Tracing

805512271812

Location Moses Lake Date 11/20
 Project / Client NOV 2014 Sampling

Cooler 4

Sample ID	Date	Time	VOL 524.3	Notes
14MLW120NWP27	11/20	0824	3	
"NWP04	11/20	0947	3	
WP86	11/20	1029	3	
WP167	11/20	1102	3	
WP168	11/20	1120	3	
WP12BA1	11/20	1207	3	
WP12BB1	11/20	1210	3	
WP12BC1	11/20	1213	3	
WP12BA1	11/20	1437	3	
WP12BB1	11/20	1440	3	
WP12BC1	11/20	1443	3	
WP70A2	11/20	1508	3	
WP124A1	11/20	1534	3	
WP124B1	11/20	1541	3	
WP124C1	11/20	1544	3	
WP83	11/20	1625	9	
DWP83	11/20	1630	3	
TB08	11/21	0920	2	
Fedex	805512271801			

moved to
Cooler 5

Cooler 5

Location Moxes lakeDate 11/21Project / Client Nov 2014 sampling

Cooper 5

Sample ID	Date	Time	VOC 524.3	Notes
14MLW1121 NWP125	11/21	1113	3	
" "NWP14A1	11/21	0906	9	
" "NWP131	11/21	1114	3	
" "DWP14A1	11/21	0910	3	
" "N04BW01	11/21	0942	3	
" "N12BW01	11/21	0754	3	
14MLW1120 NWP83A1	11/20	1625	9	
14MLW1120 DWP83A1	11/20	1630	3	
14MLW1120 NWP70A2	11/20	1508	3	
14MLW1121 TB09	11/21	1201	3	
14MLW1121 FBWP14A1	11/21	0915	3	
14MLW1121 EBWP131	11/21	1154	3	

Fedex Tracking
8055 1227 1812

Location _____

Date _____

Project / Client _____

Location Moses Lake

Date 11/17

Project / Client Moses Lake wellfield

Field Notes

pg 1

Weather: clear / sunny 35°F

04CW02 arrived 1123

WL: 165.21'

04CW02 sample time 1133

[New PDB installed at 1149

→ color of water was clear. oily residue on bag and string

04BW05 arrived 1151

WL: 130.34'

sample time 1157

deploy New bag 1206

color clear, no residue on bag

04BW06 arrived at 12:27

WL: 105.71'

sample time 12:37 clear

New deploy 1248

01AW09 arrived 1254

Well has a pump so no PDB deployed

Location Moses Lake

Date 11/17

Project / Client Nov. 2014

Field Notes pg 2

04CW03 arrived at 1302

WL: 142.58'

sample time 1326 clear

New PDB 1337

01AW07 1345Can not open lock
might need bolt cutter04CW01 arrived 1356

WL: 163.33'

sample time 1402 clear

~~duplicate time 1415 on~~04BW04 arrived 1417

WL: 138.42'

sample time 1423 clear

~~duplicate 1430 water on~~

New PDB 1434

PDB01 1437

Blank pouch

Location Moses Lake

Date 11/17

Project / Client NOV 2014 Sampling

pg 3

04CW04 1501 arrived

collect ~~MS/MSD~~ duplicate

WL 126.93'

Sample time 1521

Spoke w/ Cathy confusion about
MS/MSD FD

1526 NEW PDB is 2-330

~~smelled gasoline from one
stop fuel 200ft away took
field blank~~~~Sample time 1540~~

04BW07 arrived 1543

WL 124.43'

Sample time 15:49

new PDB installed 15:52

Trip Blank 1552

END OF 11/17

Location Moses Lake

Date 11/18

Project / Client NOV 2014 Sampling

Foggy freighting

pg 4

12CW02 arrived 8:12

WL 153.15

sample time 8:30

New PDB install 0836

12BW03^{ARB} arrived 0909

WL 126.20

Screened interval sample time

A 0918

B 0923

B duplicate 0930

-Bottle on MSD bottle

New PDB installed 0950

12BW06 arrived 1002

well cover was frozen

WL 115.14

Sample time 1011

Deployed New PDB 1019

12CW05 arrived 1020

WL 139.48'

sample time 1025

New PDB 1034

12EX02 arrived 1233

WL: 116.67

Sample time 1245

PDB in black mesh
line and black mesh were
covered in fur12BW08 arrived 1306

WL: 116.53

* Broke 12CW05 bottle

Sample time 1315

Deployed new PDB 1324

12CW01 arrived 1343

WL: 134.26

Sample time 1348

New PDB deployed 1400

12BW02 arrived 1401

WL: 113.58'

Sample time 1403

New PDB installed 1416

14BW02 arrived 1426

WL: 105.81'

Sample time 1430

Installed new PDB 1440

14EX04 arrived 1441

WL: 106.07

Sample time 1450

Duplicate 1455

Installed 2-330 bags

PDRB02 151412CW03 1531 arrived

WL: 107.95

Sample time 1536
New PDB deployed12BW04 A/B 1551

WL: 98.83

A Sample time 1601

Duplicate A 1603

B 1608

New PDB installed

END DAY
11/17

pg 8

11/19

Date

Nov 2014

Project / Client

II

Moses Lake

Location

DUWUS 0940 arrived

WL: 99.02'

sample time 0944

New PDB deployed

JABWJ arrived 1000

WL: 88.91'

sample time 1008

New PDB

JEXU1 arrived 1014

WL: 88.41'

sample time 1031

New PDB deployed 1035

JIAWIT

WL: 117.85

Growth from Moses
Lake City water

JABWJ arrived 1122

WL: 84.61

Sample

New PDB

1129

1133

Moses Lake

Location

Nov 2014

Project / Client

11/19 Day 3

Sampling

pg 7

J4BWJ arrived 0810

WL: 94.50'

sample time 0812

New PDB deployed 0821

red line mark on line?

JLEX03 arrived 0824

rust covered WL meter

WL: 94.47

PDB line is covered in rust

sample time 0835

J2BWS arrived 0903

WL: 89.12'

sample time 0906

New PDB install 0913

J2BWJ arrived 0915

WL: 101.11

sample time 0924

only 1 330ml bag

SB WL took

sample time 0930

deployed 2-330 bags

143W03 arrived 1141

WL: 86.82'

Sample time 1147

NEW PDB installed

14EX05 arrived 1157

WL: 86.63

Sample 1228

NEW PDB deployed

00AW14 install

WL: 83.56'

anchor 5ft retractor
line on bottom

Lunch/Fed ex

62BWD1 1515

WL: 129.81

Sample time 1520

NEW PDB deployed

~~04AW07~~ arrived 1532

WL: 145.04'

Sample time

A 1539

B 1547

Deployed 2-220 at screened
intervals.

END DAY 11/19

WP-27 0802

Purge 0804 rate 1/2 gallon

temp 58.1

0816 58.1

0818 58.3

Purge complete 0818

Sample time 0824

04AW08 arr 0840

WL: 142.49'

Sample time 0847

NEW PDB deployed

Location Moses Lake

Date 11/20

Project / Client Nov 2014 Sampling

pg 11

WPD4 arrived 0926

X new a-eul needed

pump on

purge 936 / 5 gallons

	Time	Temp
0	939	60.2°F
2	941	60.3
4	943	60.5
6	945	60.3

sample time 0947

WPS6 arrived 1005

totalizer 0325857.5

purge total 4.5 gal

	Time	Temp
0	1009	10.6
2	1011	10.3
4	1013	10.4
6	1015	10.2

sample time 1029

Location Moses Lake

Date 11/20

Project / Client Nov 2014 Sampling

pg 12

WP-167 arrived 1044

purge	time	temp °C	5gal
0	1048	11.3	
2	1050	11.9	
4	1052	12.2	
6	1054	12.8	
8	1056	13.2	
10	1058	13.2	
12	1100	13.2	

sample time 1102

WP-168 arrived 1110

purge

p	2	4	6
time	1112	1114	1116
temp	15.5	15.1	15.3

sample time 1120 20 gal purged

WP-121 arrived 1141 totalizer 15.00

	0	2	4	6	running
time	1155	1157	1159	1201	A 1207
temp	8.6	8.6	8.6	8.7	B 1210
					C 1213

sample time

Location Moses Lake

Date 11/20

Project / Client Nov 2014 sampling

pg 13

WP-123 arrived 1410

pumped 10 gal

	0	2	4	6	8	10/12
time	1413	1415	1417	1419	1421	1423
temp	6.5	6.1	10.2	9.3	8.6	8.4

WP 123A 1437
 B 1440
 C 1443

TOTALIZER
 14887.5

WP70 Arrived 1455

totalizer

	0	2	4	6
time	1455	1457	1459	1501
temp	12.9	12.8	12.9	12.9

132254

Sample Port A 1508

pumped 35 gal

WP124 two lines on pump house on

	0	2	4	6	8
temp	1527	1529	1531	1533	1535
time	9.5	10.7	11.1	11.1	11.1

pumped 6 gal

Location Moses Lake

Date 11/20

Project / Client Nov 2014 sampling

pg 14

Sample time

124A 1536

124B 1541

124C 1544

WP-83 arrived 1610

	0	2	4	6
time	1614	1616	1618	1620
temp	9.5	9.6	9.6	9.6

pumped from ground on corner of WHE house

Collected MS/MSD

Primary: 1625

Duplicate: 1630

QIAW14

WL: 123.52'

needs new lock

has bladder pump

Location Moses Lake Date _____Project / Client Nov 2014 sampling
11/21

pg 15

12BW01 arrived

WL: 84.59'

Sample time 0754

00AW12

install only

WL: 78.85'

Deployed new PDB 1-220 bags

99AW08says PDB but there is
a pump in it
No Label

WL: 69.24

NP-14 arrived 08:54

	0	2	4	6
time	0855	0857	0859	0901
temp	19.7	19.9	19.7	19.8

Purged 7 gal.
Primary MS/MSD: 0906
Field Dup: 0910

Location Moses Lake Date 11/21Project / Client Nov 2014 sampling

pg 16

took Field blank noted
there was paint thinner,
weed killer, gas can, oil
NO strong odors though
Field blank
Sample 0916

04BW01 arrived 0937

WL: 65.56'

Sample time 0942

install 2-330 bags

99AW09

WL: 88.52'

99AW07

WL: 88.56 install 1-228 bags

screen is 81-101 but

WL is 88.56 so we did not
pull up the stone anchor
resting bottom

Location MOSES Lake

Date 11/21

Project / Client NOV 2014 Sampling

pg 17

WP-125 arrived 10:58
 no one home

	0	2	4	6
time	1103	1105	1107	1109
temp	12.3	12.3	12.3	12.2

purge amount 5.8 gal
 sample from hose tube
 sample time 1113

WP-131 arrived 1120

	0	2	4	6	8	10	12
time	1123	1125	1127	1129	1131	1133	1135
c. temp	18.0	17.4	17.3	16.2	15.7	14.7	14.7

Side of garage was
 turned off. sampled from
 Northeast side of house

sample time ~~1137~~ 1141

time	1137	1139	1141
temp	14.5	13.8	

temp did not stabilize

Location MOSES Lake

Date 11/21

Project / Client NOV 2014 Sampling

pg 18

ED 1154 was taken through
 tubing used to sample WP-131
 using DI water

Private Wells and Monitoring Wells Groundwater Sampling Field Report February 2015 Field Sampling Event

**Moses Lake Wellfield Superfund Site
Moses Lake, Washington**



**Field Investigation:
23-27 February 2015
Report Prepared:
April 2015**

By: Technical Services Branch



**US Army Corps
of Engineers** (®)
Seattle District

TABLE OF CONTENTS

1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION	1
1.1 BACKGROUND	1
1.2 GROUNDWATER SAMPLING EVENT SUMMARY AND OBJECTIVES	2
2.0 DESCRIPTION OF WORK	3
2.1 ACTIVITIES PRIOR TO THE FEBRUARY 2015 GROUNDWATER SAMPLING EVENT	3
2.2 PRIVATE WELL SAMPLING PROCEDURES.....	3
2.3 WHOLE HOUSE FILTER SAMPLING PROCEDURES.....	4
2.4 MONITORING WELL SAMPLING PROCEDURES	5
<i>2.4.1 Monitoring Well Sampling Using Dedicated Bladder Pumps.....</i>	<i>5</i>
<i>2.4.2 Monitoring Well Sampling Using Passive Diffusion Bags.....</i>	<i>7</i>
2.5 SAMPLING EVENT ACTIVITIES AND OBSERVATIONS	8
<i>2.5.1 Team 1 Monitoring Well Bladder Pump Sampling</i>	<i>8</i>
<i>2.5.2 Team 2 Private Well System Sampling.....</i>	<i>10</i>
<i>2.5.3 Passive Diffusion Bag Sampling and Deployment</i>	<i>12</i>
3.0 INVESTIGATION-DERIVED WASTE.....	14
4.0 SAMPLE PACKAGING AND DELIVERY	14
5.0 LABORATORY ANALYSIS.....	15
6.0 DECONTAMINATION PROCEDURES.....	15
7.0 PROTECTION LEVEL	15
 TABLE 1: PRIVATE WELL STABILIZED WATER TEMPERATURES AND PURGE TIMES.....	 11

APPENDICES

APPENDIX A – SITE AND WELL LOCATION MAPS (ON FILE)

APPENDIX B – FIELD SAMPLING PHOTOS

APPENDIX C – FIELD NOTES

1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION

1.1 BACKGROUND

The Moses Lake Wellfield Superfund Site is located between the Grant County Airport and the City of Moses Lake, Washington. The Site includes the former Larson Air Force Base (LAFB) property, Port of Moses Lake property and adjacent private properties affected by Site groundwater contamination. The Site is listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 National Priorities List (NPL) for Uncontrolled Hazardous Waste Sites.

The Moses Lake Wellfield Superfund Site is an area of approximately 15 square miles, which includes the former LAFB, commercial facilities, and residences. The former LAFB occupied approximately 9,607 acres three miles northwest of the City of Moses Lake. The United States Air Force was active at the site from 1942 until 1966. During 1988 and 1989, the Washington State Department of Health confirmed the presence of trichloroethylene (TCE) above the Federal Maximum Contaminant Level (MCL) in three City of Moses Lake municipal wells and two Skyline community wells. The Seattle District, US Army Corps of Engineers (USACE) completed a Remedial Investigation (RI) phase in 2003. Appendix A of this report shows the general location map and a site map.

During the course of the RI, several private wells were tested and found to be contaminated with TCE. In 2001, the USACE contracted installation of carbon filtration units – known as whole house filter systems (WHF) - at five of those wells. Several years of groundwater monitoring data has been evaluated since the original WHF systems were installed.

The final results of the Phase I RI released in a report in March 1993 indicated that TCE was consistently found in shallow alluvial and upper basalt (α -basalt) groundwater in the central area of the former base.

On October 14, 1992, the affected areas of the former LAFB and off-site down gradient areas, termed the "Moses Lake Wellfield Contamination", were listed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 for Uncontrolled Hazardous Waste Sites. The former LAFB property is one part of the Moses Lake Wellfield Superfund Site; the site also includes the contaminant plume.

Chemical results from 1993 and 1994 combined with historical data indicated that TCE occurred in the central and southern portion of the former LAFB in alluvial and α -basalt groundwater. In 2004, USACE confirmed TCE contamination in the next lower basalt aquifer (c-basalt). As of 1995, the data suggest that more than one source may have contributed TCE to the alluvial and α -basalt groundwater in the central portion of the former LAFB.

In 1998, URS Greiner completed a sampling round of private water wells and wells for Class A and Class B water systems east, south and southwest of the previously known TCE plume. There were eight detections of TCE during this study. Four wells that were previously outside the plume extent were found to be above the detection limit.

1.2 GROUNDWATER SAMPLING EVENT SUMMARY AND OBJECTIVES

In coordination with the US Environmental Protection Agency (USEPA) Region 10, two USACE environmental field teams deployed to conduct the February 2015 Moses Lake Wellfield groundwater sampling event during a single mobilization. The events described in this report involve USACE field teams verifying sample point locations; discussion of sampling techniques; recording groundwater observations; collecting groundwater samples; and shipping those samples by overnight delivery for laboratory analysis. Environmental sampling team members responsible for the February 2015 field event were Joseph Marsh, Jonathan Moen, Rebecca Weiss, and Tyler Quick.

All of the work described in this report was accomplished in accordance with the Moses Lake Wellfield Superfund Site Quality Assurance Project Plan. In addition, the teams followed the guidance presented in: the Seattle District, USACE Safety and Health Plan; USACE Safety Manual EM 385-1-1; and all applicable Seattle District, USACE, Sampling Standard Operating Procedures (SOP).

The private wells and monitoring wells designated for sampling are displayed on a map found at Appendix A and available in USACE files. These wells have been selected based on their down-gradient locations relative to the inferred flow direction of TCE-contaminated groundwater and validated sampling analytical data from previous monitoring events.

The two environmental field teams deployed to the Site and collected groundwater samples from seven private whole house filter systems, six private well systems, and 56 monitoring wells during the February 2015 sampling event as summarized below:

Team 1: Joseph Marsh and Jonathan Moen collected groundwater samples from 26 monitoring wells fitted with dedicated bladder pumps. Team 1 also collected static water level data from all other designated project monitoring wells in coordination with team 2. These activities were conducted between 23 and 27 February 2015.

Team 2: Rebecca Weiss and Tyler Quick collected groundwater samples from seven private whole-house filter systems, six private well systems and 30 monitoring wells fitted with passive diffusion bags. New PDBs were also redeployed in designated wells immediately following sampling at each location. In coordination with team 1, they also collected static water level data in designated project monitoring wells as required. As with team 1, these activities were also conducted between 23 and 27 February 2015.

The objectives of groundwater sampling at Moses Lake are to: 1) collect representative samples from designated private well systems and monitoring wells yielding data of known and sufficient quality to evaluate TCE concentrations and define existing TCE plumes; 2) to assure compliance with the requirements of USEPA; and 3) to make critical project - specific decisions based on the evaluated data.

2.0 DESCRIPTION OF WORK

2.1 ACTIVITIES PRIOR TO THE FEBRUARY 2015 GROUNDWATER SAMPLING EVENT

The USACE project team worked to collect signatures on Department of the Army Right of Entry forms as required before conducting the well sampling on private, city or county government property. For most properties, previously signed Right of Entry forms were still valid. For all properties designated for sample collection, owners (and renters if applicable) were contacted to coordinate sample collection times during the scheduled field sampling week.

Prior to conducting sampling activities at each location, both teams verified the address or well location and map location matched, and that the Right of Entry form had been signed prior to arriving at each sampling location.

Each team was responsible for identifying potential health and safety hazards at each sampling location. If a hazard is verified at a private well sampling location, an alternate hose bib connected to the same water source may be selected in a safer area of the subject property. In the case of hazardous monitoring well conditions, the well may be situated in an active construction zone requiring the cancellation of sampling at that well until the next scheduled sampling event.

Also for private well sampling, the field team was tasked with determining the most appropriate cold-water tap or other sample port as close to each wellhead as practical. At each location, the team worked to collect water samples from the same sample point selected during previous sampling events to ensure consistent results. The team was briefed that groundwater samples would not be collected from taps delivering chlorinated, aerated, softened or filtered water.

2.2 PRIVATE WELL SAMPLING PROCEDURES

During the February 2015 groundwater sampling event, samples were collected from a total of 13 private wells consisting of: 7 WHF systems (WP-14, WP-70, WP-83, WP-86, WP-121, WP-123, and WP-124), and 6 private well system hose bibs (WP-04, WP-27, WP-125, WP-131, WP-167, and WP-168).

USACE (in cooperation with USEPA) has determined private well and WHF groundwater purging shall to consist of: allowing water flow at the sampling port at a rate of approximately 0.5 to 1 gallon per minute (gpm), while measuring the temperature of the water stream with a digital thermometer every two minutes until stabilization is achieved. These procedures follow the general principles of the New Hampshire private well system water sampling guidance.

During purging, the flow rate at each location was verified by graduated cylinder. While purging continued, the field team monitored the surrounding area and flowing water for unusual observations and odors as purge water was captured in a five gallon bucket. They recorded the start time of the purging in the field logbook immediately after opening each hose bib sample point and establishing the flow rate. While one team member used the digital thermometer to measure water temperatures, the other recorded the temperatures every two minutes until the parameters stabilized.

Upon reaching stabilization, the approximate total purged volume was recorded in the project field book along with any other significant observations. The team then conducted the sample collection activities.

Prior to collecting a water sample, the team reduced the flow rate at each tap to approximately 150 to 200 ml/min. to minimize sample water turbulence and aeration. The samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of each plumbing system were noted to assist in data interpretation. A photographic record of each sample point was made by the team. In addition, each team placed handle tags (indicating that water samples were taken by USACE on that date and time) on the front doors of homes sampled if nobody was home during sample collection. A photo was taken of the handle tag and front of house in that case for the project files.

After the sample containers are filled, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time are placed on the containers. The samples are then packaged in bubble wrap bags and plastic zipper type bags, placed into pre-iced sample shipping coolers and prepared for shipment as described in Section 3.0. All sampling teams worked to ensure each property was left just as they found it with no damage done, and any doors or gates closed as required.

2.3 WHOLE HOUSE FILTER SAMPLING PROCEDURES

In coordination with USEPA and affected Moses Lake area homeowners, granular activated carbon (GAC) water filters have been installed in private well systems showing TCE results of 3.5 µg/l or greater. Each GAC filter system consists of two lightweight composite GAC filter tanks (acting as lead and lag filters), associated piping, bag filters (to prevent GAC particles from entering the household plumbing system), pressure gauges and valved/regulated sample collection ports.

As described previously, groundwater samples were collected from 7 WHF systems during this February 2015 sampling event. Each system was purged according to the revised private well sampling SOP consisting of allowing water flow at a hose bib nearest the wellhead at a rate of

approximately 0.5 to 1 gpm, while measuring the temperature of the water stream with a digital thermometer every two minutes until stabilization is achieved. Purge flow rates averaged approximately 0.5 gpm as measured with graduated cylinder, and purged water at each location was captured in a five gallon bucket to verify purged volumes. During purging, continuous temperature readings were recorded using a digital thermometer until water temperature stabilization was achieved. Once water temperature had stabilized, the hose bib was closed, and the field team prepared to collect samples from the pre-determined WHF sample ports (labeled “A” for the lead inlet port, “B” for the lead outlet port, and “C” for the lag outlet port).

WHF sample collection consists of opening each designated sample port valve fully to allow the maximum restricted flow rate of approximately 150 to 200 ml/min to flow into a capture bucket for a few seconds to ensure organic matter or air bubbles have been flushed out of the system. Restrictors have been placed on the sampling lines to provide a smooth, non-turbulent stream at a low-flow rate to minimize loss of volatiles that may be present in the water stream. Next, the sampling team immediately fills three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface away from the shed or pump house GAC filter location after the samples were collected.

After filling the sample containers, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time were placed on each container and the container was placed in a plastic zipper bag. The bagged sample vials were placed into bubble wrap bags. Finally, the filled sample containers were placed into pre-iced shipping coolers to begin sample cooling to the required 4° centigrade sample preservation temperature prior to shipment to the analytical laboratory. One set of trip blanks were required and included per sample shipping cooler.

2.4 MONITORING WELL SAMPLING PROCEDURES

2.4.1 MONITORING WELL SAMPLING USING DEDICATED BLADDER PUMPS

Moses Lake monitoring well groundwater purging and sampling was performed in accordance with the Seattle District’s Low-Flow Ground Water Purging and Sampling SOP, prepared in March 1999 and revised on 1 Sep 2009. Data generated during purging were recorded on the MicroPurge/Low-Flow Sampling Log forms (Appendix C – available in USACE files).

The team verified each monitoring well location and identification number with project maps and tables. They verified work can proceed safely in the vicinity of moving vehicular traffic, heavy industry, and other hazards as required. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard “stick-up” well completions. Prior to purging each well, the depth to static water level in each well was measured and checked periodically to monitor draw down as a guide to flow rate adjustment (no greater than 0.4 foot drawdown is permitted to prevent sampling stagnant casing water).

Purging operations at each well commenced once the following equipment was prepared: the MP20 MicroPurge® Controller equipped with an adjustable pressure regulator was connected to the Well Wizard® bladder pumps via air line and quick connect fittings. Another air line was quick-connected to a pressurized CO₂ cylinder to drive the pump. Pump flow rates were then adjusted during a “pre-purge” period to maximize withdrawal rates and minimize excessive drawdown in each well. The evacuated pre-purge volume at each well was intended to flush out a bladder pump and tubing volume prior to monitoring stabilization parameters. Finally, a QED MicroPurge® basics MP20 Flow Cell was connected to the pump’s discharge line at ground surface to measure established stabilization parameters (pH, specific conductivity, temperature, DO, ORP, and turbidity).

Depth to water measurements during purging were monitored and recorded to verify that minimal drawdown occurred. A graduated measuring cup was used to determine the volume purged. Generally, acceptable low-flow rates are no greater than 500 milliliters per minute (ml/min.), and are typically closer to 400 ml/min. for the Well Wizard® bladder pump systems, depending upon the amount of water level drawdown detected during pumping at each well. Purge data was recorded on the micro-purge logs every two minutes.

Low-flow purging continued until three consecutive measurements of the stabilization parameters met stabilization requirements.

Stabilization parameter requirements for all private well and bladder pump monitoring wells are as follows:

Temperature	+/- 0.2 °C
Specific Conductivity	+/- 0.020 millisiemens/centimeter (mS/cm)
DO	+/- 0.2 milligrams/liter (mg/l)
pH	+/- 0.2 units
ORP	+/- 20 millivolts (mV)

At each monitoring well, groundwater sample collection would begin immediately after achieving stabilization of water quality parameters during low flow purging.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

In addition to groundwater sample collection for TCE analysis at each monitoring well, additional samples were requested by USEPA during this event: Two monitoring wells (00BW06 and 91AW13) were selected for PFOA/PFOS analysis, requiring the filling of four 250 ml sample containers at each location. Also, perchlorate sampling and analysis was requested at the

following 8 wells 91AW01, 91BW01, 00BW11, 91AW15, 99BW01, 91AW07, 00BW16, and 00AW13. Sample collection procedures for the perchlorate samples were modified from standard TCE sample collection methods as follows: The collected water sample water was transferred directly from the sampling equipment (bladder pump or dedicated discrete interval sampler) into a new, clean syringe holding approximately 50 ml. The water in the syringe was then forced through a 0.2 micron pore size filter to fill the 250 ml sample container to approximately 2/3 full, thereby ensuring that anaerobic conditions during transport do not induce microbial degradation of any perchlorate in the sample.

All sample containers were filled immediately following purging by disconnecting the flow-through cell from the pump tubing system, and capturing water directly from the discharge end of the tubing. All sample containers were carefully filled at a low-flow rate to minimize agitation. During sample collection, significant physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms and project field book as needed.

After filling the sample containers, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time were placed on each container and the container was placed in a plastic zipper bag. The bagged glass sample vials were placed into bubble wrap bags. The bagged plastic sample containers were loaded directly into the shipping coolers. All filled sample containers were placed into pre-iced shipping coolers to begin sample cooling to the required 4° centigrade sample preservation temperature prior to shipment to the analytical laboratory. One set of trip blanks were required and included per sample shipping cooler.

At the conclusion of groundwater sampling at each well, the flush mount well covers were bolted closed and stick up well caps padlocked.

2.4.2 MONITORING WELL SAMPLING USING PASSIVE DIFFUSION BAGS

Passive diffusion bags (PDBs) were been selected by the Moses lake Project Delivery Team as the most appropriate, cost-effective method for groundwater sample collection from Moses Lake monitoring wells lacking dedicated bladder pumps. The PDBs were purchased from ALS Environmental laboratory under license by the US Geological Survey and The General Electric Company, both co patent-holders. The 1 ¼" diameter low-density polyethylene PDBs were pre-filled with 220 ml or 330 ml of ASTM Type II certified, laboratory-grade, deionized water. Each filled PDB was then heat sealed by the laboratory prior to shipment to USACE via overnight delivery in hermetically sealed pouches.

USACE ensures a minimum of 14 days of PDB equilibration time before returning to the Moses Lake site for groundwater sample collection per established PDB guidance. During this event, both sampling teams worked to collect the PDB samples as described in Section 2.5.3. PDB retrieval and sampling consisted of the following procedures:

1. The team verified each monitoring well location and identification number with project maps and the sample matrix. They verified work can proceed safely in the vicinity of moving

vehicular traffic as required. The PDBs were prepared over clean sheets of aluminum foil prior to being placed into each well. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard “stick-up” monitoring well completions. The team donned new Nitrile gloves for groundwater sample collection.

2. The team carefully hauled each weighted PDB to the surface using the nylon suspension line. The sampling team carefully cut the top corner off each PDB and filled each sample vial. The team filled each vial just to overflowing and maintained a reverse meniscus. There was no down time once the PDB has been brought to the surface until sample collection was complete at each well. Any residual sample water in the used PDBs was discharged to ground surface.

3. Each PDB represented a unique sample ID number based on the well ID (and sample interval if two PDBs are deployed into one well). With the exception of the MS/MSD, all QC samples were submitted “blind” to the laboratory using a separate unique sample ID number not labeled as duplicate or trip blank per USACE standard sampling procedure. One set of trip blanks were required and included per sample shipping cooler. An extra laboratory- prepared PDB was shipped to the site and was used for collection of the trip and field blanks at the direction of the USACE project chemist.

4. Once recovered and sampled the PDBs and suspension lines were be discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials were disposed of as municipal waste. The PDBs and other solid waste material were placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and recycled during redeployment of the new, pre-filled PDBs in preparation for the next sampling event.

5. Finally, the team securely capped and locked each monitoring well riser and cover plate when finished.

2.5 SAMPLING EVENT ACTIVITIES AND OBSERVATIONS

2.5.1 TEAM 1 MONITORING WELL BLADDER PUMP SAMPLING

Groundwater sample collection commenced immediately after achieving stabilization of water quality parameters during low flow purging at each well using dedicated bladder pump systems as described previously. The team worked from the far north end of the Site, moving to the far south end sampling each designated well as it was encountered. The project well maps and sample matrix were used to ensure samples were collected at the correct locations. The team used one 15 lb. compressed CO₂ cylinder acquired from Oxarc in Moses Lake to drive the pump systems, airlines, pump controllers, and flow cells to conduct the sampling of dedicated bladder pumps.

During the February 2015 sampling event, Team 1 collected groundwater samples from a pre-determined set of 26 monitoring wells: 91AW01, 91AW07, 91AW13, 91AW15, 91BW01,

91BW03, 91BW04, 92BW01, 92BW02, 99AW01, 99AW04, 99AW09, 99BW01, 99BW10, 99BW12, 99BW15, 99BW16, 99BW18, 00AW11, 00AW13, 00BW02, 00BW06, 00BW11, 00BW12, 00BW15, and 00BW16.

As mentioned previously in this report, additional samples for PFOA (2 wells) and perchlorate (10 wells) were also collected from a small subset of project groundwater monitoring wells (included in the list shown in this section).

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated monitoring well, the sampling team always attempted to contact the property owner for each monitoring well location before beginning the field sampling activities.

During this sampling event, sampling team 1 met with Grant County Port Director Jeffrey Bishop, and Port Security Manager Greg Becken to update them on field sampling procedures at their request. Greg Becken agreed to act as the team escort to wells within the terminal security area. On 24 February 2015, groundwater samples were collected from the following airport wells: 00BW12, 00BW02, 00BW11, 91AW15 (first use of dedicated bladder pump in this well in over 10 years), 00BW06, and 91AW13. Static water levels were measured in all other project monitoring wells before completing the sampling event.

Other than property owner notifications, no special access procedures were required for any of the other bladder pump monitoring wells sampled during this event.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All sample containers were filled immediately following low-flow purging by disconnecting the flow-through cell from the pump tubing system, and capturing pumped groundwater directly from the discharge end of the pump tubing. During sample collection, physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms.

Stabilization of water quality parameters during purging occurred within four to seven readings (6 to 12 minutes) during this event. Measured temperatures ranged from 12.33°C at well 00BW12 to 14.30°C at well 00BW11. Specific conductivity ranged from 0.35mS/cm (well 99BW10) to 0.65 ms/cm (well 00BW02). Dissolved oxygen measurements ranged from a low 1.35 ppm (well 00BW11 where petroleum odors were detected in recovered groundwater) to 10.13 ppm (well 00BW12). PH values ranged from 6.10 units (well 99BW18) to 7.08 units (well 00AW11). Oxygen reduction potential ranged from 266 mV (well 99BW12) to 649 mV (well 91BW04).

Significant Observations Made During Team 1 Bladder Pump Sampling

Team 1 experienced great difficulty filtering the perchlorate samples due to the small pore size of the water filter. Sample collection for perchlorate analysis took much longer than expected due to this water filtering.

The well casing at 91AW14 was secured with a worn out and rusted padlock. The padlock was replaced with a new padlock keyed to the standard USACE well key.

The team noticed small floating black particles suspended in water recovered from well 91AW07.

A slight petroleum type odor was detected in water recovered from well 00BW11 on airport property.

No other significant observations were made during this event.

2.5.2 TEAM 2 PRIVATE WELL SYSTEM SAMPLING

While environmental field team 1 worked independently on their set of wells, Team 2 collected samples at their own pre-assigned set of seven whole house filter well system sample ports, six private well system hose bibs, and 30 PDB monitoring wells requiring sampling and/or PDB installation for the next sampling event.

During the period of 23 to 27 February 2015, Team 2 collected groundwater samples from the following seven private well systems with whole house filters installed: WP-14, WP-70, WP-83, WP-86, WP-121, WP-123, and WP-124. During that same time period, they collected groundwater samples from the following six private well systems: WP-04, WP-27, WP-125, WP-131, WP-167, and WP-168.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

Trip blanks were sent inside each sample shipping cooler delivered to the analytical lab.

Upon arrival at each private well property designated for sample collection, the team verified they were at the correct address using maps, notes, and the sampling matrix, and verified through field documentation they were ready to collect samples at the correct sampling point (hose bib, or suitable water discharge port nearest to the wellhead. The team always attempted to contact the owner or resident at each private well location before beginning the field sampling activities.

Per modified SOP, sampling point valves were opened, and water allowed to flow at approximately 0.5 gpm into a capture bucket. Next, water temperature readings were measured every two minutes until stabilization was achieved. During the February 2015 sampling event, water temperature stabilization ranged from 6 to 10 minutes elapsed purging time with most locations reaching stabilization within six minutes as shown in Table 1 below.

TABLE 1: PRIVATE WELL STABILIZED WATER TEMPERATURES AND PURGE TIMES

Well Location ID	Stable Temp. °C	Total Purge Time (Minutes)
WP-04	16.0	6
WP-14	20.8	8
WP-27	15.1	8
WP-70	14.6	8
WP-83	15.0	10
WP-86	8.7	8
WP-123	8.1	8
WP-124	9.7	8
WP-125	11.6	10
WP-131	16.1	10
WP-167	12.6	8
WP-168	11.7	8

Upon achieving stabilization, the final stabilized readings were entered into the project field book. Prior to collecting a water sample, the flow rate at each tap was reduced to approximately 100 to 200 ml/min. to minimize sample aeration and turbulence. The sampling team donned new Nitrile gloves prior to sample collection at each residence. In the case of the WHF sample ports, restrictors on the sample ports provided a stream of sample water at approximately 150 to 200 ml/min. All sample containers were be filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. A photographic record of each sample point was made by the team.

Significant observations made during Private Well/WHF Sampling

Door handle tags (indicating samples were collected) were left on the front doors at WP-123 and WP-131 where the residents were not at home during the sampling activities.

The resident at WP-04 asked why it takes a year to receive private well sample results. USACE will resolve the issue with the homeowner.

No other significant observations were made during this event.

2.5.3 PASSIVE DIFFUSION BAG SAMPLING AND DEPLOYMENT

Sampling team 2 was responsible for PDB sample collection and the deployment of new pre-filled PDBs in a pre-determined set of 30 monitoring wells during the February 2015 event.

The selected PDB wells were: 02BW01, 04BW04, 04BW05, 04BW06, 04BW09, 04CW01, 04CW03, 04CW04, 04CW05, 04CW07, 12BW02, 12BW03, 12BW04, 12BW05, 12BW06, 12BW07, 12BW08, 12CW01, 12CW02, 12CW03, 12CW04, 12CW05, 12EX01, 12EX02, 14BW01, 14BW02, 14BW03, 14EX03, 14EX04, 14EX05.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

The teams first verified each monitoring well location and identification number with project maps and the sample matrix. The teams also verified that work could proceed safely in the vicinity of moving vehicular traffic or other physical, biological, or environmental hazards that may have been present near each monitoring well.

Each team member donned new Nitrile gloves for groundwater sample collection at each well. Once the wells were unlocked and opened, one team member lifted the well riser plug and began hauling the PDB vertically to the surface.

Once each PDB was raised to the surface, the sampling team worked together to carefully cut the top corner off each bag using decontaminated steel scissors. Next, one person held the open sample vials and the other carefully and slowly tilted the bags - open side down - toward each open sample vial. The pre-preserved vials were filled just to overflowing to maintain a reverse meniscus. Then the vials were immediately capped making sure there were no bubbles or headspace per standard VOC sampling procedure. This entire sampling process can be completed within one minute to minimize loss of volatiles while preventing introduction of contaminants into the water from surface sources. After all required vials were filled; any residual sample water remaining in the used PDBs was discharged to ground surface. Therefore, no Investigation-derived waste (IDW) water was generated during this sampling event.

At the suggestion of the PDB laboratory, the sampling team placed protective mesh sleeves over the filled PDBs deployed in the large diameter extraction wells. The mesh sleeves are intended to prevent damage to the PDBs due to contact with minor imperfections in the steel casing used at these wells (monitoring wells 12EX01, 12EX02, 14EX03, 14EX04, and 14EX05).

Once recovered and sample water removed, the PDBs and suspension lines were discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials were disposed of as municipal waste. The PDBs and other solid waste material were placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and reused during the deployment of the new pre-filled PDBs for the next sampling event.

After collecting water samples from the PDBs, the teams deployed PDB assemblies into a pre-determined set of monitoring wells selected for groundwater sampling during May 2015.

Two sizes of PDBs were ordered: The bags consisted of the standard 220 ml size, and a larger 330 ml bag selected to accommodate primary and field duplicate samples where required. In some wells, two 330 ml PDBs were connected in tandem and lowered to the mid-screen depth to accommodate primary, field duplicate, and MS/MSD sample volumes as required. Two PDBs were installed at two mid-screen depths if a designated well had two screened intervals (as found in wells 04CW07, 12BW03, and 12BW04). All PDBs and stainless steel anchor weights were purchased from ALS Environmental, and shipped to the District office by UPS overnight delivery.

Following the established PDB deployment procedures, both environmental team members worked together using a table of Moses Lake monitoring well logs to determine the number of required weights, length of nylon suspension line, and number of PDBs required at each designated well. Wells deeper than 200 feet generally required two steel weights to allow proper PDB positioning. Each team member donned a new pair of Nitrile gloves prior to working on PDB assemblies at each well. Steel weights, suspension lines, and PDBs were quickly assembled on a strip of clean aluminum foil on the tailgate of the sampling vehicle. The prepared assembly of PDB, suspension lines, and weights was lowered into place at each well within 10 to 15 minutes to reduce the possibility of contaminants entering the diffusion bags during deployment.

At each specific well, the team lowered the weight into the well first, followed by the suspension line and PDB. The team worked to keep the assembly centered within the well casing as they slowly lower it to the well bottom. When the team felt the weight hit well bottom, they pulled up the line approximately one foot and tied it off securely to the casing plug or well cap. This method ensured the PDB would always be centered at the mid-well screen depth. Finally, the well cap was locked, or the cover plate secured with locking bolts depending on type of well encountered – stick up or flush mount.

Most of the laboratory-filled PDBs arrived at the USACE office in good condition prior to field deployment. Two PDBs arrived leaking water due to faulty seam welds, and were discarded. Extra PDBs are always ordered to account for problems in shipping. Each PDB was packed in groups of 10 into sealed foil pouches to prevent inadvertent contamination until deployment into the designated monitoring wells. No specific difficulties or problems were noted during PDB deployment.

Significant Observations Made During Passive Diffusion Bag Sampling

Numerous rust particles were observed on the PDBs and PDB suspension lines installed in wells 14EX03 and 14EX04.

No other significant observations were made during this event.

3.0 INVESTIGATION-DERIVED WASTE

No investigation-derived waste was generated during this sampling event. All residual PDB water or purged well water was transferred directly to ground surface on each property away from the sample collection point.

4.0 SAMPLE PACKAGING AND DELIVERY

As mentioned in the narrative of each sampling event, groundwater samples were packaged in shipping coolers on ice and under chain of custody for overnight shipment to the USACE contract laboratory Analytical Resources, Inc. during the course of the sampling event.

All sample shipping coolers were prepared for laboratory delivery in the following manner: Each cooler was lined (sides and bottom) with plastic "bubble-wrap" sheets for shock absorption. A large 30-gallon plastic garbage bag was then placed into the cooler to contain the sample water in the event of container breakage during shipment to the laboratories. The glass sample vials were labeled, placed into plastic zip-seal bags, and placed into foam shipping blocks or bubble-wrap bags for shock protection. All the samples were placed in the shipping coolers as indicated on the corresponding chain of custody forms. Gallon size plastic zipper bags of cubed ice bags were placed between and on top of the samples in each cooler to ensure maintenance of the required four degrees centigrade (plus/minus two degrees) sample preservation temperature. The completed chain of custody (COC) forms were placed in gallon size plastic zipper bags and taped to the inside of each cooler lid. Two custody seals were affixed to the outside of each cooler. The custody seals were placed so that the coolers could not be opened without breaking the seals. Each cooler was then securely sealed with fiber tape. The field team ensured drain plugs were securely taped inside and out to prevent possible water leakage.

The laboratory was informed of the sample delivery and ensured the samples were properly accepted and checked in upon receipt the following morning after the sample containers were shipped. All sample coolers and sample containers were accounted for at the contract laboratory following each shipment.

5.0 LABORATORY ANALYSIS

Chemical analyses performed on the samples were as follows:

VOCs (Method 524.3)

PFOAs/PFOs (Method 537)

Perchlorate (Method 6850)

6.0 DECONTAMINATION PROCEDURES

PDB weights, flow cells and associated tubing, water level indicator meters, and water volume measurement containers used by each team were decontaminated at the end of the project with an Alconox®-water solution followed by triple rinsing using distilled water in the USACE Geology Laboratory.

7.0 PROTECTION LEVEL

All sampling activities were conducted under Worker Protection Level D. For this project, personnel protective equipment included reflective safety vests, safety splash protection glasses, Nitrile gloves, and safety steel toe boots. New pairs of Nitrile gloves were donned prior to handling acid-preserved sample containers and between each unique private well sample point or monitoring well.

End of Field Sampling Report

APPENDIX A

Site and Well Location Maps
(Available in USACE Files)

APPENDIX B

Field Sampling Photos

Figure 1



Jonathan Moen prepares syringe (filled with recovered water sample from well 91AW01) for filtration prior to filling the sample container.

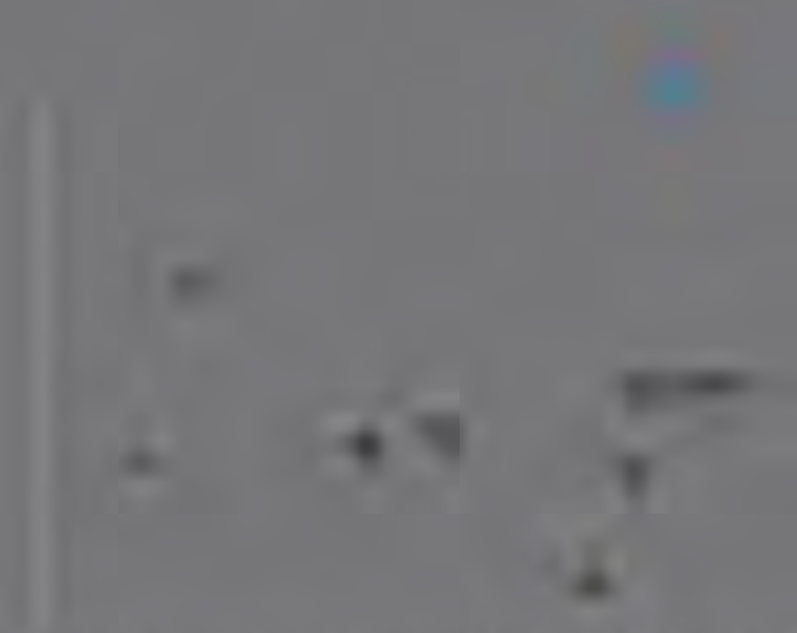
Figure 2



Filtration of well 91AW01 water sample through 0.2 micron pore size filter for perchlorate analysis.

Photographer: Joseph Marsh

Figure 3



Well 00BW04 shown after conversion from stick-up casing to flush mount (by contractor) to accommodate a new access road to the Genie facility.

Figure 4



Sample collection activities at airport well 91AW15. This well has not been sampled in many years.

Figure 5



Photo shows one-time deployment of PDB in city well MW-2 (A PDB was also installed in city well MW-4). The gray PVC pipe resting on the well riser secures the PDB suspension line.

Figure 6



Groundwater sampling activities shown under the windmill constructed around monitoring well 99AW04.



APPENDIX C

Field Notes

(Acknowledgement Form, Private Well SOP, Micropurge Logs
available in USACE Files)

SEATTLE DISTRICT, USACE
ENVIRONMENTAL SAMPLING
FIELD LOG BOOK
Project: MOSES LAKE WELLFIELDS
MONITORING WELL SAMPLING

Book 5



FY 14-
FY 15

Rite in the Rain®
ALL-WEATHER
**ENVIRONMENTAL
FIELD BOOK**

Nº 550F

FEB. 2015
EVENT

Location Moses Lake, WA

Date

2-23-15 Thru

Project / Client

Moses Lake WellfieldFebruary 2015 EventBladder Pump WellGroundwater Sampling TableTeam 1: Joseph Marsh, Jonathan Moore

SAMPLE ID	2015 DATE	TIME	Perchlorate (0.850) 100% py.	VOCs 524.3 3 x 40m Vials
ISMLW0223M91AW01			1	2
ISMLW0223N91BW01			1	2
ISMLW0223N99BW16	2-23	1050		3
ISMLW0223N99BW15	2-23	1315		9 ^{MSD}
ISMLW0223D99BW15	2-23	1330		3
ISMLW0223N99BW12	2-23	1127		3
ISMLW0224N00BW12	2-24	0902		3
ISMLW0224N00BW02	2-24	0937		3
ISMLW0224TB01	2-24	0810		3 Trip Blank

↳ prepared by
Lab on 2/12/15
by RH

This table represents samples shipped
in cooler B on COC 1. -shipped @ 1120 on 2-24-15
3 vials submitted for Trip Blanks
* can ship on 2-24-15. (done)

Location

Date

Project / Client

Moses Lake WellfieldGroundwater Sample Table Cont.

SAMPLE ID	2015 DATE	TIME	VOCs 524.3	NOTES
ISMLW0225M91BW03	2-25	0903	3	
0225N99BW01	2-25	0920	9	MS MSD
0225D99BW01	2-25	0942	3	Field Dip
0225N99AW01	2-25	0945	3	
0225N92BW01	2-25	1121	3	
0225N00AW11	2-25	1139	3	
0225N92BW02	2-25	1309	3	
0225D92BW02	2-25	1320	3	
0225N00BW15	2-25	1350	3	
ISMLW0225TB02	2-25	0900	3	Trip Blank

This table represents samples shipped
in cooler 2 on COC 2.
shipped @ 1430 on 2-25-15
✓ * can ship on 2-28-15

Moses Lake Wellfield
Sample table cont.

SAMPLE ID	2015 DATE	TIME	VOCs	Notes
15MLW0226N91BW04	2-26	0853	3	
0226N99AW09	2-26	0937	9	MS MSD
0226D99AW09	2-26	0950	3	Field Dupe
0226N99BW18	2-26	0958	3	
Fixed → 0226N99BW10	2-26	1300	3	
0227N99AW04	2-27	1002	3	
15MLW0227TB03	2-27	0800	3	Trip Blanks

*Trip Blanks prepared 2-12-15 on
by ARI

This table represents samples shipped
in cooler #2 on Coc. 3.
cooler shipped @ on 27 FEB 15

Moses Lake Wellfield
Sample table cont.

SAMPLE ID	2015 DATE	TIME	PFOAs/PFOs/Thiame 4 x 250ml method 537	Notes
15MLW0224N00BW06	2-24	1435	12	ms/msd
15MLW0224D00BW06	2-24	1448	4	Field Dupe
15MLW0224N91AW13	2-24	1515	4	
15MLW0224FRB01	2-24	1600	4	Field Blanks

*Field reagent blank provided by
Lab and transferred to sample
containers in the field

This table represents samples shipped
in Cooler 1 on Coc. 4
for all PFC samples.

Field on

Shipped @ 1430 hrs on 2-25-15

Location _____

Date _____

Project / Client _____

Moses Lake Wellfield
Sample table continued

SAMPLE ID	2015 DATE	TIME	Perrchlorate method CBS 1 x 250 ml	
15MLW0223N91AW01	2-23	0906	1	
15MLW0223N91BW01	2-23	0952	1	
15MLW0224N00BW11	2-24	1008	1	
15MLW0224N91AW15	2-24	1050	3	MS/MSD
15MLW0224D91AW15	2-24	1110	1	
15MLW0225N99BW01	2-25	0920	1	
15MLW0225N91AW07	2-25	1040	1	
15MLW0226N00BW16	2-26	1124	1	
15MLW0226N00AW13	2-26	1050	1	

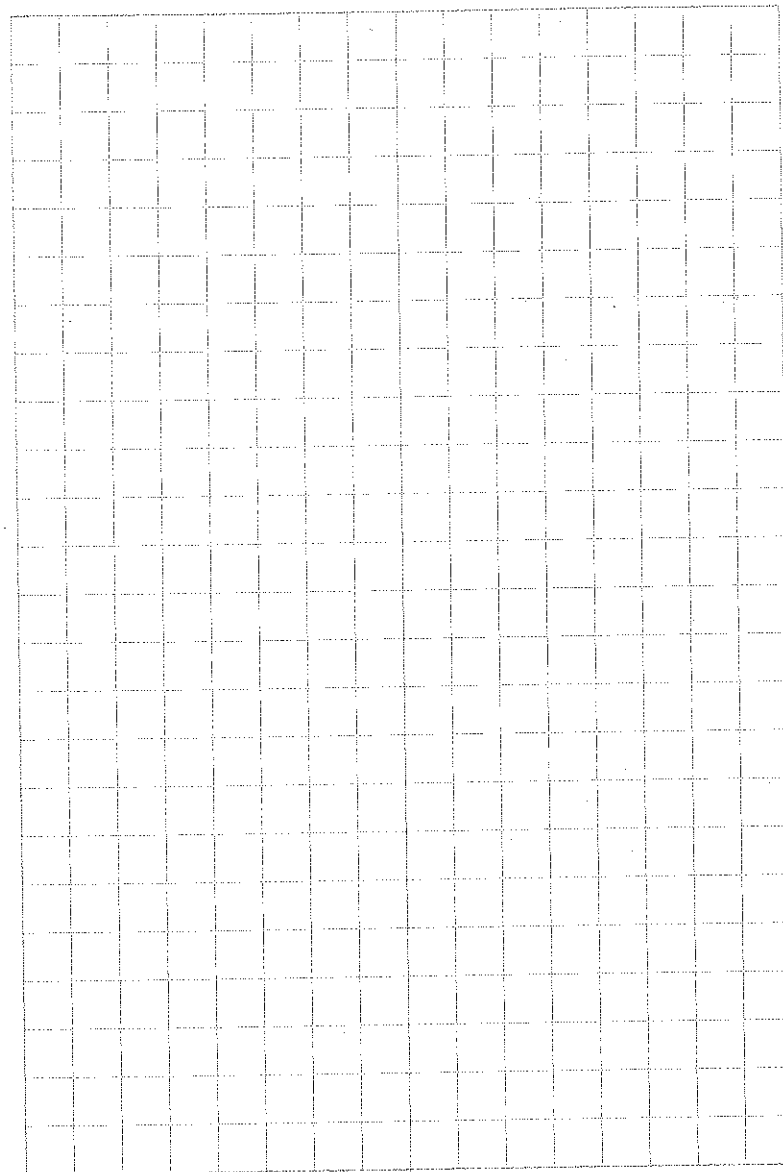
This table represents samples for Perrchlorate
sent in Cooler X on COC 5.

Field Notes begin
on page 80.

Location _____

Date _____

Project / Client _____



Location Moses Lake, WA Date 2-23-2015
 Project / Client Moses Lake Wellfield
February 2015 Event

Field Activity Notes TEAM 1

0700 - Flow cell calibrated, Marsh + Moen

0735 Pick up Ice + CO₂ cylinder

for sampling today.

Mob. to site

0817

99AW10

SWL only

at Northwest
corner

SWL = 129.76'

91AW01

SWL = 129.02'

Sample tubing from contractor removed,
preparing to sample.

0906

= Sample time - 1 container for
perc through 0.2 μ filter

1/3 head space - used discrete
interval sampler to recover water
from mid-screen.

close + lock well Mob. to 91BW01

0916

91BW01

SWL = 129.70'

Dedicated Bladder pump here

Micropurge to stabilization

0952

Sample time then close + lock well

Mob. to 99BW16

1028

99BW16

SWL = 123.67'

Dedicated pump

Location _____ Date 2-23-15
 Project / Client Moses Lake Wellfield

* SWL at 91AW14 = 123.01'

B.P. installed + padlock broken Lock replaced

- 99BW16 Micropurge to stability

1050 Sample time - for VOCs, close +
lock well. Mob. to 99BW12

1106

99BW12

SWL = 112.85'

Micropurge to stabilization

1127

= Sample time

close + lock well

Lunch

Mob. to 99BW15

SWL reading = 71.24'

Micropurge to stability

Sample time (P) + MSD = (FD Time)

99AW08

SWL reading = 71.05 ft

water level at 1305 on 2/23/15

02BW02

swl reading = 70.62

swl at 1315 on 2/23/15

close + secure all wells.

Mob. to North for water level readings

00BW14 SWL = 57.94'

00BW01 SWL =

1430

Genie Well

SWL = 72.40'

48.58

Location _____ Date 2-23-15
 Project / Client Moses Lake Wellfield
Feb. 2015 event

Static Water Levels, continued

00BW04 64.79' Genie Parking area
 SWL reading - converted well
 Stick up to flush mount - No cover
 Well ID.
 0.41' Top of PVC to top ring ^{No} survey?
 on Vault (G.S.) move to

1503 00BW07 SWL = 70.24' close +
 deck well. Mob. to locate
 MW-2 + MW-4 + SWLs at
 LOX Plant

1520 04BW01 SWL = 66.40' close up
01BW01 SWL = 67.16' close up ^{Needs} 1 bolt
 Mob. to stick up well 2

1541 00BW05 SWL = 66.29'

Located MW-2 and MW-4 behind
 barbed wire fence in field - locked
 gate - Masterlock padlock - No trespassing
 sign - city property. - Can walk through
 gate or fence to do this PDB install
 work over the next 2 days.

1600 - end of day 1

Jim R.W.

Location _____ Date 2-24-15
 Project / Client Moses Lake Wellfield
February 2015 Event

Field Activity Notes Day 2

0800 - calibrated flow cell, met with
 Greg Becken + Jeffrey Bishop
 Bugged ice - setup for sampling
 airport wells.

0854 00BW12 SWL = 81.98'
 micro purge to stability

0902 Sample time VOCs close + lock well
 Mob. to 91AW16 for SWL = 81.33"
 No lock - need to add.

Mob. to 00BW03 SWL = 84.91'
 close + lock well - Mob. to 2

00BW02 - purge to stabilization

0937 Sample time, close + lock well
 Mob. to snowplow shed area

0954 00BW11 = SWL = 92.54
 purged to stabilization

1008 Sample time - perc only -
 Mob. to 91AW15 after closing well
91AW15 SWL = 91.88

Purged to stability - Pump performance
 OK after 10-14 years inactive.

1050 (P) sample time 1110 (FO) sample time

Lunch

Mob to MW-4 (Northwell)

SWL = 64.30' → Hydrostar

INW piston pump removed 10' line

PDB 20 (220ml) ~~removed~~ installed

well locked - New padlock

Mob. to MW-2 - Hydrostar pump

SWL = 64.05' removed

PDB installed, 10' line

1312

1355

on airport 91BW02

SWL = 92.80' close/lock well

Mob. south to 00BW08 = 91.37'

Mob. west to 00BW06 SWL = 146.39'

Micropurge to stability

(91AW13 has bladder pump)

1435 = 00BW06 primary time - sample for

1448 - MS/MSD also.

→ FD Time

close/lock well mob. west to

91AW13 SWL = 146.32'

→ micropurge to stability

1515 = Sample time - close up well

*Bring New Lock next time

1600 - end of Day

mm mm

Field Activity Notes

0730 - calibrated flow cell - buying
2 bags of cubed ice.

SWL readings first

0815 = 91BW03 = 90.61'

91AW09 = 89.56'

04CW03 = 132.62'

99BW01 = 90.83'

99AW01 = 90.23'

0838 = 91AW07 = 89.64'

0849 setup for sampling at 91BW03

→ micropurge to stabilization

0903 = Sample time close + lock well

Mob. to 99BW01

Setup for sampling @ 99BW01

Micropurge to stabilization

0920 (P) sample time 0942 (FD) Time close + lock well

Mob. to 99AW01

Micropurge to stabilization

0945 = Sample time, close + lock well

Mob. to 91AW07

Sampling for perchlorate, then installing

2 330ml PDBs at mid screen for

May sampling.

Floating Black organic flecks

1040 = Perchlorate Sample time - organic flecks

1059 = 92BW01 SWL = 85.77' setup for
sampling - micropurge to stability

1121 = Sample time close lock well
Mob to 00AW11. - No problems

00AW11 SWL = 84.95'

setup for sampling -
micropurge to stabilization

1139 = Sample time

* (Master lock Pro Series 6830 Lock
- good brass lock here 1.5 inch (don and)
close + lock well.

Lunch

1245 = 92BW02 SWL = 83.30'

purging to stability

1309 (P) Sample time (FD) Field Dye

1320

Close + lock well.

Mob. to 00BW15 SWL = 80.83'

Micropurge to stabilization

1350 = Sample time

1331 = (00AW12 SWL = 80.71')

1435 = Shipped 2 casks via FedEx for ARE

1514 = 99BW14 SWL = 60.10'

99BW09 SWL = 74.18'

00BW10 SWL = 134.38'

1530 * tried to get (b) (6) to sign ROE - NOT HOME

1600 - end of day. Perchlorate samples
kept on ice overnight under
chain of custody.

2-26-15

Quik Me

0730 - Mob. to field with ice after Howell calibration

Mob. to field S of runway

91BW04 SWL = 85.54'

Micropurge to stabilization - NSTR

0853 = Sample time (VOCs)

close + lock well. Mob. to 99AW09

0937 P SWL = 99.83' - micropurge to stability

0950 PD = Sample time @ 99AW09 - close + lock well

99BW18 SWL = 105.46'

Micropurge to stability. - Some drawdowns.

0958 - Sample time close + lock well

Mob. to 00AW13 + 00BW16

00AW13 SWL = 123.55'

00AW13 stabilized - 1050 Sample time

Mob. to adjacent well 00BW16

EVENT
Feb. 2012

00BW16 SWL = 132.32'

Micropurge to stabilization

1124 = Sample time, well secured

Samples labeled + placed on ice

in shipping coolers

Lunch

1243 = 99BW10 SWL = 130.02'

Micropurge to stability

1300 - sample time close up well

1330 → Mobs. to 00BW15 for water level

SWL = 86.19'

return to Hotel to fill out chain of custody forms, reice samples, prepare sample shipping coolers for tomorrow. All samples kept on ice for delivery to Fedex tomorrow.

1600 - end of day

2-27-15

0830 meet with Port Director

0942 - setup at 99AW17 SWL = 43.26

Micropurge to stabilization

1002 Sample time close-secure well.

Adjacent well

1005 = 99BW-11 SWL = 43.19' close well.

Sampling complete for February event.

1100 = Shipped final VOC sample cooler and the single Perchlorate sample cooler via Fedex for Sat. Saturday delivery to Fedex.

1130 = Depart Moses Lake for District Office.

Jim N. Allen
2-27-15

SEATTLE DISTRICT USACE
ENVIRONMENTAL SAMPLING
FIELD LOG BOOK

Project: Moses Lake Wellfield
Superfund Site
TEAM 2



Book 4
FY13-
FY14-
FY15

Rite in the Rain®
ALL-WEATHER
**ENVIRONMENTAL
FIELD BOOK**
Nº 550F

Location Moses Lake Date 2/23

Project / Client Feb 2015 Sampling

Fed Ex Tracking 8062 5561 710 Day 1

Groundwater Sampling Table

Sampling Team: Rebecca Weiss, Tyler Quick

Sampling ID	Date	Time	VOC#	Notes
15MLW0223N04BW05	2/23	1130	3	-
" BW06	2/23	1215	3	-
CW03	2/23	1240	3	-
CW01	2/23	1305	3	-
BW04	2/23	1320	3	-
BW07	2/23			ML only
N04CW04	2/23	1400	9	-
D04CW00	2/23	1405	3	-
N12CW02	2/23	1440	3	-
N12BW03A	2/23	1530	3/3	-
N12BW03B	2/23	1530		-
N12BW06	2/23	1615	3	-
N12CW05	2/23	1645		-
15MLW0223F001	2/23	+		
15MLW0223P01B01	2/23	1655	3	Passive Diffuser Trip Blank

Location Moses Lake Date 2/24

Project / Client Feb 2015 Sampling

Day 2

Groundwater Sampling Table

Sampling Team: Rebecca Weiss, Tyler Quick

Sampling ID	Date	Time	VOC#	Notes
15MLW0224N012BW02	2/24	0817	3	
" N012CW01	2/24	0827	3	
N012EX02	2/24	0900	3	installed 2-3-20
N012BW08	2/24	0920	3	installed 2-3-20
N014EX04	2/24	0940	9	
D014EX04	2/24	0942	3	
N014BW02	2/24	0945	3	
N012BW04A	2/24	1035	3	
W12BW04B	2/24	1040	3	
D04CW05	2/24	1120	3	
12BW05	2/24	1145	3	
12CW04A	2/24	1200	9	ship tomorrow
12CW04B	2/24	1205	3	
14EX03	2/24	1240	3	
12CW03	2/24	1100	3	

Fed Ex Tracking

8062 5561 7379

Fed Ex Tracking: 8062 5561 7380

Groundwater Sampling Table

Sampling Team: Rebecca Weiss, Tyler Quick

Sampling ID	Date	Time	# of VOCs	Notes
15MLW0225N143W01	2/25	0810	3	
15MLW0225NWP27	2/25	0900	3	
15MLW0225EBWP02	2/25	0905	3	equip blank for WWP27
12BW07	2/25	0930	3	
12EX01	2/25	0945	3	
04BW09	2/25	1010	3	
14BW03	2/25	1030	3	
14EX05	2/25	1045	3	
02BW01	2/25	1210	3	
04CW07A	2/25	1230	3	
04CW07B	2/25	1235	3	
15MLW0225TB04	2/25	1250	3	(Didn't do in last 2 weeks)
PDTB02	2/25	1255	3	

Fed Ex Tracking: 8062 5561 7081

Groundwater Sampling Table

Sampling Team: Rebecca Weiss, Tyler Quick

Sample ID	Date	Time	# of VOCs	Notes
15MLW0226NWP70A1	2/25	0833	3	plug vol on meter
15MLW0226NWP121A1	2/25	0910	3	
15MLW0226NWP83A1	2/25	1003	3	
15MLW0226NWP14A1	2/25	1030	3	
15MLW0226NWP124A1	2/25	1120	3	
15MLW0226NWP125	2/25	1150	9	
15MLW0226NWP125	2/25	1155	3	
¹²³ 15MLW0226NWP1A1	2/25	1240	3	
¹²³ 15MLW0226NWP1B1	2/25	1235	3	
¹²³ 15MLW0226NWP1C1	2/25	1230	3	No one here left door to No one here left door to
15MLW0226NWP131	2/25	1310	3	
15MLW0226TB05	2/25	1322	3	

Location: Moses Lake Date: 2/23

Project / Client: Moses Lake Wellfield

Field Notes Page 1

Weather: Clear, Sunny 39° 11:24

04CW02 — WL 157.49

04BW05 arrive 11:30

WL 129.89

04BW06 — Arrive 12:07

WL 105.58 Sample 12:15

04CW03 — Arrive 12:31

WL 132.89 Sample 12:40

04CW01 — Arrive 12:55

WL 156.34 Sample 13:05

04BW04 Arrive 1:13

WL 133.66 Sample 13:20

04BW07 Arrive 1:37 WL 125.73

04CW04 Arrive 1:45

WL 126.44 Sample 14:00

04CW04 Sample 14:05

12CW02 Arrive 14:30

WL 147.20 Sample 14:40

Location: Moses Lake Date: 2/23

Project / Client: Moses Lake Wellfield

Field Notes Pg 2

12BW03 23" anchor in between A+B
WL 128.05 ' 1530 / 1538

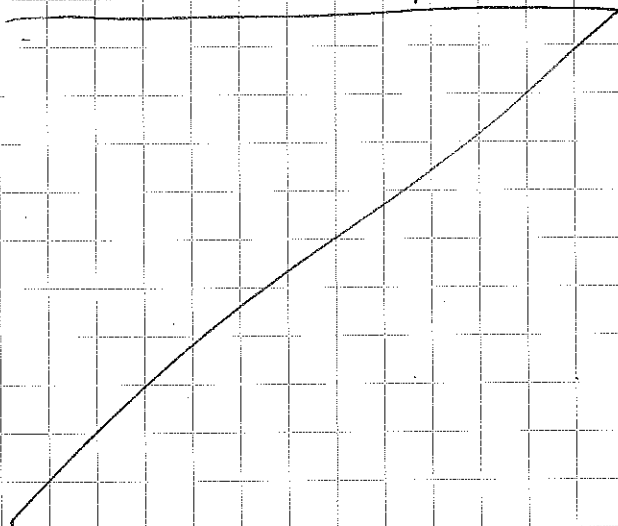
12BW06 arrive 16:06

WL 117.23 16:15

12BW05 arrive 16:30

WL 134.83 16:45

PDTB01

15MLW0223 ~~15:50~~ arrive 16:50PDTB01 → filled w FDB water
sampled 16:55

Location Moses Lake

Date 2/24

Project / Client Moses Lake Wellfield

Pg 3

Field Notes

Weather: Clear, Sunny, 28°C Arrive 8:08

12BW02

WL 116.03 Sample 0817

12CW01 WL 129.89 Sample 0827

0847 Arrive

12EX02 WL 118.87 Sample 0900
placed 2 320 bags w black mesh12BW08 WL 118.71 Sample 0920
placed 2 320 bags w 10 mesh14EX04 (arrive 0935)WL 108.10 N Sample 0940
D 094214BW02

WL 107.90 Sample 0945

12BW04 Arrive 10:30

WL 100.36 Sample A 1035

5" anchor 18" interval

sample B 1040

12CW03 Arrive 10:53

WL 107.43 Sample 1100

04CW05 Arrive 11:14

WL 98.39 Sample 1120

12BW05 Arrive 11:34

WL 91.49 Sample 1145

12CW04 11:51 Arrive

WL 100.55

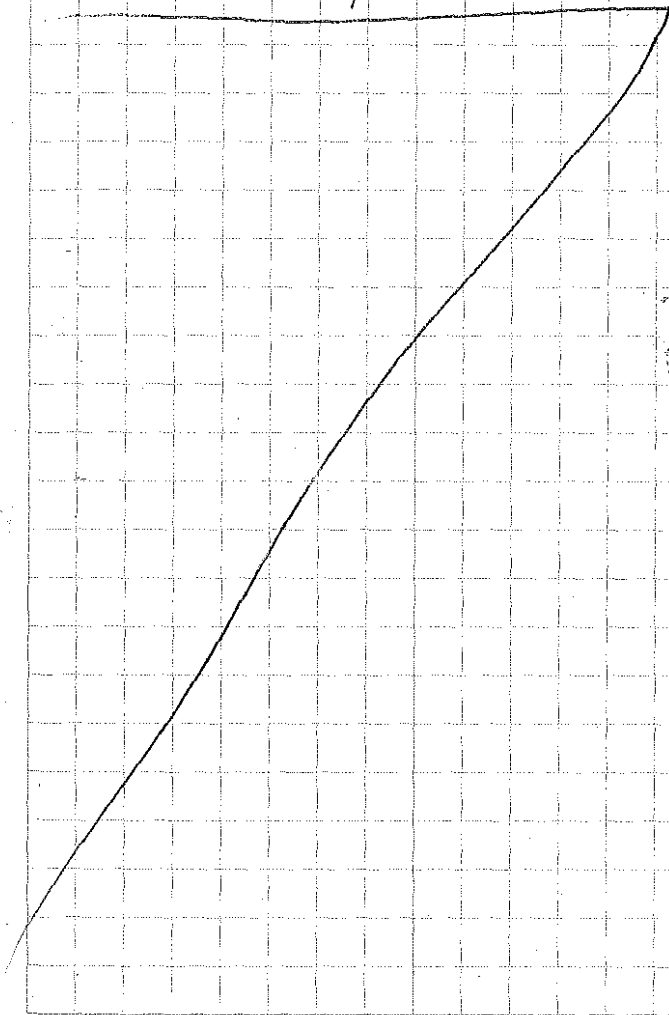
Sample A B
1200/1205

Location Moses Lake

Date 2/24-25

Project / Client

Pg 4

14EX03 Arrive 12:35WL 96.56 Sample 1240
1 black plastic cover

Location Moses Lake Date 2/25/15
 Project / Client Moses Lake Wellfield Pgs
Field Notes

Weather: blue sky, 28°C 0757
14BW01 WL 96.41 Sample 0810

NWP27: Arrived 0830, pre-scheduled
 sample time 9:00.
 using teflon tubing to prevent spray
 Sample 0900.

0846 59.0°F washed tubing with dI
 0848 59.0 then collected equipment
 0850 59.4 blank at 0905
 0852 59.3
 0854 59.2 ~ stable 15MLW0225EBW02.
 0856

12BW07 Arrive 0917
 WL 96.80 Sample 0930

12EX01
 WL 90.71 Sample 0945

04BW09 Arrive 0958
 WL 96.49 Sample 1010

14BW03 Arrive 1027
 WL 88.60 Sample 1030

14EX05
 WL 87.66 Sample 1045

12BW01 Arrive 11:30 only WL 85.49

12BW01 Arrive 11:38 WL 86.34

Location Moses Lake Date 2/25/15
 Project / Client Moses Lake Wellfield Pg 6
Field Notes

02BW01 Arrive 12:00
 WL 129.97 Sample 1210

04CW07 Arrive 1220
 WL 140.60 Sample A 1230
 B 1235
 anchors 3, 16 interbay lines

Trip Blank 1250
 15MLW0225TBO4

PDB Trip Blank 1255
 15MLW0225PDTBO2

04CW08 Arrive 1343 WL 139.48
 20 ft anchor pulled pdb placed
 2-320mL new PDB

00AW12 Arrive 1440 WL 80.78
04BW01 Arrive 1448 WL 66.46

~~0825~~ 11.8°C
~~0824~~
~~0823~~
~~0821~~

Location Moses Lake Date 2/26/15
 Project / Client Moses Lake Wellfield Pg 7

Field Notes

Weather Overcast, 43°C

WP-20 arrive 8:21 sampling

influent only. Sample time 0833

0825 - 14.8°C

Initial Reading 01526302

0827 - 14.8°C

01526209

0829 - 14.5°C

0831 - 14.5°C

0833 - 14.1°C

Pumped legal from effluent
 temp stabilized.
 NWP70A1

WP-121 arrive 8:55

influent only. flow meter (turning)

0900 - 8.7°C

Initial Reading 0000.0703

0902 - 8.8°C

Final Reading 0000.0703

0904 - 8.8°C

0906 - 8.8°C

~ Volume Purged from hose - 7 gal
 bib post filter

stable sample time 0910

Sump system water to N was
 leaking, owner moved. (WP-119)

WP-83 arrive 0940

influent only. flow meter

Initial Reading 127716/04

Final Reading 12771703

sample time 10:03

purged 10 gal

temp stable.

NWP83A1

0950 15.2°C

0952 15.1°C

0954 15.1°C

0956 14.9°C

0958 15.0°C

1000 15.0°C

Location Moses Lake Date 2/26/15 131
 Project / Client Moses Lake Wellfield Pg 8
 Field Notes

WP-14 Arrive 1019, influent only

10:20 - 19.9°C

flow meter is turning

10:22 - 20.8

Initial Reading 08600804

10:24 - 20.5

Final Reading 08600905

10:26 - 20.8

Purged volume 10 gal

10:28 - 20.8

temp stabilized, NWP14A1

sample time 10:30

WP-124 Arrive 1105, influent only

11:11 - 9.6°C

flow meter is turning, just a little

11:13 - 9.6°C

Initial Reading 01758606

11:15 - 9.6°C

Final Reading 01758600

11:17 - 10.8°C

Purge Volume 6 gal

11:19 - 9.7°C

temp stabilized, but 10 min not, NWP124A1

sample time 11:20

WP-125

Arrive 1138, no WAF

1138 - 11.1°C

purged 5 gal.

1140 - 11.1°C

Sample time NWP125: 1150

1142 - 11.6°C

DWP125 1155

1144 - 11.5°C

1146 - 11.6°C

1148 - 11.6°C

NWP125 - 9 vials

DWP125 - 3 vials

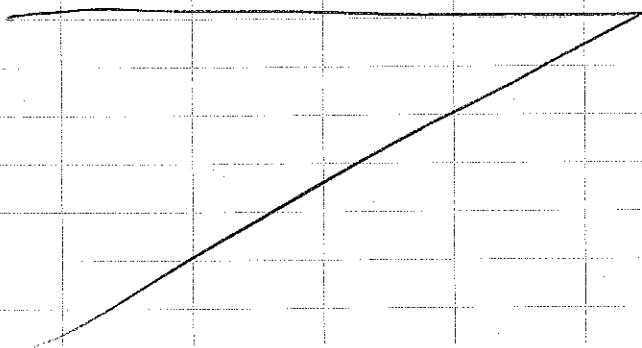
Location Moses Lake Date 2/26/14
 Project / Client Moses Lake Wellfield
Field Notes

WP-123 Arrive 12:15, WtLF, in, mid, off
 12:21 - 7.8°C purged 8 gal,
 12:23 - 6.9°C sample time A 1240
 12:25 - 7.5°C B 1235
 12:27 - 7.6°C C 1230
 12:29 - 8.1°C

WP-131 Arrive, 12:53, spigot at back
 of house

~~1251~~ 1259 - 19.0°C - purged 6 gallons
~~1252~~ 1301 - 17.9°C sample time 1310
~~1253~~ 1303 - 17.3°C
 1305 - 16.6°C
 1307 - 16.1°C
~~1308~~
 1309 - 16.1°C

Trip Blank Sample time 1322
 TR05



Location Moses Lake Date 2/27/14
 Project / Client Moses Lake Wellfield

Weather: cloudy, 38°C
 Arrived 8:18

WP-08 Gravel quarry - owner asked
 why it takes a year to get
 results. Arrived

08:20 - 15.9°C - temperature stabilized
 08:23 - 15.8 - purged ~ 4.5 gal
 08:25 - 16.0
 08:27 - 16.0

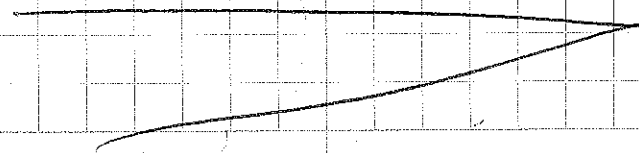
Sample time 0830

Verified with owner that people do
 not use water, he agreed that they don't.

WP-06 Arrive 8:50, inspect WtLF
 only for MS/MSD

08:53 - 10.6°C purged ~ 8 gal
 08:55 - 8.8°C sampled after 10 min
 08:57 - 8.5°C sample time 905
 08:59 - 8.10°C
 0901 8.7°C

NWP06AT 905
 DWP06A1 910



Location Moses LakeDate 2/27/15Project / Client Moses Lake WellfieldField Notes- WP-167 - Arrive 0930 sample spigot

0931 11.9°C

Sample after 10 minutes

0933 11.9°C

Sample time 0941

0935 12.5°C

0937 12.6°C

0939 12.6°C

- WP-168 - Arrive 0934, sample spigot

0955-14.0°C

Sample after 10 min

0957-13.8°C

Sample time 1005

0959-10.8°C

1001-11.2°C

1003-11.7°C

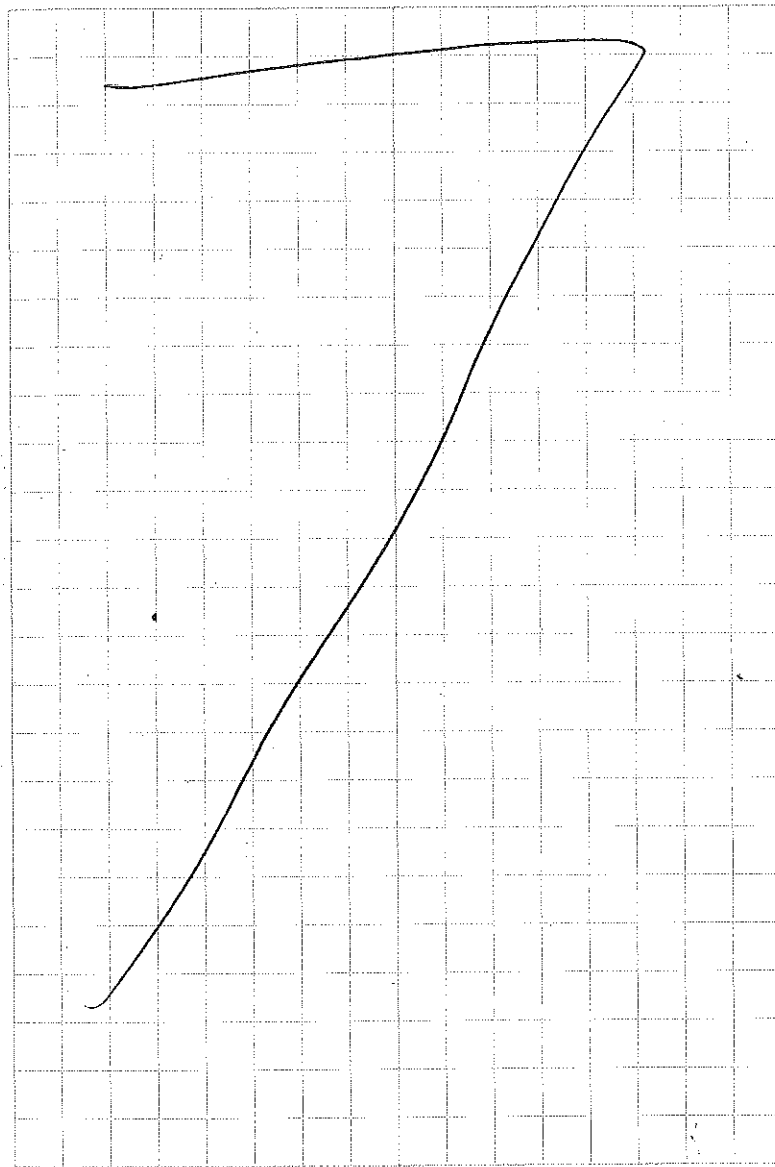
Trip Blank

Sample time 10:09
TBD6

Location _____

Date _____

Project / Client _____



Private Wells and Monitoring Wells Groundwater Sampling Field Report May 2015 Field Sampling Event

**Moses Lake Wellfield Superfund Site
Moses Lake, Washington**

**Field Investigation:
4-11 May 2015
Report Prepared:
July 2015**

By: Technical Services Branch



TABLE OF CONTENTS

1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION	1
1.1 BACKGROUND	1
1.2 GROUNDWATER SAMPLING EVENT SUMMARY AND OBJECTIVES	2
2.0 DESCRIPTION OF WORK	3
2.1 ACTIVITIES PRIOR TO THE MAY 2015 GROUNDWATER SAMPLING EVENT.....	3
2.2 PRIVATE WELL SAMPLING PROCEDURES.....	3
2.3 WHOLE HOUSE FILTER SAMPLING PROCEDURES.....	4
2.4 MONITORING WELL SAMPLING PROCEDURES	5
<i>2.4.1 Monitoring Well Sampling Using Dedicated Bladder Pumps.....</i>	<i>5</i>
<i>2.4.2 Monitoring Well Sampling Using Passive Diffusion Bags.....</i>	<i>7</i>
2.5 SAMPLING EVENT ACTIVITIES AND OBSERVATIONS	8
<i>2.5.1 Team 1 Monitoring Well Bladder Pump Sampling</i>	<i>8</i>
<i>2.5.2 Team 2 Private Well System Sampling.....</i>	<i>10</i>
<i>2.5.3 Team 3 Passive Diffusion Bag Sampling and Deployment.....</i>	<i>16</i>
3.0 INVESTIGATION-DERIVED WASTE.....	18
4.0 PACKAGING AND SHIPMENT.....	18
5.0 LABORATORY ANALYSIS.....	19
6.0 DECONTAMINATION PROCEDURES.....	19
7.0 PROTECTION LEVEL	19
 TABLE 1: PRIVATE WELL STABILIZED WATER TEMPERATURES AND PURGE TIMES.....	 11

APPENDICES

APPENDIX A – SITE AND WELL LOCATION MAP

APPENDIX B – FIELD SAMPLING PHOTOS

APPENDIX C – FIELD NOTES, MICROPURGE LOGS

1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION

1.1 BACKGROUND

The Moses Lake Wellfield Superfund Site is located between the Grant County Airport and the City of Moses Lake, Washington. The Site includes the former Larson Air Force Base (LAFB) property, Port of Moses Lake property and adjacent private properties affected by Site groundwater contamination. The Site is listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 National Priorities List (NPL) for Uncontrolled Hazardous Waste Sites.

The Moses Lake Wellfield Superfund Site is an area of approximately 15 square miles, which includes the former LAFB, commercial facilities, and residences. The former LAFB occupied approximately 9,607 acres three miles northwest of the City of Moses Lake. The United States Air Force was active at the site from 1942 until 1966. During 1988 and 1989, the Washington State Department of Health confirmed the presence of trichloroethylene (TCE) above the Federal Maximum Contaminant Level (MCL) in three City of Moses Lake municipal wells and two Skyline community wells. The Seattle District, US Army Corps of Engineers (USACE) completed a Remedial Investigation (RI) phase in 2003. Appendix A of this report shows the general location map and a site map.

During the course of the RI, several private wells were tested and found to be contaminated with TCE. In 2001, the USACE contracted installation of carbon filtration units – known as whole house filter systems (WHF) - at five of those wells. Several years of groundwater monitoring data has been evaluated since the original WHF systems were installed.

The final results of the Phase I RI released in a report in March 1993 indicated that TCE was consistently found in shallow alluvial and upper basalt (α -basalt) groundwater in the central area of the former base.

On October 14, 1992, the affected areas of the former LAFB and off-site down gradient areas, termed the "Moses Lake Wellfield Contamination", were listed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 for Uncontrolled Hazardous Waste Sites. The former LAFB property is one part of the Moses Lake Wellfield Superfund Site; the site also includes the contaminant plume.

Chemical results from 1993 and 1994 combined with historical data indicated that TCE occurred in the central and southern portion of the former LAFB in alluvial and α -basalt groundwater. In 2004, USACE confirmed TCE contamination in the next lower basalt aquifer (c-basalt). As of 1995, the data suggest that more than one source may have contributed TCE to the alluvial and α -basalt groundwater in the central portion of the former LAFB.

In 1998, URS Greiner completed a sampling round of private water wells and wells for Class A and Class B water systems east, south and southwest of the previously known TCE plume. There were eight detections of TCE during this study. Four wells that were previously outside the plume extent were found to be above the detection limit.

1.2 GROUNDWATER SAMPLING EVENT SUMMARY AND OBJECTIVES

In coordination with the US Environmental Protection Agency (USEPA) Region 10, three USACE environmental field teams deployed to conduct the May 2015 Moses Lake Wellfield groundwater sampling event during a single mobilization. The events described in this report involve USACE field teams verifying sample point locations; discussion of sampling techniques; recording groundwater observations; collecting groundwater samples; and shipping those samples by overnight delivery for laboratory analysis. Environmental sampling team members responsible for the May 2015 field event were Joseph Marsh, Sally Gorham, David Sullivan, Jason Villarreal, Karah Haskins, and Jacob Williams.

All of the work described in this report was accomplished in accordance with the Moses Lake Wellfield Superfund Site Quality Assurance Project Plan. In addition, the teams followed the guidance presented in: the Seattle District, USACE Safety and Health Plan; USACE Safety Manual EM 385-1-1; Seattle District, USACE, Sampling Standard Operating Procedures (SOP).

The private wells and monitoring wells designated for sampling are displayed on a map found at Appendix A. These wells have been selected based on their down-gradient locations relative to the inferred flow direction of TCE-contaminated groundwater and validated sampling analytical data from previous monitoring events.

Three environmental field teams deployed to the Site and collected groundwater samples from 9 whole house filter systems, 58 private well systems, and 83 monitoring wells during the May 2015 sampling event as summarized below:

Team 1: Joseph Marsh and Sally Gorham (Jacob Williams replaced Sally Gorham from 8 to 11 May 2015) collected groundwater samples from 44 monitoring wells fitted with dedicated bladder pumps between 4 and 11 May 2015.

Team 2: Karah Haskins and Jacob Williams collected groundwater samples from 49 private well systems, and 9 whole house filter systems between 3 and 7 May 2015.

Team 3: David Sullivan and Jason Villarreal collected groundwater samples from 39 passive diffusion bag monitoring wells between 4 and 7 May 2015.

The objectives of groundwater sampling at Moses Lake are to: 1) collect representative samples from designated private well systems and monitoring wells yielding data of known and sufficient quality to evaluate TCE concentrations and define existing TCE plumes; 2) to assure compliance with the requirements of USEPA; and 3) to make critical project - specific decisions based on the evaluated data.

2.0 DESCRIPTION OF WORK

2.1 ACTIVITIES PRIOR TO THE MAY 2015 GROUNDWATER SAMPLING EVENT

The USACE project team worked to collect signatures on Department of the Army Right of Entry forms as required before conducting the well sampling on private, city or county government property. For most properties, previously signed Right of Entry forms were still valid. For all properties designated for sample collection, owners (and renters if applicable) were contacted to coordinate sample collection times during the scheduled field sampling week. Many of the owners allowed the sampling teams to work on their property while they were not at home. At some of the properties, home owners or well system managers had to unlock pump houses and open valves for the sampling teams – requiring prior coordination.

Prior to conducting sampling activities at each location, both teams verified the address or well location and map location matched, and that the Right of Entry form had been signed prior to arriving at each sampling location.

Each team was responsible for identifying potential health and safety hazards at each sampling location. If a hazard is verified at a private well sampling location, an alternate hose bib connected to the same water source may be selected in a safer area of the subject property.

Also for private well sampling, the field team was tasked with determining the most appropriate cold-water tap or other sample port as close to each wellhead as practical, while comparing notes on sample points collected during previous sampling events. The team was briefed that groundwater samples would not be collected from taps delivering chlorinated, aerated, softened or filtered water. In addition, residents present during the sampling activities often guided the sampling team to the correct sample point where required.

2.2 PRIVATE WELL SAMPLING PROCEDURES

During the May 2015 groundwater sampling event, samples were collected from a total of 58 private wells consisting of: 49 private well system hose bibs and yard hydrants closest to the wellheads (WP-04, WP-09, WP-10, WP-13E, WP-18N, WP-18S WP-25W, WP-27, WP-28, WP-33, WP-45, WP-50, WP-52, WP-54, WP-57, WP-66, WP-68, WP-82, WP-105, WP-120, WP-122, WP-126, WP-127, WP-128, WP-130, WP-131, WP-137, WP-138, WP-139, WP-143, WP-144, WP-145, WP-147, WP-148, WP-149, WP-150, WP-151, WP-152, WP-154, WP-156, WP-164, WP-167, WP-168, WP-169, WP-175, WP-177, WP-178, WP-179, and WP-180), and nine WHF systems (WP-14, WP-70, WP-83, WP-86, WP-121, WP-123, WP-124, WP-125, and WP-129).

The USACE Environmental Center of Expertise assisted with a revision of existing standard operating procedures for WHF systems and private well sampling with the intent of increasing reliability and repeatability in analytical data quality. Beginning with the May 2015 sampling event described in this field report, USACE has determined private well and WHF groundwater purging shall to consist of: allowing water flow at the sampling port at a rate of approximately

0.5 to 1 gallon per minute (gpm), while measuring the temperature of the water stream with a digital thermometer every two minutes until stabilization is achieved. These procedures follow the general principles of the New Hampshire private well system water sampling guidance.

During purging, the flow rate at each location was verified by graduated cylinder. While purging continued, the field team monitored the surrounding area and flowing water for unusual observations and odors as purge water was captured in a five gallon bucket. They recorded the start time of the purging in the field logbook immediately after opening each hose bib sample point and establishing the flow rate. While one team member used the digital thermometer to measure water temperatures, the other recorded the temperatures every two minutes until the parameters stabilized.

Upon reaching stabilization, the approximate total purged volume was recorded in the project field book along with any other significant observations. The team then conducted the sample collection activities.

Prior to collecting a water sample, the team reduced the flow rate at each tap to approximately 150 to 200 ml/min. to minimize sample water turbulence and aeration. Prior to sample collection at each private well system, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled with well water collected directly from each hose bib or yard hydrant – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of each plumbing system were noted to assist in data interpretation. A photographic record of each sample point has been collected and archived by the environmental field teams. In addition, each team placed handle tags (indicating that water samples were taken by USACE on that date and time) on the front doors of homes sampled if nobody was home during sample collection. A photo was taken of the handle tag and front of house in that case to be archived in the project files.

After the sample containers are filled, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time are placed on the containers. The samples are then packaged in bubble wrap bags and plastic zipper type bags, placed into pre-iced sample shipping coolers and prepared for shipment as described in Section 3.0. All field teams worked to ensure each property was left just as they found it with no damage done, and any doors or gates closed as required.

2.3 WHOLE HOUSE FILTER SAMPLING PROCEDURES

In coordination with USEPA and affected Moses Lake area homeowners, granular activated carbon (GAC) water filters have been installed in private well systems showing TCE results of 3.5 µg/l or greater. Each GAC filter system consists of two lightweight composite GAC filter tanks (acting as lead and lag filters), associated piping, bag filters (to prevent GAC particles from

entering the household plumbing system), pressure gauges and valved/regulated sample collection ports.

Groundwater samples were collected from nine WHF systems (WP-14, WP-70, WP-83, WP-86, WP-121, WP-123, WP-124, WP-125, and WP-129) during the May 2015 sampling event. Each system was purged according to the revised private well sampling SOP consisting of allowing water flow at a hose bib nearest the wellhead at a rate of approximately 0.5 to 1 gpm, while measuring the temperature of the water stream with a digital thermometer every two minutes until stabilization is achieved. Purge flow rates averaged approximately 0.5 gpm as measured with graduated cylinder, and purged water at each location was captured in a five gallon bucket to verify purged volumes. During purging, continuous temperature readings were recorded using a digital thermometer until water temperature stabilization was achieved. Once water temperature had stabilized, the hose bib was closed, and the field team prepared to collect samples from the pre-determined WHF sample ports (labeled "A" for the lead inlet port, "B" for the lead outlet port, and "C" for the lag outlet port).

WHF sample collection consists of opening each designated sample port valve fully to allow the maximum restricted flow rate of approximately 150 to 200 ml/min to flow into a capture bucket for a few seconds to ensure organic matter or air bubbles have been flushed out of the system. Restrictors have been placed on the sampling lines to provide a smooth, non-turbulent stream at a low-flow rate to minimize loss of volatiles that may be present in the water stream. Next, the sampling team immediately fills three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface away from the shed or pump house GAC filter location after the samples were collected.

2.4 MONITORING WELL SAMPLING PROCEDURES

2.4.1 MONITORING WELL SAMPLING USING DEDICATED BLADDER PUMPS

Moses Lake monitoring well groundwater purging and sampling was performed in accordance with the Seattle District's Low-Flow Ground Water Purging and Sampling SOP, prepared in March 1999 and revised on 1 Sep 2009. Data generated during purging were recorded on the MicroPurge/Low-Flow Sampling Log forms (Appendix C).

The team verified each monitoring well location and identification number with project maps and tables. They verified work can proceed safely in the vicinity of moving vehicular traffic, heavy industry, and other hazards as required. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard "stick-up" well completions. Prior to purging each well, the depth to static water level in each well was measured and checked periodically to monitor draw down as a guide to flow rate adjustment (no greater than 0.4 foot drawdown is permitted to prevent sampling stagnant casing water).

Purging operations at each well commenced once the following equipment was prepared: the MP20 MicroPurge® Controller equipped with an adjustable pressure regulator was connected to the Well Wizard® bladder pumps via air line and quick connect fittings. Another air line was quick-connected to a pressurized CO₂ cylinder to drive the pump. Pump flow rates were then adjusted during a “pre-purge” period to maximize withdrawal rates and minimize excessive drawdown in each well. The evacuated pre-purge volume at each well was intended to flush out a bladder pump and tubing volume prior to monitoring stabilization parameters. Finally, a QED MicroPurge® basics MP20 Flow Cell was connected to the pump’s discharge line at ground surface to measure established stabilization parameters (pH, specific conductivity, temperature, DO, ORP, and turbidity).

Depth to water measurements during purging were monitored and recorded to verify that minimal drawdown occurred. A graduated measuring cup was used to determine the volume purged. Generally, acceptable low-flow rates are no greater than 500 milliliters per minute (ml/min.), and are typically closer to 400 ml/min. for the Well Wizard® bladder pump systems, depending upon the amount of water level drawdown detected during pumping at each well. Purge data was recorded on the micropurge logs every two minutes.

Low-flow purging continued until three consecutive measurements of the stabilization parameters met stabilization requirements.

Stabilization parameter requirements for all private well and bladder pump monitoring wells are as follows:

Temperature	+/- 0.2 °C
Specific Conductivity	+/- 0.020 millisiemens/centimeter (mS/cm)
DO	+/- 0.2 milligrams/liter (mg/l)
pH	+/- 0.2 units
ORP	+/- 20 millivolts (mV)

At each monitoring well, groundwater sample collection would begin immediately after achieving stabilization of water quality parameters during low flow purging.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled immediately following purging by disconnecting the flow-through cell from the pump tubing system, and capturing water directly from the discharge end of the tubing. All sample containers were carefully filled at a low-flow rate to minimize agitation. During sample collection, significant physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms and project field book as needed.

After filling the sample containers, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time were placed on each container and the container was placed in a plastic zipper bag. The bagged sample vials were placed into bubble wrap bags. Finally, the filled sample containers were placed into pre-iced shipping coolers to begin sample cooling to the required 4° centigrade sample preservation temperature prior to shipment to the analytical laboratory. One set of trip blanks were required and included per sample shipping cooler.

At the conclusion of groundwater sampling at each well, the flush mount well covers were bolted closed and stick up well caps padlocked.

2.4.2 MONITORING WELL SAMPLING USING PASSIVE DIFFUSION BAGS

Passive diffusion bags (PDBs) were been selected by the Moses lake Project Delivery Team as the most appropriate, cost-effective method for groundwater sample collection from Moses Lake monitoring wells lacking dedicated bladder pumps. The PDBs were purchased from ALS Environmental laboratory under license by the US Geological Survey and The General Electric Company, both co patent-holders. The 1 ¼" diameter low-density polyethylene PDBs were pre-filled with 220 ml or 330 ml of ASTM Type II certified, laboratory-grade, deionized water. Each filled PDB was then heat sealed by the laboratory prior to shipment to USACE via overnight delivery in hermetically sealed pouches.

The environmental field team allowed a minimum of 14 days to elapse before returning to the Moses Lake site for groundwater sample collection per PDB guidance. PDB retrieval and sampling consisted of the following procedures:

1. The team verified each monitoring well location and identification number with project maps and the sample matrix. They verified work can proceed safely in the vicinity of moving vehicular traffic as required. The PDBs were prepared over clean sheets of aluminum foil prior to being placed into each well. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard "stick-up" well completions. The team donned new Nitrile gloves for groundwater sample collection.
2. The team carefully hauled each weighted PDB to the surface using the nylon suspension line. The sampling team carefully cut the top corner off each PDB and filled each sample vial. The team filled each vial just to overflowing and maintained a reverse meniscus. There was no down time once the PDB has been brought to the surface until sample collection was complete at each well. Any residual sample water in the used PDBs was discharged to ground surface.
3. Each PDB represented a unique sample ID number based on the well ID (and sample interval if two PDBs are deployed into one well). With the exception of the MS/MSD, all QC samples were submitted "blind" to the laboratory using a separate unique sample ID number not labeled as duplicate or trip blank per USACE standard sampling procedure. One set of trip

blanks were required and included per sample shipping cooler. An extra laboratory- prepared PDB was shipped to the site and was used for collection of the trip and field blanks at the direction of the USACE project chemist.

4. Once recovered and sampled the PDBs and suspension lines were be discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials were disposed of as municipal waste. The PDBs and other solid waste material were placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and returned to the Seattle District, USACE office.

5. Finally, the team securely capped and locked each monitoring well riser and cover plate when finished.

2.5 SAMPLING EVENT ACTIVITIES AND OBSERVATIONS

2.5.1 TEAM 1 MONITORING WELL BLADDER PUMP SAMPLING

Groundwater sample collection commenced immediately after achieving stabilization of water quality parameters during low flow purging at each well using dedicated bladder pump systems as described previously. As with the PDB sampling, the sampling team worked from the far north end of the Site, moving to the far south end sampling each designated well as it was encountered. The project well maps and sample matrix were used to ensure samples were collected at the correct locations. The team used 15 lb. (and occasionally 5 lb.) compressed CO₂ cylinders acquired from Oxarc in Moses Lake to drive the pump systems, airlines, pump controllers, and flow cells to conduct the sampling of dedicated bladder pumps.

During the May 2015 sampling event, USACE Environmental Field Team 1 successfully collected groundwater samples from each of the planned 44 monitoring wells fitted with dedicated bladder pumps. The bladder pump wells designated for sample collection in May of 2015 were: City Well MW-2, City Well MW-4, 91AW09, 91AW15, 91AW16, 91AW17, 91BW02; 91BW03; 91BW04; 92BW01; 92BW02; 99AW01; 99AW08, 99AW09; 99AW10, 99BW01; 99BW09; 99BW10; 99BW11; 99BW12; 99BW14, 99BW15, 99BW16; 99BW18; 00AW11; 00AW13; 00BW01; 00BW02; 00BW03; 00BW04; 00BW05; 00BW06; 00BW07; 00BW08, 00BW09; 00BW10; 00BW11; 00BW12; 00BW13; 00BW14; 00BW15; 00BW16; 01BW01; and 02BW02.

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated monitoring well, the sampling team always attempted to contact the property owner for each monitoring well location before beginning the field sampling activities. This was essential to conduct groundwater sampling, water level measurement, or inspection of ten designated monitoring wells located within the restricted area of the Grant County Airport (Port of Moses Lake property). A Port of Moses Lake escort must be assigned (arranged in advance of the field sampling) to accompany the sampling team to any location on the airfield. Airport monitoring wells designated for sampling, or water level measurement, consisted of: 00BW12, 91AW16, 00BW03, 00BW02, 00BW11, 91AW15, 91BW02, 00BW08, 00BW06, and 91AW13 (in sampling order from east to west). During this sampling

event, Port Security Manager Greg Becken acted as escort during airport property sampling on both days inside the restricted airport property 6 and 7 May 2015.

Other than property owner notifications, no special access procedures were required for any of the other bladder pump monitoring wells sampled during the May 2015 event.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All sample containers were filled immediately following low-flow purging by disconnecting the flow-through cell from the pump tubing system, and capturing pumped groundwater directly from the discharge end of the pump tubing. During sample collection, physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms.

Stabilization of water quality parameters during purging bladder pump wells occurred within 6 to 15 minutes during this event. Measured temperatures ranged from a low of 13.42°C at well 00BW01 to a high of 19.17°C at well 00BW04. Specific conductivity ranged from a very low 0.10 mS/cm (well 99BW09), low 0.31 mS/cm (00BW03) low 0.32 mS/cm (00BW13) to a high of 0.64 mS/cm at well 91AW15. Overall, specific conductivity averaged approximately 0.5 mS/cm across the project site during this event. Dissolved oxygen measurements ranged from a very low 0.61 ppm at well 91AW15 to a high of 9.19 ppm at well 00BW12 (high D.O. readings noted previously here). Dissolved oxygen averaged approximately 7.5 ppm across the project site during this event. PH ranged from 6.25 units at well 00BW06 to 7.89 units at well 00AW13. The stabilized pH normally averages close to 7 units (neutral) at this site. Oxygen reduction potential ranged from a low of 226 mV at well 99AW15 to a high of 670 mV at well 99BW18. ORP averages approximately 375 mV across the project site.

Significant Observations Made During Team 1 Bladder Pump Sampling

Monitoring well 00BW09 is located on Genie Industries property. During this event, the well was located behind a row of new lift vehicles making access difficult. The sampling team checks in with Genie staff and is issued visitor badges prior to accessing this well for sampling or water level readings.

A portable bladder pump system was used to sample well 00BW04. The former dedicated bladder pump was removed previously by USACE staff to allow well conversion from stick-up to flush mount by Genie sub-contractor due to new road construction.

Well 00BW14 (located on CDSI – transfer and recycle center property) is located approximately two feet beneath ground surface in a vault under a heavy iron utility cover. The cover had openings to allow water and debris to fill the vault, but these openings have been previously filled by USACE staff in 2014. Minor clearing work still had to be accomplished during this event to remove standing water and debris over the watertight well cover at the base of the vault before purging and sampling could begin. In addition, black organic particles were observed floating in recovered purge water at well 00BW14.

City wells MW-2 and MW-4 contain USACE installed bladder pumps. During this event, the USACE team purged and sampled both wells and then permitted the Moses Lake Wastewater staff to collect groundwater samples for their own permitting requirements before departing the area. During the USACE team work, dissolved oxygen was observed as extremely low (0.77 ppm) in well MW-2 (nearest to the Larson sewage treatment plant).

The USACE team noted the lowest dissolved oxygen reading (0.61 ppm) at well 91AW15 on airport property near the former snow plow shed. This well is located adjacent to the location of a fuel spill (many years ago) as reported by Airport staff. A petroleum odor was detected in purge water recovered from adjacent well 00BW11 also located in front of the former snow plow shed.

The team attempted to sample well 99AW10 containing a dedicated bladder pump. They discovered the water level to be too low for the pump to operate, and no purging and sampling could be conducted at that location. In the future, recommend the USACE team consider removing the bladder pump and installing a passive diffusion bag sampler near mid-well screen if possible.

Well 91AW09 was noted to have a severely undermined concrete pad due to what appeared to be rodent burrowing. Recommend inspecting the well in the future to determine if repairs are needed.

Significant drawdown was observed during purging at wells 02BW02, 99BW18, 00BW16, and 99BW10. Reducing the flow rate halted the drawdown at these wells- and partial recovery was observed prior to sample collection. Minor drawdown was observed at well 99BW15, but did not exceed the 0.4 ft. limitation of the low-flow SOP.

Between 4 and 11 May 2015, groundwater samples were shipped under chain of custody via the Grant County Airport Fedex Station priority overnight to the contract laboratory - Analytical Resources, Inc. in Tukwila, WA. Environmental field team 1 departed the Site on the morning of 11 May 2015, and returned to the USACE District Office in Seattle.

2.5.2 TEAM 2 PRIVATE WELL SYSTEM SAMPLING

Team 2 collected samples at their own pre-assigned set of nine whole house filter well system sample ports, and 49 private well system sample points.

During the period of 3-7 May 2015, Team 2 collected groundwater samples from the following private well systems with whole house filters installed: WP-14, WP-70, WP-83, WP-86, WP-121, WP-123, and WP-124. During that same time period, Team 2 collected groundwater samples from the following private well systems: WP-04, WP-09, WP-10, WP-13E, WP-18N, WP-18S, WP-25W, WP-27, WP-28, WP-33, WP-45, WP-50, WP-52, WP-54, WP-57, WP-66,

WP-68, WP-82, WP-105, WP-120, WP-122, WP-126, WP-127, WP-128, WP-130, WP-131, WP-137, WP-138, WP-139, WP-143, WP-144, WP-145, WP-147, WP-148, WP-149, WP-150, WP-151, WP-152, WP-154, WP-156, WP-164, WP-167, WP-168, WP-169, WP-175, WP-177, WP-178, WP-179, and WP-180.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

Trip blanks were sent inside each sample shipping cooler delivered to the analytical lab.

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated location, the sampling team always attempted to contact the owner or resident at each private well location before beginning the field sampling activities. Upon arrival at each private well property designated for sample collection, the team verified they were at the correct address using maps, notes, and the sampling matrix, and verified through field documentation they were ready to collect samples at the correct sampling point (hose bib, or suitable water discharge port nearest to the wellhead).

Per modified SOP, sampling point valves were opened, and water allowed to flow at approximately 0.5 gpm into a capture bucket. Next, water temperature readings were measured every two minutes until stabilization was achieved. During the November sampling event, water temperature stabilization averaged approximately eight minutes elapsed purging time with most locations reaching stabilization within six minutes as shown in Table 1 below.

TABLE 1: PRIVATE WELL STABILIZED WATER TEMPERATURES AND PURGE TIMES

Well Location ID	Stable Temp. °C	Total Purge Time (Minutes)
WP-03	14.6	10
WP-04	16.1	6
WP-9	13.4	6
WP-10	15.6	6
WP-13E	14.3	6
WP-14	18.7	6
WP-18N	15.8	6
WP-18S	14.4	6
WP-25W	Not Measured	na

Well Location ID Continued	Stable Temp. °C	Total Purge Time (Minutes)
WP-27	15.2	6
WP-28	15.2	6
WP-33	13.9	6
WP-45	15.0	6
WP-50	14.6	6
WP-52	15.4	10
WP-54	13.0	6
WP-57	13.0	6
WP-65	No Access	na
WP-66	15.6	4
WP-68	15.2	8
WP-69	15.5	10
WP-70	15.0	6
WP-71A	13.5	10
WP-74	15.0	10
WP-82	13.7	6
WP-83	16.2	6
WP-86	14.4	6
WP-105	15.1	10
WP-111	16.3	10
WP-116	11.8	13
WP-118	No Access	na

Well Location ID Continued	Stable Temp. °C	Total Purge Time (Minutes)
WP-120	14.8	6
WP-121	15.3	6
WP-122	15.0	8
WP-123	15.1	10
WP-124	14.3	6
WP-125	13.6	6
WP-126	15.4	12
WP-127	15.2	8
WP-128	14.2	8
WP-129	13.6	6
WP-130	15.4	6
WP-131	15.7	6
WP-136	14.9	10
WP-137	15.8	6
WP-138	16.1	6
WP-139	16.7	6
WP-143	18.1	6
WP-144	15.0	6
WP-145	13.3	4
WP-147	15.2	6
WP-148	15.4	6
WP-149	16.1	10

Well Location ID Continued	Stable Temp. °C	Total Purge Time (Minutes)
WP-150	16.6	6
WP-151	13.3	6
WP-152	17.8	6
WP-153	15.3	10
WP-154	14.7	10
WP-155	15.9	10
WP-156	16.1	6
WP-164	16.7	6
WP-165	14.3	10
WP-167	13.8	6
WP-168	15.2	6
WP-169	14.6	10
WP-172	15.3	10
WP-175	14.0	6
WP-177	14.1	6
WP-178	13.6	4
WP-179	16.9	6
WP-180	15.4	4

Upon achieving stabilization, the final stabilized readings were entered into the project field book. Prior to collecting a water sample, the flow rate at each tap was reduced to approximately 100 to 200 ml/min. to minimize sample aeration and turbulence. The sampling team donned new Nitrile gloves prior to sample collection at each residence. In the case of the WHF sample ports, restrictors on the sample ports provided a stream of sample water at approximately 150 to 200 ml/min. All sample containers were be filled with water directly

from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. A photographic record of each sample point was made by the team.

Significant observations made during Team 2 Private Well/WHF Sampling

Door handle tags were attached to the front doors of the following residences where private wells were sampled by Team 2, but the resident was not at home during sample collection activities: WP-82, WP-131, WP-154, and WP-180. As mentioned previously, the door handle tags are intended to inform the residents that a sample had been collected by the USACE team while they were away from home, and provide them with a point of contact and phone number if they had any questions or concerns. Photos of the handle tags have been archived in USACE project files.

Purging was minimized at WP-150 since the hose bib was close to ground surface (three gallons purged). During purging at WP-127, unknown white crystals were observed forming around the hose bib. Sample integrity is not expected to be compromised at WP-127 due to this observation. No odors were detected in the vicinity of the WP-13E sample point as detected in the past. At WP-25W, the homeowner provided the sampling team with a new length of sample hose for purging and sampling since the water is plumbed through a small hole in the well house that is difficult to access. Purging to water temperature stabilization could not be accomplished at WP-25W for this reason. At WP-178, the water pressure and temperature fluctuated during purging, but no impact to sample integrity is expected. The house at WP-154

(b) (6) An extended purge time was required at WP-143 since the water temperature was initially very warm (25 gallons purged). (b) (6)

(b) (6) WP-131 (b) (6) USACE must coordinate future sampling (b) (6)

(b) (6) The homeowner at WP-69 instructed the sampling team to not collect samples during this event without explanation. USACE will attempt to gain access for sampling here again next year. No contact could be made with the homeowner at WP-118. Upon arrival, the team found the property gate to be locked, and phone calls were not answered. No sample collection this time at WP-118. Purge time was short at WP-66 since the water had been running for many hours.

Since no unusual chemical odors were detected at the sample points, no field blank samples were collected during private well/WHF sampling in May 2015.

Teflon sample tubing was attached to the hose bib at WP-4 to mitigate turbulent water flow. After decontamination, reagent grade water was passed through the tubing and collected as an equipment blank sample.

Between 3 and 7 May 2015, Team 2 groundwater samples were shipped priority overnight to Analytical Resources, Inc. via the Grant County Airport Fedex Station. Environmental Field Team 2 departed project site on 7 May 2015 and returned to the USACE District Office in Seattle.

2.5.3 TEAM 3 PASSIVE DIFFUSION BAG SAMPLING AND DEPLOYMENT

USACE Environmental Field Team 3 collected samples from a pre-installed set of 39 PDB wells, and deployed new PDBs for August 2015 sampling into a pre-assigned set of PDB monitoring wells during the May 2015 mobilization. In addition, Team 2 collected groundwater samples from 11 private well systems.

The team generally worked from the north end of the Site and moved to the far south end sampling each designated well as it was encountered. 39 Pre-designated monitoring wells were fitted with new PDBs during the February 2015 sampling event in preparation for the May 2015 event. The PDB wells were: 91AW07, 91AW14, 00AW12, 00AW14, 02BW01; 0-BW01; 04BW04; 04BW05; 04BW06; 04BW07; 04BW09; 04CW01; 04CW02; 04CW03; 04CW04; 04CW05; 04CW07; 04CW08; 12BW01; 12BW02; 12BW03; 12BW04; 12BW05; 12BW06; 12BW07; 12BW08; 12CW01; 12CW02; 12CW03; 12CW04; 12CW05; 12EX01; 12EX02; 14BW01, 14BW02, 14BW03, 14EX03, 14EX04, and 14EX05. The 11 private well systems sampled were WP-03, WP-69, WP-71A, WP-74, WP-111, WP-116, WP-136, WP-153, WP-155, WP-165, and WP-172.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

The team first verified each monitoring well location and identification number with project maps and the sample matrix. The team also verified that work could proceed safely in the vicinity of moving vehicular traffic or other physical, biological, or environmental hazards that may have been present near each monitoring well.

Each team member donned new Nitrile gloves for groundwater sample collection at each well. Once the wells were unlocked and opened, one team member lifted the well riser plug and began hauling the PDB vertically to the surface.

Once each PDB was raised to the surface, the sampling team worked together to carefully cut the top corner off each bag using decontaminated steel scissors. Next, one person held the open sample vials and the other carefully and slowly tilted the bags - open side down - toward each open sample vial. The pre-preserved vials were filled just to overflowing to maintain a reverse meniscus. Then the vials were immediately capped making sure there were no bubbles or headspace per standard VOC sampling procedure. This entire sampling process can be completed within one minute to minimize loss of volatiles while preventing introduction of contaminants into the water from surface sources. After all required vials were filled; any residual sample water remaining in the used PDBs was discharged to ground surface. Therefore, no Investigation-derived waste (IDW) water was generated during this sampling event.

The sampling team recommends continued use of protective mesh PDB sleeves in wells with steel risers due to a greater potential for damage to the PDB membranes (monitoring wells 12EX01, 12EX02, 14EX03, 14EX04, and 14EX05).

Once recovered and sample water removed, the PDBs and suspension lines were discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials were disposed of as municipal waste. The PDBs and other solid waste material were placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and returned to the Seattle District, USACE office for future reuse.

Finally, the sampling team closed and locked each monitoring well casing cover or secured the flush mount well cover plates when sample collection was completed at each location.

After collecting water samples from the PDBs, team 2 deployed PDB assemblies into 38 monitoring wells selected for groundwater sampling.

Two sizes of PDBs were ordered: The bags consisted of the standard 220 ml size, and a larger 330 ml bag selected to accommodate primary and field duplicate samples where required. In some wells, two 330 ml PDBs were connected in tandem and lowered to the mid-screen depth to accommodate primary, field duplicate, and MS/MSD sample volumes as required. Two PDBs were installed at two mid-screen depths if a designated well had two screened intervals (as found in wells 04CW07, 12BW03, and 12BW04). All PDBs and stainless steel anchor weights were purchased from ALS Environmental, and shipped to the District office by UPS overnight delivery.

Following the established PDB deployment procedures, both environmental team members worked together using a table of Moses Lake monitoring well logs to determine the number of required weights, length of nylon suspension line, and number of PDBs required at each designated well. Wells deeper than 200 feet generally required two steel weights to allow proper PDB positioning. Each team member donned a new pair of Nitrile gloves prior to working on PDB assemblies at each well. Steel weights, suspension lines, and PDBs were quickly assembled on a strip of clean aluminum foil on the tailgate of the sampling vehicle. The prepared assembly of PDB, suspension lines, and weights was lowered into place at each well within 10 to 15 minutes to reduce the possibility of contaminants entering the diffusion bags during deployment.

At each specific well, the team lowered the weight into the well first, followed by the suspension line and PDB. The team worked to keep the assembly centered within the well casing as they slowly lower it to the well bottom. When the team felt the weight hit well bottom, they pulled up the line approximately one inch and tied it off securely to the casing plug or well cap. This method ensured the PDB would always be centered at the mid-well screen depth. Finally, the well cap was locked, or the cover plate secured with locking bolts depending on type of well encountered – stick up or flush mount.

All laboratory-filled PDBs arrived at the USACE office in good condition prior to field deployment. Each PDB was packed in groups of 10 into sealed foil pouches to prevent

inadvertent contamination until deployment into the designated monitoring wells. No specific difficulties or problems were noted during PDB deployment.

Significant Observations Made During Team 3 Passive Diffusion Bag/Private Well Sampling

USACE Field Team 2 detected rusty residue on protective mesh PDB sleeve and suspension line installed in well 12EX01. No other unusual observations were recorded.

Team 2 was unable to collect samples at private well system WP-71B due to homeowner difficulty coordinating access to the well house key. According to homeowner, a lockbox with enclosed key will be installed on the WP-71B well house in the future. At WP-165, Team 2 found difficult access to sample collection point due to position of hose bib behind pressure tank – samples were collected, but there is no resolution to access difficulties at this time.

3.0 INVESTIGATION-DERIVED WASTE

No investigation-derived waste was generated during this sampling event. All residual PDB water or purged well water was transferred directly to ground surface on each property away from the sample collection point.

4.0 PACKAGING AND SHIPMENT

As mentioned in the narrative of each sampling event, groundwater samples were packaged in shipping coolers on ice and under chain of custody for priority overnight shipping to the USACE contract laboratory Analytical Resources, Inc. via the Grant County Airport Fedex Station. Team 1 hand delivered the final three coolers directly to the laboratory at the conclusion of the sampling event.

All sample shipping coolers were prepared for laboratory delivery in the following manner: Each cooler was lined (sides and bottom) with plastic “bubble-wrap” sheets for shock absorption. A large 30-gallon plastic garbage bag was then placed into the cooler to contain the sample water in the event of container breakage during shipment to the laboratories. The glass sample vials were labeled, placed into plastic zip-seal bags, and placed into foam shipping blocks or bubble-wrap bags for shock protection. All the samples were placed in the shipping coolers as indicated on the corresponding chain of custody forms. Gallon size plastic zipper bags of cubed ice bags were placed between and on top of the samples in each cooler to ensure maintenance of the required four degrees centigrade (plus/minus two degrees) sample preservation temperature. The completed chain of custody (COC) forms were placed in gallon size plastic zipper bags and taped to the inside of each cooler lid. Two custody seals were affixed to the outside of each cooler. The custody seals were placed so that the coolers could not be opened without breaking the seals. Each cooler was then securely sealed with fiber tape. The field team ensured drain plugs were securely taped inside and out to prevent possible water leakage.

The laboratory was informed of the sample delivery and ensured the samples were properly accepted and checked in upon receipt the following morning after the sample containers were

shipped. All sample coolers and sample containers were accounted for at the contract laboratory following each shipment.

5.0 LABORATORY ANALYSIS

Chemical analyses performed on the samples were as follows: VOCs (Method 524.3).

6.0 DECONTAMINATION PROCEDURES

PDB weights, flow cells and associated tubing, water level indicator meters, and water volume measurement containers used by each team were decontaminated at the end of the project with an Alconox®-water solution followed by triple rinsing using distilled water in the USACE Geology Laboratory.

7.0 PROTECTION LEVEL

All sampling activities were conducted under Worker Protection Level D. For this project, personnel protective equipment included reflective safety vests, safety splash protection glasses, Nitrile gloves, and safety steel toe boots. New pairs of Nitrile gloves were donned prior to handling acid-preserved sample containers and between each unique private well sample point or monitoring well.

End of Field Sampling Report

APPENDIX A

Site and Well Location Maps
(Available in USACE Files)

APPENDIX B

Field Sampling Photos

Figure 1



Figure 2



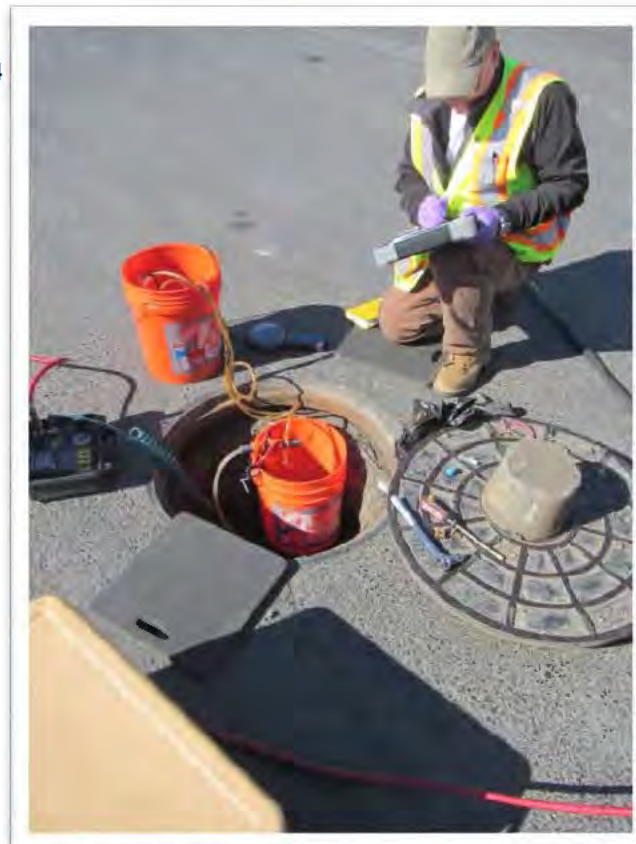
Well site 00BW04 showing installation of portable bladder pump for purging and sampling at this location.

Figure 3



USACE Team 3 is visible in background at well 04BW01 as Team 1 works at well 01BW01 in foreground.

Figure 4



Joseph Marsh shown recording water quality readings at subsurface vault mounted well 00BW14 in CDSI recycle center.

Photographer: Marsh/Gorham

Sheet 2 of 3



**US Army Corps
of Engineers**
Seattle District

Figure 5



Sally Gorham (right) looks on as a crew from the Moses Lake Wastewater Department collect compliance monitoring samples after USACE samples were collected at well MW-2.

Figure 6



Sheet 3 of 3

Burrowing rodent damage evident under concrete pad at monitoring well 91AW09.

Photographer: Joseph Marsh

APPENDIX C

Field Notes
(Micropurge Logs Available in
USACE Files)

SEATTLE DISTRICT, USACE
ENVIRONMENTAL SAMPLING
FIELD LOG BOOK
Project: MOSES LAKE WELLFIELDS
MONITORING WELL SAMPLING

BOOK 5



FY14
FY15

Rite in the Rain.
ALL-WEATHER
**ENVIRONMENTAL
FIELD BOOK**

Nº 550F

TEAM 1

Location Moses Lake, WA Date 5-4-2015 ThuProject / Client Moses Lake Wellfield Field Notes
Begin on MAY 2015 EVENT Pg: 95

Bladder Pump Wells

Groundwater Sampling Table

TEAM 1: Joseph Marsh, Sally Gerhan, Jake Williams

SAMPLE ID	(2015) DATE	TIME	VOC (5243) 3x401 VOA 2 Multi field
15MLW0504N99AW10	—	—	3 NO water
15MLW0504N99BW16	5-4	0915	3
15MLW0504N00BW09	5-4	1020	3
15MLW0504N00BW07	5-4	1206	3
15MLW0504N00BW04	5-4	1125	3
15MLW0505N01BW01	5-4	1344	3
15MLW0505N00BW05	5-5	1248	3
15MLW0505N00BW14	5-5	0927	3
15MLW0505N00BW01	5-5	0828	9 MS/MSD
15MLW0505D00BW01	5-5	0845	3 F.D.
15MLW0505NMW4	5-5	1034	3
15MLW0505NMW2	5-5	1122	3
15MLW0505TBO1	5-5	0800	2
15MLW0504N91AW14	5-4	1432	3

TBO1 prepared by Lab on 4-20-15 2 vials per F.D.

- This table represents COC 1 samples

shipped in cooler M3 on 5-5-2015

@ Grant County Airport FedEx Station.

Location _____ Date _____

Project / Client Moses Lake Wellfield Field Notes

Sample table continued

Bladder Pump Wells May 2015 event

SAMPLE ID	(2015) DATE	TIME	VOC (5243)	NOTES
15MLW0506N00BW12	5-6	0832	3	
15MLW0506D00BW12	5-6	0845	3	F.D.
15MLW0506N91AW16	5-6	0904	3	
15MLW0506N00BW03	5-6	0930	3	
15MLW0506N00BW02	5-6	1001	3	
15MLW0506N00BW11	5-6	1050	3	
15MLW0506N91AW15	5-6	1130	3	
15MLW0507N918W02	5-7	0844	9	MS/MSD
15MLW0507D91BW02	5-7	0900	3	F.D.
15MLW0507N00BW08	5-7	0928	3	
15MLW0507N00BW06	5-7	1003	3	
15MLW0507N91AW17	5-5	1402	3	
15MLW0507N99BW12	5-7	1114	3	
15MLW0507TBO2	5-7	0900	2	

TBO2 prepared by Lab on 4-20-15

- This table represents COC 2

Samples shipped in cooler M2

on 5-7-15 @ Grant County

Airport FedEx Station

Location _____ Date _____

Project / Client Moses Lake WellfieldSample table continued
May 2015 eventField
Notes
Begin on
Pg. 95

SAMPLE ID	(2015) DATE	TIME	VOCs (5243)	NOTES
15MLW0508N99BW15	5-8	0947	3	
15MLW0508N99AW08	5-8	0917	3	
15MLW0508N02BW02	5-8	0848	3	
15MLW0508N91AW08	5-8	1040	3	
15MLW0508N91BW03	5-8	1115	3	
15MLW0508N99BW01	5-8	1238	3	
15MLW0508N99AW01	5-8	1350	3	
15MLW0509N92BW01	5-9	0827	3	
15MLW0509N00AW11	5-9	0855	3	
15MLW0509N92BW02	5-9	0930	3	
15MLW0509N00BW15	5-9	1000	3	
15MLW0509N91BW04	5-9	1052	3	
15MLW0509N00BW13	5-9	1129	3	
15MLW0509FB92BW02	—	—	3 *	Field Blank
15MLW0509TB03	5-9	0930	2	

TB03 prepared by Lab on 4-20-15

-This table represents COC 3 samples
shipped in cooler MB21 on

* Field Blank not needed

Location _____ Date _____

Project / Client Moses Lake WellfieldSample table continued
May 2015 eventField
Notes Begin
on Page 95

SAMPLE ID	(2015) DATE	TIME	VOCs (5243)	NOTES
15MLW0510N99AW09	5-10	0830	3	
15MLW0510N99BW18	5-10	0807	3	
15MLW0510N00BW16	5-10	0920	3	
15MLW0510N00AW13	5-10	0953	3	
15MLW05 ⁰⁷ 10N99BW14	5-7	1305	3	out of Seq. order
15MLW05 ⁰⁷ 10N99BW09	5-7	1348	9	MS MSD
15MLW05 ⁰⁷ 10D99BW09	5-7	1400	3	FID
15MLW0510TB04	5-10	1000	2	

2 vials per Trip Blank, TB04 prepared
by Lab on 4-20-15-This table represents COC 4 samples
shipped in cooler M4 on 5-11-15
(Hand Delivery directly to ARI)

Location _____

Date _____

Field Notes

Begin on

Pg. 95

Project / Client

Moses Lake Wellfield

Sample Table Continued
Bladder Pump Team 1 May 2015 Event

SAMPLE ID	(2015) DATE	TIME	VOCs (5245)	NOTES
ISMLW05IIN99BW10	5-11	0844	9	MSD
ISMLW05IIN99BW11	5-11	1005	3	
ISMLW05IIN00BW10	5-11	0923	3	
ISMLW05IITB05	5-11	0810	2	

2 vials per trip Blank, TB05 prepared
by Lab on 4-20-15.

- This table represents COC5 samples
shipped in cooler ^{NO} number on 5-11-15
Hand-delivered

Location _____

Date _____

Project / Client

MOSES LAKE WELLFIELD

MAY 2015 EVENT

BLADDER PUMP TEAM 1 FIELD NOTES

Team: Joseph Marsh, Sally Gorham

0700 - calibrated flow cell, picked
up cubed ice at Safeway to keep
samples cool during day, - Mobilized
to NW corner of airport. Road blocked
- Static water level readings first on
→ contacted Greg Becker for access Thursday
0830 Setup @ 99BW16

micropurge to stabilization

0915 sample time, close lock well

1000 → Mob. to Genie Well 00BW09

Visitor badges picked up - well

Blocked by lifts! - walking

equipment in to sample well

Micropurge to stabilization

1020: sample time (Note: No static
Well ID tag) well closed + locked
checked out at Genie office -
Visitor badges removed

1041 Mob to 00BW04 - portable pump
installed - micropurge to stability

1125: sample time - minor turbidity
due to pump installation noted.

retrieve pump - close well covers

Handwritten text at the top left of the page.

Main body of handwritten text on the left page, consisting of several paragraphs.



Handwritten text at the top right of the page.

Main body of handwritten text on the right page, continuing from the left page.

Moses Lake Wellfield
May 2015 Sampling event
Field Notes

Lunch -

Mob. to 008W05

micropurge to stability
No issues.

1248 - Sample time, Close/lock well
Mob. to FedEx to ship
Cooler MB3. Note: shipping
time moved to 1400 hrs due to
Fedex break 1300-1400 hrs.

1323 - Mob to 91AW17 at city well 2)
X will replace missing padlock on
well casing (entered gate to
well with city key)
Micropurge to stabilization

1402 = sample collection time (samples placed
in cooler MB2)
close + lock well - padlock too
large for well cover - must bring
smaller padlock next time

1600 - end of Day.

Jim R. Hume

Moses Lake Wellfield
May 2015 Sampling event
Field Notes

- ~~Purchase~~ Purchase ice at Safeway.
- Calibrated flow cell

0800 - Meet with Greg Becken at
Port of Moses Lake airport office
setup @ 00BW12 - pre purging
Then micropurge to stabilization

0832 = Sample time - No issues.

0845 = FD Sample time - close/lock well
Mob to well 91AW16
prepurging, then Micropurge to stability

0904 = Sample time, Close/lock well.
(485 pad lock added - No lock at this well)

Mob. to 00BW03 - prepurging
Then Micropurge to stabilization.

0930 = Sample time, close + lock well
mob to 00BW02 opened well

Cover - 2 yellow jackets, inside - removed
pre purge + micropurge to stability

1001 = Sample time, close + ~~lock~~ lock well
Break → D.O. very low

setup @ 00BW11 - Micropurge to
stability sample time = 1050
close up - secure well, Mob. over
to 91AW15

May 1944 (continued)

[The text in this column is extremely faint and largely illegible. It appears to be a series of entries or notes, possibly organized in a list or table format, but the specific details cannot be discerned.]

[The text in this column is also extremely faint and largely illegible. It continues the series of entries or notes from the left column. Some words like "May 1944" and "continued" are visible at the top, suggesting it's a continuation of the same document. The text is organized in a similar fashion to the left column, with multiple lines of entries.]

(b) (6)

Field Notes cont.Mob. to 92BW02

micropurge to stability

0930 = Sample time, close-lock well

Mob. to 00BW15

micropurge to stability NSTR

1000 = Sample time, close/lock well

Mob. to 91BW04

micropurge to stability NSTR

1052 = Sample time close-lock well

Mob. to 00BW13pre-purge, then micropurge to
stability NSTR

1129 = Sample time, close + lock well

~~4-10-15~~ 5-10-15 Sundaycalibrated flow cell, add ice to
cooler setup @ well 99BW18

micropurge to stability - drawdown controlled

0807 = Sample time, close + lock well.

Mob. immediately west to adjacent well

99AW09 - micropurged to stability

0830 = Sample time, close + lock well.

mob. to DOT property wells:

setup @ 00BW16.Moses Lake WellfieldField Notes cont.

00BW16 micropurge to stability

0920 = Sample time, close + lock well

Mob. east to adjacent well 00BW13prepurging - Low SWL - need more
time to fill bladder pump.

micropurge to stability

0953 = Sample time close/lock well.

Done5-11-15

Buy 3 bags ice @ Safeway

calibrated flow cell

0820 = Set up @ 99BW10 - pre-purging

micropurge to stability

0844 = Sample time (P+MS/MSD) close-lock well

0900 = Mob. to well 00BW10 atchurch parking lot - welling good
condition, pre-purge, then micropurge
to stabilization.

0923 = Sample time, close/secure well

mob. to ~~00BW10~~ 99BW11To east of 99AW04 - (water level only)→ 99AW04 SWL = 40.63' to top of
PVC

Moses Lake Wellfield~~August 2015~~(on second New CO₂ bottle)99BW11 - pre-purge, then
Micro-purge to stabilization1005 - Sample time, close/secure both
wells on propertyprepping 3 sample coolers
for delivery direct to Lab.Returning 2 CO₂ bottles to OXARC

1130 - Depart Moses Lake for ARI -

~~81150~~ Analytical Lab in Tukwila,
WA

Project complete

Jm Rind

Project: Moser Lake Wellfield
Groundwater Sampling



Book 7

Rite in the Rain®
ALL-WEATHER
**ENVIRONMENTAL
FIELD BOOK**

Nº 550F

FY 15

MAY 2015 Thru

TEAM 2

CONTENTS

Location Moses Lake, WA

Date _____

Project / Client: MOSES Lake Wellfield

2015 May Private Well Sampling

Sample ID	2015 Date	Time	VOC	Notes
15MLW0503NWP14A1	05/03	1312	3	
15MLW0503NWP14B1	05/03	1312	3	
15MLW0503NWP14C1	05/03	1312	3	
15MLW0503NWP83A1	05/03	1354	3	
15MLW0503NWP83B1	05/03	1354	3	
15MLW0503NWP83C1	05/03	1354	3	
15MLW0503NWP82	05/03	1425	3	
15MLW0503NWP50	05/03	1451	3	
15MLW0504NWP149	05/04	0810	3	
15MLW0504NWP150	05/04	0840	3	
15MLW0504DWP150	05/04	0856	3	
15MLW0504NWP121A1	05/04	0910	3	
15MLW0504NWP122	05/04	0945	9	Ans/MSD
15MLW0504NWP127	05/04	1108	3	

Cooler # 1

Tracking #

Location Moses Lake, WA Date _____Project / Client Moses Lake WellfieldMay 2015 Private Well Sampling

Sample ID	Date	Time	VOC	Notes
- 15MLW0504NWP70A1	05/04	0944	3	
- 15MLW0504NWP70B1	05/04	0950	3	
- 15MLW0504NWP70C1	05/04	1000	9	MS/MSD
15MLW0504NWP70C1	05/04	1005	9	MS/MSD
15MLW0504NWP13E	05/04	1330	3	
15MLW0504NWP164	05/04	1310	3	
15MLW0504NWP175	05/04	1355	3	
15MLW0504NWP09	05/04	1420	3	
15MLW0504NWP62	05/04	1438	3	
15MLW0504NWP169	05/04	1510	3	
15MLW0504NWP25W	05/04	1615	3	
15MLW0504DWP25W	05/04	1620	3	
- 15MLW0505NWP86A1	05/05	0820	3	
- 15MLW0505DWP86A1	05/05	0833	3	
- 15MLW0505NWP86B1	05/05	0835	3	

Cooler # 2
Tracking #Location Moses Lake, WA Date _____Project / Client Moses Lake WellfieldMay 2015 Private Well Sampling

Sample ID	2015 Date	Time	VOC	Notes
- 15MLW0505NWP86A1	05/05	0830	3	
15MLW0505NWP167	05/05	0910	3	
15MLW0505NWP168	05/05	0933	3	
15MLW0505NWP45	05/05	0955	3	
15MLW0505NWP177	05/05	1017	3	
15MLW0505NWP178	05/05	1045	3	
15MLW0505NWP178	05/05			
15MLW0505NWP57	05/05	1120	9	
15MLW0505DWP57	05/05	1126	3	
15MLW0505NWP10	05/05	1320	3	
15MLW0505NWP145	05/05	1347	3	
15MLW0505NWP164	05/05	1412	3	
15MLW0505NWP144	05/05	1430	3	
15MLW0505NWP138	05/05	1513	3	
15MLW0505NWP139	05/05	1530	3	

Cooler # 3
Tracking #

Location MOSES Lake, WA Date _____Project / Client MOSES Lake WellfieldMAY 2015 PRIVATE WELL SAMPLING

SAMPLE ID	2015 DATE	TIME	VOC	NOTES
15MLW0506NWP143.	05/06	1945	3	
15MLW0506NWP127.	05/06	0850	3	
15MLW0506NWP128.	05/06	0910	3	
15MLW0506NWP191.	05/06	0950	3	
15MLW0506NWP147.	05/06	1010	3	
15MLW0506NWP148.	05/06	1025	3	
15MLW0506NWP131.	05/06	1125	9	MS/MS
15MLW0506NWP33.	05/06	1050	3	
15MLW0506NWP131.	05/06	1135	3	
15MLW0506NWP129A1.	05/06	1315	3	
15MLW0506NWP54.	05/06	1440	3	
15MLW0506NWP130.	05/06	1520	3	
15MLW0506NWP124A1.	05/06	1545	3	
15MLW0506NWP188.	05/06	1740	3	
15MLWD				

COOLER #
TRACKING#Location MOSES LAKE, WA Date _____Project / Client MOSES LAKE WELLFIELDMAY 2015 PRIVATE WELL SAMPLING

SAMPLE ID	2015 DATE	TIME	VOC	NOTES
15MLW0506NWP185	05/06	1730	3	
15MLW0506NWP185	05/06	1733	3	
15MLW0506NWP196	05/06	1800	3	
15MLW0507NWP105	05/07	0840	3	
15MLW0507NWP120	05/07	0900	3	
15MLW0507NWP122A	05/07	0946	3	
15MLW0507NWP123B1	05/07	0943	3	
15MLW0507NWP123C1	05/07	0946	3	
15MLW0507NWP125A1	05/07	1020	9	
15MLW0507NWP125B1	05/07	1023	3	
15MLW0507NWP125C1	05/07	1026	3	
15MLW0507NWP125A1	05/07	1029	3	
15MLW0507NWP66	05/07	1100	9	
15MLW0507NWP66	05/07	1105		
15MLW0507NWP128	05/07	1245	3	
15MLW0507NWP126	05/07	1305	3	

TB16

COOLER #
TRACKING#

10

Location MOSES LAKE, WA

Date

Project / Client MOSES LAKE WELLFIELDMAY 2015 PRIVATE WELL SAMPLING

SAMPLE ID	2015 DATE	TIME	VOL	NOTES
• 15MLW0507NWP66	05/07	1100	9	MS/MSD
• 15MLW0507DWP66	05/07	1105	3	
• 15MLW0507NWP137	05/07	1335	3	
• 15MLW0507NWP180	05/07	1400	3	
• 15MLW0507NWP04	05/07	1435	3	
• 15MLW0507EBNWP14	05/07	1446	3	
• 15MLW0507NWP179	05/07	1530	3	
• 15MLW0507NWP180	05/07	1540	3	
• 15MLW0507NWP152	05/07	1600	3	
TBIT				

COOLER #

TRACKING #

Location Mose Lake, WA Date 05/03/15 11Project / Client MLWMay 2015 Private WellsArrived WP-14 1242

Totalizer

0943599
Initial

0943609

Final

Time / Temp Purged 7 gal

0 18.6

2 18.7

4 18.5

6 18.7

SAMPLE time: 13:12

Arrived WP83 1320

Totalizer 1346019

1346029

Time Temp

Time / Temp

0 16.0

2 16.0

4 16.1

6 16.2

Sample time 1354

Location Moses Lake, WA Date 05/03/15Project / Client MLWMay 2015 Private WellsArrived at WP-82 (b) (6)

arrived 1414

Time	Temp
0	13.7
2	13.7
4	13.6
6	13.7

Purged 5 gal

Sample time 1425

Arrived at WP-50 at 1459

Time	Temp
0	14.7
2	14.6
4	14.5
6	14.6

Purged
8 gal

Sample time 1451

Location Moses LakeDate 05/04Project / Client MLWMay 2015 Private WellsArrived at WP-149

Time	Temp
0	16.2
2	15.6
4	15.8
6	16.3
8	16.1
10	16.1

Purged 10 gal

Sample was taken from
Sample time 0810Arrived at WP-190

Time	Temp
0	16.7
2	16.6
4	16.7
6	16.6

Less purged
because faucet
is low to ground.
Maybe 3 galSample time 0840
Duplicate 0856

Location Moses LakeDate 05/04Project / Client MLWMay 2015

Arrived at WP-121 0854
 totalizer 1375

Time	Temp
0	15.2
2	14.3
4	15.1
6	15.3

purged 8 gal

sample time 0910

Arrived at WP-70 0924
 totalizer 0166159

Time	Temp
0	15.0
2	14.9
4	14.9
6	15.0

Purged 2 gal

sampled all three ports

Sample time

A 0944 C1000 MS/MSD

B 0950 ~~PC1000~~Location Moses Lake WA Date 05/04Project / Client MLWMay 2015

Arrived at WP 122 1030

Time	Temp
0	14.4
2	14.8
4	14.9
6	15.0
8	15.0

purged
approx 1 galsample time
1045

Arrived at WP-127

Time	Temp
0	15.0 15.5
2	15.4
4	15.3
6	14.9
8	15.2

Purged
3 Gal.Sample
time
1108

note: white crystals
 deposited around spicket
 head,

16

Location Moses Lake, WA Date 05/04Project / Client MLWMay 2015Arrived at WP-164 at 1300

Time	Temp
0	16.7
2	16.7
4	16.7
6	16.7

Sample Time 1310

Arrived at WP-13E 1320

Time	Temp
0	14.4
2	14.3
4	14.3
6	14.3

purged
approximately
7 gal

No odors like we have smelled
in the past

Sample time 1330

17

Location Moses Lake, WA Date 05/04Project / Client MLWMay 2015Arrived at WP-175 1345

Time	Temp
0	14.0
2	14.0
4	14.0
6	14.0

Sample time 1355

Arrived at WP-09 1400

Time	Temp
0	13.2
2	13.4
4	13.3
6	13.4

purged
approx 8 gal

sample time 1420

Arrived WP-52 1425

Time	Temp
0	12.9
2	13.9
4	15.2
6	15.4

Time	Temp
8	15.2
10	15.4

sample Time
1435

Location Moses Lake WA Date 09/04Project / Client MLWMay 2015

Arrived at WP- 169 ¹⁶⁹ 1445 ¹⁵⁰⁰			
Time	Temp	Time	Temp
0	12.8	8	14.4
2	13.0	10	14.6
4	13.6	12	
10	14.1	14	

(b) (6)

Sample time 1517

Arrived WP-26W Deep well

No purge timer temp
 water came through small
 test hole John cut a fresh
 piece of hose for us

Sample time 16:15

Duplicate - 1620

Location _____ Date _____

Project / Client _____

Arrived at WP86 at 0800

Time	Temp
0	14.4
2	14.4
4	14.4
6	14.4

Totalizer 0355476

purge from front of
house

Sample Time A: 0820

B: 0825

C: 0830

AD: 0833

Arrived at WP-167 at 0853

Time	Temp
0	13.8
2	13.8
4	13.8
6	13.8

Sample time 0910

Arrived at WP-168 at 0920

	Time	Temp	
Water was	0	15.2	Purged
Warm at	2	15.2	about 5gal
first 17th	4	15.4	
	6	15.2	

Then after 6 min temp started dropping
Sample time 0933

Arrived at WP-45 at 0946

Time	Temp
0	15.0
2	15.0
4	15.0
6	15.0

Sample time 0955

Arrived at WP 177 1006

Time	Temp
0	14.1
2	14.2
4	14.1
6	14.1

Took sample from north west
corner of property where
owner requested (b) (6)
(b) (6)

Sample time 1017

Arrived at WP-178 1032

Time	Temp
0	15.0
2	13.5
4	13.6
6	

Water pressure fluctuates
and temperature

Took sample from the front
of house. Spigot closes to well.
purged approximately 5gal
after temp stabilized at 13.6

Sample time 1045

Arrived at WP-57 @ 1100

took sample from front
of house

Time	Temp
0	12.8
2	13.0
4	13.0
6	13.0

Sample time 1120

Arrived at WP-10 at 1300

	Time	Temp	
Collected from east side of bldg	0	14.1	
	2	15.6	purged 7 gal
	4	13.6	
	6	15.6	

Sample time 1320

Arrived at WP-145 1336

Time	Temp
0	13.3
2	13.3
4	13.3
6	

Sample was taken from ^{near} front
door

Sample time 1347

Arrived at WP-154 1357

Time	Temp
0	12.3
2	13.3
4	14.5
6	14.6
8	14.7
10	14.7

(b) (6)

Sample time 1412

Location _____ Date _____

Project / Client _____

WP-144 shares with neighbor
arrived 1424

	Time	Temp
purged about 5 gal	0	15.0
	2	15.0
	4	15.0
	6	15.0

Sample time 1430

WP-138 arrived at 1500

	Time	Temp
purged about 7 gal	0304	16.1
	2306	14.1
	4	14.1
	6	14.1

~~Arrived at~~ Sample 1513

WP-139 arrived at 1521

Time	Temp
0	14.8
2	14.8
4	14.7
6	14.7

Sample time
1530

Location _____ Date _____

Project / Client _____

arrived at WP-143 1534

	Time	Temp
water is	0	19.0
warm	2	18.3
could be	4	17.9
from exposed	6	16.1
pipe see photo		

Sample time
1545

purged 25 gal
because water
was still pretty
warm then
it levelled out at
18°C

Location _____ Date _____

Project / Client _____

Arrived at WP-27 at 0840

Time 0 | 2 | 4 | 6

Temp 15.1 | 15.1 | 15.2 | 15.2

purged about 2 gal
Sample time 0850

Arrived at WP-28 at 0858

Time 0 | 2 | 4 | 6

Temp 15.2 | 15.2 | 15.2 | 15.2

Sample time 0910

Arrived at WP-151 0930

Time 0 | 2 | 4 | 6

Temp 12.7 | 13.3 | 13.3 | 13.3

owner asked about neighbors
well being added. Also (b)(6)
instructed us to take a sample
(b)(6)

cumulative time 1950

Location _____ Date _____

Project / Client _____

Arrived at WP-147 1000

Time 0 | 2 | 4 | 6

Temp 15.4 | 15.4 | 15.2 | 15.2

Sample Time 1010

Arrived at WP-48 1017

Time 0 | 2 | 4 | 6

Temp 15.6 | 15.4 | 15.4 | 15.4

Sample Time 1025

Arrived at WP-33 1039

Time 0 | 2 | 4 | 6

Temp 13.7 | 13.9 | 13.9 | 13.9

purged about 5 gal
Sample Time 1050

Location _____

Date _____

Project / Client _____

Arrived at WP-131 at 1100

Time	0	2	4	6
Temp	15.6	15.7	15.6	15.7

(b) (6)

(b) (6)

August event

Water was really warm so
we purged 20 gal before starting
temp

Sample time 1125

Arrived at WP-129 at 1300

Time	0	2	4	6
Temp	13.7	13.4	13.6	13.6

purged 5 gal

Totalizer 41765

Sample time 1315

Location _____

Date _____

Project / Client _____

Arrived at WP-54 at 1440

Time	0	2	4	6
Temp	12.8	13.0	13.0	13.0

purged approx. 4 gal

Sample time: 1447

Arrived WP-130 at 1600

(b) (6)

RDE to sign.

Time	0	2	4	6
Temp	15.6	15.4	15.4	15.4

purged about 6 gal

Sample Time 1520

Arrived WP-124

Time	0	2	4	6
Temp	14.1	14.1	14.3	14.3

Totalizer 194176

Sample time 1545

Location _____ Date _____

Project / Client _____

WP-188 arrived at 0710

Time	0	2	4	6
Temp	14.2	14.4	14.4	14.9

Sample time 1530
Duplicate 1533

WP-18N arrived at 1536

Time	0	2	4	6
Temp	15.8	16.8	15.8	15.8

Sample time 1740

WP-166 arrived at 1750

Time	0	2	4	6
Temp	16.2	16.2	16.2	16.1

Sample time 1800

Location _____ Date _____

Project / Client _____

WP-65 arrived at 0800
owner requested that we
not sample and did not
explain why. We can try
to contact (b)(6) later or
sample next year?

WP-118 did not answer phone
gate is locked

WP-106 arrived at 0810

Time	0	2	4	6	8	10	12
Temp	13.0	14.1	14.6	15.3	15.1	15.1	

Sample time is 0840

WP-120 arrived at 0845

Time	0	2	4	6
Temp	14.8	14.8	14.8	14.8

Sample time: 0900

Location _____ Date _____

Project / Client _____

Arrived at WP-123 at 0910
 totalizer 35632

Time	0	2	4	6	8	10
TEMP	13.9	14.5	14.6	15.0	15.0	15.7

Sample time A 0940
 B 0943
 C 0946

Arrived at WP-125 at 1007

Time	0	2	4	6
Temp	13.6	13.6	13.6	13.6

Sample Time:

A 1030
 B 1023
 C 1026
 AD 1029

Location _____ Date _____

Project / Client _____

Arrived at WP-126 at 1053
 Time 0 2 4 6
 Temp 15.6 15.6 15.6

Water was running all morning so stabilized quickly

Sample Time 1100
 Duplicate 1105

Arrived at WP-128 at 1230
 time 0 2 4 6 8
 Temp 13.4 13.4 14.0 14.2 14.2
 Sample time 1245

Arrived at WP-126 at 1253

Time	0	2	4	6
Temp	12.1	12.2	13.8	Purged 10 gal

Temp fluct. until 15.7

10	12
15.5	15.4

Sample Time 1305

Location _____ Date _____

Project / Client _____

WP-137 arrived at 1326

Temp	0	2	4	6
Time	13.7	15.8	15.8	15.8

Sample time: 1335

seems like owner (b) (6) and (b) (6) will come back later to have them sign ROE

WP-68 arrived at 1345

Time	0	2	4	6	8
temp	14.3	14.4	15.2	15.2	15.2

Sample time 1400

WP-04 arrived at 1426

Time	0	2	4	6
Temp	16.1	16.1	16.1	16.1

Sample Time 1435

Location _____ Date _____

Project / Client _____

Equipment Blank for tubing was taken after WP-04 was sampled. 1/2 gal was run through here before it was collected

~~WP-15~~ MLW0507EB04 ^{MMW} Sample time 1446

WP-179 arrived at 1500 Spoke with owner of (b) (6) and (b) (6); said that the well is (b) (6)

Time	0	2	4	6
Temp	17.0	16.9	16.9	16.9

Sample Time: 1530

WP-180 will come back to get right of entry

Time	0	2	4	6
Temp	15.4	15.4	15.4	

Sample time 1540

Location _____

Date _____

Project / Client _____

WP-152 arrived at 1550

Time	0	2	4	6
Temp	17.8	17.8	17.8	17.8

Sample Time: 1600

~~WP-152~~

Project: Moses Lake Wellfield
Groundwater Sampling

Book 6



Rite in the Rain®
ALL-WEATHER
**ENVIRONMENTAL
FIELD BOOK**
No 550

FY 15 MAY 2015 Thru

TEAM 3

Location Moses Lake, WADate Project / Client Moses Lake Wellfield Superfund Site

Sampling Table

Well ID	Sample ID	Date (2015)	Sample	Notes
12BW03	ISMLW050412BW03A	04/05/04	P	
	ISMLW050412BW03B	0830	P	
12CW02	ISMLW050412CW02	04/05/04	P	
04BW07	ISMLW050404BW07	0905	P	
	ISMLW050404BW07	04/05/04	P	
04CW04	ISMLW050404CW04	0930	P	
	ISMLW050404CW04	0935	P	
04BW05	ISMLW050404BW05	05/04	P	
	ISMLW050404BW05	1015	P	
04CW02	ISMLW050404CW02	05/04	P	
	ISMLW050404CW02	1030	P	
04BW04	ISMLW050404BW04	05/04	P	
	ISMLW050404BW04	1050	P	
04CW01	ISMLW050404CW01	05/04	P	
	ISMLW050404CW01	1105	P	
04AW14	ISMLW050404AW14		P	(WL Aug)
04BW01	ISMLW050404BW01	05/04	P/m/m/MSD	
	ISMLW050404BW01	1300	P/m/m/MSD	05/04 1315 FD
04CW03	ISMLW050404CW03	05/04 1400	P	Tank Farm
04BW06	ISMLW050404BW06	05/04	P/m/m/MSD	
	ISMLW050404BW06	1425	P/m/m/MSD	
	ISMLW050404BW06		FD	
00AW12	ISMLW050500AW12	05/05	P	
	ISMLW050500AW12	0750	P	
91AW07	ISMLW0505091AW07	05/05	P/m/m/MSD	(WL Aug)
	ISMLW0505091AW07	0815	P/m/m/MSD	
	ISMLW0505091AW07	0805	FD	
12BW04	ISMLW050512BW04A	05/05	P	
	ISMLW050512BW04A	0830	P	
	ISMLW050512BW04B	0850	P	
	ISMLW050512BW04B	0855	P	
12CW03	ISMLW050512CW03	05/05	P	
	ISMLW050512CW03	0915	P	
04CW05	ISMLW050504CW05	05/05	P	
	ISMLW050504CW05	0950	P	
12BW07	ISMLW050512BW07	05/05	P	
	ISMLW050512BW07	1005	P	
12EX01	ISMLW050512EX01	05/05	P	
	ISMLW050512EX01	1015	P	

Location Moses LakeDate Project / Client m2 Wellfield

Sampling Table

Well ID	Sample ID	Date (2015)	Sample	Notes
04BW09	ISMLW050504BW09	05/05	P	
	ISMLW050504BW09	1115	P	
14BW03	ISMLW050514BW03	05/05	P	
	ISMLW050514BW03	1130	P	
14EX05	ISMLW050514EX05	05/05	P	
	ISMLW050514EX05	1150	P	
00AW14	ISMLW050500AW14	05/05	P	
	ISMLW050500AW14	1240	P	
12BW01	ISMLW050512BW01	05/05	P	
	ISMLW050512BW01	1305	P	
12BW05	ISMLW050612BW05	05/06	P	
	ISMLW050612BW05	0750	P	
12CW04	ISMLW050612CW04	05/06	P	
	ISMLW050612CW04	0805	P	
14BW01	ISMLW050614BW01	05/06	P	
	ISMLW050614BW01	0820	P	
14EX03	ISMLW050614EX03	05/06	P	
	ISMLW050614EX03	0840	P	
14EX04	ISMLW050614EX04	05/06	P	
	ISMLW050614EX04	0910	P	
14BW02	ISMLW050614BW02	05/06	P	
	ISMLW050614BW02	0920	P	
12CW05	ISMLW050612CW05	05/06	P	
	ISMLW050612CW05	1100	P	
12BW06	ISMLW050612BW06	05/06	P	
	ISMLW050612BW06	1025	P	
12EX02	ISMLW050612EX02	05/06	P/m/m/MSD	
	ISMLW050612EX02	1055	P/m/m/MSD	
	ISMLW050612EX02	1105	FD	
12BW08	ISMLW050612BW08	05/06	P	
	ISMLW050612BW08	1125	P	
12BW02	ISMLW050612BW02	05/06	P	
	ISMLW050612BW02	1150	P	
12CW01	ISMLW050612CW01	05/06	P	Large bits
	ISMLW050612CW01	1210	P	
02BW01	ISMLW050602BW01	05/06	P	
	ISMLW050602BW01	1335	P	
04CW07	ISMLW050604CW07A	05/06	P	
	ISMLW050604CW07A	1355	P	
	ISMLW050604CW07B	1400	P	
04CW08	ISMLW050604CW08	05/06	P/m/m/MSD	
	ISMLW050604CW08	1410	P/m/m/MSD	
	ISMLW050604CW08	1406	FD	
	ISMLW050604CW08	1455	FD	

Sampling Table (CONT.)

Well ID	Sample ID	Date (2015)	Sample	Notes
WP-165	15MLW0507NWP165 15MLW0507NWP165	5/7 1305	P	05
WP-155	15MLW0507NWP155 15MLW0507NWP155	5/7 1515	P	05
WP-03	15MLW0507NWP03 15MLW0507NWP03	5/7 0935	P	05
WP-69	15MLW0507NWP69 15MLW0507NWP69	5/7 1005	P	✓04
WP-111	15MLW0507NWP111 15MLW0507NWP111	5/7 1427	P	05
WP-116	15MLW0507NWP116 15MLW0507NWP116	7 may 0840	P	ms/msd 05
WP-123	15MLW0507NWP123A1 15MLW0507NWP123A1		P	Lead
	15MLW0507NWP123B1 15MLW0507NWP123B1		P	mid
	15MLW0507NWP123C1 15MLW0507NWP123C1		P	log
WP-125	15MLW0507NWP125A1 15MLW0507NWP125A1		P/ms/msd	Coal
	15MLW0507NWP125B1 15MLW0507NWP125B1		P	mid
	15MLW0507NWP125C1 15MLW0507NWP125C1		P	log
WP-126	15MLW0507NWP126 15MLW0507NWP126		P	
WP-136	15MLW0507NWP136 15MLW0507NWP136	5/7 1330	P	15
WP-172	15MLW0507NWP172 15MLW0507NWP172	5/7 1110	P	✓04
WP-71A	15MLW0507NWP71A 15MLW0507NWP71A	5/7 1048	P	✓04
WP-74	15MLW0507NWP74 15MLW0507NWP74	5/7 1355	P	05
WP-153	15MLW0507NWP153 15MLW0507NWP153	5/7 1447	P	05
WP-03	15MLW0507DWP03	5/7 0950	FD	05 75x3=225=5 45
PDB1	15MLW0507PDB01	5/7 1120	P	✓04
PDB2	15MLW0507PDB02	5/7 1148	P	✓04

Location

Date _____

Project / Client

Location Moses Lake, WA Date 04 May 15Project / Client Moses Lake Wellfield Superfund Site
Field Notes

WX: mostly clear, 39°F, sl breeze

Pers: Jason Vallarreal, David Sullivan

0630 Departed hotel. Bought a bag of ore, prepped gear for day

0755 Arr 12BW03. WL - 130.35'
Extracted 2 PDBs, collected samples, 2 PDBs ^{Replaced}
Closed & locked well. No unusual conditions.0850 12CW02. WL - 156.98'
Extracted PDB, collected samples, 0905. 1 PDB ^{Replaced}
Closed & locked. No unusual conditions.0925 04CW04. WL - 128.28'
Extracted PDB, collected samples, 0935. -
Closed & locked. No unusual conditions.0940 04BW07. WL - 127.65'
Extracted PDB, collected samples, 0950 -
Closed & locked. No unusual conditions.1005 04BW05. WL - 130.55'
Extracted PDB, collected samples, 1015. -
Closed & locked. No unusual conditions.1020 04CW02. WL - 160.25'
Extracted PDB. Black sludge on bag and string below bag. Photo. Collected samples, 1030.Location Moses Lake, WA Date 04 May 15Project / Client me Wellfield (cont.)1040 04BW04 WL - 137.73'
Extracted PDB, collected samples, 1050
Closed and locked. No unusual conditions.1055 04CW01 WL - 162.55'
Extracted PDB, collected samples, 1105
Closed and locked. No unusual conditions.1130 Returned to hotel to get paperwork
1150 Lunch1220 91AW14 WL - 123.10
Bladder pump installed. No PDB.
Contacted Karah Huskins, unable to get at
the marsh. Closed & locked well.1250 04BW01. WL - 67.20'
Extracted 2-300ml PDBs. Not on schedule
→ ms/msd/FD. changed labels, did the
well → ms etc. 1300 sample & time.
1315 FD time, no unusual conditions.
Closed well.1350 04CW03. WL - 146.35'
Extracted PDB, collected samples, 1400.
Closed and locked. No unusual conditions.1415 04BW06. WL - 106.35'
Extracted 2-300ml PDBs. Only need 1
since ms/msd/FD was collected at 04BW01.

Location Moses Lake, WADate 04 May 15Project / Client ML Wellfield (cont.)

- 1425 Sample time 043W06. No unusual conditions.
Closed + locked well.
- 1445 Prepped cooler for shipping
- 1520 Shipped 1 cooler via FedEx.
- 1540 Bought supplies at Safeway
- 1605 Returned to hotel
Prepped paperwork for next day, planned route, sent updates.
- 1710 End of day

Location Moses Lake, WADate 05 May 15Project / Client ML Wellfield (cont.)

- 0640 Departed hotel, stopped for ice at Safeway. Prepped ice bags.
- 0735 00AW12 - 79.70' - WL.
Extracted PDB. Collected samples. 0750
Closed and locked. No unusual cond.
- 0805 01AW07, WL - 90.75
Extracted 2-330 ml PDBs. Sample time
P/Ws / med: 0815 Sample time FA: 0830
Replaced over large leak
Closed and locked well. Nothing unusual.
- 0835 12BW04, WL - 100.52
Extracted 2 PDBs. Sample time:
A - 0850, B - 0855
Deployed 2 new PDBs. Nothing unusual, closed + locked well.
- 0905 12CW03, WL - 109.25
Extracted PDB. Time: 0915
Replaced 1 PDB. Nothing unusual
Closed + locked well.
- 0940 04CW05, WL - 100.25
Extracted PDB. Collected samples. 0950
Replaced 1 PDB. Nothing unusual.
Closed and locked well.

Location Moses Lake, WA Date 05 May 15Project / Client MC Wellfield (cont.)

- 1010 12BW07. WL-89.78'
 Extracted 1 PDB. collected samples. 1025.
 Added 2 weights to anchor line. Installed 2-
 330 ml PDBs. Nothing unusual. Closed
 and locked well.
- 1035 12EX01. WL-89.75'
 Extracted 1 PDB. collected samples. 1045.
 String, sleeve, weights coated with rust from
 steel riser. Installed sleeves on 2-330 ml
 PDBs and re-installed in well. Closed &
 locked well.
- 1100 04BW09. WL-85.45'
 Extracted 1 PDB. collected samples. 1115.
 Installed 1 PDB. Nothing unusual.
 Replaced O-ring on cover.
- 1120 14BW03. WL-87.77'
 Extracted 1 PDB. collected samples. 1130
 Installed 1 PDB. Nothing unusual.
 closed & locked well.
- 1135 14EX05. WL-87.70'
 Extracted 1 PDB. collected samples. 1150.
 Placed sleeve on PDB and installed in
 well. Nothing unusual. Closed and locked
 well.

Location Moses Lake, WA Date 05 May 15Project / Client MC Wellfield (cont.)

- 1150 Handed off supplies to Team 2.
- 1200 Lunch
- 1230 00AW14. WL-84.33'
 Extracted PDB. collected samples. 1240.
 Closed & locked well. Nothing unusual.
- 1250 12BW01. WL-85.10'
 Extracted PDB. collected samples. 1305
 Closed & locked well. Nothing unusual.
- 1315 Prepped cooler for shipping
- 1400 Shipped 1 cooler via FedEx
- 1435 Returned to hotel
 Prepped paperwork and maps for next
 day, planned route, sent updates
- 1545 End of day

Done

Location Moses Lake, WADate 06 May 15Project / Client ML Wellfield (cont.)

0650 Departed hotel. Muddy, 42°F, breezy.
Bought ice at Safeway, bagged ice
for coolers.

0730 12BW05, WL - 90.70'
Extracted PDB, collected samples. 0750.
Replaced 1 PDB. Nothing unusual.
Closed + locked well.

0755 12CW04, WL - 102.55'
Extracted PDB, collected samples. 0805
Installed 1 PDB. Nothing unusual.
Closed + locked well.

0810 14BW01, WL - 96.00'
Extracted PDB, collected samples. 0820
Installed 1 PDB. Nothing unusual.
Closed + locked well.

0825 14EX03, WL - 96.25'
Extracted PDB, collected samples. 0840
Installed 1 PDB. Nothing unusual.

0900 14EX04, WL - 109.23'
Extracted PDB, collected samples. 0910
Installed 1 PDB. Nothing unusual.

0915 14BW02, WL - 109.00'
Extracted PDB, collected samples. 0920
Installed 1 PDB. Nothing unusual.

Location Moses Lake, WADate 06 May 15Project / Client ML Wellfield (cont.)

0950 12CW05, Lots of water inside flush
mount. Cap not seated properly. Photo.
WL - 144.50'

Extracted PDB, collected samples. 1000
Installed 1 PDB. Nothing unusual.
Closed flush mount well.

1020 12BW06, standing water in flush
mount, photo. WL - 119.33'

Extracted PDB, collected samples. 1025
Installed 1 PDB. Nothing unusual.
Closed flush mount well.

1040 12EX02, standing water in flush
mount, photo. WL - 121.92'

Extracted 2-330 ml PDB. Sample time
P/W/MSD: 1055. F/O: 1105
Installed 1 PDB. Nothing unusual.
Closed flush mount.

1115 12BW08, standing water in flush
mount, WL - 121.80'

Extracted 2-330 ml PDB. Sample time: 1125
Installed 1 PDB. Nothing unusual.
Closed flush mount.

Location Moses Lake, WADate 06 May 15Project / Client ML Wellfield (cont.)

- 1135 12BW02, WL - 119.28, No water in flush mount. Extracted PDB, collected samples. Time: 1150. Nothing unusual. Installed 1 PDB. Closed flush mount well.
- 1200 12CW01, WL - 139.72. No water in flush mount. Extracted PDB, collected samples. Time: 1210. No bolts securing cover; takes large bolts. Installed 1 PDB, closed flush mount well.
- 1225 Lunch.
- 1255 Packed cooler for shipping. Shipped 1 cooler via FedEx.
- 1322 02BW01, WL - 135.23. Opened flush mount, no water inside. Extracted PDB, collected samples. 1335. Nothing unusual. Closed flush mount.
- 1350 04CW07, WL - 150.70'. Extracted 2 PDB, A+B, collected samples. A: 1355, B: 1400. Nothing unusual. Installed 2 PDBs for A and B. Closed and locked well.
- 1425 04CW08, WL - 151.83'. Flush mount well. Extracted 2-330 and PDBs. Collected samples.

Location Moses Lake, WADate 06 May 15Project / Client ML Wellfield (cont.)

- Time P/mo/wed: 1440. Time FD: 1455
Installed 1 ~~PDB~~ PDB. Nothing unusual noted. Closed flush mount well.
- 1535 Returned to hotel.
Prepped paperwork and maps for next day, planned route, sent updates.
- 1650 End of day

APR

Location Moses Lake, WA
Project / Client MR Wellfield (cont.)

Date 07 May 15

- 0745 Departed hotel. Bought ice at Safeway, bagged ice.
- 0816 WP-116 - Talked to homeowner, (b) (6) and questions re results timing. Went to sample pt per instructions. Purge 13 min, temp stable w/ well pump running at 11.8°C. Purged 3 gals. Collected w/ wsd. 0840
- 0916 WP-03, Talked to homeowner. Sampled at faucet (b) (6). Purged for 10 min. T stable @ 14.6°C. Purged 2.5 gal. Sample time: P-0935. FD-0950
- 0950 WP-69. Talked to homeowner. Sampled at faucet (b) (6). Pre-purged w/ 10 gal, for 10 min. T stable @ 15.5°C. Sample time 1005.
- 1016 WP-74. No answer at door, left door tag. Unable to find location, (b) (6)
- 1033 WP-71A. No answer at door. Left door tag + photo. Pre-purged 10 min @ 2 gpm. T stable @ 13.5°C. Sample time. 1048
- 1055 WP-172. Found homeowner (b) (6) in sideyard. Pre-purged 10 min @ 2 gpm. T stable @ 15.3°C. Sample time. 1110.

Location Moses Lake, WA

Date _____

Project / Client MR Wellfield (cont.)

- 1130 Went to FedEx. Prepped cooler for shipping. Re-lined cooler. Took PDB samples, added to cooler.
- 1210 Shopped 1 cooler via FedEx
- #1215 Lunch.
- 1245 WP-165, Talked to owner at (b) (6). Said getting to valve in pump house was tough. (b) (6) is right! Valve is behind expansion tank. Connected PVC pipe to elbow outside house, turned valve a bit purged back sample. T = 14.3°C. Sample time 1305.
- 1315 WP-136. No answer. Left tag. Photo. Pre-purged 10 min @ 2 gpm. T stable at 14.9°C. Sample time. 1330.
- 1335 WP-74 take 2. Found homeowner in (b) (6). Said we could use the pump house in (b) (6) to get samples. Could not get water. Found a spigot (b) (6) in (b) (6). Photos. Pre-purged 10 min @ 3 gpm.

Location Moses Lake, WA Date 7 May 15
 Project / Client Mr. Wellfield (cont)

WP-111
 1410 T stable @ 15.2°C. Sample time, 1355
WP-111
 1410 WP-111. Talked to homeowner, (b) (6) let us into the wellhouse. (b) (6)
 There is a faucet on the floor, but need a hose - even then we would (b) (6)
 (b) (6) Used faucet (b) (6)
 (b) (6)

Pre-purged for 10 min @ 3 gpm.
 T stable @ 16.3°C. Sample time - 1427
 1432 WP-153. Talked to the homeowner. (b) (6)
 Sample point
 Pre-purged 10 min @ 3 gpm. T stable @ 15.3°C. Sample time 1447.

1500 WP-155. Talked to homeowner. Pointed out sample point. Spigot (b) (6)
 at 50' for pump. Pre-purged 10 min @ 2 gpm.
 T stable @ 15.9°C. Sample time: 1515

1520 71-B. Went to (b) (6), the (b) (6) there said (b) (6) no longer has the key the (b) (6) (b) (6)
 (b) (6) now control the key for the wellhouse on the property.
 No one home at (b) (6)

Location Moses Lake, WA Date 7 May 15
 Project / Client Mr. Wellfield (cont)

~~left~~ Called (b) (6) (b) (6) said that (b) (6) still has the keys. I declined to get involved in a "he said, he said" battle. The sampling will not be done this time. (b) (6) also said that once (b) (6) gets the keys, (b) (6) will put a lockbox on the pump house and give us the combination. (b) (6)
 (b) (6)