



FINAL
Corrected Copy

November 2016

Summary Report Groundwater Sampling for Perfluorinated Compounds Hanger 5 and Areas 16 and 31

NAS Whidbey
Oak Harbor, Washington

Department of the Navy
Naval Facilities Engineering Command Northwest
1101 Tautog Circle
Silverdale, WA 98315

Contract No. N62473-12-D-2012, CTO JP02



**Summary Report
Groundwater Sampling for Perfluorinated Compounds
Hangar 5 and Areas 16 and 31
Oak Harbor, Washington**

April 2016

**Prepared for
Naval Facilities Engineering Command Northwest
1101 Tautog Circle
Silverdale, Washington**

**Prepared by
MMEC Group
9177 Sky Park Court
San Diego, CA 92123**

**Prepared under
U.S. Navy Contract No. N62473-12-D-2012
Task Order JP02
Document Control Number MMEC-2012-JP02-0010**

Approval Signatures:



Kevin Olness/MMEC Group Project Manager

4/14/16

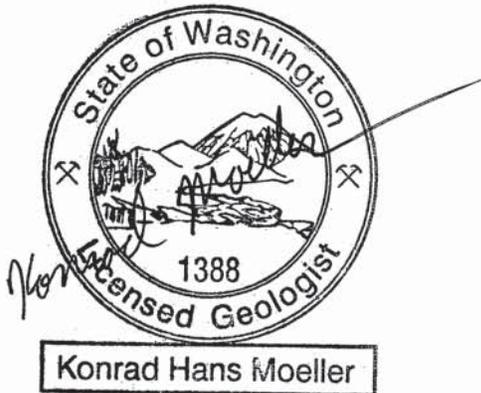
Date



Konrad H. Moeller, L.G. #1388/Senior Geologist

4/14/16

Date



EXECUTIVE SUMMARY

This Summary Report for groundwater sampling conducted at Hangar 5, Area 16, and Area 31 at Naval Air Station (NAS) Whidbey Island in September 2015 has been prepared by the Multimedia Environmental Compliance Group (MMEC Group), which comprises joint venture members Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) and KMEA. Work was conducted under the United States Department of the Navy (Navy), Naval Facilities Engineering Command Southwest (NAVFAC SW) Contract Number N62473-12-D-2012, Contract Task Order (CTO) Number JP02. Field activities followed Addendum #1 to the Final Sampling and Analysis Plan (SAP), Groundwater Sampling, Hangar 5 and Areas 16 and 31, Oak Harbor, Washington (Document Control Number [DCN] MMEC-2012-JP02-0004).

The work conducted included groundwater collection and analysis for perfluorinated compounds (PFCs), specifically perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), at Hangar 5 and Areas 16 and 31. Groundwater was sampled from five monitoring wells within these three areas in September 2015. The objective of this report is to summarize the results of the groundwater sampling event to evaluate the presence of PFCs in groundwater at NAS Whidbey Island.

TABLE OF CONTENTS

| | Page |
|--|-------------|
| EXECUTIVE SUMMARY | I |
| ACRONYMS AND ABBREVIATIONS..... | V |
| 1.0 INTRODUCTION..... | 1 |
| 1.1 SITE DESCRIPTIONS | 1 |
| 1.1.1 Hangar 5..... | 1 |
| 1.1.2 Area 16..... | 2 |
| 1.1.3 Area 31 | 2 |
| 1.2 SAMPLING RATIONALE..... | 3 |
| 1.2.1 Hangar 5..... | 3 |
| 1.2.2 Area 16..... | 3 |
| 1.2.3 Area 31 | 4 |
| 2.0 GROUNDWATER GAUGING AND SAMPLING PROCEDURES..... | 5 |
| 2.1 GROUNDWATER LEVELS..... | 5 |
| 2.2 GROUNDWATER SAMPLING METHODOLOGY..... | 5 |
| 3.0 ANALYTICAL RESULTS..... | 7 |
| 3.1 HANGAR 5..... | 7 |
| 3.2 AREA 16..... | 7 |
| 3.3 AREA 31..... | 7 |
| 4.0 DECONTAMINATION AND WASTE DISPOSAL..... | 9 |
| 5.0 DATA QUALITY REVIEW | 11 |
| 6.0 SUMMARY AND CONCLUSIONS..... | 13 |
| 7.0 REFERENCES..... | 15 |

FIGURES

| | | |
|----------|--|----|
| Figure 1 | Hangar 5, Area 16, and Area 31 Locations..... | 25 |
| Figure 2 | Well Locations and PFOA and PFOS in Groundwater – Hangar 5 Area, September 2015 | 27 |
| Figure 3 | Well Locations and PFOA and PFOS in Groundwater – Area 16, September 2015 | 29 |
| Figure 4 | Well Locations and PFOA and PFOS in Groundwater – Area 31, September 2015 | 31 |

TABLES

| | | |
|---------|--|----|
| Table 1 | Monitoring Well Locations..... | 19 |
| Table 2 | Monitoring Well Construction and Water Levels, September 2015..... | 20 |
| Table 3 | In-situ Water Quality Parameters, September 2015 | 21 |
| Table 4 | PFOA and PFOS Laboratory Analysis, September 2015..... | 22 |

ATTACHMENTS

Attachment 1 Purge Logs

Attachment 2 Laboratory Analytical Report (Included on CD)

Attachment 3 Data Validation Report (Included on CD)

ACRONYMS AND ABBREVIATIONS

| | |
|---------------------|--|
| µg/L | micrograms per liter |
| AFFF | aqueous film forming foam |
| Amec Foster Wheeler | Amec Foster Wheeler Environment & Infrastructure, Inc. |
| AST | above ground storage tank |
| AVGAS | aviation gasoline |
| bgs | below ground surface |
| CTO | Contract Task Order |
| DCN | document control number |
| Degree C | degree Celsius |
| DO | dissolved oxygen |
| DoD | United States Department of Defense |
| DOT | United States Department of Transportation |
| DTW | depth to water |
| EPA | United States Environmental Protection Agency |
| FD | field duplicate |
| ft btoc | feet below top of casing |
| ft bgs | feet below ground surface |
| HDPE | high-density polyethelene |
| JP-5 | jet propellant 5 |
| MDL | method detection limit |
| mg/L | milligrams per liter |
| mL/min | milliliter per minute |
| MMEC Group | Multimedia Environmental Compliance Group |
| mV | microvolts |
| mS/cm | millisiemens per centimeter |
| NAS | Naval Air Station |
| NAVFAC NW | Naval Facilities Engineering Command Northwest |
| NAVFAC SW | Naval Facilities Engineering Command Southwest |
| Navy | United States Department of the Navy |
| NTU | nephelometric turbidity unit |
| ORP | oxygen-reduction potential |
| PFC | perfluorinated compound |
| PFOA | perfluorooctanoic acid |
| PFOS | perfluorooctane sulfonate |
| PHA | Provisional Health Advisory |
| PVC | polyvinyl chloride |

ACRONYMS AND ABBREVIATIONS (continued)

| | |
|-----|------------------------------|
| QC | quality control |
| QSM | Quality Systems Manual |
| SAP | Sampling and Analysis Plan |
| SOP | standard operating procedure |
| SU | standard unit |
| TOC | top of casing |
| UST | underground storage tank |

1.0 INTRODUCTION

Perfluorinated compounds (PFCs) are a class of synthetic fluorinated chemicals used in many industrial and consumer products, including firefighting foams such as aqueous film forming foam (AFFF). From the early 1970s until 2002, the United States Department of Defense (DoD) purchased and used AFFF containing perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) to extinguish petroleum fires, conduct firefighting training, and use in fire suppression systems. PFCs may have migrated to groundwater in areas where AFFF was stored, handled, used, or released during these activities.

In 2009, the United States Environmental Protection Agency (EPA) Office of Water issued Provisional Health Advisories (PHAs) for PFOS and PFOA to protect humans from potential risk of exposure through drinking water (EPA, 2009). PHAs represent reasonable, health-based hazard concentrations above which action should be taken to reduce exposure to these contaminants in drinking water. Per the EPA, PHAs are not construed as legally enforceable federal standards and are subject to change as new information becomes available (EPA, 2012). Currently there are no established regulatory limits for PFCs in water for the State of Washington.

1.1 SITE DESCRIPTIONS

Three areas where AFFF may have been stored, handled, or released at Naval Air Station (NAS) Whidbey Island include Hangar 5, and Areas 16, and 31. Descriptions of each site follow.

1.1.1 Hangar 5

Hangar 5 is located in the western portion of the installation along the flight line (Figure 1).

The sources of potential PFC impacts to groundwater at Hangar 5 are assumed to be from incidental spills and leaks related to storage and handling of AFFF at Hangar 5. In this task, areas of Hangar 5 were identified where sump pumps, recovery tanks, or storage areas were used to collect and store AFFF. The AFFF system at Hangar 5 consists of two above ground storage tanks (ASTs) located outside the building near the western wall (Figure 2). A 10-inch diameter pipe runs from the ASTs below ground to the central portion of Hangar 5 where Fire Suppression Valve Rooms connect to below-ground piping laid in trenches in the hangar floor. There are two fire suppression valve rooms in the central portion of each hangar bay and also one on the southern exterior wall. The trenches are covered with grates that cover the AFFF piping and also appear to serve as drains for surface water, which presumably drips off equipment and airplanes stored in the hangar bays. Each hangar bay has five rows of AFFF piping that are approximately 50 feet apart. Each row of AFFF piping has five Viking Grate Nozzles visible at the floor surface for a total of 25 nozzles in each hangar

bay. Therefore, a total of 50 fire suppression nozzles service the two bays inside Hangar 5.

The surface of the investigation area at Hangar 5 is concrete paved and flat. The purpose of the sampling effort is to assess potential PFC (PFOS and PFOA) impacts to groundwater from incidental spills and leaks during storage of AFFF at Hangar 5.

1.1.2 Area 16

Area 16 comprises the eastern portion of Ault Field Runway Ditches, including the flight line area and the onsite drainage areas through Clover Valley (Figure 1). The Ault Field Runway Ditches consist of approximately 9 miles of connected ditches and 1 mile of culverts that drain the runway area and receive discharge from many of the station's storm drains. Most of the ditches eventually connect with the Clover Valley Stream, which flows east toward the Clover Valley Lagoon and Dugualla Bay (United States Navy [Navy], 1995).

The purpose of the sampling effort is to assess potential PFC (PFOS and PFOA) impacts to groundwater from infiltration of surface water discharged from the ditch network that may have contained PFCs from incidental spills and leakage of AFFF at Ault Field. Historical information does not indicate sumps pumps, storage tanks, or piping associated with AFFF was present at Area 16. There is potential surface water or stormwater run-off from the airfield where AFFF may have been discharged from fire training or emergency activities could have migrated to the drainage ditch network and impacted groundwater at Area 16. Groundwater sampling was performed for PFOS and PFOA to assess this potential.

1.1.3 Area 31

Area 31, Former Runway Fire Training School, is located approximately 400 yards northeast of the intersection of Runways 13-31 and 7-25 (Figure 1). Area 31 was used for firefighting training from 1967 to 1982. Waste fuels such as aviation gasoline (AVGAS) and jet propellant 5 (JP-5), waste oil, solvents, thinners, and other flammable materials were ignited and extinguished in a shallow concrete burn pad. The entire area encompasses 1 to 2 acres, sloping gently southwest. The burn pad, roughly 50 feet by 50 feet, consists of a retaining lip around the perimeter and a floor that slopes toward a drain in the center. A mixture of flammable liquids used for firefighting training was stored in an underground storage tank (UST) in the southeastern corner of the area, approximately 175 feet from the burn pad. Oily water from the burn pad was drained through underground piping to an oil/water separator in the southwestern corner of the drill area, approximately 200 feet from the burn pad. After water was separated from floating product in the oil/water separator, it was discharged to a small earthen ditch that led to a depression in the southwestern portion of Area 31 and subsequently drained to the runway ditches. The remains of some of the materials burned on the pad were removed from the pad and piled in various areas on or near the perimeter of the training area. The piles consisted of ash and metal debris, including landing gear components

and other aircraft parts (Navy, 2004). The potential sources of PFCs (PFOS and PFOA) in groundwater at Area 31 are from potential use of AFFF during firefighting training, and incidental spills and leaks related to storage and handling of AFFF during firefighting activities. AFFF may also have drained to the oil/water separator and flowed into the ditch that drained the runways. Historical information does not indicate sumps pumps, storage tanks, or piping associated with AFFF was present at Area 31 but AFFF was likely handled on site as part of the fire training activities.

The purpose of groundwater sampling at Area 31 is to assess potential impacts from PFCs (PFOA and PFOS) from potential use of AFFF during historical firefighting training activities.

1.2 SAMPLING RATIONALE

Monitoring wells in the Hangar 5 area, Area 16, and Area 31 have been installed as part of numerous investigations since 1992. The specific sampling locations and rationale for location selection are described in Sections 1.2.1 through 1.2.3.

1.2.1 Hangar 5

Given that the investigation area is approximately 200 feet from Hangar 5, groundwater is the most likely medium to transport constituents beneath the hangar. Therefore, groundwater monitoring wells were selected on the basis of varying potential groundwater flow patterns based on historical information (Navy, 1994).

Monitoring wells H5-MW-1 and H5-MW-3 (Table 1) are shown on Figure 2. These locations were selected to provide spatial coverage of the investigation area near Hangar 5.

During the planning phase of this investigation, monitoring well H5-MW-1 was selected because it is closest to Hangar 5 and monitoring well H5-MW-3 was selected to provide a monitoring point to the northeast in the event that groundwater flow was to the north or east.

Based on the groundwater flow evaluation conducted as part of this task order, apparent groundwater flow is to the southeast. Therefore, the groundwater sampling locations selected near Hangar 5 would potentially capture any historical releases of PFCs that occurred north to northwest of Hangar 5.

1.2.2 Area 16

Groundwater samples for PFOA and PFOS analysis were to be collected from monitoring well 16-26A in accordance with SAP Addendum #1 (MMEC Group, 2015). However, during the field work, monitoring well 16-26A could not be located because of tall vegetation in the area. A location was identified that appeared to be an abandoned well, which was likely monitoring well 16-26A. Historical records in the 2004 Final Five-Year Review (Navy, 2004) further confirmed that monitoring well 16-26A was properly

abandoned in April 2000 (Navy, 2000). Therefore, groundwater sampling in Area 16 was conducted at monitoring well 16-26B, which is located approximately 10 feet northeast of monitoring well 16-26A, according to geographical surveying coordinates (Navy, 1994). Monitoring well 16-26B is located east of the taxiway and hangars and would be most likely to capture PFC contamination in groundwater if a release of AFFF occurred along the taxiway and hangars. Monitoring well 16-26A had a total depth of 35.5 feet, screened from 25.5 to 35.5 feet below ground surface (bgs), while monitoring well 16-26B has a total depth of 67.6 feet, screened from 62.3 to 67.3 feet bgs (Navy, 1994) (Figure 3).

1.2.3 Area 31

Groundwater samples were collected in Area 31 from monitoring wells MW31-7A and MW31-9A (Figure 4) and analyzed for PFOA and PFOS.

Monitoring well MW31-7A was selected because of its proximity to the historical burn pad that was previously used at Area 31. It is likely that AFFF was used during training exercises at the burn pad and monitoring well MW31-7A is the closest monitoring well to the burn pad that would capture potential PFC contamination in shallow groundwater.

Monitoring well MW31-9A was selected because of its proximity to the historical oil/water separator at Area 31. Fluids from the burn pad were historically transferred to the oil/water separator from the burn pad. If a release occurred from the oil/water separator, it potentially could have contained residual AFFF used at the burn pad. Monitoring well MW31-9A is the closest well to the historical oil/water separator location and it is the most likely to capture potential PFC contamination in groundwater.

2.0 GROUNDWATER GAUGING AND SAMPLING PROCEDURES

2.1 GROUNDWATER LEVELS

The depth to water (DTW) was measured from the top of casing (TOC) in each monitoring well prior to the start of purging. Measured DTW ranged from above ground surface (monitoring well 16-26B) to 20.64 feet bgs. These data are presented in Table 2.

2.2 GROUNDWATER SAMPLING METHODOLOGY

Groundwater sampling during this sampling event was conducted by MMEC Group field personnel in accordance with the procedures outlined in Addendum #1 to the Final SAP (MMEC Group, 2015). All monitoring wells at Hangar 5 and Area 31 were purged using low-flow purging methods. A peristaltic pump with silicone high-density polyethylene (HDPE) tubing was used to sample wells at Hangar 5 and Area 31. In general, the pump intake for both shallow wells and deep wells was at the approximate center of the well screen. The depth of the screened interval for each well is summarized in Table 2. Wells were purged using a low-flow methodology that withdrew groundwater at a flow rate of approximately 150 to 250 milliliters per minute (mL/min). Water quality parameters, including pH, conductivity, temperature, oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity, were measured at 3- to 5-minute intervals during purging. Wells were purged until water quality parameters were stable. In-situ measured water quality parameters are shown in Table 3. Field logs showing the water quality measurements and volume of water purged are included in Attachment 1.

Monitoring well 16-26B was identified as an artesian well during the September 2015 sampling event. To sample groundwater from this well, a polyvinyl chloride (PVC) cap with a valve threaded into the top was sealed onto the top of the well casing. Tubing was attached to the valve piece, and three well volumes of groundwater were purged before the sample was collected. Monitoring well 16-26B yielded flow of approximately 900 mL/min during the sampling.

According to Naval Facilities Engineering Command Northwest (NAVFAC NW) Standard Operating Procedure (SOP) I-C-5 and specific SOPs for PFC, groundwater samples were analyzed using the following methods:

- EPA Method 537 Modified (PFOA)
- EPA Method 537 Modified (PFOS)

Screening levels for PFOA and PFOS for groundwater are based on EPA PHA for public drinking water (EPA, 2009) and are specified in Table 4.

3.0 ANALYTICAL RESULTS

All groundwater samples were analyzed for PFOA and PFOS by EPA Method 537 Modified. The laboratory reports summarizing the results of the analytical testing and quality control measures are included in Attachment 2. The analytical results for the September 2015 sampling event are summarized in Table 4 and Figure 2 through Figure 4. Discussions of analytical results for each area are provided in Sections 3.1 through 3.3.

3.1 HANGAR 5

PFOA and PFOS were detected in monitoring wells H5-MW-1 and H5-MW-3. Detected PFOA concentrations ranged from 0.003 micrograms per liter ($\mu\text{g/L}$) (H5-MW-3-091715) to 0.007 $\mu\text{g/L}$ (H5-MW-1-091715). Detected PFOS concentrations ranged from 0.004 $\mu\text{g/L}$ (H5-MW-3-091715) to 0.035 $\mu\text{g/L}$ (H5-MW-1-091715). The maximum PFOA and PFOS concentrations detected in the Hangar 5 area monitoring wells were below PHA screening levels.

3.2 AREA 16

PFOA and PFOS were analyzed in groundwater samples from monitoring well 16-26B in Area 16. Neither PFOA nor PFOS was detected at concentrations above the method detection limit (MDL) of 0.004 $\mu\text{g/L}$ in the groundwater samples collected.

3.3 AREA 31

PFOA and PFOS were analyzed in groundwater samples taken from monitoring wells MW31-7A and MW31-9A. PFOA concentrations in monitoring wells MW31-7A and MW31-9A were measured at 58.5 $\mu\text{g/L}$ and 26.1 $\mu\text{g/L}$, respectively. PFOS concentrations in monitoring wells MW31-7A and MW31-9A were measured at 0.422 $\mu\text{g/L}$ and 2.37 $\mu\text{g/L}$, respectively. PFOA and PFOS concentrations detected in both monitoring wells exceeded the PHA screening levels.

4.0 DECONTAMINATION AND WASTE DISPOSAL

The silicone HDPE tubing used on the peristaltic pump was replaced with new tubing between sample collections at each well. The water level meter was decontaminated using a three-step wash, which consisted of a bucket wash with a Liqui-Nox® detergent solution, followed by a potable water rinse, and then a final rinse with deionized water. Water used for the final rinse during decontamination of sampling equipment was laboratory-certified “PFC-free” water. Before sampling started, an equipment blank sample was collected from “PFC-free” water flushing through the tubing. The equipment blank exhibited a minor PFOA detection of 0.001 µg/L and no detections of PFOS.

Sampling purge water and decontamination water was contained in United States Department of Transportation (DOT)-approved drums and transported to a NAVFAC NW approved location within NAS Whidbey Island. Once characterization data were received, water drums and tubing were transported by a MMEC Group subcontractor to an approved waste disposal facility.

5.0 DATA QUALITY REVIEW

Pyron Environmental performed Stage 3 (as defined in EPA 2009) or Level IV (as defined in NAVFAC NW 2006) review of the data provided by Vista Analytical Laboratory. Data were evaluated using quality control (QC) criteria specified in the analytical methods, the *DoD Quality Systems Manual Version 5.0*, and the project-specific scope of work for data validation (Navy, 2014). Validation findings are discussed for each QC parameter pertinent to each type of analysis evaluated. As part of the Level IV validation, 10 percent of the initial calibrations, calibration verifications, laboratory QC analyses, and sample results were verified via recalculation checks. This data quality review has been performed in general accordance with:

- *Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories (QSM), Final Version 5.0*, DoD Environmental Data Quality Workgroup. July 2013.
- *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*. Office of Superfund Remediation and Technical Innovation. August 2014. EPA 540-R-013-001.
- *EPA Contract Laboratory Program National Functional Guidelines for Organic Superfund Data Review*. Office of Superfund Remediation and Technical Innovation. August 2014. EPA 540-R-014-002.
- *Naval Facilities Engineering Command Northwest (NAVFAC NW) Standard Operation Procedure (SOP): Field Standard Operating Procedures, Version 4.0*. August, 2006.

The data validation report is provided in Attachment 3.

6.0 SUMMARY AND CONCLUSIONS

Groundwater sampling and analysis was performed for PFOA and PFOS at five monitoring wells (H5-MW-1, H5-MW-3, 16-26B, MW31-7A, and MW31-9A) in the Hangar 5 area, Area 16, and Area 31 of NAS Whidbey Island.

Groundwater samples from Hangar 5 area monitoring wells H5-MW-1 and H5-MW-3 exhibited no detections for PFOA or PFOS in concentrations that exceeded the PHA screening levels. Additional investigation for PFCs in groundwater is not warranted north and northwest of Hangar 5, based on groundwater analytical results for PFOA and PFOS.

PFOA and PFOS were not detected in the groundwater samples collected at Area 16 monitoring well 16-26B. It appears that groundwater within the deeper portion of the aquifer (approximately 60 feet bgs) at the central drainage ditch portion of Area 16 has not been impacted by PFOA and PFOS. Additional investigation at Area 16 is necessary to assess potential PFOA and PFOS contamination in shallow groundwater and other drainage ditch sections.

Concentrations of PFOA and PFOS exceeded PHA screening levels in groundwater samples collected from both monitoring wells MW31-7A and MW31-9A in Area 31. Additional investigation of the nature and extent of PFCs at Area 31 is warranted on the basis of the sample results of this investigation.

7.0 REFERENCES

- AECOM. 2015. *Final Project Specific Sampling and Analysis Plan, Hangar 5 and Rothbeck Ravine, Naval Air Station Whidbey Island, Oak Harbor, Washington*. June.
- MMEC Group. 2015. *Final Addendum #1 To The Project Specific Sampling and Analysis Plan, Hangar 5 and Rothbeck Ravine, NAS Whidbey Island, Oak Harbor, Washington*. Prepared by MMEC Group under Contract No. N62473-12-D-2012, Task Order JP02. August.
- Naval Facilities Engineering Command Northwest (NAVFAC NW). 2006. *Standard Operating Procedure: EFA NW Field Procedures Manual*. Version 4.0. Revised August.
- United States Department of Defense (DoD). 2013. *Quality Systems Manual (QSM) for Environmental Laboratories, Version 5*. July.
- United States Environmental Protection Agency (EPA). 2009. *Provisional Health Advisories for Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS)*. January.
- . 2012. *Risk Management Activities on Perfluorinated Chemicals*.
- . 2014. *National Functional Guidelines for Inorganic Superfund Data Review*, Office of Superfund Remediation and Technical Innovation. EPA-540-R-013-001. August.
- . 2014. *National Functional Guidelines for Superfund Organic Methods Data Review*, Office of Superfund Remediation and Technical Innovation. EPA-540-R-014-002. August.
- United States Navy (Navy). 1994. *Final Remedial Investigation Report for Operable Unit 3, Naval Air Station Whidbey Island*. Prepared for Engineering Field Activity Northwest, Naval Facilities Engineering Command Prepared by URS Consultants Under Contract No. N62474-89-D-9295, CTO 0074. January.
- . 1995. *Final Record of Decision for the Comprehensive Long-term Environmental Action Navy (Clean) Northwest Area, NAS Whidbey Island Operable Unit 3*. Prepared by URS Consultants, Seattle, Washington under CTO 0074. March.
- . 2000. *Final Monitoring Well Closure Report for Facility and Field Sites at Naval Air Station Whidbey Island*, Prepared by The Environmental Company for Engineering Field Activity, NW. June.

- . 2004. *Final Five-Year Review, Operable Units 1 Through 5, Naval Air Station Whidbey Island, Oak Harbor, Washington*. Prepared by The Environmental Company for Engineering Field Activity, NW under Contract No. N44255-98-D-4416, Task Order 041. Executed April 15.
- . 2014. *Final Fourth Five-Year Review for NAS Whidbey Island Ault Field and Seaplane Base, NAS Whidbey, Oak Harbor, Washington*. August.
- . 2015. *Project Specific Sampling and Analysis Plan, Hangar 5 and Rothbeck Ravine, NAS Whidbey Island, Oak Harbor, Washington*. Prepared by AECOM under Contract No. N62473-12-D-2012, Task Order JP02. June.

TABLES

| | |
|---------|---|
| Table 1 | Monitoring Well Locations |
| Table 2 | Monitoring Well Construction and Water Levels, September 2015 |
| Table 3 | In-situ Water Quality Parameters, September 2015 |
| Table 4 | PFOA and PFOS Laboratory Analysis, September 2015 |

Table 1 Monitoring Well Locations

| Location | Well ID | Northing (feet) | Easting (feet) |
|-----------------|----------------------|------------------------|-----------------------|
| Hangar 5 | H5-MW-1 ^a | 496962.62 | 1193393.13 |
| | H5-MW-3 ^a | 497044.98 | 1193465.95 |
| Area 16 | 16-26B ^b | 495498.94 | 1555610.48 |
| Area 31 | MW31-7A ^b | 499829.74 | 1557754.65 |
| | MW31-9A ^b | 499621.09 | 1557619.24 |

Notes:

a. AECOM, 2015. Final Project Specific Sampling and Analysis Plan, Hangar 5 and Rothbeck Ravine, Naval Air Station Whidbey Island, Oak Harbor, Washington. June.

b. Navy, 1994. Final Remedial Investigation Report for Operable Unit 3, Naval Air Station Whidbey Island. January

Projection: Washington State Plane North (NAD 1983)

Table 2 Monitoring Well Construction and Water Levels, September 2015

| Location | Well ID | Well Diameter (inch) | Total Well Depth (ft btoc) | Well Screen (ft bgs) | Depth to Water (ft btoc) |
|----------|----------------------|----------------------|----------------------------|----------------------|--------------------------|
| Hangar 5 | H5-MW-1 ^a | 2 | 35 | 25-35 | 7.36 |
| | H5-MW-3 ^a | 2 | 35 | 25-35 | 5.10 |
| Area 16 | 16-26B ^b | 2 | 69 | 62-67 | 0.00 |
| Area 31 | MW31-7A ^b | 2 | 27 | 17-27 | 20.64 |
| | MW31-9A ^b | 2 | 26 | 16-26 | 18.85 |

Notes:

a. AECOM, 2015. Final Project Specific Sampling and Analysis Plan, Hangar 5 and Rothbeck Ravine, Naval Air Station Whidbey Island, Oak Harbor, Washington. June.

b. Navy, 1994. Final Remedial Investigation Report for Operable Unit 3, Naval Air Station Whidbey Island. January

ft btoc = feet below top of casing

ft bgs = feet below ground surface

Table 3 In-situ Water Quality Parameters, September 2015

| | | | Temperature | pH | Specific Conductivity | Turbidity | Dissolved Oxygen | ORP |
|-----------------|----------------|-------------|--------------------|-----------|------------------------------|------------------|-------------------------|------------|
| Location | Well ID | Date | degree C | SU | mS/cm | NTUs | mg/L | mV |
| Hangar 5 | H5-MW-1 | 9/17/2015 | 16.87 | 8.37 | 1.322 | 1.55 | 0.91 | 143.7 |
| | H5-MW-3 | 9/17/2015 | 15.73 | 8.38 | 1.592 | 2.16 | 0.65 | 135.6 |
| Area 16 | 16-26B | 9/18/2015 | 12.85 | 7.61 | 0.5 | 2.86 | 2.18 | -65.6 |
| Area 31 | MW31-7A | 9/15/2015 | 12.53 | 6.36 | 0.632 | 0.29 | 5.28 | 133.5 |
| | MW31-9A | 9/15/2015 | 13.28 | 6.39 | 0.814 | 10.14 | 0.71 | -13.5 |

Notes:

degree C = degree Celsius

SU = standard unit

mS/cm = millisiemens per centimeter

NTU = Nephelometric Turbidity Unit

mg/L = milligrams per liter

mV = microvolts

Table 4 PFOA and PFOS Laboratory Analysis, September 2015

| | | | PFOA | PFOS |
|-----------------|----------------|-------------|----------------|----------------|
| | | | 0.400 | 0.200 |
| Location | Sample ID | Sample Date | µg/L | µg/L |
| Hangar 5 | | | | |
| H5-MW-1 | H5-MW-1-091715 | 9/17/2015 | 0.007 J | 0.035 |
| H5-MW-1 | FD-091715 | 9/17/2015 | 0.007 J | 0.035 |
| H5-MW-3 | H5-MW-3-091715 | 9/17/2015 | 0.003 J | 0.004 J |
| Area 16 | | | | |
| 16-26B | 16-26B-091815 | 9/18/2015 | 0.004 U | 0.004 U |
| Area 31 | | | | |
| MW31-7A | MW31-7A-091515 | 9/15/2015 | 58.5 | 0.422 |
| MW31-9A | MW31-9A-091515 | 9/15/2015 | 26.1 | 2.37 |

Notes:

BOLD = detection

Results have been validated

µg/L = micrograms per liter

FD = field duplicate

PFOA = Perfluorooctanoic Acid

PFOS = Perfluorooctane Sulfinatate

Screening level values from the U.S. Environmental Protection Agency (EPA)

January 2009 Provisional Health Advisories (PHA) for Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS)

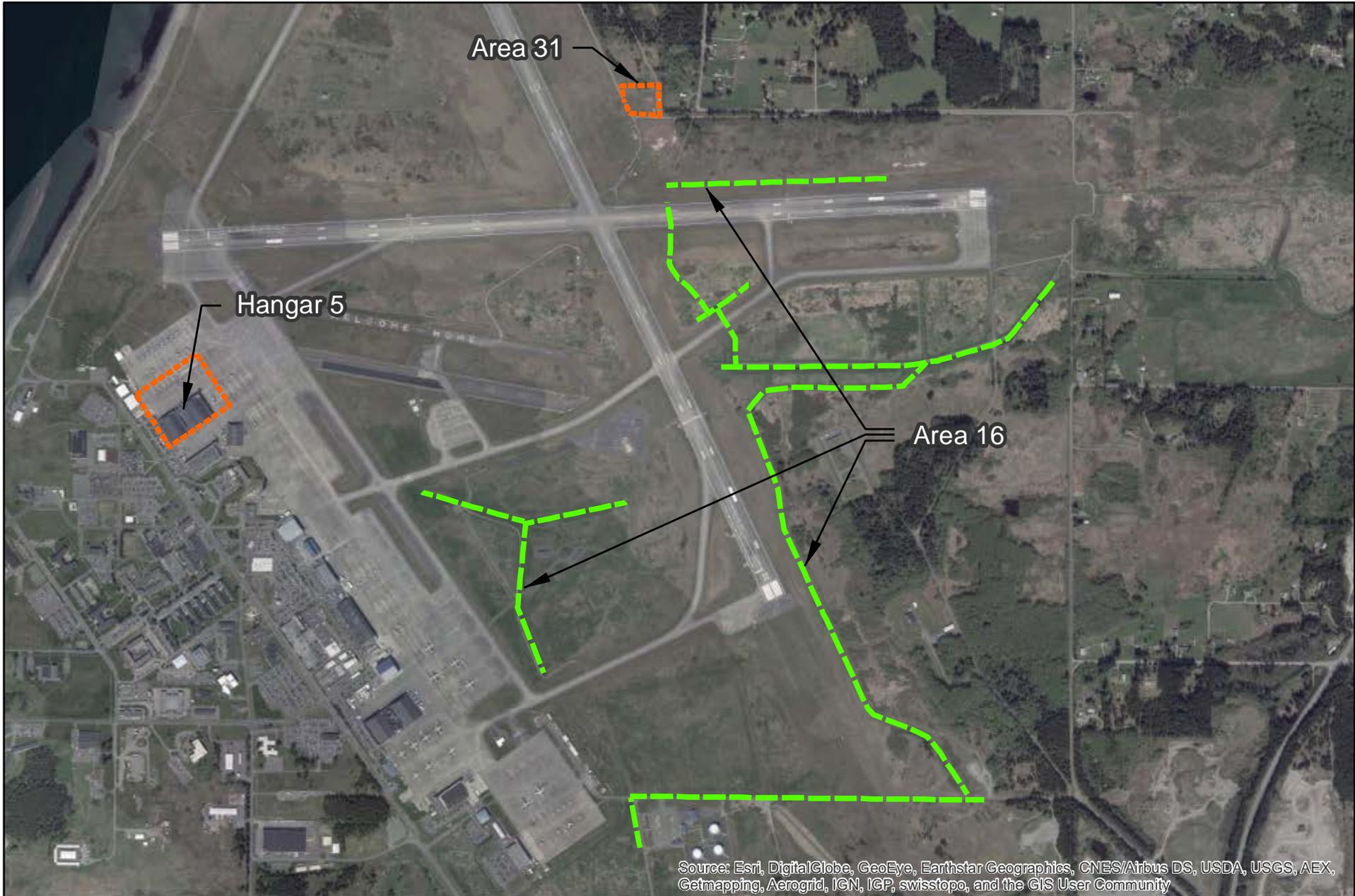
J = estimated concentration

U = not detected above indicated reporting limit

Result exceeds the 2009 EPA PHA

FIGURES

- Figure 1 Hangar 5, Area 16, and Area 31 Locations
- Figure 2 Well Locations and PFOA and PFOS in Groundwater – Hangar 5 Area, September 2015
- Figure 3 Well Locations and PFOA and PFOS in Groundwater – Area 16, September 2015
- Figure 4 Well Locations and PFOA and PFOS in Groundwater – Area 31, September 2015



U.S. NAVY

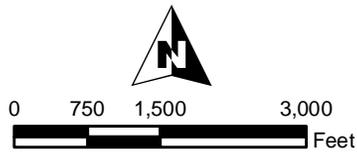


Figure 1
Hangar 5, Area 16 and Area 31 Locations

N62473-12-D-2012, JP02
NAS WHIDBEY ISLAND



Legend

-  Well Sampled
-  Well not Sampled
-  Estimated Groundwater Flow
-  AFFF Pipeline
-  AFFF Aboveground Storage Tanks
-  Hangar 5 Boundary

Notes:
 PFOA EPA SL: 0.400 µg/L*
 PFOS EPA SL: 0.200 µg/L*

Results have been validated
 J = Estimated Value
 SL - Screening Level
 µg/L - Micrograms per Liter
 PFOA - Perfluorooctanoic Acid
 PFOS - Perfluorooctane Sulfonate

*January 2009 Provisional Health Advisories (PHA) for PFOA and PFOS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community Source: Esri,

U.S. NAVY

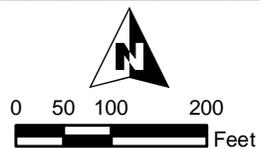


Figure 2
Well Locations and PFOA and PFOS in Groundwater - Hangar 5 Area, September 2015

N62473-12-D-2012, JP02
NAS WHIDBEY ISLAND



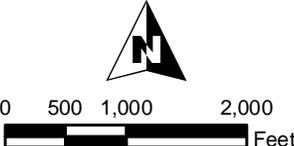
Legend

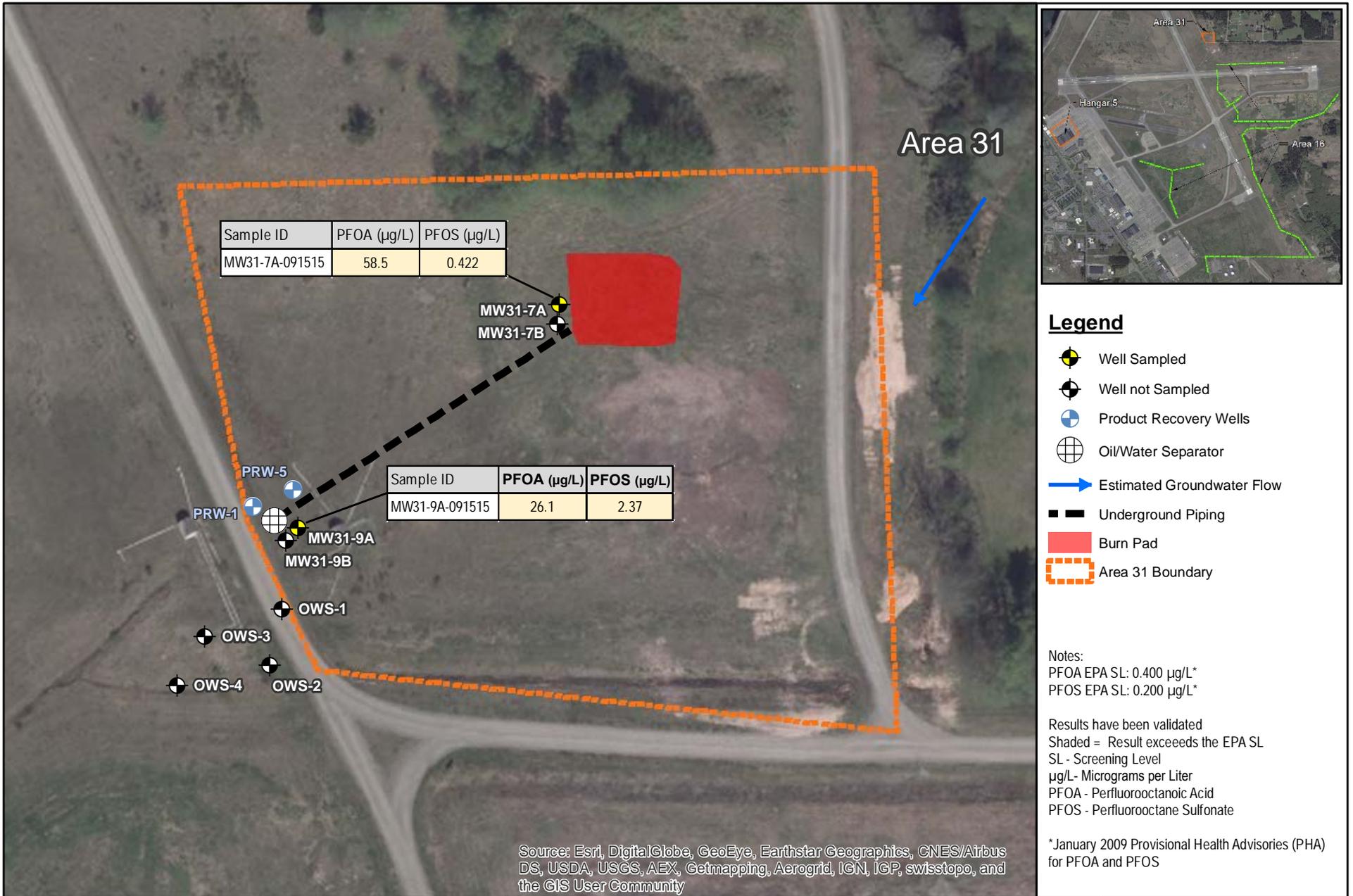
-  Well Sampled
-  Well not Sampled
-  Estimated Groundwater Flow
-  Drainage Ditches

Notes:
 PFOA EPA SL: 0.400 µg/L*
 PFOS EPA SL: 0.200 µg/L*

Results have been validated
 U = Not Detected Above Indicated Reporting Limit
 SL - Screening Level
 µg/L - Micrograms per Liter
 PFOA - Perfluorooctanoic Acid
 PFOS - Perfluorooctane Sulfonate

* January 2009 Provisional Health Advisories (PHA) for PFOA and PFOS

| | | | |
|------------------|---|---|--|
| U.S. NAVY |  | Figure 3 Well Locations and PFOA and PFOS in Groundwater - Area 16, September 2015 | N62473-12-D-2012, JP02 NAS WHIDBEY ISLAND |
|------------------|---|---|--|



U.S. NAVY

0 40 80 160 Feet

Figure 4
Well Locations and PFOA and PFOS in Groundwater - Area 31, September 2015

N62473-12-D-2012, JP02 NAS WHIDBEY ISLAND

Reference: 1994, URS. Final Remedial Investigation Report for Operable Unit 3, Naval Air Station Whidbey Island, January 1994.

ATTACHMENTS

Attachment 1

Purge Logs

Attachment 2

Laboratory Analytical Report (Included on CD)

Attachment 3

Data Validation Report (Included on CD)

Attachment 1
Purge Logs



**MMEC Group
GROUNDWATER
SAMPLING FIELD FORM**

Job #: 5023-14-JP02

Date: 09/17/15

Page of 1

Field Personnel: Joseph Dumont / Kelli Miller

Monitoring Well ID: H5-MW-1

Start Time: 11:20

Weather Conditions: overcast, cool, breezy

Approx. Air Temp (F): 100°F

INITIAL WELL DATA & WELL PURGING INFORMATION

| Water Temperature (degree C) | Water pH (S.U.) | Specific Conductivity (µS/cm) | Turbidity (NTUs) | Dissolved Oxygen (mg/L) | ORP (mV) | Water Level (feet bgs) | Time (0:00 - 23:59) | Volume Purged (milliliters) |
|------------------------------|-----------------|-------------------------------|------------------|-------------------------|----------|------------------------|---------------------|-----------------------------|
| 10.72 | 7.78 | 1.311 | 1.57 | 4.15 | 155.1 | 7.30 | 11:23 | 150 mL |
| 10.72 | 8.15 | 1.316 | 1.71 | 1.24 | 150.1 | 7.98 | 11:26 | 1000 |
| 10.79 | 8.24 | 1.315 | 1.58 | 0.92 | 148.2 | 8.44 | 11:29 | 1050 |
| 10.80 | 8.31 | 1.317 | 2.33 | 0.88 | 146.1 | 8.86 | 11:31 | 1500 |
| 10.85 | 8.32 | 1.319 | 1.18 | 1.01* | 144.9 | 9.45 | 11:34 | 1950 |
| 10.87 | 8.37 | 1.322 | 1.55 | 0.91 | 143.7 | 10.09 | 11:37 | 2400 |
| SAMPLED | | | | | | | | |

Stabilization: 3 consecutive readings within:

| | | | | | | | | |
|------|-----------|---------|-------|-----------|--------|---|---|---|
| ±1°C | ±0.1 S.U. | ±0.1 µS | <5NTU | ±0.2 mg/L | ±10 mV | - | - | - |
|------|-----------|---------|-------|-----------|--------|---|---|---|

Results of Field Ferrous Iron Kit (mg/L):

Total Purged: 2400 mL

Measurements: 0.5 inch tubing: 0.020 gallons/linear foot 2" well casing: 0.17 gal/linear foot 4" well casing: 0.65 gal/linear foot

Purge Pumping Rate (approx. mL/min): 150 mL/min

Approx. Pump/Intake Depth: 15' btoC

Well Yield: High / Moderate / Low Decontamination Method: A/C only; PFC Free H₂O

WELL CONDITION

Casing Size and Type: 2" PVC

Casing Condition: OK / NA / Needs Repairs/Repaired Lock Condition: NA OK / NA / Needs Repairs/Repaired

Cap Condition: OK / NA / Needs Repairs/Repaired Monument Condition: OK / NA / Needs Repairs/Repaired

NOTES:

SAMPLING INFORMATION / DATA

QA/QC Sample (circle one): Duplicate Lab QA/QC: NONE

Sampling Method (circle one): dedicated Dual Valve Pump peristaltic pump

| Analytical Parameters | Minimum Sample Vol. | Preservative | Bottle Size | Number of bottles | Sample ID | Time Sampled |
|-----------------------|---------------------|--------------|-------------|-------------------|----------------|--------------|
| PFOA | 125 mL | None | 125 mL | 1 | H5-MW-1-091715 | 11:42 |
| PFOS | 125 mL | None | 125 mL | 1 | H5-MW-1-091715 | 11:42 |
| PFOA | 125 mL | None | 125 mL | 1 | H5-MW-1-091715 | 11:40 |
| PFOS | 125 mL | None | 125 mL | 1 | FD-091715 | 11:40 |

Method of Transportation of samples: Fed Ex / cooler

All samples were immediately placed into a cooler and packed with ice YES / NO

Field Observations/Notes of Sampling Event: DTW = 10.32' btoC; TD = 35.00' btoC

Water level - 11.00' btoC after sampling

Water level continued to decrease despite low flow. Well did not recharge.

Signature of Field Personnel: [Signatures]

* Bubbles in low flow



MMEC Group
GROUNDWATER
SAMPLING FIELD FORM

Job #: 5023-14-JP02

Date: 09/17/15

Page 1 of 1

Field Personnel: Joseph Dumont / Kelli Miller

Monitoring Well ID: H5-MW-3

Start Time: 12:00

Weather Conditions: Newcastle, CO, breezy

Approx. Air Temp (F): 100°F

INITIAL WELL DATA & WELL PURGING INFORMATION

| Water Temperature (degree C) | Water pH (S.U.) | Specific Conductivity (µS/cm) | Turbidity (NTUs) | Dissolved Oxygen (mg/L) | ORP (mV) | Water Level (feet bgs) | Time (0:00 - 23:59) | Volume Purged (milliliters) |
|-------------------------------|-----------------|-------------------------------|------------------|-------------------------|----------|------------------------|---------------------|-----------------------------|
| 15.95 | 8.05 | 1.795 | 8.35 | 3.11 | 148.4 | 5.10 | 12:10 | 250ml |
| 15.50 | 8.52 | 1.752 | 12.1 | 1.31 | 142.8 | 10.29 | 12:13 | 1000 |
| 15.45 | 8.16 | 1.718 | 12.9 | 0.99 | 145.2 | 7.46 | 12:16 | 1750 |
| 15.55 | 8.15 | 1.662 | 11.24 | 0.83 | 142.8 | 8.28 | 12:19 | 2500 |
| 15.80 | 8.25 | 1.626 | 10.88 | 0.75 | 139.0 | 9.18 | 12:22 | 3100 |
| 15.89 | 8.31 | 1.620 | 4.62 | 0.71 | 137.9 | 9.68 | 12:25 | 3700 |
| 15.94 | 8.34 | 1.611 | 3.26 | 0.67 | 136.8 | 10.49 | 12:28 | 4300 |
| 15.92 | 8.35 | 1.606 | 2.94 | 0.66 | 136.2 | 11.04 | 12:31 | 4900 |
| 15.88 | 8.37 | 1.596 | 2.53 | 0.66 | 135.8 | 11.65 | 12:34 | 5500 |
| 15.73 | 8.38 | 1.592 | 2.16 | 0.65 | 135.6 | 12.47 | 12:37 | 6100 |
| SAMPLED SAMPLED | | | | | | | | |

Flow lowered to 200ml/min

| | | | | | | | | |
|----------------|--------------------------------|---------|-------|-----------|--------|---|---|---|
| Stabilization: | 3 consecutive readings within: | | | | | | | |
| ±1°C | ±0.1 S.U. | ±0.1 uS | <5NTU | ±0.2 mg/L | ±10 mV | - | - | - |

Results of Field Ferrous Iron Kit (mg/L): NA Total Purged: 6100ml

Measurements: 0.5 inch tubing: 0.020 gallons/linear foot 2" well casing: 0.17 gal/linear foot 4" well casing: 0.65 gal/linear foot

Purge Pumping Rate (approx. mL/min): 250ml/min, 200ml/min @ 12:22

Approx. Pump/Intake Depth: 30' bfgc

Well Yield: High / Moderate / Low Decontamination Method: Alconox / PFC Free Water

WELL CONDITION

| | | | |
|--|--|--|--|
| Casing Size and Type: 2" PVC | | | |
| Casing Condition: OK / NA / Needs Repairs/Repaired | Lock Condition: NA OK / NA / Needs Repairs/Repaired | | |
| Cap Condition: OK / NA / Needs Repairs/Repaired | Monument Condition: OK / NA / Needs Repairs/Repaired | | |

NOTES:

SAMPLING INFORMATION / DATA

QA/QC Sample (circle one): Duplicate Lab QA/QC NONE
 Sampling Method (circle one): dedicated Dual Valve Pump peristaltic pump

| Analytical Parameters | Minimum Sample Vol. | Preservative | Bottle Size | Number of bottles | Sample ID | Time Sampled |
|-----------------------|---------------------|--------------|-------------|-------------------|----------------|--------------|
| PFOA | 125 mL | None | 125 mL | ± 3 | H5-MW-3-091715 | 12:41 |
| PFOS | 125 mL | None | 125 mL | ± 3 | H5-MW-3-091715 | 12:41 |

Method of Transportation of samples: FedEx/ cooler
 All samples were immediately placed into a cooler and packed with ice YES / NO

Field Observations/Notes of Sampling Event: DW - 4.45' bfgc; TD = 35.06' bfgc
 14 S/MSP samples collected from well
 13.84' bfgc after sampling
 Water level continued to decrease despite increasing the flow. Well did not recharge.

Signature of Field Personnel: [Signatures]



MMEC Group
GROUNDWATER
SAMPLING FIELD FORM

Job #: 5023-14-JP02

Date: 09/18/15

Page 1 of 1

Field Personnel: Joseph Dumont / Kelli Miller

Monitoring Well ID: 110-210B

Start Time: 09:30

Weather Conditions: Overcast, cool, windy

Approx. Air Temp (F): 58°F

INITIAL WELL DATA & WELL PURGING INFORMATION

| Water Temperature (degree C) | Water pH (S.U.) | Specific Conductivity (µS/cm) | Turbidity (NTUs) | Dissolved Oxygen (mg/L) | ORP (mV) | Water Level (feet bgs) | Time (0:00 - 23:59) | Volume Purged (milliliters) <i>gallons</i> |
|------------------------------|-----------------|-------------------------------|------------------|-------------------------|----------|------------------------|---------------------|--|
| 13.03 | 7.39 | 0.506 | 7.10 | 3.20 | 15.3 | <0 | 09:35 | 10 1 |
| 12.73 | 7.20 | 0.501 | 4.59 | 2.63 | -41.6 | <0 | 10:09 | 20 10 |
| 13.14 | 7.52 | 0.501 | 4.62 | 2.41 | -56.6 | <0 | 10:44 | 30 20 |
| 13.20 | 7.57 | 0.500 | 3.25 | 2.38 | -57.6 | <0 | 11:05 | 30 30 |
| 12.85 | 7.61 | 0.500 | 2.80 | 2.18 | -65.6 | <0 | 11:18 | 35 |
| <i>5amp. ED</i> | | | | | | | | |

Stabilization: 3 consecutive readings within:

| | | | | | | | | |
|------|-----------|---------|-------|-----------|--------|---|------|---|
| ±1°C | ±0.1 S.U. | ±0.1 uS | <5NTU | ±0.2 mg/L | ±10 mV | - | - 35 | - |
|------|-----------|---------|-------|-----------|--------|---|------|---|

Results of Field Ferrous Iron Kit (mg/L): NA

Total Purged: ~ 30 gallons

Measurements: 0.5 inch tubing: 0.020 gallons/linear foot 2" well casing: 0.17 gal/linear foot 4" well casing: 0.65 gal/linear foot

Purge Pumping Rate (approx. mL/min): 900 mL/min (at pump) 900 mL/min

Approx. Pump/Intake Depth: At surface of well

Well Yield: High / Moderate / Low Decontamination Method:

WELL CONDITION

Casing Size and Type: 2" PVC

Casing Condition: OK / NA / Needs Repairs/Repaired Lock Condition: OK / NA / Needs Repairs/Repaired

Cap Condition: OK / NA / Needs Repairs/Repaired Monument Condition: OK / NA / Needs Repairs/Repaired

NOTES: Well casing lid rusted - ~~well~~ plug rusted.

SAMPLING INFORMATION / DATA

QA/QC Sample (circle one): Duplicate Lab QA/QC NONE
Sampling Method (circle one): dedicated Dual Valve Pump peristaltic pump

| Analytical Parameters | Minimum Sample Vol. | Preservative | Bottle Size | Number of bottles | Sample ID | Time Sampled |
|-----------------------|---------------------|--------------|-------------|-------------------|-----------------|--------------|
| PFOA | 125 mL | None | 125 mL | 1 | 110-210B-091815 | 11:27 |
| PFOS | 125 mL | None | 125 mL | 1 | 110-210B-091815 | 11:22 |

Method of Transportation of samples: FedEx/coder

All samples were immediately placed into a cooler and packed with ice (YES) NO

Field Observations/Notes of Sampling Event:

TP = 109.8' btpc
Sampling cap installed on well / turning 1000 ft. Flow of natural well under pressure is greater than the rate of pumping / sampling.

Signature of Field Personnel:

[Signature] / Kelli Miller



**MMEC Group
GROUNDWATER
SAMPLING FIELD FORM**

Job #: 5023-14-JP02

Date: 9/15/15

Page 1 of 1

Field Personnel: Joseph Dumont / Kelli Miller

Monitoring Well ID: MW31-7A

Start Time: 12:30/14:20

Weather Conditions: Sunny, cool, breezy

Approx. Air Temp (F): 100°F

INITIAL WELL DATA & WELL PURGING INFORMATION

| Water Temperature (degree C) | Water pH (S.U.) | Specific Conductivity mS (µS/cm) | Turbidity (NTUs) | Dissolved Oxygen (mg/L) | ORP (mV) | Water Level (feet bgs) | Time (0:00 - 23:59) | Volume Purged (milliliters) |
|------------------------------|-----------------|----------------------------------|------------------|-------------------------|----------|------------------------|---------------------|-----------------------------|
| 12.68 | 6.49 | 0.644 | 0.08 | 5.83 | 133.7 | 20.64 | 14:25 | 240 mL |
| 12.63 | 6.40 | 0.643 | 0.05 | 5.31 | 131.2 | 20.64 | 14:28 | 960 |
| 12.57 | 6.39 | 0.644 | 0.74 | 5.20 | 131.1 | 20.64 | 14:31 | 1680 |
| 12.57 | 6.37 | 0.644 | 0.51 | 5.27 | 131.0 | 20.65 | 14:34 | 2400 |
| 12.47 | 6.35 | 0.642 | 0.65 | 5.24 | 131.8 | 20.64 | 14:37 | 3120 |
| 12.38 | 6.34 | 0.643 | 0.64 | 5.26 | 132.3 | 20.64 | 14:40 | 3840 |
| 12.43 | 6.35 | 0.638 | 0.41 | 5.26 | 132.5 | 20.64 | 14:43 | 4560 |
| 12.40 | 6.35 | 0.638 | 0.50 | 5.26 | 133.0 | 20.65 | 14:46 | 5280 |
| 12.53 | 6.36 | 0.632 | 0.12 | 5.31 | 133.1 | 20.65 | 14:49 | 6000 |
| 12.53 | 6.36 | 0.632 | 0.29 | 5.28 | 133.5 | 20.65 | 14:52 | 6720 |
| SAMPLED | | | | | | | 14:54 | |
| km 9/15/15 | | | | | | | | |

Stabilization: 3 consecutive readings within:

±1°C ±0.1 S.U. ±0.1 uS <5NTU ±0.2 mg/L ±10 mV - - -

Results of Field Ferrous Iron Kit (mg/L): NA

Total Purged: 10720 mL

Measurements: 0.5 inch tubing: 0.020 gallons/linear foot 2" well casing: 0.17 gal/linear foot 4" well casing: 0.65 gal/linear foot

Purge Pumping Rate (approx. mL/min): 240 mL/min

Approx. Pump/Intake Depth: 24' bgs btoC

Well Yield: High/Moderate/Low Decontamination Method: Airmax: PFC certified free water

WELL CONDITION

Casing Size and Type: 2" PVC

Casing Condition: OK / NA / Needs Repairs/Repaired

Lock Condition: NA OK / NA / Needs Repairs/Repaired

Cap Condition: OK / NA / Needs Repairs/Repaired

Monument Condition: OK / NA / Needs Repairs/Repaired

NOTES: No lock, rusted screws

SAMPLING INFORMATION / DATA

QA/QC Sample (circle one): Duplicate Lab QA/QC (NONE)

Sampling Method (circle one): dedicated Dual Valve Pump peristaltic pump

| Analytical Parameters | Minimum Sample Vol. | Preservative | Bottle Size | Number of bottles | Sample ID | Time Sampled |
|-----------------------|---------------------|--------------|-------------|-------------------|----------------|--------------|
| PFOA | 125 mL | None | 125 mL | 1 | MW31-7A-091515 | 14:54 |
| PFOS | 125 mL | None | 125 mL | 1 | MW31-7A-091515 | 14:54 |
| | | | | | | |
| | | | | | | |

Method of Transportation of samples: Cooler/FedEx

All samples were immediately placed into a cooler and packed with ice YES/NO

Field Observations/Notes of Sampling Event: DTW: 20.61' btoC TD: 27.40' btoC

Sample A3 MW31-7A-091515 @ 14:54

No odor in well water, water very clear

Signature of Field Personnel:



**MMEC Group
GROUNDWATER
SAMPLING FIELD FORM**

Job #: 5023-14-JP02

Date: 9/15/15

Page 1 of 1

Field Personnel: Joseph Dumont / Kelli Miner

Monitoring Well ID: MW31-9A

Start Time: 15:30

Weather Conditions: Sunny, cool, breezy

Approx. Air Temp (F): 105°F

INITIAL WELL DATA & WELL PURGING INFORMATION

| Water Temperature (degree C) | Water pH (S.U.) | Specific Conductivity mS (µS/cm) | Turbidity (NTUs) | Dissolved Oxygen (mg/L) | ORP (mV) | Water Level (feet bgs) | Time (0:00 - 23:59) | Volume Purged (milliliters) |
|------------------------------|-----------------|----------------------------------|------------------|-------------------------|----------|------------------------|---------------------|-----------------------------|
| 13.54 | 6.44 | 0.838 | 22.4 | 1.05 | -6.5 | 18.85 | 15:50 | 250 mL |
| 13.56 | 6.39 | 0.832 | 16.7 | 1.16 | -3.4 | 18.85 | 15:55 | 1500 |
| 13.72 | 6.39 | 0.830 | 15.7 | 0.95 | -6.2 | 18.85 | 15:58 | 2250 |
| 13.95 | 6.47 | 0.836 | 16.6 | 3.01 | -20.3 | 18.90 | 16:01 | 3000 |
| 13.76 | 6.32 | 0.578 | 12.9 | 2.17 | -10.3 | 18.84 | 16:04 | 3750 |
| 13.56 | 6.33 | 0.795 | 12.6 | 1.58 | -11.7 | 18.84 | 16:07 | 4500 |
| 13.59 | 6.36 | 0.806 | 13.1 | 0.93 | -12.7 | 18.85 | 16:10 | 5250 |
| 13.58 | 6.38 | 0.819 | 11.44 | 0.77 | -12.1 | 18.83 | 16:13 | 6000 |
| 13.49 | 6.39 | 0.822 | 10.16 | 0.71 | -12.7 | 18.83 | 16:16 | 6750 |
| 13.35 | 6.39 | 0.823 | 9.94 | 0.69 | -12.8 | 18.83 | 16:19 | 7500 |
| 13.31 | 6.39 | 0.817 | 10.46 | 0.71 | -13.6 | 18.83 | 16:22 | 8250 |
| 13.28 | 6.39 | 0.814 | 10.14 | 0.71 | -13.5 | 18.83 | 16:25 | 9000 |
| Sampled | | | | | | | 16:28 | |
| K.A. 9/15/15 | | | | | | | | |

Stabilization: 3 consecutive readings within:

| | | | | | | | | |
|------|-----------|---------|-------|-----------|--------|---|---|---|
| ±1°C | ±0.1 S.U. | ±0.1 uS | <5NTU | ±0.2 mg/L | ±10 mV | - | - | - |
|------|-----------|---------|-------|-----------|--------|---|---|---|

Results of Field Ferrous Iron Kit (mg/L): NA

Total Purged: 9000 mL

Measurements: 0.5 inch tubing: 0.020 gallons/linear foot 2" well casing: 0.17 gal/linear foot 4" well casing: 0.65 gal/linear foot

Purge Pumping Rate (approx. mL/min): 250 mL/min

Approx. Pump Intake Depth: 2.2' bto c

Well Yield: High / Moderate / Low Decontamination Method: Alconox & PFC certified free water

WELL CONDITION

Casing Size and Type: 2" PVC

Casing Condition: OK / NA / Needs Repairs/Repaired

Lock Condition: OK / NA / Needs Repairs/Repaired

Cap Condition: OK / NA / Needs Repairs/Repaired

Monument Condition: OK / NA / Needs Repairs/Repaired

NOTES: Lock located on cap cannot be adjusted without cutting

SAMPLING INFORMATION / DATA

QA/QC Sample (circle one): Duplicate

Lab QA/QC: NONE

Sampling Method (circle one): dedicated Dual Valve Pump

peristaltic pump

| Analytical Parameters | Minimum Sample Vol. | Preservative | Bottle Size | Number of bottles | Sample ID | Time Sampled |
|-----------------------|---------------------|--------------|-------------|-------------------|----------------|--------------|
| PFOA | 125 mL | None | 125 mL | 1 | MW31-9A-091515 | 16:28 |
| PFOS | 125 mL | None | 125 mL | 1 | MW31-9A-091515 | 16:28 |

Method of Transportation of samples: Courier / FedEx

All samples were immediately placed into a cooler and packed with ice YES / NO

Field Observations/Notes of Sampling Event:

D70 - 18.81' bto c, TD: 25.85' bto c

Strong petroleum odor in well, light brown color

Sample MW31-9A-091515 @ 16:28

Signature of Field Personnel:

[Signatures]

* Purging stopped to clean flow through cell

Attachment 2
Laboratory Analytical Report

October 03, 2015

Vista Work Order No. 1500896

Mr. Kevin Olness
AMEC Foster Wheeler
800 North Bell Avenue, Suite 200
Pittsburgh, PA 15106

Dear Mr. Olness,

Enclosed are the results for the sample set received at Vista Analytical Laboratory on September 19, 2015. This sample set was analyzed on a rush turn-around time, under your Project Name '5023-14-JP02 WE02'. The work was authorized under your Purchase Order No. 262.

Vista Analytical Laboratory is committed to serving you effectively. If you require additional information, please contact me at 916-673-1520 or by email at mmaier@vista-analytical.com.

Thank you for choosing Vista as part of your analytical support team.

Sincerely,

Martha Maier
Laboratory Director



Vista Analytical Laboratory certifies that the report herein meets all the requirements set forth by NELAC for those applicable test methods. Results relate only to the samples as received by the laboratory. This report should not be reproduced except in full without the written approval of Vista.

Vista Work Order No. 1500896

Case Narrative

Sample Condition on Receipt:

Seven aqueous samples were received in good condition and within the method temperature requirements. The samples were received and stored securely in accordance with Vista standard operating procedures and EPA methodology.

Analytical Notes:

Modified EPA Method 537

The aqueous samples were extracted and analyzed for PFOA and PFOS using Modified EPA Method 537.

Holding Times

The samples were extracted and analyzed within the method hold times.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Ongoing Precision and Recovery (OPR) sample were extracted and analyzed with the preparation batch. No analytes were detected in the Method Blank above the LOQ. The OPR recoveries were within the method acceptance criteria.

The recoveries of all internal standards in the QC and field samples were within the acceptance criteria.

As requested, an MS/MSD was performed on sample "H5-MW-3-091715". The recoveries and RPDs were within the QC criteria.

TABLE OF CONTENTS

| | |
|-------------------------|----|
| Case Narrative..... | 1 |
| Table of Contents..... | 3 |
| Sample Inventory..... | 4 |
| Analytical Results..... | 5 |
| Qualifiers..... | 16 |
| Certifications..... | 17 |
| Sample Receipt..... | 18 |

Sample Inventory Report

| Vista Sample ID | Client Sample ID | | Sampled | Received | Components/Containers |
|-----------------|------------------|--------|-----------------|-----------------|--|
| 1500896-01 | MW31-7A-091515 | | 15-Sep-15 14:54 | 18-Sep-15 09:04 | HDPE Bottle, 125 mL HDPE Bottle, 125 mL |
| 1500896-02 | MW31-9A-091515 | | 15-Sep-15 16:28 | 18-Sep-15 09:04 | HDPE Bottle, 125 mL HDPE Bottle, 125 mL |
| 1500896-03 | JP02-FB | | 17-Sep-15 10:32 | 19-Sep-15 08:50 | HDPE Bottle, 125 mL HDPE Bottle, 125 mL |
| 1500896-04 | H5-MW-1-091715 | | 17-Sep-15 11:42 | 19-Sep-15 08:50 | HDPE Bottle, 125 mL HDPE Bottle, 125 mL |
| 1500896-05 | FD-091715 | | 17-Sep-15 11:46 | 19-Sep-15 08:50 | HDPE Bottle, 125 mL HDPE Bottle, 125 mL |
| 1500896-06 | H5-MW-3-091715 | MS/MSD | 17-Sep-15 12:41 | 19-Sep-15 08:50 | HDPE Bottle, 125 mL |
| | | MS/MSD | | | HDPE Bottle, 125 mL |
| | | MS/MSD | | | HDPE Bottle, 125 mL |
| | | MS/MSD | | | HDPE Bottle, 125 mL |
| | | MS/MSD | | | HDPE Bottle, 125 mL |
| | | MS/MSD | | | HDPE Bottle, 125 mL |
| 1500896-07 | 16-26B-091815 | | 18-Sep-15 11:22 | 19-Sep-15 08:50 | HDPE Bottle, 125 mL HDPE Bottle, 125 mL |

ANALYTICAL RESULTS

| Sample ID: Method Blank | | | | | | Modified EPA Method 537 | | | |
|-------------------------|--------------|----------------------------------|------|--------------------------------|-----------------|-------------------------|------|----------|------------|
| Matrix: Aqueous | | QC Batch: B510119 | | Lab Sample: B510119-BLK1 | | | | | |
| Sample Size: 0.125 L | | Date Extracted: 21-Sep-2015 7:52 | | Date Analyzed: 01-Oct-15 16:00 | Column: BEH C18 | Analyst: AC | | | |
| Analyte | Conc. (ng/L) | MDL | LOD | LOQ | Qualifiers | Labeled Standard | %R | LCL-UCL | Qualifiers |
| PFOA | ND | 1.31 | 4.00 | 8.00 | | IS 13C2-PFOA | 110 | 60 - 150 | |
| PFOS | ND | 0.424 | 4.00 | 8.00 | | IS 13C8-PFOS | 91.5 | 60 - 150 | |

DL - Sample specific estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL - Lower control limit - upper control limit

Results reported to the MDL

Sample ID: OPR

Modified EPA Method 537

| Matrix: Aqueous Sample Size: 0.125 L | QC Batch: B5I0119 Date Extracted: 21-Sep-2015 7:52 | Lab Sample: B5I0119-BS1 Date Analyzed: 01-Oct-15 15:35 Column: BEH C18 Analyst: AC | | | | | |
|---|---|---|------|----------|------------------|------|----------|
| Analyte | Amt Found (ng/L) | Spike Amt | %R | Limits | Labeled Standard | %R | LCL-UCL |
| PFOA | 69.2 | 80.0 | 86.5 | 70 - 130 | IS 13C2-PFOA | 102 | 60 - 150 |
| PFOS | 66.3 | 80.0 | 82.9 | 70 - 130 | IS 13C8-PFOS | 95.8 | 60 - 150 |

LCL-UCL - Lower control limit - upper control limit

Sample ID: MW31-7A-091515**Modified EPA Method 537**

| Client Data | | Sample Data | | Laboratory Data | | | | | |
|-----------------|---------------------|--------------|---------|-----------------|-----------------|------------------|-------------|----------|------------|
| Name: | AMEC Foster Wheeler | Matrix: | Aqueous | Lab Sample: | 1500896-01 | Date Received: | 19-Sep-2015 | 8:50 | |
| Project: | 5023-14-JP02 WE02 | Sample Size: | 0.133 L | QC Batch: | B5I0119 | Date Extracted: | 21-Sep-2015 | 7:52 | |
| Date Collected: | 15-Sep-2015 14:54 | | | Date Analyzed: | 01-Oct-15 17:16 | Column: | BEH C18 | Analyst: | AC |
| Location: | | | | | 02-Oct-15 10:44 | Column: | BEH C18 | Analyst: | AC |
| Analyte | Conc. (ng/L) | MDL | LOD | LOQ | Qualifiers | Labeled Standard | %R | LCL-UCL | Qualifiers |
| PFOA | 58500 | 61.6 | 3.76 | 376 | D | IS 13C2-PFOA | 146 | 60 - 150 | D |
| PFOS | 422 | 0.399 | 3.76 | 7.52 | | IS 13C8-PFOS | 96.8 | 60 - 150 | |

DL - Sample specific estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL - Lower control limit - upper control limit

Results reported to the MDL

Sample ID: MW31-9A-091515**Modified EPA Method 537**

| Client Data | | Sample Data | | Laboratory Data | | | | | | |
|-----------------|---------------------|--------------|---------|-----------------|-----------------|------------------|-------------|----------|------------|--|
| Name: | AMEC Foster Wheeler | Matrix: | Aqueous | Lab Sample: | 1500896-02 | Date Received: | 19-Sep-2015 | 8:50 | | |
| Project: | 5023-14-JP02 WE02 | Sample Size: | 0.128 L | QC Batch: | B5I0119 | Date Extracted: | 21-Sep-2015 | 7:52 | | |
| Date Collected: | 15-Sep-2015 16:28 | | | Date Analyzed: | 01-Oct-15 17:28 | Column: | BEH C18 | Analyst: | AC | |
| Location: | | | | | 02-Oct-15 10:57 | Column: | BEH C18 | Analyst: | AC | |
| Analyte | Conc. (ng/L) | MDL | LOD | LOQ | Qualifiers | Labeled Standard | %R | LCL-UCL | Qualifiers | |
| PFOA | 26100 | 25.5 | 3.91 | 156 | D | IS 13C2-PFOA | 124 | 60 - 150 | D | |
| PFOS | 2370 | 0.413 | 3.91 | 7.79 | | IS 13C8-PFOS | 91.6 | 60 - 150 | | |

DL - Sample specific estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL - Lower control limit - upper control limit

Results reported to the MDL

Sample ID: JP02-FB**Modified EPA Method 537**

| Client Data | | Sample Data | | Laboratory Data | | | | | | |
|-----------------|---------------------|--------------|---------|-----------------|-----------------|------------------|-------------|----------|------------|--|
| Name: | AMEC Foster Wheeler | Matrix: | Aqueous | Lab Sample: | 1500896-03 | Date Received: | 19-Sep-2015 | 8:50 | | |
| Project: | 5023-14-JP02 WE02 | Sample Size: | 0.121 L | QC Batch: | B5I0119 | Date Extracted: | 21-Sep-2015 | 7:52 | | |
| Date Collected: | 17-Sep-2015 10:32 | | | Date Analyzed: | 01-Oct-15 17:41 | Column: | BEH C18 | Analyst: | AC | |
| Location: | | | | | | | | | | |
| Analyte | Conc. (ng/L) | MDL | LOD | LOQ | Qualifiers | Labeled Standard | %R | LCL-UCL | Qualifiers | |
| PFOA | 1.96 | 1.36 | 4.13 | 8.29 | J | IS 13C2-PFOA | 109 | 60 - 150 | | |
| PFOS | ND | 0.439 | 4.13 | 8.29 | | IS 13C8-PFOS | 101 | 60 - 150 | | |

DL - Sample specific estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL - Lower control limit - upper control limit

Results reported to the MDL

Sample ID: H5-MW-1-091715**Modified EPA Method 537**

| Client Data | | Sample Data | | Laboratory Data | | | | | |
|-----------------|---------------------|--------------|---------|-----------------|-----------------|-----------------|------------------|----------|----|
| Name: | AMEC Foster Wheeler | Matrix: | Aqueous | Lab Sample: | 1500896-04 | Date Received: | 19-Sep-2015 8:50 | | |
| Project: | 5023-14-JP02 WE02 | Sample Size: | 0.125 L | QC Batch: | B5I0119 | Date Extracted: | 21-Sep-2015 7:52 | | |
| Date Collected: | 17-Sep-2015 11:42 | | | Date Analyzed: | 01-Oct-15 17:54 | Column: | BEH C18 | Analyst: | AC |
| Location: | | | | | | | | | |

| Analyte | Conc. (ng/L) | MDL | LOD | LOQ | Qualifiers | Labeled Standard | %R | LCL-UCL | Qualifiers |
|---------|--------------|-------|------|------|------------|------------------|------|----------|------------|
| PFOA | 7.08 | 1.31 | 4.00 | 8.03 | J | IS 13C2-PFOA | 108 | 60 - 150 | |
| PFOS | 34.7 | 0.425 | 4.00 | 8.03 | | IS 13C8-PFOS | 97.8 | 60 - 150 | |

DL - Sample specific estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL - Lower control limit - upper control limit

Results reported to the MDL

Sample ID: FD-091715**Modified EPA Method 537**

| Client Data | | Sample Data | | Laboratory Data | | | | | | |
|-----------------|---------------------|--------------|---------|-----------------|-----------------|------------------|-------------|----------|------------|--|
| Name: | AMEC Foster Wheeler | Matrix: | Aqueous | Lab Sample: | 1500896-05 | Date Received: | 19-Sep-2015 | 8:50 | | |
| Project: | 5023-14-JP02 WE02 | Sample Size: | 0.124 L | QC Batch: | B5I0119 | Date Extracted: | 21-Sep-2015 | 7:52 | | |
| Date Collected: | 17-Sep-2015 11:46 | | | Date Analyzed: | 01-Oct-15 18:06 | Column: | BEH C18 | Analyst: | AC | |
| Location: | | | | | | | | | | |
| Analyte | Conc. (ng/L) | MDL | LOD | LOQ | Qualifiers | Labeled Standard | %R | LCL-UCL | Qualifiers | |
| PFOA | 6.54 | 1.32 | 4.03 | 8.06 | J | IS 13C2-PFOA | 113 | 60 - 150 | | |
| PFOS | 34.5 | 0.427 | 4.03 | 8.06 | | IS 13C8-PFOS | 95.5 | 60 - 150 | | |

DL - Sample specific estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL - Lower control limit - upper control limit

Results reported to the MDL

Sample ID: H5-MW-3-091715**Modified EPA Method 537**

| Client Data | | Sample Data | | Laboratory Data | | | | | | |
|-----------------|---------------------|--------------|---------|-----------------|-----------------|-----------------|-------------|----------|----|--|
| Name: | AMEC Foster Wheeler | Matrix: | Aqueous | Lab Sample: | 1500896-06 | Date Received: | 19-Sep-2015 | 8:50 | | |
| Project: | 5023-14-JP02 WE02 | Sample Size: | 0.118 L | QC Batch: | B5I0119 | Date Extracted: | 21-Sep-2015 | 7:52 | | |
| Date Collected: | 17-Sep-2015 12:41 | | | Date Analyzed: | 01-Oct-15 18:57 | Column: | BEH C18 | Analyst: | AC | |
| Location: | | | | | | | | | | |

| Analyte | Conc. (ng/L) | MDL | LOD | LOQ | Qualifiers | Labeled Standard | %R | LCL-UCL | Qualifiers |
|---------|--------------|-------|------|------|------------|------------------|------|----------|------------|
| PFOA | 2.90 | 1.39 | 4.24 | 8.48 | J | IS 13C2-PFOA | 111 | 60 - 150 | |
| PFOS | 4.18 | 0.449 | 4.24 | 8.48 | J | IS 13C8-PFOS | 91.9 | 60 - 150 | |

DL - Sample specific estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL - Lower control limit - upper control limit

Results reported to the MDL

Matrix Spike Results

Modified EPA Method 537

| Source Client ID: H5-MW-3-091715 | | QC Batch: B5I0119 | | Lab Sample: B5I0119-MS1/B5I0119-MSD1 | | | | | | | | |
|----------------------------------|-----------------|----------------------------------|---------------|--|--------|-------|---------------|------------------|-------|---------------|--------|---------------|
| Source LabNumber: 1500896-06 | | Date Extracted: 21-Sep-2015 7:52 | | Date Analyzed: 01-Oct-15 20:00 Column: BEH C18 Analyst: AC | | | | | | | | |
| Matrix: Aqueous | | | | 01-Oct-15 20:13 Column: BEH C18 Analyst: AC | | | | | | | | |
| Sample Size: 0.121/0.124 L | | | | | | | | | | | | |
| Analyte | Spike-MS (ng/L) | MS %R | MS Qualifiers | Spike-MSD (ng/L) | MSD %R | RPD | MS Qualifiers | Labeled Standard | MS %R | MS Qualifiers | MSD %R | MS Qualifiers |
| PFOA | 82.7 | 89.0 | | 80.7 | 88.9 | 0.112 | | IS 13C2-PFOA | 103 | | 108 | |
| PFOS | 82.7 | 96.6 | | 80.7 | 93.7 | 3.05 | | IS 13C8-PFOS | 94.8 | | 90.7 | |

Sample ID: 16-26B-091815**Modified EPA Method 537**

| Client Data | | Sample Data | | | Laboratory Data | | | | | |
|-----------------|---------------------|--|---------|------|-----------------|------------------|-----------------|------------------|------------|--|
| Name: | AMEC Foster Wheeler | Matrix: | Aqueous | | Lab Sample: | 1500896-07 | Date Received: | 19-Sep-2015 8:50 | | |
| Project: | 5023-14-JP02 WE02 | Sample Size: | 0.125 L | | QC Batch: | B5I0119 | Date Extracted: | 21-Sep-2015 7:52 | | |
| Date Collected: | 18-Sep-2015 11:22 | Date Analyzed: 01-Oct-15 19:09 Column: BEH C18 Analyst: AC | | | | | | | | |
| Location: | | | | | | | | | | |
| Analyte | Conc. (ng/L) | MDL | LOD | LOQ | Qualifiers | Labeled Standard | %R | LCL-UCL | Qualifiers | |
| PFOA | ND | 1.31 | 4.00 | 7.97 | | IS 13C2-PFOA | 116 | 60 - 150 | | |
| PFOS | ND | 0.422 | 4.00 | 7.97 | | IS 13C8-PFOS | 91.6 | 60 - 150 | | |

DL - Sample specific estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL - Lower control limit - upper control limit

Results reported to the MDL

DATA QUALIFIERS & ABBREVIATIONS

| | |
|--------------|---|
| B | This compound was also detected in the method blank. |
| D | Dilution |
| E | The associated compound concentration exceeded the calibration range of the instrument. |
| H | Recovery and/or RPD was outside laboratory acceptance limits. |
| I | Chemical Interference |
| J | The amount detected is below the Lower Calibration Limit of the instrument. |
| * | See Cover Letter |
| Conc. | Concentration |
| DL | Sample-specific estimated detection limit |
| MDL | The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero in the matrix tested. |
| EMPC | Estimated Maximum Possible Concentration |
| NA | Not applicable |
| RL | Reporting Limit – concentrations that correspond to low calibration point |
| ND | Not Detected |
| TEQ | Toxic Equivalency |

Unless otherwise noted, solid sample results are reported in dry weight. Tissue samples are reported in wet weight.

CERTIFICATIONS

| Accrediting Authority | Certificate Number |
|---|---------------------------|
| California Department of Health – ELAP | 2892 |
| DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005 | 3091.01 |
| Florida Department of Health | E87777 |
| Hawaii Department of Health | N/A |
| Louisiana Department of Environmental Quality | 01977 |
| Maine Department of Health | 2014022 |
| Michigan Department of Natural Resources | 9932 |
| Nevada Division of Environmental Protection | CA004132015-1 |
| New Jersey Department of Environmental Protection | CA003 |
| New York Department of Health | 11411 |
| Oregon Laboratory Accreditation Program | 4042-003 |
| Pennsylvania Department of Environmental Protection | 012 |
| South Carolina Department of Health | 87002001 |
| Tennessee Department of Environment & Conservation | TN02996 |
| Texas Commission on Environmental Quality | T104704189-15-6 |
| Virginia Department of General Services | 7923 |
| Washington Department of Ecology | C584 |
| Wisconsin Department of Natural Resources | 998036160 |

SAMPLE LOG-IN CHECKLIST



Vista Project #: 1500896 TAT Std

| | | | |
|--|---|---|---|
| Samples Arrival: | Date/Time <u>9/18/15 0904</u> | Initials: <u>DB</u> | Location: <u>WR-2</u> Shelf/Rack: <u>N/A</u> |
| Logged In: | Date/Time <u>9/18/15 1330</u> | Initials: <u>BSB</u> | Location: <u>WR-2</u> Shelf/Rack: <u>A5</u> |
| Delivered By: | <input checked="" type="checkbox"/> FedEx | <input type="checkbox"/> UPS | <input type="checkbox"/> On Trac |
| | <input type="checkbox"/> DHL | <input type="checkbox"/> Hand Delivered | <input type="checkbox"/> Other |
| Preservation: | <input checked="" type="checkbox"/> Ice | <input type="checkbox"/> Blue Ice | <input type="checkbox"/> Dry Ice |
| | <input type="checkbox"/> None | | |
| Temp °C: <u>0.5</u> (uncorrected) | Time: <u>0946</u> | | Thermometer ID: IR-2 |
| Temp °C: <u>0.4</u> (corrected) | | | |

| | YES | NO | NA |
|--|-------|--------|---------|
| Adequate Sample Volume Received? | ✓ | | |
| Holding Time Acceptable? | ✓ | | |
| Shipping Container(s) Intact? | ✓ | | |
| Shipping Custody Seals Intact? | ✓ | | |
| Shipping Documentation Present? | ✓ | | |
| Airbill | ✓ | | |
| Trk # <u>7745 2908 4740</u> | | | |
| Sample Container Intact? | ✓ | | |
| Sample Custody Seals Intact? | | | ✓ |
| Chain of Custody / Sample Documentation Present? | ✓ | | |
| COC Anomaly/Sample Acceptance Form completed? | | ✓ | |
| If Chlorinated or Drinking Water Samples, Acceptable Preservation? | | | ✓ |
| Na ₂ S ₂ O ₃ Preservation Documented? | | | None |
| Shipping Container | Vista | Client | Retain |
| | | Return | Dispose |

Comments:



CHAIN OF CUSTODY

FOR LABORATORY USE ONLY *ASB 9/21/15* Storage Secured No
 Laboratory Project ID: 1500909
 Storage ID: WR-7 Temp: 2-1 °C

1500896

TAT: (Check One):
 Standard: 21 Days
 Rush (surcharge may apply):
 14 days 7 days Specify: _____

Project I.D.: ED23-14-JP02 WE02 P.O.# 262 Sampler: Joseph Dumont / Kelli Miller

Lisa Yespas KMEA 2423 Hoover Ave. San Diego (Name) CA 91950

Invoice to: Name Company Address City State Zip Ph# Fax#

Relinquished by: (Signature and Printed Name) Joseph Dumont Date: 09/18/15 Time: 12:30 Received by: (Signature and Printed Name) W. Lyksen Date: 9/19/15 Time: 08:50

Relinquished by: (Signature and Printed Name) _____ Date: _____ Time: _____ Received by: (Signature and Printed Name) _____ Date: _____ Time: _____

See "Sample Log-in Checklist" for additional sample information

SHIP TO: Vista Analytical Laboratory
 1104 Windfield Way
 El Dorado Hills, CA 95762
 (916) 673-1520 • Fax (916) 673-0106
 ATTN: Martha Maier (PM)

Method of Shipment: FedEx

Tracking No.: _____

| Add Analysis(es) Requested | | Container(s) | | EPA1613 | | EPA8290 | | EPA8280 | | EPA1668 | | EPA1614 | | CARB429 | | | | |
|----------------------------|------|--------------|-----------|----------------|-----------|-----------|----------------|-----------|-----------|----------------|-----------|---------|----------------|---------------|------|-----|--------|------------------|
| Quantity | Type | Matrix | 2378-TCDD | 2378-TCDD/TCDF | PCDD/PCDF | 2378-TCDD | 2378-TCDD/TCDF | PCDD/PCDF | 2378-TCDD | 2378-TCDD/TCDF | PCDD/PCDF | TOTALS | COPLANAR PCB's | 209 CONGENERS | PBDE | PAH | WHO-29 | EPA537 Mod (P/P) |

| Sample ID | Date | Time | Location/Sample Description | Quantity | Type | Matrix | 2378-TCDD | 2378-TCDD/TCDF | PCDD/PCDF | 2378-TCDD | 2378-TCDD/TCDF | PCDD/PCDF | TOTALS | COPLANAR PCB's | 209 CONGENERS | PBDE | PAH | WHO-29 | EPA537 Mod (P/P) |
|-----------------|---------|-------|-----------------------------|----------|------|--------|-----------|----------------|-----------|-----------|----------------|-----------|--------|----------------|---------------|------|-----|--------|------------------|
| JP02-FB | 9/17/15 | 10:32 | Field Blank | 2 | 0 | AQ | | | | | | | | | | | | X | X |
| H5-MW-1-091715 | 9/17/15 | 11:42 | H5-MW-1 | 2 | 0 | AQ | | | | | | | | | | | | X | X |
| FD-091715 | 9/17/15 | 11:40 | FD | 2 | 0 | AQ | | | | | | | | | | | | X | X |
| *H5-MW-3-091715 | 9/17/15 | 12:41 | H5-MW-3 | 6 | 0 | AQ | | | | | | | | | | | | X | X |
| 16-26B-091815 | 9/18/15 | 11:22 | 16-26B | 2 | 0 | AQ | | | | | | | | | | | | X | X |

Special Instructions/Comments:
*Sample H5-MW-3-091715 - MS/MSD also collected

SEND DOCUMENTATION AND RESULTS TO:

Name: Kevin Olness
 Company: Amec Foster Wheeler
 Address: 9177 Sky Park Court
 City: San Diego State: CA Zip: 92123
 Phone: 412-4412-3171 Fax: _____
 Email: Kevin.olness@amectw.com
 Matrix Types: DW = Drinking Water, EF = Effluent, PP = Pulp/Paper,
 SD = Sediment, SL = Sludge, SO = Soil, WW = Wastewater, B = Blood/Serum
 AQ = Aqueous, O = Other _____

Container Types: A = 1 Liter Amber, G = Glass Jar
 P = PUF, T = MMS Train, O = Other 125mL HPPE

*Bottle Preservative Type: T = Thiosulfate,
 O = Other _____

WHITE - ORIGINAL

YELLOW - ARCHIVE

PINK - COPY

SAMPLE LOG-IN CHECKLIST



PSB 9/21/15
1500909-1500896 TAT 14

Vista Project #: _____

| | | | | | | |
|---------------------|--|--------------------------------|-------------------------------|----------------------------|--------------------------------------|-----------------------------|
| Samples Arrival: | Date/Time <i>9/19/15 08:50</i> | | Initials: <i>MP</i> | | Location: <i>WR-2</i> | |
| | | | | | Shelf/Rack: <u>NA</u> | |
| Logged In: | Date/Time <i>9/21/15 1104</i> | | Initials: <i>PSB</i> | | Location: <i>WR-2</i> | |
| | | | | | Shelf/Rack: <u>A5</u> | |
| Delivered By: | <input checked="" type="radio"/> FedEx | <input type="radio"/> UPS | <input type="radio"/> On Trac | <input type="radio"/> DHL | <input type="radio"/> Hand Delivered | <input type="radio"/> Other |
| Preservation: | <input checked="" type="radio"/> Ice | <input type="radio"/> Blue Ice | <input type="radio"/> Dry Ice | <input type="radio"/> None | | |
| Temp °C: <i>2.2</i> | <i>(uncorrected)</i> | Time: <i>09:15</i> | | Thermometer ID: IR-2 | | |
| Temp °C: <i>2.1</i> | <i>(corrected)</i> | | | | | |

| | | YES | NO | NA |
|--|--|-------------------------------------|---|---------------------------------------|
| Adequate Sample Volume Received? | | <input checked="" type="checkbox"/> | | |
| Holding Time Acceptable? | | <input checked="" type="checkbox"/> | | |
| Shipping Container(s) Intact? | | <input checked="" type="checkbox"/> | | |
| Shipping Custody Seals Intact? | | <input type="checkbox"/> | | |
| Shipping Documentation Present? | | <input type="checkbox"/> | | |
| Airbill | Trk # <i>8087 9797 1651</i> | <input checked="" type="checkbox"/> | | |
| Sample Container Intact? | | <input checked="" type="checkbox"/> | | |
| Sample Custody Seals Intact? | | | | <input checked="" type="checkbox"/> |
| Chain of Custody / Sample Documentation Present? | | <input checked="" type="checkbox"/> | | |
| COC Anomaly/Sample Acceptance Form completed? | | | <input checked="" type="checkbox"/> | |
| If Chlorinated or Drinking Water Samples, Acceptable Preservation? | | | | <input checked="" type="checkbox"/> |
| Na ₂ S ₂ O ₃ Preservation Documented? | COC | Sample Container | | <input checked="" type="radio"/> None |
| Shipping Container | <input checked="" type="radio"/> Vista | Client | <input checked="" type="radio"/> Retain | Return <input type="radio"/> |
| Dispose <input type="radio"/> | | | | |

Comments:

Attachment 3
Data Validation Report

Data Validation Report

Soil and Groundwater Sampling Hangar 5 and Rothbeck Ravine, Naval Air Station Whidbey Island Oak Harbor, Washington

Naval Facility Engineering Command Northwest
Prime Contract Number: N62473-12-D-2012
Task Order JP02

Groundwater Samples

Laboratory SDG Numbers:

K1508083, K1509242, 1500896

Prepared for:

AECOM

1501 Fourth Avenue, Suite 1400
Seattle, WA 98101-1616

Prepared by:

Pyron Environmental, Inc.

3530 32nd Way NW
Olympia, WA 98502

October 27, 2015

ACRONYMS

| | |
|-----------------|--|
| %D | Percent difference |
| %R | Percent recovery |
| %RSD | Percent relative standard deviation |
| ALS | ALS Environmental |
| BFB | Bromofluorobenzene |
| CCB | Continuing calibration blank |
| CCV | Continuing calibration verification |
| CF | Calibration factor |
| CLP | U.S. EPA Contract Laboratory Program |
| COC | Chain-of-custody |
| CVAA | Cold vapor atomic absorption |
| DoD | U.S. Department of Defense |
| DRO | Diesel range organics |
| EPA | U.S. Environmental Protection Agency |
| EPH | Extractable petroleum hydrocarbons |
| GC/FID | Gas chromatography/flame ionization detector |
| GC/MS | Gas chromatography/mass spectrometry |
| GRO | Gasoline range organics |
| ICAL | Initial calibration |
| ICB | Initial calibration blank |
| ICP/MS | Inductively coupled plasma/mass spectrometry |
| ICS | ICP Interference check sample |
| ICV | Initial calibration verification |
| LC/MS/MS | Liquid chromatography/tandem mass spectrometry |
| LCS | Laboratory control sample |
| LCSD | Laboratory control sample duplicate |
| LOD | Limit of detection |
| LOQ | Limit of quantitation |
| MDL | Method detection limit |
| MS | Matrix spike |
| MSD | Matrix spike duplicate |
| µg/L | Microgram per liter |
| NFG | CLP National Functional Guidelines for Data Review (EPA 2014a,b) |

| | |
|-------------|---------------------------------|
| ng/L | Nanogram per liter |
| OPR | Ongoing precision and recovery |
| PFOA | Perfluorooctanoic acid |
| PFOS | Perfluorooctanesulfonic acid |
| QC | Quality control |
| RF | Response factor |
| RPD | Relative percent difference |
| RRO | Residual range organics |
| RRT | Relative retention time |
| RT | Retention time |
| SDG | Sample delivery group |
| SOP | Standard operating procedure |
| SVOC | Semi-volatile organic compound |
| VOC | Volatile organic compound |
| VPH | Volatile petroleum hydrocarbons |

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during July and September 2015 for the referenced project. The laboratory reports validated herein were submitted by ALS Environmental (ALS) in two sample delivery groups (SDG) assigned ALS Service Request Numbers: K1508083 and K1509242; and by Vista Analytical Laboratory (Vista) in one SDG assigned Vista Work Order No. 1500896.

A Stage 3 (as defined in EPA 2009b) or Level IV (as defined in NAVFAC NW 2006) data validation was performed on these laboratory reports. The validation followed the guidelines and protocols below, as applicable:

- *Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories (QSM), Final Version 5.0*, DoD Environmental Data Quality Workgroup. July 2013.
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*. Office of Superfund Remediation and Technical Innovation. August 2014. EPA 540-R-013-001.
- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Superfund Data Review*. Office of Superfund Remediation and Technical Innovation. August 2014. EPA 540-R-014-002.
- *Naval Facilities Engineering Command Northwest (NAVFAC NW) Standard Operation Procedure (SOP): Field Standard Operating Procedures, Version 4.0*. August, 2006.

Data were evaluated using quality control (QC) criteria specified in the analytical methods, the *DoD QSM Version 5.0*, and the project-specific scope of work for data validation (AECOM2014).

Validation findings are discussed for each QC parameter pertinent to each type of analyses evaluated. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. As part of the level IV validation, 10 percent of the initial calibrations, calibration verifications, laboratory QC analyses, and sample results were verified via re-calculation checks. Samples and the associated analyses validated herein are summarized as follows:

| Field SampleID | Laboratory Sample ID | Sampling Date | Matrix | Analysis | | | | | | |
|----------------|----------------------|---------------|--------|----------|------|--------------|--------|-----|------------|------------|
| | | | | VOC | SVOC | PFOA PFOS | Metals | GRO | DRO RRO | VPH EPH |
| RR-MW-5-072215 | K1508083-001 | 07/22/15 | Water | X | X | | X | X | X | |
| RR-MW-4-072215 | K1508083-002 | 07/22/15 | Water | X | X | | X | X | X | |
| RR-MW-3-072215 | K1508083-003 | 07/22/15 | Water | X | X | | X | X | X | |
| RR-MW-2-072315 | K1508083-004 | 07/23/15 | Water | X | X | | X | X | X | |

| Field SampleID | Laboratory Sample ID | Sampling Date | Matrix | Analysis | | | | | | |
|-----------------|----------------------|---------------|--------|----------|------|--------------|--------|-----|------------|------------|
| | | | | VOC | SVOC | PFOA PFOS | Metals | GRO | DRO RRO | VPH EPH |
| RR-MW-1-072315 | K1508083-005 | 07/23/15 | Water | X | X | | X | X | X | |
| RR-GW-FD-072315 | K1508083-006 | 07/23/15 | Water | X | X | | X | X | X | |
| RR-GW-ER-072215 | K1508083-007 | 07/22/15 | Water | X | X | | X | X | X | |
| Trip Blank | K1508083-008 | 07/22/15 | Water | X | | | | X | | |
| H5-MW-1-081915 | K1509242-001 | 08/19/15 | Water | X | X | | X | X | X | X |
| H5-GW-FD-081915 | K1509242-002 | 08/19/15 | Water | X | X | | X | X | X | X |
| H5-MW-2-082015 | K1509242-003 | 08/20/15 | Water | X | X | | X | X | X | X |
| H5-MW-3-082015 | K1509242-004 | 08/29/15 | Water | X | X | | X | X | X | X |
| Trip Blank | K1509242-005 | 08/19/15 | Water | | | | | | | VPH |
| MW31-7A-091515 | 1500896-01 | 09/15/15 | Water | | | X | | | | |
| MW31-9A-091515 | 1500896-02 | 09/15/15 | Water | | | X | | | | |
| JP02-FB | 1500896-03 | 09/17/15 | Water | | | X | | | | |
| H5-MW-1-091715 | 1500896-04 | 09/17/15 | Water | | | X | | | | |
| FD-091715 | 1500896-05 | 09/17/15 | Water | | | X | | | | |
| H5-MW-3-091715 | 1500896-06 | 09/17/15 | Water | | | X | | | | |
| 16-26B-091815 | 1500896-07 | 09/18/15 | Water | | | X | | | | |

Notes:

X – The analysis was requested and performed on the sample.

DRO – Diesel range organics

EPH – Extractable petroleum hydrocarbons

GRO – Gasoline range organics

Metals – Dissolved arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver

PFOA –Perfluorooctanoic acid

PFOS –Perfluorooctanesulfonic acid

RRO – Residual range organics

SVOC – Semi-volatile organic compound

VOC – Volatile organic compound

VPH – Volatile petroleum hydrocarbons

Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

| Parameter | Analytical Method | Laboratory |
|---------------|--------------------------|--|
| VOCs | SW846 Method 8260C | ALS Environmental Kelso, Washington |
| SVOCs | SW846 Method 8270D | |
| GRO | NWTPH-Gx | |
| DRO and RRO | NWTPH-Dx | |
| Metals | SW846 Methods6020A/7470A | |
| VPH | NWTPH-VPH | ALS Environmental Everett, Washington |
| EPH | NWTPH-EPH | |
| PFOA and PFOS | EPA Method 737 Modified | Vista Analytical Laboratory El Dorado Hills, California |

Notes:

SW846 Methods –USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.

NWTPH Methods – Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997.

EPA Method 537 - Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), EPA/600/R-08/092. USEPA. September 2009.

DRO – Diesel range organics

EPH – Extractable petroleum hydrocarbons

GRO – Gasoline range organics

Metals – Dissolved arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver

PFOA – Perfluorooctanoic acid

PFOS – Perfluorooctanesulfonic acid

RRO – Residual range organics

SVOC – Semi-volatile organic compound

VOC – Volatile organic compound

VPH – Volatile petroleum hydrocarbons

DATA VALIDATION FINDINGS

1. Volatile Organic Compounds (VOCs) by GC/MS (SW846 Method 8260C)

1.1 Sample Management and Holding Time

No anomalies in relation to sample delivery and preservation were noted, according to the completed chain-of-custody (COC) forms submitted by the laboratory.

Water samples should be analyzed within 14 days of collection. All samples were analyzed within the required holding time.

1.2 GC/MS Instrument Tuning

The method requires that (1) a gas chromatograph/mass spectrometer (GC/MS) tuning analysis be performed using bromofluorobenzene (BFB) at the beginning of each 12-hour period prior to any analysis, and (2) specific mass ions meet the criteria provided in the method. Tuning analyses were performed at the required frequency; all required ion abundance ratios met the method requirements.

1.3 Initial Calibration

The method and the laboratory standard operation procedures require that (1) if linear average response factors (RFs) is chosen as the quantitation option, the %RSD of RFs be $\leq 15\%$ for target compounds, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be ≥ 0.99 and the recovery of lowest standard is within 70-130%, (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be ≥ 0.99 , (4) compound RFs are \geq the minimum RF specified in Method 8260C, Table 4, and (5) a second source standard (ICV) should be analyzed immediately after the initial calibration and the percent difference (%D) values for all target and surrogate compounds should be within $\pm 30\%$. The Initial calibration met all the criteria, except that the average RFs for trichloroethene, 1,4-dioxane, and bromodichloromethane were less than the minimum RF criteria. The recovery of the reporting-limit check standard was acceptable for these compound. No data qualifying action was taken based on this ICAL deviation.

1.4 Calibration Verification

The method requires that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D values be within $\pm 20\%$, (3) compound RFs are \geq the minimum RF specified in Method 8260C, Table 4, and (4) the internal standards in the calibration verification standard changes by a factor of two (-50% to + 100%) from that in the mid-point

standard level of the most recent initial calibration sequence. Calibration verification analyses met the criteria, except for the following:

| Calibration Verification ID | Analyte | %D | Bias | Affected Sample | Data Qualifier |
|-----------------------------|--|--|------|--|----------------|
| MS18\0729F007.D | Dichlorodifluoromethane Bromomethane Chloromethane Vinyl Chloride Naphthalene | -28% -28% -43% -27% -27% | Low | RR-MW-4-072215 RR-MW-3-072215 RR-MW-2-072315 RR-MW-1-072315 RR-GW-FD-072315 RR-GW-ER-072215 | UJ |
| MS18\0729F007.D | Naphthalene | -29% | Low | H5-MW-1-081915 | UJ |
| MS13\0901F010.D | Carbon Disulfide <i>trans</i> -1,3-Dichloropropene Dibromochloromethane Bromoform 1,2-Dibromo-3-chloropropane Naphthalene | -21% -22% -23% -33% -23% -27% | Low | H5-MW-1-081915 H5-GW-FD-081915 H5-MW-2-082015 H5-MW-3-082015 | UJ |

1.5 Blanks

Method Blanks: Method blanks were prepared and analyzed as required. Target compounds were either not detected at or above the method detection limits (MDLs) in the method blanks or the detected compounds were not detected in associated samples, except that chloroform, ethylbenzene, m- & p-xylenes, and o-xylene were detected in method blank KWG1508338-4 at levels greater than their MDLS but less than the LOQs. Associated ample results greater than MDLs but less than LOQs were qualified (U) as non-detected at their LOQs. As summarized in **SUMMARY, Table II**.

Trip Blanks: Four trip blanks were submitted for VOCs analyses. Target compounds were either not detected at or above the MDLs in the trip blanks or the detections were qualified as non-detected based on method blank results with the exception of toluene. Toluene was detected in all trip blanks at levels greater than the MDLs but less than the limits of quantitation (LOQs). All toluene results were qualified (U) at their LOQs, as summarized in **SUMMARY, Table II**.

Rinsate Blanks: One equipment rinsate blanks were submitted for VOCs analyses. Target compounds were either not detected at or above the MDLs in the rinsate blank or the detections were qualified as non-detected based on method blank and/or trip blank results. No data were qualified as a result of detections in the rinsate blank.

1.6 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required. All percent recovery (%R) and relative percent difference (RPD) values were either within the project control limits or

the outliers had no adverse effects on data usability (*e.g.*, biased-high surrogate spike %R value where associated compounds were not detected in the sample).

1.7 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were either within the project control limits or the outliers had no adverse effects on data usability (*e.g.*, biased-high surrogate spike %R value where associated compounds were not detected in the sample; or only one of the surrogate spike had %R value less than the lower control limits where %R values for the remaining surrogate spikes were within the control limits).

1.8 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were performed on project samples as requested. All %R and RPD values were either within the project control limits or the outliers had no adverse effects on data usability (*e.g.*, biased-high matrix spike %R value for a compound which was not detected in the un-spiked sample).

1.9 Internal Standard

The project and method require that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to $+100\%$ of the associated 12-hour calibration verification standard.

1.10 Target Compound Identification

Target compound identification was evaluated by examining if (1) the RRT was within ± 0.06 RRT units of the standard RRT for a positively identified compound, (2) the characteristic ion intensity of a positively identified compound was within $\pm 30\%$ in comparison with the reference spectrum, and (3) ions of a positively identified compound with $>10\%$ relative abundance should be present. No anomalies were found in relation to target compound identification.

1.11 Target Compound Quantitation and Limits of Quantitation (LOQs)

The sample-specific LOQs were supported with adequate initial calibration concentrations. Sample-specific LOQs attained to the project requirement.

A verification calculation was performed on 10% of the reported calibrations, laboratory QC analysis, and sample results. No transcription and calculation anomalies were found.

1.12 Field Duplicates

One field duplicate pair were submitted for VOCs analyses. Sample results, RPD (or concentration difference) values, and data qualification were presented in **Appendix A**.

1.13 Overall Assessment of VOCs Data Usability

VOCs data are of known quality and acceptable for use as qualified.

2. Semi-volatile Organic Compounds (SVOCs) by GC/MS (EPA Method 8270D)

2.1 Sample Management and Holding Time

No anomalies in relation to sample delivery and preservation were noted, according to the completed chain-of-custody (COC) forms submitted by the laboratory.

Water samples should be extracted within seven days and soil within 14 days of collection; extracts should be analyzed within 40 days of extraction. All samples were analyzed within the required holding time.

2.2 GC/MS Instrument Tuning

The method requires that (1) a gas chromatograph/mass spectrometer (GC/MS) tuning analysis be performed using bromofluorobenzene (BFB) at the beginning of each 12-hour period prior to any analysis, and (2) specific mass ions meet the criteria provided in the method. Tuning analyses were performed at the required frequency; all required ion abundance ratios met the method requirements.

2.3 Initial Calibration

The method and the laboratory standard operation procedures require that (1) if linear average response factors (RFs) is chosen as the quantitation option, the %RSD of RFs be $\leq 15\%$ for target compounds, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be ≥ 0.99 and the recovery of lowest standard is within 70-130%, (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be ≥ 0.99 , (4) compound RFs are \geq the minimum RF specified in Method 8270D, Table 4, and (5) a second source standard (ICV) should be analyzed immediately after the initial calibration and the percent difference (%D) values for all target and surrogate compounds should be within $\pm 30\%$. The Initial calibration met all the criteria.

2.4 Calibration Verification

The method requires that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D values be within $\pm 20\%$, (3) compound RFs are \geq the minimum RF specified in Method 8270D, Table 4, and (4) the internal standards in the calibration verification standard changes by a factor of two (-50% to + 100%) from that in the mid-point standard level of the most recent initial calibration sequence. Calibration verification analyses met the criteria.

2.5 Blanks

Method Blanks: Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the MDLs in the method blanks.

Rinsate Blanks: One equipment rinsate blank was submitted for SVOCs analyses. Target analytes were not detected at or above the MDLs in the rinsate blank except for diethyl phthalate. Diethyl phthalate results in affected samples were greater than their MDLs but less than LOQs; these results were qualified (U) as non-detects at their LOQs, as summarized in **SUMMARY, Table II**.

2.6 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required. All percent recovery (%R) and relative percent difference (RPD) values were within the project control limits.

2.7 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were either within the project control limits or the outliers had no adverse effects on data usability (*e.g.*, biased-high surrogate spike %R value where associated compounds were not detected in the sample).

2.8 Matrix Spike (MS) and MS Duplicate (MSD)

MS/MSD analyses were performed on project samples as requested. All %R and RPD values were either within the project control limits or the outliers had no adverse effects on data usability (*e.g.*, biased-high matrix spike %R value for a compound which was not detected in the un-spiked sample), except that RPD value (39%) for 3,3'-dichlorobenzidine in the MS/MSD analyses performed on sample RR-MW-2-072315 was outside the project control limit ($\leq 20\%$). The 3,3'-dichlorobenzidine result for sample RR-MW-2-072315 was qualified (UJ) as estimated.

2.9 Internal Standards

The project and method require that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to $+100\%$ of the associated 12-hour calibration verification standard. All internal standards in the sample and associated QC analyses met the criteria.

2.10 Target Compound Identification

Target compound identification was evaluated by examining if (1) the RRT was within ± 0.06 RRT units of the standard RRT for a positively identified compound, (2) the characteristic ion intensity of a positively identified compound was within $\pm 30\%$ in comparison with the reference spectrum, and (3) ions of a positively identified compound with $>10\%$ relative abundance should be present. No anomalies were found in relation to target compound identification.

2.11 Limits of Quantitation (LOQs) and Compound Quantitation

The sample-specific LOQs were supported with adequate initial calibration concentrations. LOQ attained to the project requirements.

A verification calculation was performed on 10% of the reported calibrations, laboratory QC analysis, and sample results. No transcription and calculation anomalies were found.

2.12 Field Duplicates

Four field duplicate pairs were submitted for SVOCs analyses. Sample results, RPD (or concentration difference) values, and data qualification were presented in **Appendix A**.

2.13 Overall Assessment of SVOC Data Usability

SVOCs data are of known quality and acceptable for use as qualified.

3. Perfluorooctanoic Acid (PFOA) and Perfluorooctanesulfonic Acid (PFOS) by LC/MS/MS (EPA Method 537 Modified)

3.1 Sample Management

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation. No anomalies were identified in relation to sample preservation, handling, and transport.

Water samples should be extracted within 14 days of collection. Sample extracts should be analyzed within 28 days of extraction. All samples were extracted and analyzed within the required holding times.

3.2 Initial Calibration

The method requires that at least five standards at different concentration for each analyte were used to establish the initial calibration (ICAL) curve; the curve has to be forced through zero. When each CAL standard is calculated as an unknown using the calibration curve, the analyte results should be 70-130% of the true value for all except the lowest standard, which should be 50-150% of the true value.

To evaluate the linearity of the ICAL, the criteria were (1) if linear average response factors (RFs) is chosen as the quantitation option, the %RSD of RFs be $\leq 15\%$ for target compounds, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be ≥ 0.99 and the recovery of lowest standard is within 70-130%, (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be ≥ 0.99 , and (4) a second source standard (ICV) should be analyzed immediately after the initial calibration and the percent difference (%D) values for all target and surrogate compounds should be within $\pm 30\%$. The Initial calibration met all the criteria.

3.3 Calibration Verification

The method requires that (1) The ICAL should be verified by analyzing a low level (at the MRL or below) CCV standard prior to analyzing samples, after every 10 samples and after the last sample; rotating concentrations to cover the calibrated range of the instrument, and (2) Recovery for each analyte and surrogate spikes must be within 70-130% of the true value for all but the lowest level of calibration. Recovery for each analyte in the lowest CAL level must be within 50-150% of the true value and the surrogate spikes must be within 70-130% of the true value. The continuing calibration verification met the method criterion.

3.4 Blanks

Method Blanks: Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the MDLs in the method blanks.

Field Blank: One field blank was submitted for PFOA and PFOS analyses. PFOA was detected at 1.96 ng/L in the field blank. All sample results were greater than 5x this level; no data qualifying action was necessary. PFOS was not detected at or above the MDLs in the trip blanks.

3.5 Ongoing Precision and Recovery (OPR)

OPR analyses were performed as required by the method. The %R values met the project control criterion.

3.6 Surrogate Spikes

Surrogate spikes were added to all samples and QC analyses as required by the method. The %R values were within the laboratory control limits.

3.7 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were performed on a project sample as requested. All %R and RPD values met the project control criteria.

3.8 Internal Standards

The method requires that peak area counts for all internal standards in all injections must be within $\pm 50\%$ of the average peak area calculated during the initial calibration and 70-140% from the most recent CCV. All internal standard recovery met the method requirements.

3.9 Field Duplicates

One pair of field duplicates were submitted for PCBs analyses. Sample results, RPD (or concentration difference) values, and data qualification are presented in **Appendix A**.

3.10 Compound Identification

No anomaly in relation to compound identification was found.

3.11 Compound Quantitation and Reporting Limits

Recalculation was performed at 10% frequency on the reported QC and sample analyses. No anomalies were found via the verification calculation.

The sample-specific LOQs were adjusted for the sample size and percent moisture, and supported with appropriate initial calibration concentrations. LOQs met the project requirements.

3.12 Overall PFOA and PFOS Data Usability Assessment

The PFOA and PFOS data are of known quality and acceptable for use.

4. GRO by GC/FID (Method NWTPH-Gx)

4.1 Sample Management and Holding Times

No anomalies in relation to sample delivery and preservation were noted, according to the completed COC forms submitted by the laboratory.

Water samples should be analyzed within 14 days of collection. All samples were analyzed within the required holding times.

4.2 Initial Calibration

A minimum of 5-point calibration was performed. The average response factor %RSD value was $\leq 25\%$, as required by the method. In cases where the linear regression approach was applied, the coefficients of determination (R^2) were all ≥ 0.995 , as required by the method.

A second source standard (ICV) was analyzed immediately after the initial calibration. The %D values were within $\pm 25\%$ for target compounds. The initial calibration was acceptable.

4.3 Calibration Verification

The method and project require that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the %D value be within $\pm 25\%$. Calibration verification was performed at required frequency and met the method requirements.

4.4 Blanks

Method Blanks: Method blanks were prepared and analyzed as required. TPH-Gasoline was not detected at or above the MDLs in the method blanks.

Trip Blank: Two trip blanks were submitted for GRO analyses. GRO was not detected at or above the MDL in the trip blanks.

Rinsate Blank: One rinsate blank was submitted for GRO analyses. GRO was not detected at or above the MDL in the rinsate blank.

4.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were either within the control limits or the outliers were determined as results of matrix effects (rather than insufficient extraction).

4.6 Laboratory Duplicate Analyses

Laboratory duplicate analyses were performed on a project sample as requested. The RPD value met the project criteria.

4.7 Laboratory Control Sample (LCS) and LCS Duplicates (LCSD)

LCS and LCSD analyses were performed as required by the method. The %R and RPD values met the project control limits.

4.8 Target Compound Identification

The laboratory identified the GRO results as alkane range from the peak start of *n*-hexane (C₆) to the peak start of *n*-decane (C₁₀) as specified by the method. No anomalies were found in relation to target compound identification.

4.9 Target Compound Quantitation and Limit of Quantitation (LOQ)

Sample results were reported from the quantitation within the linear ICAL ranges. The reported LOQs were supported with adequate ICAL concentrations. The project-required LOQ was achieved.

A verification calculation was performed on 10% of the reported calibrations, laboratory QC analysis, and sample results. No transcription and calculation anomalies were found.

4.10 Field Duplicates

One pair of field duplicate samples were submitted for GRO analyses. Sample results, RPD (or concentration difference) values, and data qualification were presented in **Appendix A**.

4.11 Overall Assessment of GRO Data Usability

GRO data are of known quality and acceptable for use.

5. DRO and RRO by GC/FID (Method NWTPH-Dx)

5.1 Sample Management and Holding Times

No anomalies in relation to sample delivery and preservation were noted, according to the completed COC forms submitted by the laboratory.

Water samples should be extracted within 14 days of collection and extracts analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

5.2 Initial Calibration

A minimum of 5-point calibration was performed. The average response factor %RSD value was $\leq 25\%$, as required by the method. In cases where the linear regression approach was applied, the coefficients of determination (R^2) were all ≥ 0.995 , as required by the method.

A second source standard (ICV) was analyzed immediately after the initial calibration. The %D values were within $\pm 25\%$ for target compounds. The initial calibration was acceptable.

5.3 Calibration Verification

The method requires that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the %D values be within $\pm 25\%$. Calibration verifications were performed at required frequency. All %D values met the method criteria.

5.4 Method Blanks

Method blanks were prepared and analyzed as required. DRO and RRO were detected at levels greater than MDLs but less than $1/2$ LOQ in all method blanks. Associated

sample results less than their LOQs were qualified as non-detected at their LOQs. Results greater than their LOQs but less than 5x the level found in the method blank were qualified (J) as estimated as summarized in **SUMMARY, Table II**.

Rinsate Blanks: One equipment rinsate blank was submitted for DRO and RRO analyses. These detections were qualified as non-detects based on the method blank results. No data qualifying action was necessary.

5.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were either within the project control limits or the outliers had no adverse effects on data usability (*e.g.*, biased-high surrogate spike %R value where associated compounds were not detected in the sample).

5.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were performed on project samples as requested. All %R and RPD values were either within the project control limits.

5.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. The %R and RPD values met the project control limits.

5.8 Target Compound Identification

The laboratory identified DRO as the integration of response from carbon range C₁₀ to C₂₅ as specified by the project and method. No anomalies were found in relation to target compound identification.

5.9 Target Compound Quantitation and Limit of Quantitation (LOQ)

Sample results were reported from the quantitation within the linear ICAL ranges. The reported LOQs were supported with adequate ICAL concentrations. The project-required LOQ was achieved.

A verification calculation was performed on 10% of the reported calibrations, laboratory QC analysis, and sample results. No transcription and calculation anomalies were found.

5.10 Field Duplicates

One pair of water field duplicate samples were submitted for DRO and RRO analyses. Two pairs of water field duplicates were submitted for RRO analyses. Sample results, RPD (or concentration difference) values, and data qualification were presented in **Appendix A**.

5.11 Overall Assessment of DRO and RRO Data Usability

DRO and RRO data are of known quality and acceptable for use as qualified.

6. Volatile Petroleum Hydrocarbons (VPH) by GC/FID (Method NWTPH-VPH)

6.1 Sample Management and Holding Times

No anomalies in relation to sample delivery and preservation were noted, according to the completed COC forms submitted by the laboratory.

Water samples should be analyzed within 14 days of collection. All samples were analyzed within the required holding times.

6.2 Initial Calibration

A minimum of 5-point calibration was performed. The average response factor %RSD value was $\leq 25\%$, as required by the method. In cases where the linear regression approach was applied, the coefficients of determination (R^2) were all ≥ 0.995 , as required by the method.

A second source standard (ICV) was analyzed immediately after the initial calibration. The %D values were within $\pm 25\%$ for target compounds. The initial calibration was acceptable.

6.3 Calibration Verification

The method and project require that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the %D value be within $\pm 25\%$. Calibration verification was performed at required frequency and met the method requirements.

6.4 Method Blanks

Method blanks were prepared and analyzed as required. VPH was not detected at or above the MDLs in the method blanks.

6.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the control limits.

6.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS and MSD analyses were performed on a project samples as requested. The %R and RPD values met the project control limits.

6.7 Laboratory Control Sample (LCS) and LCS Duplicates (LCSD)

LCS and LCSD analyses were performed as required by the method. The %R and RPD values met the project control limits.

6.8 Target Compound Identification

No anomalies were found in relation to target compound identification.

6.9 Target Compound Quantitation and Limit of Quantitation (LOQ)

Sample results were reported from the quantitation within the linear ICAL ranges. The reported LOQs were supported with adequate ICAL concentrations. The project-required LOQ was achieved.

A verification calculation was performed on 10% of the reported calibrations, laboratory QC analysis, and sample results. No transcription and calculation anomalies were found.

6.10 Field Duplicates

One pair of field duplicate samples were submitted for EPH analyses. Target analytes were not detected in either sample. Field precision met the project requirements.

6.11 Overall Assessment of VPH Data Usability

VPH data are of known quality and acceptable for use.

7. Extractable Petroleum Hydrocarbons (EPH) by GC/FID (Method NWTPH-EPH)

7.1 Sample Management and Holding Times

No anomalies in relation to sample delivery and preservation were noted, according to the completed COC forms submitted by the laboratory.

Water samples should be extracted within 14 days of collection and extracts analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

7.2 Initial Calibration

A minimum of 5-point calibration was performed. The average response factor %RSD value was $\leq 25\%$, as required by the method. In cases where the linear regression approach was applied, the coefficients of determination (R^2) were all ≥ 0.995 , as required by the method.

A second source standard (ICV) was analyzed immediately after the initial calibration. The %D values were within $\pm 25\%$ for target compounds. The initial calibration was acceptable.

7.3 Calibration Verification

The method requires that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the %D values be within $\pm 25\%$. Calibration verifications were performed at required frequency. All %D values met the method criteria.

7.4 Method Blanks

Method blanks were prepared and analyzed as required. EPH was not detected at or above MDLs in method blanks.

7.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were either within the project control limits or the outliers had no adverse effects on data usability (*e.g.*, biased-high surrogate spike %R value where associated compounds were not detected in the sample).

7.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were performed on a project samples as requested. All %R and RPD values were either within the project control limits or the outliers had no adverse effects on data usability (*e.g.*, biased-high matrix spike %R value for a compound which was not detected in the un-spiked sample).

7.7 Laboratory Control Sample (LCS)and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. The %R and RPD values met the project control limits.

7.8 Target Compound Identification

No anomalies were found in relation to target compound identification.

7.9 Target Compound Quantitation and Limit of Quantitation (LOQ)

Sample results were reported from the quantitation within the linear ICAL ranges. The reported LOQs were supported with adequate ICAL concentrations. The project-required LOQ was achieved.

A verification calculation was performed on 10% of the reported calibrations, laboratory QC analysis, and sample results. No transcription and calculation anomalies were found.

7.10 Field Duplicates

One pair of field duplicate samples were submitted for EPH analyses. Target analytes were not detected in either sample. Field precision met the project requirements.

7.11 Overall Assessment of EPHData Usability

EPHdata are of known quality and acceptable for use.

8. Dissolved Metals by ICP/MS & CVAAS (SW846 Methods 6020A/7470A)

8.1 Sample Management

No anomalies were identified in relation to sample preservation, handling, and transport.

Water samples should be analyzed within 180 days of collection for ICP/MS metals and 28 days for mercury. All samples were analyzed within the required holding times.

8.2 ICP/MS Tuning Analysis

Instrument tuning was performed at the required frequency. The stability check (%RSD <5%), mass calibration (mass difference <0.1 AMU), and resolution check (peak width <0.9 AMU at 5% peak height) met the method criteria.

8.3 Initial Calibration

The ICP methods requires that (1) a blank and one calibration standard be used in establishing the analytical curve, and (2) if one blank and 5 standards are chosen to establish the curve, the correlation coefficient (R) value should be ≥ 0.998 . The laboratory chose the one blank and one calibration standard approach for initial calibrations.

For mercury analysis, the method required using a blank and at least four standard concentrations to establish the initial calibration curve, and the correlation coefficient (R) be ≥ 0.995 .

An Initial calibration verification (ICV), a low-level ICV (LLICV) and a low-level CCV (LLCCV) analysis were performed immediately after instrument calibration for ICP/MS metals. The percent recovery (%R) values were within 90 - 110% for ICP metals ICV, 80-120% for LLICV, and 70-130% for LLCCV. The mercury %R value for the ICV was within 80-120% as required by the method.

8.4 Initial and Continuing Calibration Verification

Continuing calibration verification (CCV) was performed at a frequency of 10% of each sequence. All %R values met the method criterion of 90 – 110%.

8.5 Blanks

Method Blanks: Method blanks were prepared and analyzed as required by the method. Target analytes were either not detected at or above their MDLs sample results were greater than 10x the levels found in the method blanks. No data qualifying action was required.

Initial Calibration Blanks (ICBs) and Continuing Calibration Blanks (CCBs): Target analytes were either not detected at or above their MDLs in ICBs and CCBs or sample results were significantly (10x) greater than the detections in ICBs/CCBs with the exception of lead. Lead results in affected samples were greater than their MDLs but

less than LOQs; these results were qualified (U) as non-detects at their LOQs, as summarized in **SUMMARY, Table II**.

Negative detections ICBs and CCBs were evaluated and determined to have no adverse effects on data quality.

Rinsate Blanks: One equipment rinsate blank was submitted for metals analyses. Target analytes were either not detected at or above the MDLs in the rinsate blank or associated sample results were significantly (10x) greater than the level found in the rinsate blank, except for chromium. Chromium results in affected samples were greater than their MDLs but less than LOQs; these results were qualified (U) as non-detects at their LOQs, as summarized in **SUMMARY, Table II**.

8.6 ICP Interference Check Sample (ICS)

The method requires that (1) an inter-element interference check sample be analyzed at the beginning of each analytical run, and (2) the results should be within $\pm 20\%$ of the true value. ICP interference check sample analyses met the requirements.

8.7 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values were within the project control limits.

8.8 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS/MSD analyses were performed on project samples as requested. All %R and RPD values met the project control criteria.

8.9 Serial Dilution Analysis

Serial dilution analysis was performed on project samples at the adequate frequency. The %D values for positive results greater than 10xMDL were within 10% of the undiluted results, except for the following:

| Sample ID | Analyte | %D | Control Limit | Affected Sample | Data Qualifier |
|----------------|---------|-------|---------------|---|----------------|
| RR-MW-2-072315 | Barium | 10.4% | $\leq 10\%$ | RR-MW-5-072215 RR-MW-4-072215 RR-MW-3-072215 RR-MW-2-072315 RR-MW-1-072315 RR-GW-FD-072315 | J |

8.10 Internal Standards

At least three internal standards were added to all samples and QC analyses. All percent relative intensity values were within the method control criterion (70 - 125% of those of the calibration blank).

8.11 Analyte Quantitation and Reporting Limit

Recalculation was performed at 10% frequency on the reported QC and sample analyses. No anomalies were found via the verification calculation.

The sample-specific reporting limits were adjusted for dilutions, and were supported with appropriate initial calibration concentrations.

8.12 Field Duplicates

One pair of field duplicates were submitted for metals analyses. Sample results, RPD (or concentration difference) values, and data qualification are presented in **Appendix A**.

8.13 Overall Metals Data Usability Assessment

Metals data are of known quality and acceptable for use, as qualified.

SUMMARY

Table I DataQualified as a Result of QC Criteria Violation

| Field Sample ID | Laboratory Sample ID | Analyte | Qualifier | Reason Code |
|-----------------|----------------------|-----------------------------|-----------|-------------|
| H5-MW-1-081915 | K1509242-001 | 1,2-Dibromo-3-Chloropropane | UJ | LC |
| H5-MW-2-082015 | K1509242-003 | 1,2-Dibromo-3-Chloropropane | UJ | LC |
| H5-MW-3-082015 | K1509242-004 | 1,2-Dibromo-3-Chloropropane | UJ | LC |
| H5-MW-1-081915 | K1509242-001 | Bromoform | UJ | LC |
| H5-MW-2-082015 | K1509242-003 | Bromoform | UJ | LC |
| H5-MW-3-082015 | K1509242-004 | Bromoform | UJ | LC |
| RR-MW-4-072215 | K1508083-002 | Bromomethane | UJ | LC |
| RR-MW-3-072215 | K1508083-003 | Bromomethane | UJ | LC |
| RR-MW-2-072315 | K1508083-004 | Bromomethane | UJ | LC |
| RR-MW-1-072315 | K1508083-005 | Bromomethane | UJ | LC |
| RR-GW-FD-072315 | K1508083-006 | Bromomethane | UJ | LC |
| RR-GW-ER-072215 | K1508083-007 | Bromomethane | UJ | LC |
| H5-MW-1-081915 | K1509242-001 | Carbon Disulfide | J | LC |
| H5-MW-2-082015 | K1509242-003 | Carbon Disulfide | J | LC |
| H5-MW-3-082015 | K1509242-004 | Carbon Disulfide | J | LC |
| RR-MW-4-072215 | K1508083-002 | Chloromethane | UJ | LC |
| RR-MW-3-072215 | K1508083-003 | Chloromethane | UJ | LC |
| RR-MW-2-072315 | K1508083-004 | Chloromethane | UJ | LC |
| RR-MW-1-072315 | K1508083-005 | Chloromethane | UJ | LC |
| RR-GW-FD-072315 | K1508083-006 | Chloromethane | UJ | LC |
| RR-GW-ER-072215 | K1508083-007 | Chloromethane | UJ | LC |
| H5-MW-1-081915 | K1509242-001 | Dibromochloromethane | UJ | LC |
| H5-MW-2-082015 | K1509242-003 | Dibromochloromethane | UJ | LC |
| H5-MW-3-082015 | K1509242-004 | Dibromochloromethane | UJ | LC |
| RR-MW-4-072215 | K1508083-002 | Dichlorodifluoromethane | UJ | LC |
| RR-MW-3-072215 | K1508083-003 | Dichlorodifluoromethane | UJ | LC |
| RR-MW-2-072315 | K1508083-004 | Dichlorodifluoromethane | UJ | LC |
| RR-MW-1-072315 | K1508083-005 | Dichlorodifluoromethane | UJ | LC |
| RR-GW-FD-072315 | K1508083-006 | Dichlorodifluoromethane | UJ | LC |
| RR-GW-ER-072215 | K1508083-007 | Dichlorodifluoromethane | UJ | LC |
| RR-MW-5-072215 | K1508083-001 | Naphthalene | UJ | LC |
| RR-MW-4-072215 | K1508083-002 | Naphthalene | UJ | LC |
| RR-MW-3-072215 | K1508083-003 | Naphthalene | UJ | LC |
| RR-MW-2-072315 | K1508083-004 | Naphthalene | UJ | LC |
| RR-MW-1-072315 | K1508083-005 | Naphthalene | UJ | LC |
| RR-GW-FD-072315 | K1508083-006 | Naphthalene | UJ | LC |

| Field Sample ID | Laboratory Sample ID | Analyte | Qualifier | Reason Code |
|-----------------|----------------------|-----------------------------------|-----------|-------------|
| RR-GW-ER-072215 | K1508083-007 | Naphthalene | UJ | LC |
| H5-MW-1-081915 | K1509242-001 | Naphthalene | UJ | LC |
| H5-MW-2-082015 | K1509242-003 | Naphthalene | UJ | LC |
| H5-MW-3-082015 | K1509242-004 | Naphthalene | UJ | LC |
| H5-MW-1-081915 | K1509242-001 | <i>trans</i> -1,3-Dichloropropene | UJ | LC |
| H5-MW-2-082015 | K1509242-003 | <i>trans</i> -1,3-Dichloropropene | UJ | LC |
| H5-MW-3-082015 | K1509242-004 | <i>trans</i> -1,3-Dichloropropene | UJ | LC |
| RR-MW-4-072215 | K1508083-002 | Vinyl Chloride | UJ | LC |
| RR-MW-3-072215 | K1508083-003 | Vinyl Chloride | UJ | LC |
| RR-MW-2-072315 | K1508083-004 | Vinyl Chloride | UJ | LC |
| RR-MW-1-072315 | K1508083-005 | Vinyl Chloride | UJ | LC |
| RR-GW-FD-072315 | K1508083-006 | Vinyl Chloride | UJ | LC |
| RR-GW-ER-072215 | K1508083-007 | Vinyl Chloride | UJ | LC |
| RR-MW-5-072215 | K1508083-001 | Barium | J | SD |
| RR-MW-4-072215 | K1508083-002 | Barium | J | SD |
| RR-MW-3-072215 | K1508083-003 | Barium | J | SD |
| RR-MW-2-072315 | K1508083-004 | Barium | J | SD |
| RR-MW-1-072315 | K1508083-005 | Barium | J | SD |
| RR-GW-FD-072315 | K1508083-006 | Barium | J | SD |

Table II Data Affected by Associated Blanks

| Field Sample ID | Laboratory Sample ID | Analyte | Unit | Original Result | Adjusted Result | Reason Code |
|-----------------|----------------------|-------------------------------|------|-----------------|-----------------|-------------|
| H5-MW-1-081915 | K1509242-001 | Chloroform | µg/L | 0.09 J | 0.5 U | MB |
| H5-MW-2-082015 | K1509242-003 | Chloroform | µg/L | 0.21 J | 0.5 U | MB |
| H5-MW-1-081915 | K1509242-001 | Ethylbenzene | µg/L | 0.13 J | 0.5 U | MB |
| H5-MW-1-081915 | K1509242-001 | <i>m</i> - & <i>p</i> -Xylene | µg/L | 0.58 J | 0.58 U | MB |
| H5-MW-1-081915 | K1509242-001 | <i>o</i> -Xylene | µg/L | 0.3 J | 0.5 U | MB |
| RR-GW-ER-072215 | K1508083-007 | Methylene Chloride | µg/L | 0.10 J | 2.0 U | TB |
| RR-MW-5-072215 | K1508083-001 | Toluene | µg/L | 0.14 J | 0.50 U | TB |
| RR-MW-4-072215 | K1508083-002 | Toluene | µg/L | 0.11 J | 0.50 U | TB |
| RR-MW-3-072215 | K1508083-003 | Toluene | µg/L | 0.12 J | 0.50 U | TB |
| RR-MW-1-072315 | K1508083-005 | Toluene | µg/L | 0.12 J | 0.50 U | TB |
| RR-GW-FD-072315 | K1508083-006 | Toluene | µg/L | 0.18 J | 0.50 U | TB |
| RR-GW-ER-072215 | K1508083-007 | Toluene | µg/L | 0.13 J | 0.50 U | TB |
| H5-MW-1-081915 | K1509242-001 | Toluene | µg/L | 0.34 J | 0.5 U | TB |

| Field Sample ID | Laboratory Sample ID | Analyte | Unit | Original Result | Adjusted Result | Reason Code |
|-----------------|----------------------|------------------|------|-----------------|-----------------|-------------|
| H5-MW-2-082015 | K1509242-003 | Toluene | µg/L | 0.17 J | 0.5 U | TB |
| H5-MW-3-082015 | K1509242-004 | Toluene | µg/L | 0.25 J | 0.5 U | TB |
| RR-MW-5-072215 | K1508083-001 | Diethylphthalate | µg/L | 0.52 J | 9.5 U | ER |
| RR-MW-4-072215 | K1508083-002 | Diethylphthalate | µg/L | 0.55 J | 9.5 U | ER |
| RR-MW-3-072215 | K1508083-003 | Diethylphthalate | µg/L | 0.49 J | 9.5 U | ER |
| RR-MW-1-072315 | K1508083-005 | Diethylphthalate | µg/L | 0.40 J | 9.5 U | ER |
| RR-GW-FD-072315 | K1508083-006 | Diethylphthalate | µg/L | 0.50 J | 9.9 U | ER |
| RR-MW-5-072215 | K1508083-001 | RRO | µg/L | 42 J | 520 U | MB |
| RR-MW-4-072215 | K1508083-002 | RRO | µg/L | 120 J | 520 U | MB |
| RR-MW-3-072215 | K1508083-003 | RRO | µg/L | 260 J | 520 U | MB |
| RR-MW-2-072315 | K1508083-004 | RRO | µg/L | 80 J | 540 U | MB |
| RR-MW-1-072315 | K1508083-005 | RRO | µg/L | 250 J | 520 U | MB |
| RR-GW-FD-072315 | K1508083-006 | RRO | µg/L | 240 J | 520 U | MB |
| RR-GW-ER-072215 | K1508083-007 | RRO | µg/L | 150 J | 520 U | MB |
| H5-MW-1-081915 | K1509242-001 | RRO | µg/L | 34 J | 550 U | MB |
| H5-MW-2-082015 | K1509242-003 | RRO | µg/L | 35 J | 540 U | MB |
| H5-MW-3-082015 | K1509242-004 | RRO | µg/L | 31 J | 540 U | MB |
| RR-MW-5-072215 | K1508083-001 | DRO | µg/L | 19 J | 260 U | MB |
| RR-MW-4-072215 | K1508083-002 | DRO | µg/L | 91 J | 260 U | MB |
| RR-MW-3-072215 | K1508083-003 | DRO | µg/L | 140 J | 260 U | MB |
| RR-MW-2-072315 | K1508083-004 | DRO | µg/L | 34 J | 270 U | MB |
| RR-MW-1-072315 | K1508083-005 | DRO | µg/L | 190 J | 260 U | MB |
| RR-GW-FD-072315 | K1508083-006 | DRO | µg/L | 160 J | 260 U | MB |
| RR-GW-ER-072215 | K1508083-007 | DRO | µg/L | 26 J | 260 U | MB |
| H5-MW-1-081915 | K1509242-001 | DRO | µg/L | 14 J | 280 U | MB |
| H5-MW-2-082015 | K1509242-003 | DRO | µg/L | 15 J | 270 U | MB |
| H5-MW-3-082015 | K1509242-004 | DRO | µg/L | 13 J | 270 U | MB |
| RR-MW-5-072215 | K1508083-001 | Chromium, Total | µg/L | 0.76 | 0.76 J | ER |
| RR-MW-4-072215 | K1508083-002 | Chromium, Total | µg/L | 0.76 | 0.76 J | ER |
| RR-MW-3-072215 | K1508083-003 | Chromium, Total | µg/L | 0.16 J | 0.20 U | ER |
| RR-MW-1-072315 | K1508083-005 | Chromium, Total | µg/L | 0.56 | 0.56 J | ER |
| RR-GW-FD-072315 | K1508083-006 | Chromium, Total | µg/L | 0.54 | 0.54 J | ER |
| RR-MW-5-072215 | K1508083-001 | Lead | µg/L | 0.009 J | 0.020 U | BC |
| RR-MW-4-072215 | K1508083-002 | Lead | µg/L | 0.004 J | 0.020 U | BC |

| Field Sample ID | Laboratory Sample ID | Analyte | Unit | Original Result | Adjusted Result | Reason Code |
|-----------------|----------------------|---------|------|-----------------|-----------------|-------------|
| RR-MW-3-072215 | K1508083-003 | Lead | µg/L | 0.008 J | 0.020 U | BC |
| RR-MW-1-072315 | K1508083-005 | Lead | µg/L | 0.013 J | 0.020 U | BC |
| RR-GW-FD-072315 | K1508083-006 | Lead | µg/L | 0.009 J | 0.020 U | BC |
| RR-GW-ER-072215 | K1508083-007 | Lead | µg/L | 0.006 J | 0.020 U | BC |

Table III DataQualifiers

| Qualifier | Description |
|-----------|---|
| J | Analyte was present. Reported value may or may not be accurate or precise |
| R | The result was rejected. |
| U | Not detected |
| UJ | Not detected, quantitation limit may be inaccurate or imprecise |

Table IV DataQualification Reason Codes

| Reason Code | Description |
|-------------|---|
| AB | Headspace in VOA vial |
| AF | Antifoam agent used; no antifoam blank. |
| AS | Alternated standard recovery outside limits |
| BB | Broken Bottle |
| BC | Calibration curve does not meet criteria. (note: use reason code RF for calibration RF infractions) |
| CB | Contaminated Blank |
| CF | Calibration frequency missed |
| CH | High CCV recovery or %D |
| CO | CRI recovery outside of QC limits |
| DB | The result should be taken from DB-225 column |
| DD | Result is from a dilution (see also ED) |
| DL | Concentration is between MDL and RL |
| DP | Diphenyl ether interference |
| DS | Detector signal was saturated |
| DT | DDT/Endrin breakdown > 20% |
| EB | Equipment blank contamination |
| ED | Excessive dilution (see also DD) |
| EM | Dioxin EMPC value |
| FB | Field blank contamination |

| Reason Code | Description |
|--------------------|--|
| HB | High background noise |
| HC | High cleanup standard recovery |
| HD | High laboratory duplicate RPD (also use for field dup, LCSD, and MSD) |
| HI | High internal standard recovery |
| HL | High laboratory control sample recovery |
| HM | High matrix spike recovery |
| HP | Extraction error |
| HS | High surrogate recovery (also use for rad tracer/carrier) |
| HT | Holding time exceeded |
| IA | ICS A result > the MDL (see also IH and IL) |
| IC | Independent calibration check fails QC refers to ICV |
| IH | Interference check standard recovery high refers to ICS AB (see also IA) |
| IL | Interference check standard recovery low refers to ICS AB (see also IA) |
| IM | Inappropriate analytical method |
| IR | Ion ratios unacceptable |
| LC | Low CCV recovery or -%D |
| LE | Laboratory quantitation error |
| LI | Low internal standard recovery |
| LL | Low laboratory control sample recovery and/or LCSD recovery |
| LM | Low matrix spike recovery and/or MSD recovery |
| LS | Low surrogate recovery (also use for rad tracer/carrier) |
| MB | Method blank contamination |
| MI | Matrix interference |
| NB | Blanks not analyzed |
| NI | No internal standard recovery |
| NL | No LCS analyzed |
| NM | Negative radiochemistry result > (-MDC) |
| NP | Sample not appropriately preserved (see also RT) |
| NQ | No QC results related to this data |
| NS | No surrogate added prior to extraction |
| NV | No vacuum left in Summa canister |
| OC | Value was below the calibration curve |
| PC | Possible carryover from previous sample |
| QI | Quantitation ion instability |
| RB | Rinsate blank contamination |
| RF | Relative response factor less than limit (see also BC) |
| RT | Samples received at laboratory at elevated temperature |
| SB | Spectra doesn't match reference |
| SC | Second column identification |
| SD | High serial dilution %D |
| SE | Difference between analytical column results is high |

| Reason Code | Description |
|-------------|------------------------------------|
| SF | Sample foamed during analysis |
| SP | Single point calibration performed |
| TB | Trip blank contamination |
| UC | Upper calibration level exceeded |

Approved By:



Mingta Lin

Date: **October 31, 2015**

REFERENCES

- USEPA 2014a. Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review.* Office of Superfund Remediation and Technical Innovation. August 2014. EPA 540-R-013-001.
- USEPA 2014b. Contract Laboratory Program National Functional Guidelines for Organic Superfund Data Review.* Office of Superfund Remediation and Technical Innovation. August 2014. EPA 540-R-014-002.
- USEPA 2009a. Method 537: Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS).* September 2009. EPA/600/R-08/092.
- USEPA 2009b. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use,* January 13 2009. EPA 540-R-08-005.
- USEPA 1996. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846,* Third Edition, December 1996.
- USEPA 1983. Methods for Chemical Analysis of Water and Wastes,* EPA-600/4-79-020, March 1983 Revision.
- Department of Defense 2013. Quality Systems Manual for Environmental Laboratories. Final Version 5.0,* DoD Environmental Data Quality Workgroup. July 2013.
- Naval Facilities Engineering Command Northwest (NAVFAC NW) 2006. Standard Operation Procedure (SOP): Field Standard Operating Procedures, Version 4.0.* August, 2006.
- Washington State Department of Ecology 1997. Analytical Methods for Petroleum Hydrocarbons, ECY 97-602,* Washington State Department of Ecology, June 1997.
- AECOM 2015. Project-Specific Sampling and Analysis Plan, Soil and Groundwater Sampling, Hangar 5 and Rothbeck Ravine, Naval Air Station Whidbey Island, Oak Harbor, Washington.* AECOM. June 22, 2015.

Appendix A

Field Duplicate Summary

Field duplicate RPD is indicative of field and laboratory precision and sample homogeneity in combination. The Sampling and Analysis Plan specified field duplicate RPD value to be $\leq 30\%$ for water samples. As a concentration of an analyte approaches the LOQ, the variability of measurements of this analyte increases. Thus, if analyte concentration was $< 5X$ LOQ, an advisory criterion of absolute difference (delta) value of $\leq 2xLOQ$ applied. The RPD (or concentration difference as applicable) values and data qualification for detected compounds in field duplicates are presented as follows:

| Compounds | Unit | LOQ | RR-MW-1-072315 | | RR-GW-FD-072315 | | RPD | delta | Qualifier |
|-----------------------|------|-------|----------------|---|-----------------|---|-----|-------|-----------|
| Arsenic, Dissolved | µg/L | 0.51 | 1.3 | | 1.2 | | | 0.1 | |
| Barium, Dissolved | µg/L | 0.051 | 11 | | 11 | | 0% | 0 | |
| Cadmium, Dissolved | µg/L | 0.02 | 0.025 | | 0.024 | | | 0.001 | |
| Chromium, Dissolved | µg/L | 0.2 | 0.54 | | 0.56 | | | 0.02 | |
| Lead, Dissolved | µg/L | 0.02 | 0.009 | J | 0.013 | J | | 0.004 | |
| Selenium, Dissolved | µg/L | 1 | 1 | U | 1 | U | | 0 | |
| Silver, Dissolved | µg/L | 0.02 | 0.01 | U | 0.014 | J | | 0.004 | |
| Mercury, Dissolved | µg/L | 0.2 | 0.05 | U | 0.05 | U | | 0 | |
| RRO | µg/L | 520 | 240 | J | 250 | J | | 10 | |
| DRO | µg/L | 260 | 160 | J | 190 | J | | 30 | |
| GRO | µg/L | 250 | 25 | U | 25 | U | | 0 | |
| 1,1,1-Trichloroethane | µg/L | 0.5 | 1.6 | | 1.5 | | | 0.1 | |
| 1,1-Dichloroethene | µg/L | 0.5 | 0.27 | J | 0.26 | J | | 0.01 | |
| Chloroform | µg/L | 0.5 | 0.13 | J | 0.14 | J | | 0.01 | |
| Toluene | µg/L | 0.5 | 0.18 | J | 0.12 | J | | 0.06 | |
| Diethylphthalate | µg/L | 9.9 | 0.5 | J | 0.4 | J | | 0.1 | |
| Compounds | Unit | LOQ | H5-MW-1-091715 | | FD-091715 | | RPD | delta | Qualifier |
| PFOS | Ng/L | 8.03 | 34.7 | | 34.5 | | 1% | | |
| PFOA | NG_L | 8.03 | 7.08 | J | 6.54 | J | | 0.54 | |

Notes:

ngL = Nanogram per liter

µg/L = microgram per liter

delta = Concentration difference between parent sample and field duplicate sample

LOQ = Limit of quantitation

RPD = Relative percent difference

Appendix B

Form-1s