



Naval Facilities Engineering Command Northwest  
Silverdale, Washington

**Final**

**Results of Investigation of  
Per- and Polyfluoroalkyl Substances in Drinking Water**

Former Naval Arctic Research Laboratory Barrow  
Utqiagvik, Alaska

May 2019





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Utqiagvik, Alaska

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Prepared for NAVFAC Northwest  
by CH2M HILL, Inc.  
Virginia Beach, Virginia  
Contract N62470-16-D-9000  
CTO 0008





# Results of Investigation of Per- and Polyfluoroalkyl Substances in Drinking Water Former Naval Arctic Research Laboratory Barrow, Alaska

PREPARED FOR: Naval Facilities Engineering Command (NAVFAC) Atlantic  
NAVFAC Northwest  
Former Naval Arctic Research Laboratory (NARL) Barrow

PREPARED BY: CH2M HILL, Inc. (CH2M)

DATE: May 2019

## Introduction

CH2M HILL, Inc. (CH2M) was contracted to evaluate impacts of potential releases of per- and polyfluoroalkyl substances (PFAS) to groundwater at the Former Naval Arctic Research Laboratory (NARL) Barrow, in Utqiagvik (Barrow), Alaska (**Figure 1**), and collect drinking water samples for PFAS analysis from drinking water sources within 1 mile of the NARL facility. This technical memorandum (TM) presents the results of the drinking water investigation, which was performed July 18, 2017, in accordance with the *Sampling and Analysis Plan for Investigation of Per- and Polyfluoroalkyl Substances in Drinking Water, Former Naval Arctic Research Laboratory Utqiagvik (Barrow), Alaska* (SAP) (Navy, 2017). CH2M prepared this TM for the Department of the Navy (Navy) under the Naval Facilities Engineering Command, Comprehensive Long-term Environmental Action—Navy 9000 Contract N62470-16-D-9000, Contract Task Order 08.

## Per- and Polyfluoroalkyl Substances

PFAS are manufactured chemicals that have been used since the 1950s in many household and industrial products because of their stain- and water-repellant properties. Within the Navy's operations, PFAS are most commonly associated with aqueous film-forming foam (AFFF) used primarily for firefighting (including emergency response, equipment testing and/or training, and fire suppression systems in buildings). PFAS can also be present in other industrial and household materials. PFAS can also be found in vapor suppression systems and in waste streams. PFAS are now present virtually everywhere in the world because of the large amounts that have been manufactured and used. Once these compounds are released into the environment, they break down very slowly. PFAS are considered "emerging" contaminants, which have no Safe Drinking Water Act (SDWA) regulatory standards or routine water quality testing requirements. The United States Environmental Protection Agency (USEPA) is studying PFAS to determine if national regulation is needed. The State of Alaska has a promulgated cleanup level of 0.4 micrograms/liter for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) in groundwater; there is no state standard for drinking water.

The USEPA issued the third Unregulated Contaminant Monitoring Rule (UCMR3)<sup>1</sup> in May 2012. The UCMR3 required monitoring between 2013 and 2015, for 30 substances in all large public water systems (PWSs) serving more than 10,000 people and 800 representative PWSs serving 10,000 or fewer people. Six PFAS compounds were

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<sup>1</sup> The 1996 SDWA amendments require that once every 5 years, USEPA issue a new list of no more than 30 unregulated contaminants to be monitored by PWSs.



included in the UCMR3 contaminant list; of these six PFAS, the USEPA has issued health advisories<sup>2</sup> for only two (PFOA and PFOS), and has published toxicity values for another, perfluorobutane sulfonate (PFBS). Health advisory levels are not regulatory standards. They are health-based concentrations that should offer a margin of protection for all Americans throughout their lives from adverse health effects resulting from exposure to PFOS and PFOA in drinking water. The USEPA health advisory level for lifetime exposure is 70 parts per trillion (ppt) for PFOS and 70 ppt for PFOA. When both PFOS and PFOA are found in drinking water, the combined concentrations should not exceed 70 ppt.

## Navy Policy

The Navy issued a policy in 2014 (Navy, 2014) requiring on-Base drinking water sampling for PFOA and PFOS for bases where groundwater was used as drinking water and where PFAS could have been released nearby in the past. Under the policy, all installations not previously tested under UCMR3 that produce drinking water from on-Base sources and have an identified or suspected PFAS release within approximately 1-mile upgradient of the drinking water source, were required to sample their finished drinking water by December 2015. Ukpeaġvik Inupiat Corporation (UIC) has several active buildings on the NARL facility, which currently are supplied drinking water from the Village of Utqiagvik (Barrow). As such, this policy did not require action by the Base. In June 2016, the Navy issued additional policy (Navy, 2016a) that required all Navy bases not previously tested under UCMR3 or the 2014 policy (Navy, 2014) to test their finished drinking water, regardless of the water source (on-Base or municipal) or potential and known source of a PFAS release to the environment.

In June 2016, the Navy also issued a policy (Navy, 2016b) to identify and prioritize sites for investigation of drinking water resources, on- or off-Base, that are thought to be vulnerable to PFAS contamination from past Navy releases of PFAS, with a focus on releases of AFFF. Sites with drinking water sources (water supply wells, surface water bodies used for drinking water, and reservoirs) within 1 mile downgradient of known or potential releases of PFAS were assigned the highest priority. These high-priority sites, Priority 1, were directed to sample the drinking water within fiscal year 2017.

As a result of this evaluation, Imikpuk Lake was identified as a drinking water source located within 1-mile downgradient of Site 5, the Airstrip site at NARL Barrow, where there is a known release of PFAS to the environment occurred at the Navy hangar located within the site boundary (**Figure 2**).

## Conceptual Site Model

This section presents a brief history of the installation, background information about the facility, a description of the environmental setting, and an evaluation of drinking water sources in the vicinity. This information is composed of the conceptual site model, which describes the relationship between potential contaminant sources and receptors through potential or actual migration and exposure pathways.

### Former Naval Arctic Research Laboratory Barrow Background

NARL Barrow is 330 miles above the Arctic Circle in the most northern tip of Alaska, in North Slope Borough (**Figure 1**). NARL Barrow operated from 1947 to the early 1980s, with the primary purpose of serving as a center for scientific study in the region. NARL Barrow contains a 5,000-foot runway, a hangar, an apron connecting the hangar to the runway, and associated buildings (Navy, 2002).

### Site 5 – Airstrip Site Description

Site 5 is located in the northern portion of NARL Barrow, north/northeast of Imikpuk Lake, and northwest of the North Salt Lagoon (**Figure 2**). The site is unoccupied by the Navy, except for annual long-term monitoring activities per the 2002 Decision Document (Navy, 2002), and remedy optimization studies conducted by contractors and

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<sup>2</sup> USEPA issued the Lifetime Health Advisory for PFOS and PFOA in May 2016, superseding the 2009 provisional health advisory. USEPA has not issued a health advisory of any other PFAS.



United States Army Corps of Engineers on behalf of the Navy. The Village of Utqiagvik (Barrow) also uses the airstrip runway for whale operations, and local businesses use the runway for staging during barging operations. Multiple fuel spills at Site 5 are documented (Hartcrowser, 2001; Alaska Department of Environmental Conservation, 2016). In 1970, 400 gallons of aviation gas was spilled in the Navy hangar. The Navy's Fire Department covered the fuel at the Navy hangar with AFFF to remove the threat of fire.

## Geology and Hydrogeology

The NARL Barrow complex is located on a gravel and tundra peninsula on the Arctic Coastal Plain (**Figure 1**). The geology at NARL Barrow consists of approximately 50 feet of unconsolidated sediments over Cretaceous age bedrock. Permafrost is continuous in the Utqiagvik area. During the summer, the upper layers of the permafrost melt, producing what is termed the active zone. Because frozen ground limits infiltration at the time of snowmelt (typically June), most of the snowmelt becomes surface runoff, with only minimal percolation to the active zone groundwater system. Summer precipitation contributes negligible recharge to the groundwater system at NARL Barrow because evapotranspiration typically equals precipitation during the thaw season.

Refreezing of the active zone typically begins by September, progressing from the surface downward.

The groundwater table depths at Site 5 typically range from 0.5 to 4 feet below ground surface at the Airstrip Site (**Figure 2**). Surface water and groundwater at Site 5 north of the beach road flow toward the Arctic Ocean, while water south (inland) of the road generally flows toward either Imikpuk Lake or North Salt Lagoon. A surface water and groundwater divide between the Imikpuk Lake drainage basin and North Salt Lagoon drainage basin occurs in the approximate middle of the airstrip apron. Surface water and groundwater west of the divide flow toward Imikpuk Lake and surface water and groundwater to the east flow toward North Salt Lagoon.

## Migration Pathways and Potential Receptors and Exposure Routes

Releases of PFAS-containing compounds, such as AFFF, to the ground surface at Site 5 may have resulted in the migration of PFAS runoff to Imikpuk Lake. Transport of PFAS may have occurred via direct release from the discharge of AFFF to the surface and/or subsurface soil, transport of PFAS currently and/or historically present from soil to groundwater via infiltration, transport via advection with groundwater flow in the active zone, and/or transport to surface water. Because of the strength of the carbon-fluorine bond, PFAS are very stable and persistent in the environment and are highly soluble and sorb only moderately to organic matter and mineral surfaces, meaning they migrate readily in the subsurface. Current users (hunters and fishers) of Imikpuk Lake may be at risk from ingesting water impacted by PFAS.

## Drinking Water Source Evaluation

Current drinking water for the UIC facility, located on the NARL Barrow property, is currently supplied by the Village of Utqiagvik (Barrow), which uses Esatkuak Lagoon as the primary drinking water source. Esatkuak Lagoon is located significantly outside the 1-mile boundary of this investigation. Imikpuk Lake is 600 feet downgradient of the boundary of Site 5, where AFFF-containing PFAS was released (**Figure 2**). Consequently, a release of PFAS to Imikpuk Lake is possible (Navy, 2016c). Imikpuk Lake is used as a periodic drinking water source by local elders, fishers, and hunters.

## Summary of Field Activities

This section provides a summary of field investigation activities that includes mobilization and dates of fieldwork, a summary of sampling activities that includes sample locations and number and type of samples collected, and a summary of sample packing and shipping procedures. All field activities were conducted in accordance with the standard operating procedures (SOPs) outlined in the SAP (Navy, 2017). Field notes are provided in **Attachment 1**.



## Mobilization

Two CH2M staff mobilized to NARL Barrow on July 18, 2017, to collect surface water samples from Imikpuk Lake, and were accompanied by UIC Science staff, who provided project support as the polar bear guard and boat captain. All fieldwork was completed on that day. A summary of activities is provided herein.

## Summary of Sampling Activities

Five surface water samples and associated field quality control samples were collected from Imikpuk Lake. Sample locations are shown on **Figure 2**. The team mobilized by boat to each location and waited for sediment to settle before sample collection. Samples were collected by lowering an unused high-density polyethylene bottle, provided by the laboratory, on a fixed length pole into the lake, and then transferred the collected water immediately into a 250-milliliter, high-density polyethylene sample bottle<sup>3</sup> (**Table 1**).

Samples were collected in accordance with the SOP for *Surface Water Sampling for PFAS*, provided in Appendix A of the SAP (Navy, 2017).

## Sample Packing and Shipping Procedures

Sample bottles were properly labeled, placed into resealable zipper storage bags, and then placed into a heavy-duty garbage bag, which was placed into the shipping cooler provided by the laboratory (Vista Analytical Laboratory, El Dorado Hills, California), and then packed with ice. The completed chain-of-custody, provided in **Attachment 2** of this TM, was included in the cooler. It is noted that the sample labels on the bottleware for NARLB-SW02 and NARLB-FB02 were switched in the field; the corrective action report documenting the correction in sample identifications is provided in **Attachment 2**. The cooler was transported by the field team back to Anchorage, Alaska, and then shipped overnight to the laboratory via FedEx Priority Overnight.

## Summary of Sample Results

This section provides a brief discussion of the project action limits and a summary of laboratory results for the drinking water samples collected for analysis of PFAS compounds, including PFOA, PFOS, and PFBS, and a data validation summary and usability assessment.

### Project Action Limits

As indicated in the SAP (Navy, 2017), the project action limits for this project are the USEPA Lifetime Health Advisory values for PFOA and PFOS (70 nanograms per liter [ng/L]), and the USEPA regional screening level (RSL) for PFBS (400,000 ng/L, based on a hazard quotient of 1.0) (USEPA, 2017).

### Sampling Results

Five surface water samples were collected and analyzed for PFOA, PFOS, and PFBS, in accordance with USEPA Method 537/WS-DW-0004, Rev. 1.1. Laboratory results indicate that these three compounds were detected in all five surface samples. A summary of detections and exceedances is provided in **Table 2** and in **Figure 2**. The raw data is provided in **Attachment 3** of this TM.

- **PFBS** – PFBS was detected in all five surface water samples ranging from an estimated 2.77 ng/L in the sample collected from NARLB-SW02-0717, to 3.1 ng/L in the sample collected from NARLB-SW04-0717. None of the detections of PFBS exceeded the RSL (USEPA, 2017) of 400,000 ng/L.

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<sup>3</sup> Samples were collected in high density polyethylene bottleware; however, per the SAP and analytical method, polypropylene bottleware is required. The Navy has determined that the difference in bottleware did not affect the results, and the data are acceptable for their intended use. A corrective action memorandum from the laboratory is provided in **Attachment 1**.



- **PFOS** – PFOS was detected in all five surface water samples ranging from an estimated 76.1 ng/L in the sample collected from NARLB-SW02-0717 to 176 ng/L in the sample collected from NARLB-SW03-0717. The results from all five surface water samples exceeded the Lifetime Health Advisory of 70 ng/L for PFOS.
- **PFOA** – PFOA was detected in all five surface water samples ranging from 67.5 ng/L in the sample collected from NARLB-SW02-0717 to 86.3 ng/L in the sample collected from NARLB-SW03-0717. The results from four surface water samples (NARLB-SW01-0717, NARLB-SW03-0717, NARLB-SW04-0717, and NARLB-SW05-0717) exceeded the Lifetime Health Advisory of 70 ng/L for PFOA.
- **PFOS+PFOA** – the combined PFOS+PFOA results exceeded the Lifetime Health Advisory in all five surface water samples.

## Data Validation Summary

No quality control deficiencies were found; therefore, all laboratory data are usable with no rejected or qualified data points. The Data Validation Summary Report is provided in **Attachment 4** of this TM.

## Conclusions

PFOA, PFOS, and PFBS were detected in all five surface water samples collected from Imikpuk Lake above the EPA Lifetime Health Advisory. Because of the periodic use of Imikpuk Lake as a drinking water source, signs have been installed at four locations, around Imikpuk Lake (**Figure 2**). The purpose of the signs is to alert hunters and fishers to the PFAS detections and recommendation that the lake no longer be used as a drinking water source.

Because of the detection of PFAS above the Lifetime Health Advisory in Imikpuk Lake, a Preliminary Assessment/Site Inspection specific to PFAS is recommended at the NARL Barrow facility, to identify all potential PFAS releases to the environment and investigate potential impacts to soil and groundwater at sites with identified releases.

## References

- Alaska Department of Environmental Conservation. 2016. Contaminated Sites Search, NARL – Airstrip Fuel Spill. Accessed September 26, 2016. <http://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/557>
- Hartcrowser. 2001. *Groundwater, Surface Water, and Sediment Monitoring Work Plan, Powerhouse, Airstrip, Dry Cleaning Facility, and Bulk Fuel Farm Sites, Former NARL, Point Barrow, Alaska*. July.
- Department of the Navy (Navy). 2002. *Decision Document, Airstrip Site, Former Naval Arctic Research Laboratory, Barrow, Alaska*. June.
- Navy. 2014. *Perfluorinated Compounds (PFCs) – An Emerging Environmental Issue*. 21 October.
- Navy. 2016a. *Perfluorinated Compounds (PFCs) Drinking Water System Testing Requirement*. 14 June.
- Navy. 2016b. *Perfluorinated Compounds/Perfluoroalkyl Substances (PFC/PFAS) – Identification of Potential Areas of Concern (AOCs)*. June 20.
- Navy. 2016c. *Technical Memorandum – Results of Desktop Evaluation to Verify Off-Base Drinking Water Sources*. Prepared by CH2M. September.
- Navy. 2017. *Sampling and Analysis Plan for Investigation of Per- and Polyfluoroalkyl Substances in Drinking Water, Naval Arctic Research Laboratory Utqiagvik (Barrow), Alaska*. Prepared by CH2M. July.
- United States Environmental Protection Agency (USEPA). 2017. USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites. November. <https://www.epa.gov/risk/regional-screening-levels-rsls>



Tables



**Table 1. Sample Summary***Former Naval Arctic Research Laboratory**Utqiaġvik (Barrow), Alaska*

Station ID	Sample ID	Sample Date	Sample Time	QC Sample ID
NARLB-SW01	NARLB-SW01-0717	7/18/2017	12:45	NARLB-FB01-0717
	NARLB-SW01P-0717	7/18/2017	12:50	
NARLB-SW02	NARLB-SW02-0717	7/18/2017	13:05	NARLB-SW02-0717-MS NARLB-SW02-0717-MSD NARLB-FB02-0717
NARLB-SW03	NARLB-SW03-0717	7/18/2017	13:25	NARLB-FB03-0717
NARLB-SW04	NARLB-SW04-0717	7/18/2017	13:35	NARLB-FB04-0717
NARLB-SW05	NARLB-SW05-0717	7/18/2017	13:45	NARLB-FB05-0717

## Notes:

FB = reagent field blank

ID = identification

MS = matrix spike

MSD = matrix spike duplicate

NARLB = Former Naval Arctic Research Laboratory Barrow

P = duplicate

QC = quality control

SW = surface water



Table 2. Detections and Exceedances of PFAS in Drinking Water  
Former Naval Arctic Research Laboratory Barrow  
Barrow, Alaska  
July 2017

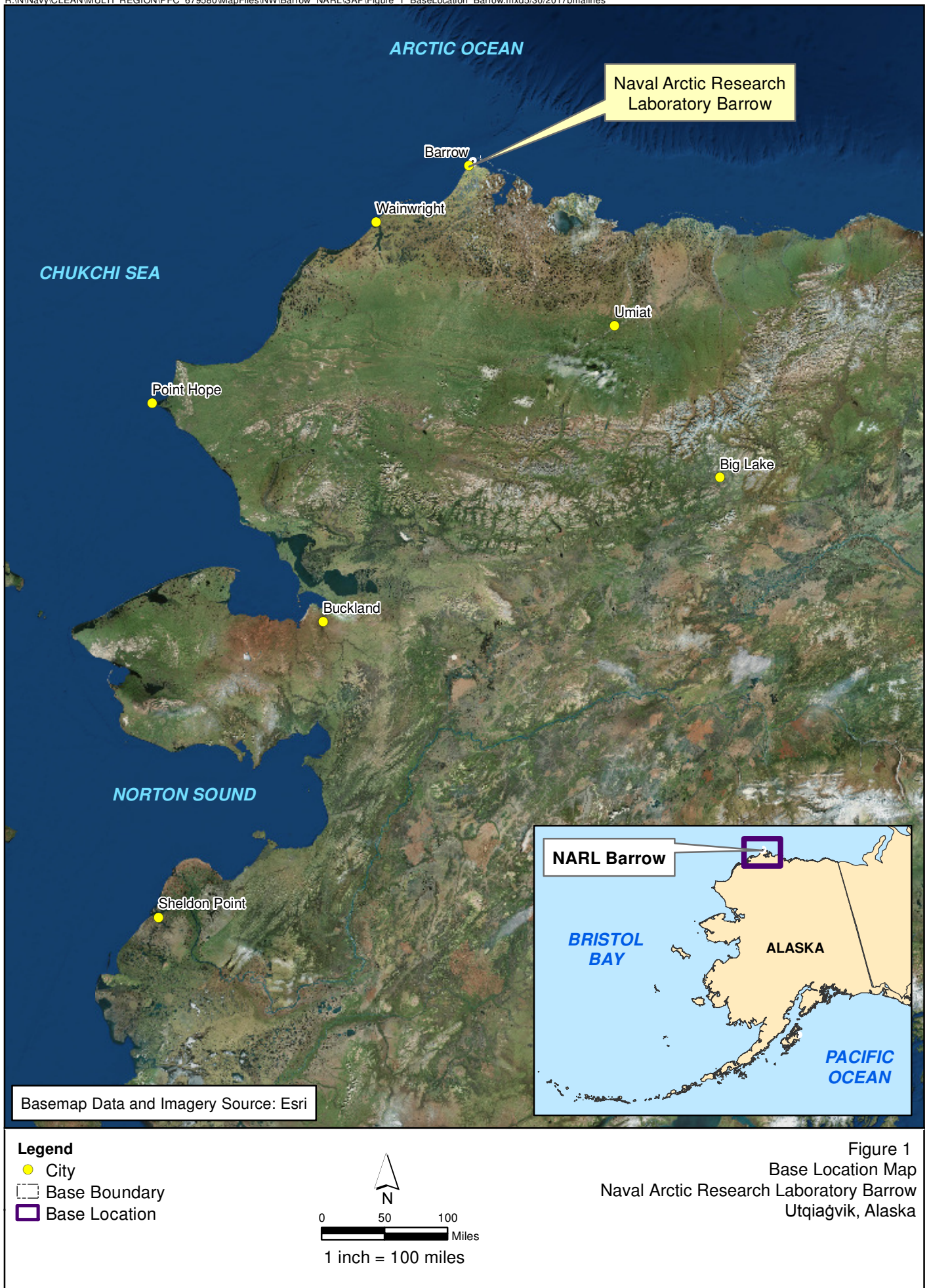
Sample ID	USEPA Lifetime Health Advisory (May 2016)	USEPA Tapwater RSL, HQ = 1.0 (November 2017)	NARLB-SW01-0717 <sup>a</sup>	NARLB-SW02-0717	NARLB-SW03-0717	NARLB-SW04-0717	NARLB-SW05-0717
Sample Date			7/18/17	7/18/17	7/18/17	7/18/17	7/18/17
Perfluorobutanesulfonic acid (PFBS)	--	400,000	3.08 J	2.77 J	2.94 J	3.1 J	2.82 J
Perfluorooctane Sulfonate (PFOS)	70	--	<b>119</b>	<b>76.1</b>	<b>176</b>	<b>94.7</b>	<b>88.6</b>
Perfluorooctanoic acid (PFOA)	70	--	<b>82.6</b>	67.5	<b>86.3</b>	<b>79</b>	<b>80.2</b>
PFOA + PFOS	70	--	<b>201.6</b>	<b>143.6</b>	<b>262.3</b>	<b>173.7</b>	<b>168.8</b>

Notes:  
a. Duplicate sample collected; the higher value is reported.  
Shading indicates detection  
**Bolded text indicated exceedance of USEPA Lifetime Health Advisory**  
Underlined text indicated exceedance of USEPA Tapwater RSLs, HQ = 1.0 (November 2017)  
Units are nanograms per liter (ng/L)  
HQ = hazard quotient  
ID = identification  
J = Analyte present. Value may or may not be accurate or precise  
RSL = Regional Screening Level  
USEPA = United States Environmental Protection Agency

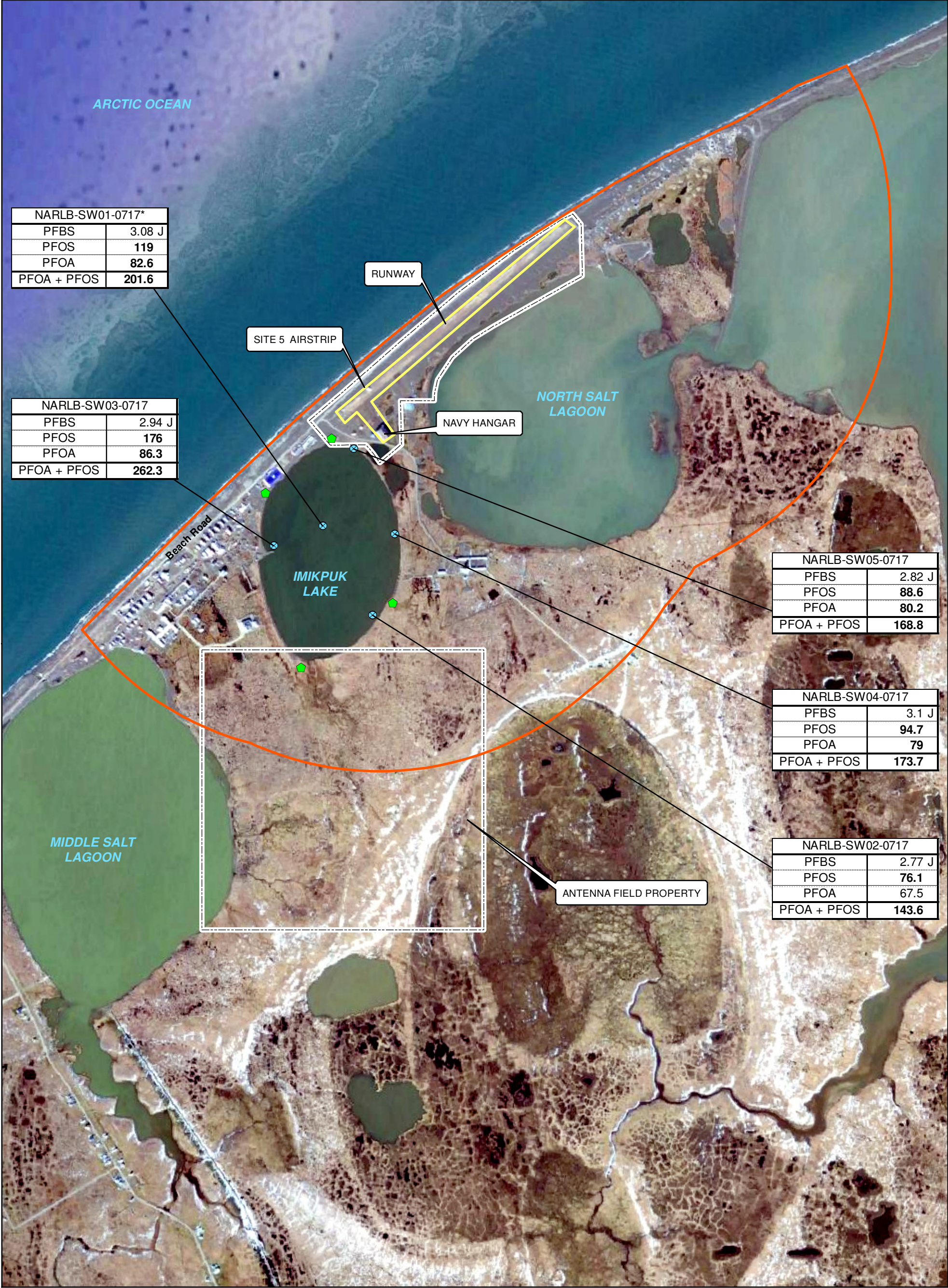


Figures



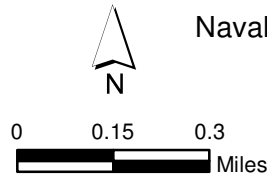






- Legend**
- ⊗ Surface Water Sampling Location
  - ◆ Sign Location
  - ▭ Site Boundary (suspected source)
  - ▭ Site 5 - 1-mile zone
  - ▭ Navy Property Boundary

Notes:  
\* - Duplicate sample collected and higher of two values is reported  
J - Analyte present. Value may or may not be accurate or precise  
Units are nanograms/liter (ng/L)  
**Bolded text indicated exceedance of USEPA Lifetime Health Advisory (70 ng/L)**  
Perfluorobutanesulfonic acid = PFBS  
Perfluorooctane Sulfonate = PFOS  
Perfluorooctanoic acid = PFOA



1 inch equals 0.3 mile  
Imagery Source: ©2017, Google

Figure 2  
Site Map  
Naval Arctic Research Laboratory Barrow  
Utqiagvik, Alaska



# Attachment 1

## Field Notes



679580

TUESDAY JULY 18, 2017

NARL BARROW

M. RADFORD/CLT

7

OBS: COLLECT 5 SURFACE WATER SAMPLES  
FROM IMIKPUK LAKE VIA BOAT.

WEATHER: CLOUDY, LIGHT RAIN, 57°F

PERSONNEL: M. RADFORD/CLT

A. SEAY / ANC

RAYMOND / VIC SCIENCE

HARVARD / VIC SCIENCE (BOAT GUARD)

HVS: BOAT AND WATERCRAFT SAFETY

\* 0845: M. RADFORD AND A. SEAY ARRIVE  
AT BARC TO MEET W/ VIC  
SCIENCE.

0905 - Depart VIC Science to meet with  
Umiaq to get the boat.

\* 1000 - FLOAT PLAN CHANGE TO MOTORIZED KODIAK  
UPDATE AHA, FLOAT PLAN, GET BOATING  
LICENSE FOR RAYMOND

1235 - LAUNCH FROM NARL PROPERTY  
1240 INTO IMIKPUK LAKE.

\* 1245 - ~~Collect At~~ set up at  
NARLB-SW01 location in the  
middle of Imikpuk Lake.

- Depth is approximately 8 feet

- Coordinates:

71°19'45.988" N

156°39'22.344" W

1245 collect sample:

\* 1245 NARLB-SW01 - 0717 for analysis of:  
- Method 537

collect sample:

NARLB-FB01 - 0717 at same time  
for same analytes

HS 7.18.17



NARL-Barnow

7.18.17

1250 - collect sample duplicate:

NARLB-SW01P-0717 for  
analysis of:

- Method 537

1255 - Move to NARLB-SW02 located  
on the southern shore line

1300 - arrive at SW02; Depth is

- approximately <sup>14</sup>12 feet

- Coordinates:

71° 19' 30.815" N

156° 38' 57.319" W

1305 - collect sample NARLB-SW02-0717  
for analysis of:

\* Method 537

collect sample NARLB-SW02-0717-MS

and sample NARLB-SW02-0717-MSD

at same time and location, for  
analysis of:

Method 537

1315 - Move to NARLB-SW03 located  
on the western shore line

1320 - arrive at SW03;

- depth is approximately 10 feet

- coordinates:

71° 19' 42.855" N

156° 39' 48.319" W

1325 - collect sample NARLB-SW03-0717  
for analysis of:

- Method 537

collect NARLB-SW03-0717 at same  
time for same analyte

At 7.18.17

2



NARL Barrow

7-18-17

1330 - Mobe to NARLB-SW04 located on the eastern shore.

- depth approximately 3 feet

- coordinates:

71° 19' 44.391" N

156° 38' 44.570" W

1335 - collect sample NARLB-SW04-0717 for analysis of:

- Method 537

Collect sample NARLB-FB04-0717

at the same time for the same analysis

Mobe to next location.

1340 - arrive at NARLB-SW05 located on the northern shore, near NARL Navy hanger.

- depth: approximately 6 feet

- coordinates:

71° 19' 58.901" N

~~At~~ 156° 39' 05.157" W

1345 - collect sample NARLB-SW05-0717 for analysis of:

- Method 537

collect sample NARLB-FB05-0717

at same time

1350 - sampling is complete. Mobe back to put-in. Pack up truck.

\* Late entry \*

1305 - Sample NARLB-FB02-0717 collected at the same time of primary for the same analysis.

At

3



NARL Barrow

7.18.17

1445 - Truck is packed; samples are iced.

Umiaq has the boat <sup>Ats</sup> ~~part~~ ready to return.

M. Radford and A. Seay offsite for the day; return to the hotel to complete the paperwork.

7.18.17

~~Matthew~~



Attachment 2  
Corrective Action Reports and  
Chain of Custody



## Action Report

Description of Issue
<p>Vista Analytical provided high density polyethylene (HDPE) sample bottles instead of polypropylene bottles for drinking water samples collected at Naval Arctic Research Lab Barstow.</p> <p>The sample results for this base location were reported on July 29, 2017. The associated Vista Work Order is 1700923.</p>
Root Cause Analysis
<p>Vista Analytical has used HDPE bottles exclusively for drinking water samples. Per EPA method 537 rev 1.1 other plastic materials (e.g., polyethylene) which meet the QC requirements of Section 9 may be substituted for polypropylene.</p> <p>EPA method 537 section 9 requires that the lab perform an Initial Demonstration of Capability (IDOC) prior to analyzing field samples, followed by ongoing Quality Control (QC) while analyzing field samples to demonstrate that the laboratory and analyst are capable of performing the analysis with acceptable precision, accuracy, sensitivity and specificity.</p> <p>The 537 drinking water IDOC was performed on 04-18-17 using HDPE bottles. The IDOC demonstrated passing results.</p> <p>Ongoing QC requirements for field samples are met by performing Laboratory Reagent Blanks (LRB), Laboratory Fortified Blanks (LFB), Laboratory Fortified Sample Matrix (LFSM) and Laboratory Fortified Sample Matrix Duplicates (LFSMD) as required. Ongoing QC results are reported as part of the Vista Analytical Laboratory final data package for all samples analyzed.</p>
Element of ISO/IEC 17025, TNI Volume 1, DoD QSM 5.1
Immediate Correction
<p>Polypropylene bottles were ordered from an approved supplier and QC'd per SOP. The QC results were passing.</p>
Corrective Action
<p>Polypropylene bottles will be used for all drinking water samples per client request from this date forward, August 30, 2018.</p>
Preventive Action
<p>Vista SOP 14, <i>Bottle Order Preparation</i> will be revised to reflect the change to Polypropylene bottles.</p>
Follow Up and Effectiveness of Action
<p>The IDOC will be repeated with polypropylene bottles and the results will be reviewed and approved by Laboratory Management.</p> <p>Passing results will demonstrate that the laboratory and analyst are capable of performing the analysis with acceptable precision, accuracy, sensitivity and specificity using the polypropylene bottles.</p>









# CHAIN OF CUSTODY

## For Laboratory Use Only

Work Order #: \_\_\_\_\_ Temp: \_\_\_\_\_ °C  
Storage ID: \_\_\_\_\_ Storage Secured: Yes ☐ No ☐

Project ID: CTO-08 PO#: 938652 Sampler: MAGGIE RADFORD  
(name)

TAT Standard: ☐ 21 days  
(check one): Rush (surcharge may apply) PER  
☐ 14 days ☒ 7 days Specify: CONTRACT

Invoice to: Name Company Address City State Ph# Fax#  
KATIE TIPPIN CH2M 5101 CLEVELAND ST, SUITE 200 VIRGINIA BEACH VA 757-671-6258 541-764-3109  
TIFFANY HILL

Relinquished by (printed name and signature) Date Time Received by (printed name and signature) Date Time  
MAGGIE RADFORD 7/19/17 1700 Annika Seay 7/19/17 1700  
Relinquished by (printed name and signature) Date Time Received by (printed name and signature) Date Time  
Annika Seay 7/20/17 1430 \_\_\_\_\_

SHIP TO: Vista Analytical Laboratory  
1104 Windfield Way  
El Dorado Hills, CA 95762  
(916) 673-1520 \* Fax (916) 673-0106

Method of Shipment:  
FED-EX

ATTN: MARTHA MAIER

Tracking No.:  
787245507868

Add Analysis(es) Requested

Container(s)

Mod. EPA  
Method 537

EPA Method  
537 (DW only)

Sample ID	Date	Time	Location/Sample Description	Quantity	Type	Matrix	PFOA/PFOS	UCMR3 PFAS List 6	537 List 14	Full List of 28	Other: Please List Below	PFOA/PFOS	UCMR3 PFAS List 6	PFAS List 14	Comments
NARLB-SW01-0717	7-18-17	1245		2	P	DW						X			PFOS, PFOA, + PFBS
NARLB-FB01-0717	7-18-17	1245		2		DW						X			
NARLB-SW01P-0717	7-18-17	1250		2		DW						X			
NARLB-SW02-0717	7-18-17	1305		2		DW						X			
NARLB-SW02-0717-MS	7-18-17	1305		2		DW						X			
NARLB-SW02-0717-MD	7-18-17	1305		2		DW						X			
NARLB-FB02-0717	7-18-17	1305		2		DW						X			
NARLB-SW03-0717	7-18-17	1325		2		DW						X			
NARLB-FB03-0717	7-18-17	1325		2		DW						X			
NARLB-SW04-0717	7-18-17	1335		2		DW						X			

Special Instructions/Comments:

SEND  
DOCUMENTATION  
AND RESULTS TO:

Name: TIFFANY HILL  
Company: CH2M  
Address: \_\_\_\_\_  
City: CORVALLIS State: OR Zip: \_\_\_\_\_  
Phone: 541-764-3109 Fax: \_\_\_\_\_  
Email: TIFFANY.HILL@CH2M.COM

Container Types: P= HDPE, PJ= HDPE Jar  
O = Other: \_\_\_\_\_

Bottle Preservation Type: T = Thiosulfate,  
TZ = Trizma: \_\_\_\_\_

Matrix Types: AQ = Aqueous, DW = Drinking Water, EF = Effluent, PP = Pulp/Paper, SD = Sediment,  
SL = Sludge, SO = Soil, WW = Wastewater, B = Blood/Serum, O = Other: \_\_\_\_\_







For Laboratory Use Only

Work Order #: \_\_\_\_\_ Temp: \_\_\_\_\_ °C

Storage ID: \_\_\_\_\_ Storage Secured: Yes ☐ No ☐

TAT Standard: ☐ 21 days  
(check one): Rush (surcharge may apply) *PER*  
☐ 14 days ☒ 7 days Specify: *CONTRACT*

Relinquished by (printed name and signature)	Date	Time	Received by (printed name and signature)	Date	Time
MAGGIE RADFORD 	7/19/17	1700	Annika Seay 	7.19.17	1700
Relinquished by (printed name and signature)	Date	Time	Received by (printed name and signature)	Date	Time

**Method of Shipment:**

ATTN: MARTHA MAIER

Tracking No.:

Tracking No.: 7872455078108

Add Analysis(es) Requested

Container(s)

Mod. EPA  
Method 537EPA Method  
37(DW only)[illegible]

Special Instructions/Comments:

**SEND  
DOCUMENTATION  
AND RESULTS TO:**

Name: \_\_\_\_\_  
Company: SEE PAGE 1  
Address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
Email: \_\_\_\_\_

Container Types: P= HDPE, PJ= HDPE Jar  
O = Other:

**Bottle Preservation Type:** T = Thiosulfate,  
TZ = Trizma:

**Matrix Types:** AQ = Aqueous, DW = Drinking Water, EF = Effluent, PP = Pulp/Paper, SD = Sediment, SL = Sludge, SO = Soil, WW = Wastewater, B = Blood/Serum, O = Other:



## Corrections to COC/Reports

TO: Martha Maier, Vista Analytical

COPIES: File  
Laboratory Package SDG: 1700923

FROM: Tiffany Hill  
Project Chemist

DATE: July 28, 2017

This memo is to document corrections made to entries on the Chains of Custody (COC) and Logins for NARL Barrow, CTO-0008.

The corrections include changes to the sample IDs on the COC and Login:

<b>Sample ID on Login/CoC</b>	<b>Correct Sample ID</b>	<b>Date Collected</b>	<b>Time Collected</b>	<b>SDG</b>
NARLB-SW02-0717	NARLB-FB02-0717	7/18/17	13:05	1700923
NARLB-FB02-0717	NARLB-SW02-0717	7/18/17	13:05	1700923



## Attachment 3

### Raw Data Table



**Attachment B. Raw Data for PFAS in Drinking Water***Naval Arctic Research Laboratory Barrow**Barrow, Alaska**July 2017*

Sample ID	NARLB-SW01-0717	NARLB-SW01P-0717	NARLB-SW02-0717	NARLB-SW03-0717	NARLB-SW04-0717	NARLB-SW05-0717
Sample Date	7/18/17	7/18/17	7/18/17	7/18/17	7/18/17	7/18/17
Perfluorobutanesulfonic acid (PFBS)	3.08 J	2.94 J	2.77 J	2.94 J	3.1 J	2.82 J
Perfluorooctane Sulfonate (PFOS)	117	119	76.1	176	94.7	88.6
Perfluorooctanoic acid (PFOA)	82.6	81.9	67.5	86.3	79	80.2

## Notes:

J - Analyte present. Value may or may not be accurate or precise

NG/L - Nanograms per liter

NS - Not sampled



# Attachment 4

## Data Validation Report



**DATA VALIDATION SUMMARY REPORT  
NARL BARROW, ALASKA**

Client: CH2M HILL, Inc., Corvallis, Oregon  
SDG: 1700923  
Laboratory: Vista Analytical Laboratory, El Dorado Hills, California  
Site: NARL Barrow, CTO-0008, Alaska  
Date: August 16, 2017

PFCs			
EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1	NARLB-SW01-0717	1700923-01	Water
2	NARLB-FB01-0717	1700923-02	Water
3	NARLB-SW01P-0717	1700923-03	Water
4*	NARLB-FB02-0717	1700923-04	Water
5*	NARLB-SW02-0717	1700923-05	Water
5MS	NARLB-SW02-0717MS	1700923-05MS	Water
5MSD	NARLB-SW02-0717MSD	1700923-05MSD	Water
6	NARLB-SW03-0717	1700923-06	Water
7	NARLB-FB03-0717	1700923-07	Water
8	NARLB-SW04-0717	1700923-08	Water
9	NARLB-FB04-0717	1700923-09	Water
10	NARLB-SW05-0717	1700923-10	Water
11	NARLB-FB05-0717	1700923-11	Water

\* - These samples were incorrectly identified on the COC and per client request were switched.

A full data validation was performed on the analytical data for six water samples and five aqueous field blank samples collected on July 18, 2017 by CH2M HILL at the NARL Barrow site in Alaska. The samples were analyzed under the EPA Method "Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)".

Specific method references are as follows:

Analysis  
PFCs

Method References  
USEPA Method 537

The data have been validated according to the protocols and quality control (QC) requirements of the analytical method, and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM), Version 5.0 (July 2013) and the USEPA National Functional Guidelines for Organic Data Review as follows:



- The USEPA “Contract Laboratories Program National Functional Guidelines for Superfund Organic Methods Data Review,” August 2014;
- and the reviewer's professional judgment.

The following data quality indicators were reviewed for this report:

### ***Organics***

- Date Completeness, Case Narrative & Custody Documentation
- Holding times
- Liquid Chromatography/Mass Spectrometry (LC/MS) Tuning
- Initial and continuing calibration summaries
- Method blank and field QC blank contamination
- Surrogate Spike recoveries
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) recoveries
- Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) recoveries
- Internal standard area and retention time summary forms
- Target Compound Identification
- Compound Quantitation
- Field Duplicate sample precision

A full (Level IV) data validation was performed with this review including a recalculation of 10% of the detected results in the samples.

### **Data Usability Assessment**

There were no rejections of data.

Overall the data is acceptable for the intended purposes. There were no qualifications.

### **Perfluorinated Compounds (PFCs)**

#### **Data Completeness, Case Narrative & Custody Documentation**

- The case narrative and chain-of-custody documentation were included in the data package as required. All criteria were met.

#### **Holding Times**

- All samples were extracted within 14 days for water samples and analyzed within 28 days.



### **LC/MS Tuning**

- All criteria were met.

### **Initial Calibration**

- All relative standard deviation (%RSD) and/or correlation coefficients criteria were met.

### **Continuing Calibration**

- All percent difference (%D) and RRF criteria were met.

### **Method Blank**

- The method blanks were free of contamination.

### **Field QC Blank**

- The field blank samples were free of contamination.

### **Surrogate Spike Recoveries**

- All samples exhibited acceptable surrogate %R values.

### **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Recoveries**

- The MS/MSD samples exhibited acceptable %R and RPD values.

### **Laboratory Control Samples**

- The LCS samples exhibited acceptable percent recoveries (%R).

### **Internal Standard (IS) Area Performance**

- All internal standards met response and retention time (RT) criteria.

### **Target Compound Identification**

- All mass spectra and quantitation criteria were met.



### Compound Quantitation

- All criteria were met.

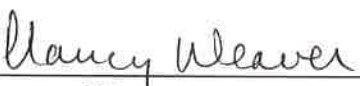
### Field Duplicate Sample Precision

- Field duplicate results are summarized below. The precision was acceptable.

Compound	NARL-SW01-0717 ng/L	NARL-SW01P-0717 ng/L	RPD	Qualifier
PFBS	3.08	2.94	5%	None
PFOA	82.6	81.9	1%	
PFOS	117	119	2%	

Please contact the undersigned at (757) 564-0090 if you have any questions or need further information.

Signed:

  
Nancy Weaver  
Senior Chemist

Dated: 8/17/17



<b>Data Qualifier</b>	<b>Definition</b>
U	The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
J	The analyte is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
NJ	The analysis has been "tentatively identified" or "presumptively" as present and the associated numerical value is the estimated concentration in the samples.
UJ	The analyte was analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the samples.



**Sample ID: NARLB-SW01-0717**

**EPA Method 537**

Client Data			Sample Data			Laboratory Data				
Name:	CH2M Hill		Matrix:	Drinking Water		Lab Sample:	1700923-01	Date Received:	24-Jul-2017 9:59	
Project:	CTO-08		Sample Size:	0.251 L		QC Batch:	B7G0113	Date Extracted:	25-Jul-2017 7:42	
Date Collected:	18-Jul-2017 12:45					Date Analyzed:	26-Jul-17 20:20	Column: Kinetex C18		
Location:										
Analyte	Conc. (ng/L)	DL	LOD	LOQ	Qualifiers	Labeled Standard		%R	LCL-UCL	Qualifiers
PFBS	3.08	0.441	4.97	9.95	J	SUR	13C2-PFHxA	104	70 - 130	
PFOA	82.6	1.07	4.97	9.95		SUR	13C2-PFDA	96.0	70 - 130	
PFOS	117	1.03	4.97	9.95						

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL.

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.

Only the linear isomer is reported for all other analytes.



Sample ID: NARLB-FB01-0717						EPA Method 537				
Client Data			Sample Data			Laboratory Data				
Name:	CH2M Hill		Matrix:	Drinking Water		Lab Sample:	1700923-02		Date Received:	24-Jul-2017 9:59
Project:	CTO-08		Sample Size:	0.254 L		QC Batch:	B7G0113		Date Extracted:	25-Jul-2017 7:42
Date Collected:	18-Jul-2017 12:45					Date Analyzed:	26-Jul-17 20:33		Column:	Kinetex C18
Location:										
Analyte	Conc. (ng/L)	DL	LOD	LOQ	Qualifiers	Labeled Standard		%R	LCL-UCL	Qualifiers
PFBS	ND	0.437	4.93	9.86		SUR	13C2-PFHxA	91.4	70 - 130	
PFOA	ND	1.06	4.93	9.86		SUR	13C2-PFDA	97.8	70 - 130	
PFOS	ND	1.03	4.93	9.86						

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers

Only the linear isomer is reported for all other analytes



Sample ID: NARLB-SW01P-0717							EPA Method 537			
<b>Client Data</b>			<b>Sample Data</b>			<b>Laboratory Data</b>				
Name:	CH2M Hill		Matrix:	Drinking Water		Lab Sample:	1700923-03	Date Received:	24-Jul-2017 9:59	
Project:	CTO-08		Sample Size:	0.243 L		QC Batch:	B7G0113	Date Extracted:	25-Jul-2017 7:42	
Date Collected:	18-Jul-2017 12:50		Date Analyzed: 26-Jul-17 20:45 Column: Kinetex C18							
Location:										
Analyte	Conc. (ng/L)	DL	LOD	LOQ	Qualifiers	Labeled Standard		%R	LCL-UCL	Qualifiers
PFBS	2.94	0.456	5.14	10.3	J	SUR 13C2-PFHxA		99.4	70 - 130	
PFOA	81.9	1.11	5.14	10.3		SUR 13C2-PFDA		99.8	70 - 130	
PFOS	119	1.07	5.14	10.3						

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.

Only the linear isomer is reported for all other analytes



Sample ID: NARLB-FB02-0717						EPA Method 537				
Client Data			Sample Data			Laboratory Data				
Name:	CH2M Hill		Matrix:	Drinking Water		Lab Sample:	1700923-04	Date Received:	24-Jul-2017 9:59	
Project:	CTO-08		Sample Size:	0.240 L		QC Batch:	B7G0113	Date Extracted:	25-Jul-2017 7:42	
Date Collected:	18-Jul-2017 13:05					Date Analyzed:	26-Jul-17 20:57	Column:	Kinetex C18	
Location:										
Analyte	Conc. (ng/L)	DL	LOD	LOQ	Qualifiers	Labeled Standard		%R	LCL-UCL	Qualifiers
PFBS	ND	0.462	5.21	10.4		SUR	13C2-PFHxA	103	70 - 130	
PFOA	ND	1.13	5.21	10.4		SUR	13C2-PFDA	114	70 - 130	
PFOS	ND	1.08	5.21	10.4						

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.

Only the linear isomer is reported for all other analytes

rev 8/16/17



Sample ID: NARLB-SW02-0717							EPA Method 537			
<b>Client Data</b>  Name: CH2M Hill Project: CTO-08 Date Collected: 18-Jul-2017 13:05 Location:			<b>Sample Data</b>  Matrix: Drinking Water Sample Size: 0.259 L			<b>Laboratory Data</b>  Lab Sample: 1700923-05      Date Received: 24-Jul-2017 9:59 QC Batch: B7G0113      Date Extracted: 25-Jul-2017 7:42 Date Analyzed: 26-Jul-17 21:34    Column: Kinetex C18				
Analyte	Conc. (ng/L)	DL	LOD	LOQ	Qualifiers	Labeled Standard		%R	LCL-UCL	Qualifiers
PFBS	2.77	0.427	4.82	9.64	J	SUR 13C2-PFHxA		96.8	70 - 130	
PFOA	67.5	1.04	4.82	9.64		SUR 13C2-PFDA		97.8	70 - 130	
PFOS	76.1	1.00	4.82	9.64						

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers

Only the linear isomer is reported for all other analytes

nw 8/16/17



**Sample ID: NARLB-SW03-0717**

**EPA Method 537**

Client Data			Sample Data			Laboratory Data				
Name:	CH2M Hill		Matrix:	Drinking Water		Lab Sample:	1700923-06	Date Received:	24-Jul-2017 9:59	
Project:	CTO-08		Sample Size:	0.247 L		QC Batch:	B7G0113	Date Extracted:	25-Jul-2017 7:42	
Date Collected:	18-Jul-2017 13:25					Date Analyzed:	26-Jul-17 21:46 Column: Kinetex C18			
Location:										
Analyte	Conc. (ng/L)	DL	LOD	LOQ	Qualifiers	Labeled Standard		%R	LCL-UCL	Qualifiers
PFBS	2.94	0.449	5.07	10.1	J	SUR 13C2-PFHxA		97.1	70 - 130	
PFOA	86.3	1.09	5.07	10.1		SUR 13C2-PFDA		99.7	70 - 130	
PFOS	176	1.05	5.07	10.1						

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.

Only the linear isomer is reported for all other analytes

sw 8/16/17



Sample ID: NARLB-FB03-0717							EPA Method 537		
Client Data			Sample Data		Laboratory Data				
Name:	CH2M Hill		Matrix:	Drinking Water		Lab Sample:	1700923-07	Date Received:	24-Jul-2017 9:59
Project:	CTO-08		Sample Size:	0.255 L		QC Batch:	B7G0113	Date Extracted:	25-Jul-2017 7:42
Date Collected:	18-Jul-2017 13:25				Date Analyzed: 26-Jul-17 21:58 Column: Kinetex C18				
Location:									
Analyte	Conc. (ng/L)	DL	LOD	LOQ	Qualifiers	Labeled Standard	%R	LCL-UCL	Qualifiers
PFBS	ND	0.434	4.90	9.81		SUR 13C2-PFHxA	109	70 - 130	
PFOA	ND	1.06	4.90	9.81		SUR 13C2-PFDA	110	70 - 130	
PFOS	ND	1.02	4.90	9.81					

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers

Only the linear isomer is reported for all other analytes

W 8/16/17



Sample ID: NARLB-SW04-0717							EPA Method 537			
Client Data Name: CH2M Hill Project: CTO-08 Date Collected: 18-Jul-2017 13:35 Location:			Sample Data Matrix: Drinking Water Sample Size: 0.244 L		Laboratory Data					
					Lab Sample: 1700923-08		Date Received: 24-Jul-2017 9:59			
					QC Batch: B7G0113		Date Extracted: 25-Jul-2017 7:42			
					Date Analyzed: 26-Jul-17 22:10 Column: Kinetex C18					
Analyte	Conc. (ng/L)	DL	LOD	LOQ	Qualifiers	Labeled Standard		%R	LCL-UCL	Qualifiers
PFBS	3.10	0.455	5.13	10.3	J	SUR 13C2-PFHxA		105	70 - 130	
PFOA	79.0	1.11	5.13	10.3		SUR 13C2-PFDA		109	70 - 130	
PFOS	94.7	1.07	5.13	10.3						

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.

Only the linear isomer is reported for all other analytes

SW 81161.7



Sample ID: NARLB-FB04-0717							EPA Method 537			
Client Data Name: CH2M Hill Project: CTO-08 Date Collected: 18-Jul-2017 13:35 Location:			Sample Data Matrix: Drinking Water Sample Size: 0.258 L		Laboratory Data Lab Sample: 1700923-09      Date Received: 24-Jul-2017 9:59 QC Batch: B7G0113      Date Extracted: 25-Jul-2017 7:42 Date Analyzed: 26-Jul-17 22:23    Column: Kinetex C18					
Analyte	Conc. (ng/L)	DL	LOD	LOQ	Qualifiers	Labeled Standard		%R	LCL-UCL	Qualifiers
PFBS	ND	0.430	4.85	9.70		SUR 13C2-PFHxA		102	70 - 130	
PFOA	ND	1.05	4.85	9.70		SUR 13C2-PFDA		101	70 - 130	
PFOS	ND	1.01	4.85	9.70						

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers

Only the linear isomer is reported for all other analytes

rw 81161.7



Sample ID: NARLB-SW05-0717						EPA Method 537				
Client Data			Sample Data			Laboratory Data				
Name:	CH2M Hill		Matrix:	Drinking Water		Lab Sample:	1700923-10		Date Received:	24-Jul-2017 9:59
Project:	CTO-08		Sample Size:	0.252 L		QC Batch:	B7G0113		Date Extracted:	25-Jul-2017 7:42
Date Collected:	18-Jul-2017 13:45					Date Analyzed:	26-Jul-17 22:35 Column: Kinetex C18			
Location:										
Analyte	Conc. (ng/L)	DL	LOD	LOQ	Qualifiers	Labeled Standard		%R	LCL-UCL	Qualifiers
PFBS	2.82	0.439	4.96	9.91	J	SUR 13C2-PFHxA		106	70 - 130	
PFOA	80.2	1.07	4.96	9.91		SUR 13C2-PFDA		110	70 - 130	
PFOS	88.6	1.03	4.96	9.91						

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.

Only the linear isomer is reported for all other analytes

rev 8/16/17



Sample ID: NARLB-FB05-0717					EPA Method 537				
<b>Client Data</b>			<b>Sample Data</b>		<b>Laboratory Data</b>				
Name:	CH2M Hill		Matrix:	Drinking Water	Lab Sample:	1700923-11	Date Received:	24-Jul-2017	9:59
Project:	CTO-08		Sample Size:	0.249 L	QC Batch:	B7G0113	Date Extracted:	25-Jul-2017	7:42
Date Collected:	18-Jul-2017 13:45		Date Analyzed: 26-Jul-17 22:47 Column: Kinetex C18						
Location:									
Analyte	Conc. (ng/L)	DL	LOD	LOQ	Qualifiers	Labeled Standard	%R	LCL-UCL	Qualifiers
PFBS	ND	0.445	5.02	10.0		SUR 13C2-PFHxA	96.8	70 - 130	
PFOA	ND	1.08	5.02	10.0		SUR 13C2-PFDA	94.0	70 - 130	
PFOS	ND	1.04	5.02	10.0					

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL.

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.

Only the linear isomer is reported for all other analytes.

rev 8/16/17