APPENDIX O Data Usability Summary Report (Level IV analytical reports included in final electronic deliverable only)



USACE Baltimore PFAS PA/SI Aberdeen Proving Ground, Maryland

DATA USABILITY SUMMARY REPORT

2021 Sampling Event

August 3, 2021 Revised December 14, 2021

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2021 Sampling Event

Prepared for:

U.S. Army Environmental Command U.S. Army Corps of Engineers Baltimore District Aberdeen Proving Ground, Maryland

Lyndi Mott Program Chemist

Lond. We had

Prepared by:

Arcadis U.S., Inc.

10205 Westheimer Road

Suite 800

Houston

Texas 77042

Tel 713 953 4800

Our Ref.:

Contract W912DR-13-D-0019 Arcadis Project: 30001996

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TABLES

Table 1. Data Usability Summary Table

ATTACHMENTS

Arcadis Data Validation Reports

ACRONYMS AND ABBREVIATIONS

%D percent difference

%R percent recovery

APG Aberdeen Proving Ground

Arcadis U.S., Inc.

DoD Department of Defense

DUA data usability assessment

DUSR data usability summary report

DVR data validation report

EIS extracted internal standards

ELAP Environmental Laboratory Approval Program

ELLE Eurofins Lancaster Laboratories Environmental

ICV/CCV initial calibration verification/continuing calibration verification

LCS/LCSD laboratory control sample/laboratory control sample duplicate

LOQ limit of quantitation

MS/MSD matrix spike/matrix spike duplicate

NELAP National Environmental Laboratory Accreditation Program

PFAS per/polyfluoroalkyl substances

PQAPP Programmatic Uniform Federal Policy-Quality Assurance Project Plan

QAPP Quality Assurance Project Plan

QC quality control

QSM Quality System Manual

RPD relative percent difference

SDG sample delivery group

TOC total organic carbon

USDOD United States Department of Defense

USEPA United States Environmental Protection Agency

EXECUTIVE SUMMARY

This Data Usability Summary Report (DUSR) for Aberdeen Proving Ground (APG) Edgewood located Maryland for the 2021 sampling event describes the findings of the data review and validation and is provided to document the quality of the analytical data used for project decisions. A Data Usability Summary Table at the end of this DUSR lists the data that was qualified and the reason for qualification. Only the sample locations associated with this site and sampling event in the associated laboratory data packages and data validation reports are addressed in this report. The text below adds details where further discussion is warranted. The project-specific sampling and analysis, overall quality control (QC), and quality assurance protocols are presented in the Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP Arcadis 2019), and the Uniform Federal Policy-Quality Assurance Project Plan Addendum for Aberdeen Proving Ground, Maryland (QAPP Addendum Arcadis 2021).

Samples were shipped to Eurofins Lancaster Laboratory Environmental (ELLE) located in Lancaster, Pennsylvania for analysis. ELLE is a United States Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) and National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory. The analytical sample delivery groups (SDGs) and associated Arcadis validation reports are listed in the table below. Summaries of the sample IDs and their associated laboratory IDs, SDGs, sampling dates, and analyses performed are provided in the laboratory reports and data validation reports (DVRs). Note the result pages in the DVRs may have a red line through specific or all compounds to indicate those results are not reportable. Results will be reported from either the initial, diluted, or re-extracted analysis.

In accordance with the project QAPP data review requirements, Stage 3, and 10 percent Stage 4 validation of the analytical data was performed by Arcadis project chemists that are independent of the project team. The validation was performed in accordance with the guidelines and control criteria specified in the following documents:

USDOD. Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 May 2019.

USDOD. DoD General Data Validation Guidelines, November 2019.

USDOD. DoD Final Data Validation Guidelines Module 3: PFAS, May 2020.

Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP Arcadis 2019).

The laboratory data packages and validation reports that were reviewed for this DUSR are listed below.

Sample Delivery Groups (SDG)	Validation Report	Matrix	Parameters	Validation Level
410-31048-1	41114R	Soil/ Water	PFAS, TOC, Soil pH	Stage 3: 6 field samples; Stage 4: 1 field sample
410-31280-1	41124R	Soil/ Water	PFAS, TOC, Soil pH	Stage 3: 7 field samples; Stage 4: 1 field sample
410-31453-1	41156R	Soil/ Water	PFAS, TOC, Soil pH	Stage 3: 4 field samples; Stage 4: 1 field sample

Sample Delivery Groups (SDG)	Validation Report	Matrix	Parameters	Validation Level
410-31454-1	41184R	Soil/ Water	PFAS, TOC, Soil pH	Stage 3: 7 field samples, 1 field duplicate; Stage 4: 1 field sample
410-31764-1	41202R	Soil/ Water	PFAS, TOC, Soil pH	Stage 3: 9 field samples; Stage 4: 1 field sample
410-31990-1	41203R	Water	PFAS	Stage 3: 7 field samples, 1 field duplicate; Stage 4: 1 field sample
410-32109-1	41204R	Soil/ Sediment/ Water	PFAS, TOC, Soil pH	Stage 3: 11 field samples, 1 field duplicate; Stage 4: 2 field samples
410-32605-1	41218R	Soil/ Water	PFAS, TOC, Soil pH	Stage 3: 9 field samples; Stage 4: 1 field sample
410-32347-1	41265R	Soil/ Water	PFAS, TOC, Soil pH	Stage 3: 4 field samples; Stage 4: 1 field sample
410-32349-1	41266R	Soil/ Water	PFAS, TOC, Soil pH	Stage 3: 10 field samples, 1 field duplicate; Stage 4: 1 field sample
410-32720-1	41219R	Soil/ Sediment/ Water	PFAS, TOC, Soil pH	Stage 3: 7 field samples, 2 field duplicates; Stage 4: 1 field sample
410-32859-1	41295R	Soil/ Water	PFAS, TOC, Soil pH	Stage 3: 6 field samples, 1 field duplicate; Stage 4: 1 field sample
410-33044-1 410-33045-1	41348R	Soil/ Water	PFAS, TOC, Soil pH	Stage 3: 6 field samples, 1 field duplicate; Stage 4: 1 field sample
410-33396-1	41349R	Water	PFAS	Stage 3: 4 field samples; Stage 4: 1 field sample
410-37146-1	41360R	Soil/ Water	PFAS	Stage 3: 3 field samples; Stage 4: 1 field sample

PRECISION

Precision is expressed as a relative percent difference (RPD) between the results of replicate sample analyses: sample duplicates, laboratory control sample duplicates (LCSDs), and matrix spike duplicates

(MSDs). The RPD limit for LCSDs and MSDs is 30 percent. Field duplicates were collected at a frequency of 5 percent. Unless documented below or in the Data Usability Summary table, the RPD between the parent samples and associated field duplicates were within acceptable limits of 35 percent for water matrix and 50 percent for soil matrix.

Groundwater sample APG-FTA-M08-031121 was identified as the parent sample to field duplicate APG-DUP-04-031121. The evaluation of the parent sample and field duplicate indicate precision was within criteria of 35 percent RPD.

Groundwater sample APG-BLDG-250-PW-1-1-GW-030921 was identified as the parent sample to field duplicate APG-DUP-02-030921. The evaluation of the parent sample and field duplicate indicate precision was within criteria of 35 percent RPD.

Groundwater sample APG-NOBLE-ROAD-1-GW-031721 was identified as the parent sample to field duplicate APG-DUP-07-031721. The evaluation of the parent sample and field duplicate indicate precision was within criteria of 35 percent RPD.

Groundwater sample APG-P1-12-2-GW-031821 was identified as the parent sample to field duplicate APG-DUP-08-031821. The evaluation of the parent sample and field duplicate indicate precision was within criteria of 35 percent RPD except for 6:2 FTS. The 6:2 FTS results for the parent sample and field duplicate were qualified as estimated.

Surface water sample APG-FUZE-1-SW-031621 was identified as the parent sample to field duplicate APG-DUP-06-031621. The evaluation of the parent sample and field duplicate indicate precision was within criteria of 35 percent RPD.

Soil sample APG-MFR1-1-SO-(8-10)-030421 was identified as the parent sample to field duplicate APG-DUP-01-030421. The evaluation of the parent sample and field duplicate indicate precision was within criteria of 50 percent RPD.

Soil sample APG-BLDG-E4081-2-SO-(0-2)-031021 was identified as the parent sample to field duplicate APG-DUP-03-031021. The evaluation of the parent sample and field duplicate indicate precision was within criteria of 50 percent RPD.

Sediment sample APG-AA5-1-SE-031621 was identified as the parent sample to field duplicate APG-DUP-05-031621. The evaluation of the parent sample and field duplicate indicate precision was within criteria of 50 percent RPD except for perfluorooctane sulfonic acid and perfluorooctanoic acid. The results for these compounds were qualified as estimated for both the parent sample and field duplicate.

ACCURACY

Accuracy is demonstrated by recovery of target analytes from fortified blank and sample matrices, LCS/LCSDs and MS/MSDs, respectively. The recovery of target analytes from fortified samples is compared to acceptance criteria. The criteria are listed in DoD QSM 5.3 Appendix C, Table C-44 and C-45. The criteria for EIS recoveries are 50 to 150 percent. In addition, Stage 4 validation of initial and continuing calibration results provide information on analytical accuracy. Unless documented below or in the Data Usability Summary table, the recoveries of LCS, MS/MSD, and extracted internal standards (EIS), and calibration criteria, were within acceptable limits.

As noted in the Data Usability Summary Table, EIS recoveries were outside control limits for many samples. Since EIS are associated with specified compounds, only a few compounds per sample may be qualified. Where EIS recoveries were less than 20 percent, and qualified as "X", a discussion of the potential impact on the reported results is in Conclusions.

REPRESENTATIVENESS

Representativeness is the degree to which sample data accurately and precisely represent site conditions and is dependent on sampling and analytical variability and the variability (or homogeneity) of the site itself. The use of the prescribed field and laboratory analytical methods with associated holding times and preservation requirements are intended to provide representative data.

All samples were collected and submitted for analysis in accordance with the procedures and sampling plan specified in the site QAPP and field SOPs. Analysis of samples was in accordance with the USACE PFAS PA/SI PQAPP, DoD QSM, and laboratory SOPs. All hold times were met except for soil pH as noted in the Data Usability Summary Table.

SENSITIVITY

Sensitivity describes the relationship between the laboratory quantitation limits and the project action limits. Reported laboratory quantitation limits are compared to the project detection limits to ensure that the analytical methods are capable of quantifying target analytes to a level that would satisfy DQOs.

The detection limits for the soil and sediment samples were elevated due to correction for percent moisture. Some compounds in aqueous samples were diluted to quantitate within the calibration range have elevated detection limits.

Sample locations APG-BLDG-1059-1-GW-030321, APG-BLDG-1065-1-GW-030321, APG-ABR3-1-GW-030821, APG-OLD-FTA-1-GW-031121, APG-OLD-FTA-2-GW-031121, APG-FTA-M08-031121, APG-DUP-04-031121, APG-AA5-1-GW-031621, APG-FUZE-1-GW-031621, and APG-DUP-08-031821 were analyzed at 10-fold and 100-fold dilution, and field duplicate APG-DUP-06-031621 was analyzed at a 10-fold dilution, due to interference from sample matrix. An undiluted analysis was not performed. Therefore, detection limits are elevated for all target compounds.

COMPLETENESS

The completeness for this data set met the criteria of 90 percent. Nineteen results were qualified as potentially unusable with an "X" qualifier. The "X" qualifiers were due to extracted internal standards (EIS) exhibiting recoveries less than 20%, which is indicative of matrix interferences. A discussion of the affected results is below in Conclusions.

CONCLUSIONS

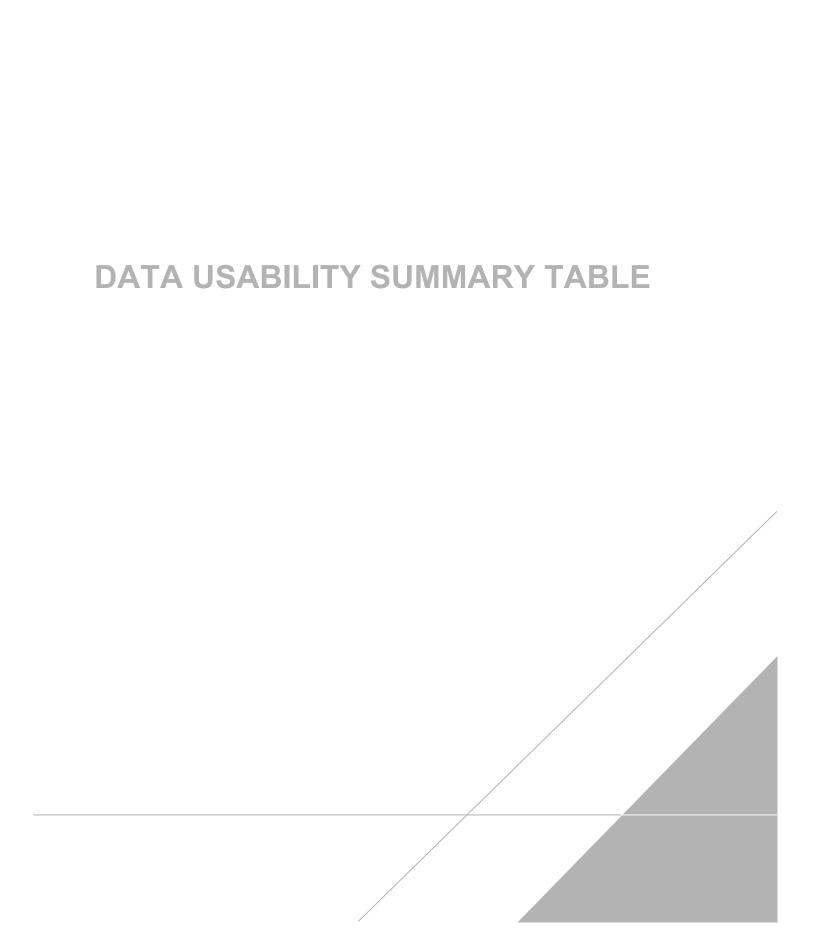
The overall assessment of the field samples, QA/QC data review by manual validation of the 2021 data set from APG Edgewood met project requirements and completeness goals. Based upon the Stage 3 and Stage 4 data validation, all results are considered valid and usable except for the data qualified as

"X". The results that are qualified as estimated are usable with caution. As the goal of these sampling events is to determine the presence or absence of PFAS, the detections are valid, but the reported concentration may be biased. If the data is evaluated against screening criteria, qualified results at or near the screening criteria should be evaluated considering the possible bias in the reported results.

The N-MeFOSAA and N-EtFOSAA data qualified as "UX" for fifteen sample locations were due to EIS recoveries less than 20%. See the Data Usability Summary for the list of sample locations. The N-MeFOSAA and N-EtFOSAA are non-detect; it is recommended that the results be rejected.

The N-MeFOSAA result qualified as "UX" for sample location APG-MFR1-1-SO-(8-10)-030421 was due to EIS recoveries less than 20%. The N-MeFOSAA result is non-detect; it is recommended that the result be rejected.

A decision to reject the "X" qualified data was agreed upon by the project team and USACE Chemist. Therefore, the "X" qualifier was revised to "R" for the results discussed above on December 14, 2021.



DATA USABILITY SUMMARY TABLE Aberdeen Proving Ground Edgewood; 2021 Sampling Event

Sample Locations	Compound	Qualifier	Reason
APG-BAF-A1-1-SO-(0-2)-030221 APG-BAF-E-1-SO-(0-2)-030321 APG-ABR6-1-SO-(0-2)-030521 APG-ABR7-1-SO-(0-2)-030521 APG-Loading-PAD-1-SO-(0-2)-030421 APG-DUP-01-030421 APG-BR3-1-(0-2)-030821 APG-HELI-FIRE-1-SO-(0-2)-031221 APG-PI-12-2-SO-(0-2)-031521 APG-BLDG-E4040-1-SO-(0-2)-031921 APG-BLDG-E5005-1-SO-042221	N-MeFOSAA N-EtFOSAA	UJ	Extracted Internal Standard (EIS) %R less than 50%
APG-BAF-B-1-SO-(0-2)-030221 APG-ABR6-2-SO-(0-2)-030521 APG-NOBLE-ROAD-1-SO-(0-2)- 031021 APG-BLDG-300-1-SO-(0-2)- 031521 APG-PI-12-1-SO-(0-2)-031521	N-MeFOSAA	UJ	EIS %R less than 50%
APG-BAF-A1-2-SO-(0-2)-030221 APG-BAF-D-1-SO-(0-2)-030321 APG-BLDG-1065-1-SO-(0-2)- 030321 APG-Hanger-1060-1-SO-(0-2)- 030421 APG-MFR1-2-SO-(8-10)-030421 APG-BONEYARD-2-SO-(0-2)- 030821 APG-BONEYARD-3-SO-(0-2)- 030821 APG-BONEYARD-4-SO-(0-2)- 030821 APG-BONEYARD-1-SO-(0-2)- 031121 APG-BONEYARD-7-SO-(0-2)- 031121 APG-OLD-FTA-1-SO-(0-2)- 031121 APG-OLD-FTA-2-SO-(0-2)- 031121	N-MeFOSAA N-EtFOSAA	R	EIS %R less than 20%
APG-OLD-FTA-1-SO-(0-2)- 031121	Perfluoroundecanoic acid	J	Ion Ratio %R less than 50%
APG-OLD-FTA-1-GW-031121	Perfluoroundecanoic acid	JDM	Result less than LOQ, Ion Ratio %R less than 50%; result from diluted analysis; manually integrated peak
APG-BLDG-1059-1-SO-(0-2)-	N-EtFOSAA	UJ	EIS %R less than 50%
030321	N-MeFOSAA	JN	EIS %R less than 50% and Ion Ratio %R Gross Exceedance

Sample Locations	Compound	Qualifier	Reason
APG-BAF-A1-1-GW-030221 APG-WB-MW-11A-030921	Perfluorooctanesulfonic acid	J	Ion Ratio %R > 150%
APG-WB-MW-14A-030921	Perfluorooctanesulfonic acid	JM	Ion Ratio %R > 150%; manually integrated peak
APG-BAF-A1-2-GW-030221	N-MeFOSAA	JN	Ion Ratio %R Gross Exceedance
APG-BLDG-1059-1-GW-030321	6:2 FTS Perfluorooctanesulfonic acid	DJ-	EIS %R greater than 150%; result reported from diluted analysis
APG-BLDG-1065-1-GW-030321 APG-OLD-FTA-2-GW-031121	Perfluorooctanesulfonic acid	DJ-	EIS %R greater than 150%; result reported from diluted analysis
ADC MED4 4 CO (0.40) 020424	N-EtFOSAA	UJ	EIS %R less than 50%
APG-MFR1-1-SO-(8-10)-030421	N-MeFOSAA	R	EIS %R less than 20%
APG-ABR3-1-GW-030821	N-MeFOSAA	DMJN	Result from diluted analysis; Manually integrated peak; Ion Ratio %R Gross Exceedance
APG-BONEYARD-5-SO-(0-2)- 030821	6:2 FTS 8:2 FTS	UJ	EIS %R less than 50%
APG-BONEYARD-6-SO-(0-2)- 031121	N-MeFOSAA N-EtFOSAA	UX	EIS %R less than 20%
APG-HELI-FIRE-1-GW-031221	6:2 FTS	J-	EIS %R greater than 150%;
	6:2 FTS	DJ-	EIS %R greater than 150%; result reported from diluted analysis
APG-AA5-1-GW-031621	Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	EDJ	Result over calibration range of instrument; reported from 100-fold dilution
	Perfluorooctanesulfonic acid	J+	MS/MSD %R; high bias; Field duplicate RPD
APG-AA5-1-SE-031621	6:2 FTS	J-	MSD %R; low bias
	Perfluorooctanoic acid	J	Field duplicate RPD
APG-DUP-05-031621	Perfluorooctanoic acid Perfluorooctanesulfonic acid	J	Field duplicate RPD
APG-FUZE-1-GW-031621	6:2 FTS	DJ-	EIS %R greater than 150%; result reported from diluted analysis
APG-FUZE-1-SW-031621	Perfluorotetradecanoic acid	J+	EIS %R less than 50%
APG-DUP-06-031621 APG-NOBLE-ROAD-1-GW- 031721	Perfluorotetradecanoic acid	UJ	EIS %R less than 50%
APG-BAF-S6-1-SO-(0-2)-031621	6:2 FTS 8:2 FTS Perfluorobutanoic acid Perfluorohexanoic acid Perfluoropentanoic acid Perfluorotetradecanoic acid	UJ	EIS %R less than 50%
	N-MeFOSAA N-EtFOSAA	R	EIS %R less than 20%

Sample Locations	Compound	Qualifier	Reason
APG-WEIDE-1-GW-031721	Perfluorotetradecanoic acid	UJ	EIS %R less than 50%
AFG-WEIDE-1-GW-031721	Perfluorobutanoic acid Perfluoropentanoic acid	MJ+	EIS %R less than 50%; manually integrated peak
APG-P1-12-2-GW-031821 APG-DUP-08-031821	6:2 FTS	DJ	Field duplicate RPD; results reported from diluted analysis
APG-DUP-08-031821	Perfluorodecanoic acid	DJ	Result greater than LOD but less than LOQ; result reported from diluted analysis
APG-WES-M09-032021	Perfluorobutanoic acid	J+	EIS %R less than 50%
	Perfluorobutanoic acid	J+	EIS %R less than 50%
APG-WES-M21-032021	NMeFOSAA NEtFOSAA Perfluorododecanoic acid Perfluorotridecanoic acid Perfluorotetradecanoic acid	UJ	EIS %R less than 50%
APG-BAF-A1-1-SO-(0-2)-030221 APG-BAF-B-1-SO-(0-2)-030221 APG-BAF-D-1-SO-(0-2)-030321 APG-BAF-E-1-SO-(0-2)-030321 APG-BLDG-1059-1-SO-(0-2)-030321 APG-BLDG-1065-1-SO-(0-2)-030321 APG-BLDG-1065-1-SO-(0-2)-030321 APG-ABR6-1-SO-(0-2)-030521 APG-ABR7-1-SO-(0-2)-030521 APG-LOADING-PAD-1-SO-(0-2)-030421 APG-HANGER-1060-1-SO-(0-2)-030421 APG-MFR1-2-SO-(8-10)-030421 APG-ABR3-1-(0-2)-030821	TOC	J+	CCV %R > 110%
APG-BLDG-E4081-1-SO-(0-2)- 031021 APG-BAF-S6-1-SO-(0-2)-031621 APG-G-STREET-1-SO-(0-2)- 031921	тос	J-	MS %R < 75%; CCV %R < 90%; LCS %R < 80%
APG-BONEYARD-1-SO-(0-2)- 031121 APG-OLD-FTA-1-SO-(0-2)- 031121 APG-BLDG-2200-1-SO-(0-2)- 031221 APG-HELI-FIRE-1-SO-(0-2)- 031221 APG-NOBLE-ROAD-1-SO-(0-2)- 031021 APG-CASEY-YARD-1-SO-(0-2)- 031021 APG-BLDG-300-1-SO-(0-2)- 031521 APG-PI-12-1-SO-(0-2)-031521	TOC	J-	CCV %R < 90%; LCS %R < 80%

Sample Locations	Compound	Qualifier	Reason
APG-PI-Minefield-1-SO-(0-2)- 031521 APG-WEIDE-1-SO-(0-2)-031721 APG-BLDG-E5180-1-SO-(0-2)- 031721 APG-BLDG-E4040-1-SO-(0-2)- 031921	TOC	J-	CCV %R < 90%; LCS %R < 80%
APG-BAF-A1-1-SO-(0-2)-030221 APG-BAF-B-1-SO-(0-2)-030221 APG-BAF-B-1-SO-(0-2)-030321 APG-BAF-D-1-SO-(0-2)-030321 APG-BLDG-1059-1-SO-(0-2)-030321 APG-BLDG-1065-1-SO-(0-2)-030321 APG-BLDG-1065-1-SO-(0-2)-030321 APG-ABR6-1-SO-(0-2)-030521 APG-ABR7-1-SO-(0-2)-030521 APG-ABR7-1-SO-(0-2)-030521 APG-HANGER-1060-1-SO-(0-2)-030421 APG-HANGER-1060-1-SO-(0-2)-030421 APG-BNEYARD-1-SO-(0-2)-031121 APG-BLDG-2200-1-SO-(0-2)-031121 APG-BLDG-2200-1-SO-(0-2)-031221 APG-BLDG-E4081-1-SO-(0-2)-031021 APG-NOBLE-ROAD-1-SO-(0-2)-031021 APG-BLDG-300-1-SO-(0-2)-031521 APG-PI-12-1-SO-(0-2)-031521 APG-PI-Minefield-1-SO-(0-2)-031521 APG-BLDG-E5180-1-SO-(0-2)-031721 APG-BLDG-E5180-1-SO-(0-2)-031721 APG-BLDG-E4040-1-SO-(0-2)-031721 APG-BLDG-E4040-1-SO-(0-2)-031921 APG-G-STREET-1-SO-(0-2)-031921 APG-G-STREET-1-SO-(0-2)-031921	рН	J	Hold time exceedance

NOTE: The laboratory qualifier "D" for result from diluted analysis, and "M" for manually integrated peak, are maintained in the database for informational purposes for the end user. These qualifiers have no impact on the usability of the data.

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however, the reported concentration is estimated due to non-conformances discovered during data validation.

- J+ (Estimated; may be biased high): The compound or analyte was analyzed for and positively identified by the laboratory; however, the reported concentration is estimated due to non-conformances discovered during data validation and may be biased high.
- J- (Estimated; may be biased low): The compound or analyte was analyzed for and positively identified by the laboratory; however, the reported concentration is estimated due to non-conformances discovered during data validation and may be biased low.
- JN The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however, the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- UJ- (Non-detected estimated; may be biased low): The compound or analyte was reported as not detected by the laboratory; however, the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation and may be biased low.
- UB (Non-detect; contamination): Compound considered non-detect at the listed value due to associated blank contamination.
- BJ+ (Estimated; contamination): The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect and reported result may be biased high.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.
- R The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Rejection of the data was decided by the project team and USACE chemist.





Aberdeen Proving Ground – Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDG # 410-31048-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report #41114R1

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-31048-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

2 12			Sample	5 / 6	Analysis		
Sample ID	Lab ID	Matrix	Collection Date	Parent Sample	PFAS	тос	рН
APG-BAF-A1-1-SO-(0-2)-030221	410-31048-1	Soil	3/2/2021		Х	Х	Х
APG-BAF-A1-1-GW-030221	410-31048-2	Water	3/2/2021		Х		
APG-BAF-A1-2-GW-030221	410-31048-3	Water	3/2/2021		Х		
APG-BAF-A1-2-SO-(0-2)-030221	410-31048-4	Soil	3/2/2021		Х		
APG-FTA-M09-030221	410-31048-5	Water	3/2/2021		Х		
APG-FTA-M10-030221	410-31048-6	Water	3/2/2021		Х		
APG-BAF-B-1-SO-(0-2)-030221	410-31048-7	Soil	3/2/2021		Х	Х	Х

Notes:

- 1. Stage 4 validation was performed on sample APG-BAF-A1-1-GW-030221.
- 2. Matrix spike (MS) analysis was performed on sample APG-BAF-A1-1-SO-(0-2)-030221 for Total Organic Carbon (TOC) analysis.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Reported		Performance Acceptable		Not
Items Reviewed	No	Yes	No	Yes	Required
Sample receipt condition		Х		Х	
2. Requested analyses and sample results		Х		X	
Master tracking list		Х		Х	
4. Methods of analysis		Х		Х	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		Х	
11. Narrative summary of QA or sample problems provided		Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

- 1. The container count for the sample APG-BAF-A1-1-GW-030221 did not match the information listed on Chain of Custody. A batch QC bottle was received with this sample bringing the count up to three (3) rather than the two (2) listed on the COC.
- 2. The sample collection date mismatch observed between container label and COC for the samples APG-BAF-A1-2-SO-(0-2)-030221 and APG-FTA-M09-030221. These samples have a collection date of 3/21/21 listed on the COC, but a collection date of 3/2/21 listed on the containers. The samples were entered following the container dates since the COC date has not occurred yet.

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - JN The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Soil USEPA modified		28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
ADO DAE AA A OO (O O) 000004	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 20%
APG-BAF-A1-1-SO-(0-2)-030221	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 20%
	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
APG-BAF-A1-2-SO-(0-2)-030221	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
APG-BAF-B-1-SO-(0-2)-030221	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 20%

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
4500/	Non-detect	No Action
> 150%	Detect	J-
500/ had 900/	Non-detect	UJ
< 50% but > 20%	Detect	J+
000/	Non-detect	UX
< 20%	Detect	X

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be ≤ 30%.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

The MS/MSD analysis was not performed on sample location associated with this SDG.

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

A field duplicate was not collected for a sample location associated with this SDG.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

Samples associated with ion ratios outside of the control limits of \pm 50 percent from the target value are presented in the following table.

Sample ID	Compounds	Ion Ratio %R
APG-BAF-A1-1-GW-030221	Perfluorooctanesulfonic acid	178%
APG-BAF-A1-2-GW-030221	NMeFOSAA	903%

In the case of an ion ratio deviation, the sample results are qualified as documented in the table below.

Control limit	Sample Result	Qualification
<50% or > 150%	Detect	J
Gross Exceedance	Detect	JN

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
	Perfluorohexanesulfonic acid		1100	1100 D
APG-BAF-A1-2-GW-030221	V-030221 Perfluorooctanoic acid Perfluorooctanesulfonic acid		700	700 D
			3900	3900 D
	6:2 Fluorotelomer sulfonic acid		340	340 D
	Perfluorohexanesulfonic acid		1700	1700 D
APG-FTA-M09-030221	Perfluorohexanoic acid		480	480 D
	Perfluorooctanoic acid		1100	1100 D
	Perfluorooctanesulfonic acid		11000	11000 D
APG-FTA-M10-030221	Perfluorohexanesulfonic acid		2500	2500 D

Note: the lab didn't report the original analysis; only the diluted result.

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification
Diluted sample result within the calibration range	D

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

As noted in Section 5.1, N-EtFOSAA and N-MeFOSAA results were qualified "X" for sample location APG-BAF-A1-2-SO-(0-2)-030221. This was due to EIS recoveries less than 20%. After review with the project team and USACE chemist, the results were rejected, and the final qualifier has been revised from "X" to "R" on December 14, 2021.

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Rep	oorted		rmance ptable	Not
	No	Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC	/MS/MS)	_	<u> </u>	
Stage 2 Validation					
Holding times		Х		Х	
Reporting limits (units)		Х		Х	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks	Х				X
C. Field blanks / Source blanks	Х				Х
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate(LCSD) %R		Х		Х	
LCS/LCSD Precision (RPD)		Х		Х	
Matrix Spike (MS) %R	Х				X
Matrix Spike Duplicate(MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				Х
Field Duplicate (RPD)	Х				Х
Extracted Internal Standard %R		Х	Х		
Injection Internal Standard %R		Х		Х	
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation					
Instrument tune and performance check		Х		Х	
Initial calibration %RSDs		Х		Х	
Continuing calibration %Ds		Х		Х	
Instrument sensitivity check		Х		Х	
Ion transitions used		Х		Х	
Compound identification and quantitation	1	1		1	1
A. Reconstructed ion chromatograms		Х		Х	
B. Quantitation Reports		Х		Х	
C. RT of sample compounds within the established RT windows		Х		Х	

PFAS: 537M/DoD QSM 5.3		Reported		mance ptable	Not Required
		Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC/	MS/MS)			
D. Ion Ratio %R		Х	Х		
E. Transcription/calculations acceptable		Х		Х	
F. Reporting limits adjusted to reflect sample dilutions		Х		Х	

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

Concentration (C) Qualifiers

- U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
- J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).

Quantitation (Q) Qualifiers

E The compound was quantitated above the calibration range.

• Validation Qualifiers

- J The reported result was an estimated value with an unknown bias.
- J+ The result was an estimated quantity, but the result may be biased high.
- J- The result was an estimated quantity, but the result may be biased low.
- UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
- UB Analyte considered non-detect at the listed value due to associated blank contamination.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria
APG-BAF-A1-1-SO-(0-2)-030221	7 days from collection; 6 days from receipt	< 24 hours of receipt at
APG-BAF-B-1-SO-(0-2)-030221	6 days from collection; 5 days from receipt	the laboratory

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

	Qualification
Criteria	Detected Analytes
Analysis completed past the holding time	J

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analytes	Standard Recovery
APG-BAF-A1-1-SO-(0-2)-030221 APG-BAF-B-1-SO-(0-2)-030221	CCV	TOC	120%

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Control Limit	Sample Result	Qualification
750/ to 900/		Non-detect	UJ
	75% to 89%	Detect	J-
TOC	4440/ 4 4050/	Non-detect	No Action
	111% to 125%	Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

A MS analysis was performed on sample APG-BAF-A1-1-SO-(0-2)-030221 for TOC and recovery was within the control limits.

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

A laboratory duplicate analysis was performed on a sample APG-BAF-A1-1-SO-(0-2)-030221 for TOC and the RPD was within the control limit.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent

sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within \pm 0.05 S.U. of the true value.

All LCS recoveries were within control limits.

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Reported		Performance Acceptable		Not
	No	Yes	No	Yes	Required
Miscellaneous Instrumentation					
Stage 2 Validation			_		
Holding times		X	Х		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	Х				Х
Laboratory Control Sample (LCS) %R		X		Х	
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х
LCS/LCSD Precision (RPD)	Х				Х
Matrix Spike (MS) %R		Х		Х	
Matrix Spike Duplicate (MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				Х
Lab Duplicate (RPD)		Х		Х	
Field Duplicate (RPD)	Х				Х
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		Х	
Continuing calibration %R		Х	Х		
Raw Data		Х		Х	
Transcription/calculations acceptable		X		X	

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE:

DATE: April 26, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 7, 2021

Stage 3 / 4 PFAS Calibration Standards

SDG #:410-31048-1Date:4/26/2021Lab:Eurofins LancasterPage:1Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 29347

PFBA 3/05/2021 Calibration

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Match Match Match Match Match Match Match

11 br 3/03/2021 calloration 1 age 702 713 01 300 410 31040 1											
Cal Conc					Calculated		Calc		Calculated	Reported	
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D	
0.2	76737	4041718	10	0.018986	0.9493117	0.8751	0.216961	0.2	8.480	8.5	
0.5	176646	4038069	10	0.043745	0.8749033	0.8751	0.499888	0.5	-0.022	0	
2	793768	4082481	10	0.194433	0.9721637	0.8751	2.221835	2	11.092	11.1	
8	2677850	3885912	10	0.689118	0.8613969	0.8751	7.874729	8	-1.566	-1.6	
20	6830316	3935411	10	1.735604	0.8678021	0.8751	19.83321	20	-0.834	-0.8	
50	16406435	3931630	10	4.172935	0.8345869	0.8751	47.68523	50	-4.630	-4.6	
100	28464329	3717120	10	7.65763	0.765763	0.8751	87.50577	100	-12.494	-12.5	

Avg RF = 0.8751325 Match

Concentration ng/ml= (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

 SDG #:
 410-31048-1
 Date:
 4/26/2021

 Lab:
 Eurofins Lancaster
 Page:
 2

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-100111/9 3/05/2021 13:32

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	Analyte					Calc		Calculated	Reported	
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D	l
Perfluorobutanoic acid	637595	3676346	10	0.1734	0.8751	1.982	2	-0.91	-0.9	М
Perfluoropentanoic acid	619100	3259175	10	0.1900	1.0370	1.832	2	-8.41	-8.5	M
Perfluorobutanesulfonic acid	739077	3444531	9.36	0.2146	1.0960	1.832	2	3.53	3.6	M
Perfluorohexanoic acid	711372	3890288	10	0.1829	0.9115	2.006	2	0.31	0.3	М
Perfluoroheptanoic acid	818242	3882972	10	0.2107	1.0960	1.923	2	-3.87	-3.9	M
Perfluorohexanesulfonic acid	674978	3439888	9.46	0.1962	1.0510	1.766	2	-6.55	-6.6	M
Perfluorooctanesulfonic acid	736490	3830413	9.57	0.1923	1.1010	1.671	2	-12.50	-12.7	M

Match
Match
Match
Match
Match
Match
Match
Match
Match

CCV 410-100974/80 3/10/2021 00:41

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	Analyte					Calc		Calculated	Reported	
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D	
Perfluorobutanoic acid	2752531	4058730	10	0.6782	0.8751	7.750	8.0	-3.13	-3.1	Match
Perfluoropentanoic acid	2932362	3779858	10	0.7758	1.0370	7.481	8.0	-6.49	-6.5	Match
Perfluorobutanesulfonic acid	3489153	4541522	9.36	0.7683	1.0960	6.561	7.1	-7.33	-7.4	Match
Perfluorohexanoic acid	2972310	4249801	10	0.6994	0.9115	7.673	8.0	-4.09	-4.1	Match
Perfluoroheptanoic acid	3618712	4262845	10	0.8489	1.0960	7.745	8.0	-3.18	-3.2	Match
Perfluorohexanesulfonic acid	2970124	3754845	9.46	0.7910	1.0510	7.120	7.3	-2.47	-2.4	Match
Perfluorooctanesulfonic acid	3386841	4352732	9.57	0.7781	1.1010	6.763	7.4	-8.60	-8.7	Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 $\begin{array}{c|cccc} SDG\# & 410\text{-}31048\text{-}1 & Date: & 4/26/2021 \\ Lab: & \hline{Eurofins Lancaster} & Page: & 3 \\ \hline Project: & Aberdeen Proving Ground & Validated by: & SPR \\ \end{array}$

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-100953/2-A

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Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported	
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	1568094	2606754	10	0.60155	0.8751	27.50	25.6	107.41	107	Matcl
Perfluoropentanoic acid	1651287	2498431	10	0.66093	1.0370	25.49	25.6	99.59	100	Matcl
Perfluorobutanesulfonic acid	2036117	2868182	9.36	0.709898	1.0960	24.25	22.6	107.30	107	Matcl
Perfluorohexanoic acid	1710571	2910572	10	0.58771	0.9115	25.79	25.6	100.75	101	Matcl
Perfluoroheptanoic acid	2177464	3017840	10	0.721531	1.0960	26.33	25.6	102.86	103	Matcl
Perfluorohexanesulfonic acid	1798531	2663753	9.46	0.675187	1.0510	24.31	24.2	100.45	100	Matcl
Perfluorooctanesulfonic acid	2012751	3048752	9.57	0.660188	1.1010	22.95	24.5	93.69	94	Match

LCSD 410-100953/3-A

Page 1291 - 1296 of SDG 410-31048-1

Sample volume = 250 ml

Final volume = 1ml

						Calculated		Calculated	Reported	1
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	1972751	3396827	10	0.580763	0.8751	26.55	25.6	103.70	104	Match
Perfluoropentanoic acid	2183330	3179163	10	0.686763	1.0370	26.49	25.6	103.48	103	Match
Perfluorobutanesulfonic acid	2479136	3421206	9.36	0.724638	1.0960	24.75	22.6	109.53	109	Match
Perfluorohexanoic acid	2250618	3716152	10	0.605631	0.9115	26.58	25.6	103.82	104	Match
Perfluoroheptanoic acid	2585159	3687919	10	0.70098	1.0960	25.58	25.6	99.93	100	Match
Perfluorohexanesulfonic acid	2118764	3273501	9.46	0.647247	1.0510	23.30	24.2	96.29	96	Match
Perfluorooctanesulfonic acid	2398153	3613788	9.57	0.663612	1.1010	23.07	24.5	94.17	94	Match

Calculated Amount ng/L = ((Peak area ratio/Avg RF) x EIS concentration)/Sample volume)*1000

				Reported	
	LCS Calc	LCSD Calc	LCS/LCSD	LCS/LCSD	
Compounds	Amount	Amount	Calc RPD	RPD	
Perfluorobutanoic acid	27.50	26.55	3.5	4	Match
Perfluoropentanoic acid	25.49	26.49	3.8	4	Match
Perfluorobutanesulfonic acid	24.25	24.75	2.1	2	Match
Perfluorohexanoic acid	25.79	26.58	3.0	3	Match
Perfluoroheptanoic acid	26.33	25.58	2.9	3	Match
Perfluorohexanesulfonic acid	24.31	23.30	4.2	4	Match
Perfluorooctanesulfonic acid	22.95	23.07	0.5	1	Match

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-31048-1
 Date:
 4/26/2021

 Lab:
 Eurofins Lancaster
 Page:
 4

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-BAF-A1-1-GW-030221 Lab ID: 410-31048-2 Page 559 - 563 of SDG 410-31048-1

						Calculated Final Amount Volume Sa			Final Calculated	Reported Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	408494	3025308	10	0.135026	0.8751	1.54	1	248.3	6.2	6.2	Matcl
Perfluoropentanoic acid	600560	2780847	10	0.215963	1.0370	2.08	1	248.3	8.4	8.4	Matcl
Perfluorobutanesulfonic acid	1218168	2941552	9.36	0.414124	1.0960	3.54	1	248.3	14.2	14	Matc
Perfluorohexanoic acid	1231147	3349609	10	0.367549	0.9115	4.03	1	248.3	16.2	16	Matc
Perfluoroheptanoic acid	1342143	3412500	10	0.393302	1.0960	3.59	1	248.3	14.5	14	Matc
Perfluorohexanesulfonic acid	5491334	2818598	9.46	1.94825	1.0510	17.54	1	248.3	70.6	71	Matc
Perfluorooctanesulfonic acid	26827474	2836823	9.57	9.456873	1.1010	82.20	1	248.3	331.1	330	Matcl

Calculated amount $ng/L = (Peak area \ ratio/Avg \ RF) \ x \ DF \ x \ EIS \ conc \ ng/L$ Final Calculated amount $ng/L = ((calculated \ ng/L \ x \ Final \ Volume \ mls) \ / \ sample \ volume \ mls)$ Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

 SDG #:
 410-31048-1
 Date:
 4/26/2021

 Lab:
 Eurofins Lancaster
 Page:
 5

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-BAF-A1-1-GW-030221 Lab ID: 410-31048-2

EIS 13C4 PFBA

REPORTED EIS %R 77

%R = 100 * EIS ConcentrationEIS TV

EIS Concentration 7.66 ng/ml Page 561 of 410-31048-1

EIS TV 10.0

%R 76.6 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental Analysis Request/Chain o

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💸 eurofins	For Eurofin

For Eurofins Lancaster Laboratories Env



COC #617017

Lancaster Laboratories Environmental	Acct. #		(Group	#		Sa	ample	·	410-31	048 C	hain of	Custody		j	COC	#617	017
Client Informatio	n		120			Matrix			- 1	1	A	nalvs	is Requ	ested	ARTHURAN	For Lab	Use Only	
Client: ARCADIS	Acct. #:		1							Pre			and Filtra		odes	FSC:	6572	-5
Project Name/#: APG PFAS SI	PWSID #:				Tissue	Ground			_			15					eservation	
Project Manager: Keith Shephed Sampler:	P.O. #: 3000\	1996.31	B×5	0		B C		ners	1 2 2 3	1		25	Santa Santa Santa	-		S =H ₂ SC	N=HNO ₃ B=NaOH S=H ₂ SO ₄ P=H ₃ PO ₄ F=Field Filtered O =Other	
Date Lynch State where samples were collected: For Compliance:			Г	0	Sediment	Potable NPDES	(A)	of Containers	35	3		5				1 -1 1614	Remark	
M D Yes □ Sample Identification	No 🗆	ected	- 유	Composite	M	Water NI	Other:	Total # of	PFAS	70,	PH	GRAIN						7: 129 A
a transfer of the second	Date	Time	Grab	ပိ	Soil	N N	<u>\$</u>	P		U			- W	132		Ť	15	Bernsty's
0 APG-6AF- APF-50 (0-2)	3/2/21	1105		×	X			4	X	×	×	X	7		9	APG-8	AF-A1-1-	50-(0-2)
MAPE BAF-AT-GW	3/2/21	1300	×	<u> </u>		×	<u> </u>	7.	×			1			1	Ap(7-1	34F-A1- 1	-6W
DL FO GW- DECEN	12/2/5		X			×		2	X			200			500 100	APG.	FB ol	030771
APG-BAF-A1-2-GW	3/2/21	1415	×	1		X		2	X						F)		2	
APG-BAE-A1-2-50-(0-2)	3/21/21	1315	7.7	×	X	Farming 1		2	X			1	man's	F 11	E			
APG-FTA-MOS	3 21 21	1450	×	141		×		2	X			- 15	gi 125		- 10	1 12	11.94	adum asser
APG-FTA-MID	3/2/21	1520	×		er med t	×		2	X		- 211				1 -1 -1	<u> </u>	The state of	Think and
APG-BAF-B-1-50-10-2)	3/2/21	1500	上	X	×			4	X	X	X	X	7		2/27	10	San Trib	
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(Rush TAT is subject to laboratory approval and surcharge	.)			quished	jar	S. J.	1/	/	^	3 3	121	Time	Receiv	mil	2	De)	352 /	Time 13402
Requested TAT in business days:	. ADIS. CON	^	9	al	(2	W.	Pl	Land	4	Date B	20	153		ed by				- Milite
E-mail address: Keith, Shepherd 2 Arca		•	Relino	quished	l by			2		Date	9-10	Time	Receiv	red by			Date	Time
Data Package Options (circle if re	∍quired)		Dalla	- dabaa						2-4-		Ti	Parali	1	1 0		Data	
Type I (EPA Level 3 Type VI (Equivalent/non-CLP)	(Raw Data	Only)	Heilno	quished	LDy.					Date		Time	8	ved by	11/2	n	13/21	Time 18:31
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NYSDEC Category A or B MA MCP	CT	RCP				ecific QC (1 100	Temp	perature u	ipon receipt	1.3	_°C

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Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-31048-1

Project/Site: APG PFAS S1

Qualifiers

LCMS
Qualifier

*5-	Isotope dilution analyte is outside acceptance limits, low biased.

D The reported value is from a dilution.

Qualifier Description

Value is EMPC (estimated maximum possible concentration).

Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Manual integrated compound.

General Chemistry

Qualifier **Qualifier Description**

MS and/or MSD recovery below control limits.

Glossary

Abbreviation	These commonly	y used abbreviations ma	v or may	not be	nresent in t	this report
Abbieviation	These commonly	y useu abbievialions ina	y oi illay	IIOL DE	present m	uus repurt.

Listed under the "D" column to designate that the result is reported on a dry weight basis

%R Percent Recovery

1C Result is from the primary column on a dual-column method. Result is from the confirmation column on a dual-column method. 2C

CFL Contains Free Liquid CFU Colony Forming Unit **CNF** Contains No Free Liquid

DER Duplicate Error Ratio (normalized absolute difference)

Dil Fac **Dilution Factor**

Detection Limit (DoD/DOE) DL

DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample

Decision Level Concentration (Radiochemistry) DLC

Estimated Detection Limit (Dioxin) **EDL** LOD Limit of Detection (DoD/DOE) LOQ Limit of Quantitation (DoD/DOE)

MCL EPA recommended "Maximum Contaminant Level" MDA Minimum Detectable Activity (Radiochemistry) MDC Minimum Detectable Concentration (Radiochemistry)

Method Detection Limit MDI Minimum Level (Dioxin) ML MPN Most Probable Number MQL Method Quantitation Limit

NC Not Calculated

Not Detected at the reporting limit (or MDL or EDL if shown) ND

NEG Negative / Absent POS Positive / Present

PQL **Practical Quantitation Limit**

PRES Presumptive QC **Quality Control**

RER Relative Error Ratio (Radiochemistry)

RL Reporting Limit or Requested Limit (Radiochemistry)

RPD Relative Percent Difference, a measure of the relative difference between two points

TEF Toxicity Equivalent Factor (Dioxin) **TEQ** Toxicity Equivalent Quotient (Dioxin)

TNTC Too Numerous To Count

Job ID: 410-31048-1

Lab Sample ID: 410-31048-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-BAF-A1-1-SO-(0-2)-030221

Date Collected: 03/02/21 11:05

Matrix: Solid Date Received: 03/03/21 15:31 **Percent Solids: 77.8**

Method: EPA 537(Mod) - PFA Analyte	•	Qualifier	LOQ	LOD		Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	<u></u>	03/05/21 18:20	1
8:2 Fluorotelomer sulfonic acid	<0.0019		0.0035	0.0019	0.0019	mg/Kg	₩	03/05/21 18:20	1
NEtFOSAA	< 0.00047	UJ	0.0024	0.00047	0.00047	mg/Kg	₩	03/05/21 18:20	1
NMeFOSAA	<0.00047	UJ	0.0024	0.00047	0.00047	mg/Kg	₽	03/05/21 18:20	1
Perfluorobutanesulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	☼	03/05/21 18:20	1
Perfluorobutanoic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	₩	03/05/21 18:20	1
Perfluorodecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	₩	03/05/21 18:20	1
Perfluorododecanoic acid	< 0.00047		0.00071	0.00047	0.00047	mg/Kg	₩	03/05/21 18:20	1
Perfluoroheptanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	₩	03/05/21 18:20	1
Perfluorohexanesulfonic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	₽	03/05/21 18:20	1
Perfluorohexanoic acid	< 0.00047		0.00071	0.00047	0.00047	mg/Kg	₩	03/05/21 18:20	1
Perfluorononanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/05/21 18:20	1
Perfluorooctanesulfonic acid	0.0018		0.00071	0.00047	0.00047	mg/Kg	₩	03/05/21 18:20	1
Perfluorooctanoic acid	0.00080	M	0.00071	0.00047	0.00047	mg/Kg	₩	03/05/21 18:20	1
Perfluoropentanoic acid	< 0.00047		0.00071	0.00047	0.00047	mg/Kg	₩	03/05/21 18:20	1
Perfluorotetradecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	₩	03/05/21 18:20	1
Perfluorotridecanoic acid	< 0.00047		0.00071	0.00047	0.00047	mg/Kg	₩	03/05/21 18:20	1
Perfluoroundecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	≎	03/05/21 18:20	1
Isotope Dilution	%Recovery Qu	ıalifier	Limits			Prepa	ared	Analyzed	Dil Fac
M2-6:2 FTS	97		50 - 150			03/04/21	07:17	03/05/21 18:20	1
M2-8:2 FTS	95		50 - 150			03/04/21	07:17	03/05/21 18:20	1
13C2 PFTeDA	102		50 - 150			03/04/21	07:17	03/05/21 18:20	1
13C3 PFBS	105		50 - 150			03/04/21	07:17	03/05/21 18:20	1
13C4 PFBA	84		50 - 150			03/04/21	07:17	03/05/21 18:20	1
13C4 PFHpA	96		50 - 150			03/04/21	07:17	03/05/21 18:20	1
13C5 PFPeA	87		50 - 150			03/04/21	07:17	03/05/21 18:20	1
13C8 PFOA	100		50 - 150			03/04/21	07:17	03/05/21 18:20	1
13C8 PFOS	116		50 - 150			03/04/21	07:17	03/05/21 18:20	1
d3-NMeFOSAA	24 *5	•	50 - 150			03/04/21	07:17	03/05/21 18:20	1
d5-NEtFOSAA	28 *5	-	50 - 150			03/04/21	07:17	03/05/21 18:20	1
13C2-PFDoDA	105		50 - 150			03/04/21	07:17	03/05/21 18:20	1
13C3 PFHxS	118		50 - 150			03/04/21	07:17	03/05/21 18:20	1
13C5 PFHxA	88		50 - 150			03/04/21	07:17	03/05/21 18:20	1
13C6 PFDA	99		50 - 150			03/04/21	07:17	03/05/21 18:20	1
100011 271									
13C7 PFUnA	107		50 - 150			03/04/21	07:17	03/05/21 18:20	1

Method: EPA 537(M	/lod) - PFAS for QSM 5.3,	Table B-15 - RE
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mothod: El / t oor (mod)	i i / to ioi dom olo,	Tubio D I							
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	₽	03/09/21 16:36	1
8:2 Fluorotelomer sulfonic acid	<0.0019		0.0036	0.0019	0.0019	mg/Kg	₽	03/09/21 16:36	1
NEtFOSAA	<0.00049		0.0024	0.00049	0.00049	mg/Kg	₽	03/09/21 16:36	1
NMeFOSAA	<0.00049		0.0024	0.00049	0.00049	mg/Kg	₽	03/09/21 16:36	1
Perfluorobutanesulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	₽	03/09/21 16:36	1
Perfluorobutanoic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	₽	03/09/21 16:36	1
Perfluorodecanoic acid	<0.00049		0.00073	0.00049	0.00049	mg/Kg	₽	03/09/21 16:36	1
Perfluorododecanoic acid	<0.00049		0.00073	0.00049	0.00049	mg/Kg	₽	03/09/21 16:36	1
Perfluoroheptanoic acid	<0.00049		0.00073	0.00049	0.00049	mg/Kg	₽	03/09/21 16:36	1
Perfluorohexanesulfonic acid	<0.00049		0.00073	0.00049	0.00049	mg/Kg	₽	03/09/21 16:36	

Eurofins Lancaster Laboratories Env, LLC

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3/18/2021 (Rev. 1)

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31048-1 Project/Site: APG PFAS S1

Client Sample ID: APG-BAF-A1-1-SO-(0-2)-030221

Lab Sample ID: 410-31048-1 Date Collected: 03/02/21 11:05 **Matrix: Solid**

Date Received: 03/03/21 15:31 Percent Solids: 77.8

Method: EPA 537(Mod) - PFA	S for QSM 5.3,	Table B-	I5 - RE (Cont	inued)				
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit E	Analyzed	Dil Fac
Perfluorohexanoic acid	<0.00049		0.00073	0.00049	0.00049	mg/Kg	03/09/21 16:36	1
Perfluorononanoic acid	<0.00049		0.00073	0.00049	0.00049	mg/Kg ∺	03/09/21 16:36	1
Perfluorooctanesulfonic acid	0.0013		0.00073	0.00049	0.00049	mg/Kg ☆	03/09/21 16:36	1
Perfluorooctanoic acid	0.00066	J M	0.00073	0.00049	0.00049	mg/Kg ∜	03/09/21 16:36	1
Perfluoropentanoic acid	< 0.00049		0.00073	0.00049	0.00049	mg/Kg ∜	03/09/21 16:36	1
Perfluorotetradecanoic acid	<0.00049		0.00073	0.00049	0.00049	mg/Kg ☆	03/09/21 16:36	1
Perfluorotridecanoic acid	<0.00049		0.00073	0.00049	0.00049	mg/Kg ∷	03/09/21 16:36	1
Perfluoroundecanoic acid	<0.00049		0.00073	0.00049	0.00049	mg/Kg ∷	03/09/21 16:36	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	55		50 - 150			03/08/21 23:24	03/09/21 16:36	
M2-8:2 FTS	55		50 - 150			03/08/21 23:24	03/09/21 16:36	1
13C2 PFTeDA	64		50 - 150			03/08/21 23:24	03/09/21 16:36	1
13C3 PFBS	81		50 - 150			03/08/21 23:24	03/09/21 16:36	1
13C4 PFBA	62		50 - 150				03/09/21 16:36	1
13C4 PFHpA	68		50 - 150				03/09/21 16:36	1
13C5 PFPeA	64		50 - 150				1 03/09/21 16:36	1
13C8 PFOA	69		50 - 150				1 03/09/21 16:36	1
13C8 PFOS	86		50 - 150				1 03/09/21 16:36	1
d3-NMeFOSAA	11 *5		50 - 150				1 03/09/21 16:36	1
d5-NEtFOSAA	13 *5		50 - 150			03/08/21 23:24	1 03/09/21 16:36	1
13C2-PFDoDA	71		50 - 150				1 03/09/21 16:36	1
13C3 PFHxS	89		50 - 150				03/09/21 16:36	1
13C5 PFHxA	65		50 - 150				03/09/21 16:36	1
13C6 PFDA	67		50 - 150				1 03/09/21 16.36	1
13C7 PFUnA	67		50 - 150				1 03/09/21 16:36	1
13C9 PFNA	68		50 ₋ 150				1 03/09/21 16:36	
General Chemistry								
Analyte		Qualifier	LOQ	LOD		Unit E		Dil Fac
Total Organic Carbon	2860	EŁ J+	2670	1780	891	mg/Kg ☆	03/13/21 14:16	6.93
Percent Moisture	22.2		1.0		1.0	%	03/04/21 09:05	1
Percent Solids	77.8		1.0		1.0	%	03/04/21 09:05	1
- General Chemistry - Soluble								
Analyte		Qualifier	LOQ	LOD	DL	Unit E	Analyzed	Dil Fac
pH	7.4	J	0.01	0.01	0.01	S.U	03/09/21 19:45	1
Temperature	20.3		0.01	0.01	0.01	Degrees C	03/09/21 19:45	1
Markey I Drog Carlo C								
Method: D422 - Grain Size	B	Ovelle			ъ.	11	A	D:: = -
Analyte		Qualifier	_ LOQ	LOD -	1.0	Unit E		Dil Fac
Gravel	<1.0		1.0	1.0			03/06/21 10:10	1
Sand	9.8		1.0	1.0	1.0		03/06/21 10:10	1
Silt	67.1		1.0	1.0	1.0		03/06/21 10:10	1
Clay	23.0		1.0	1.0	1.0		03/06/21 10:10	1
75 mm	100.0		1.0	1.0		% Passing	03/06/21 10:10	1
37.5 mm	100.0		1.0	1.0		% Passing	03/06/21 10:10	1
19 mm	100		1.0	1.0		% Passing	03/06/21 10:10	1
4.75 mm	100		1.0	1.0		% Passing	03/06/21 10:10	1
3.35 mm	99.9		1.0	1.0		% Passing	03/06/21 10:10	1
2.36 mm	99.9		1.0	1.0	1.0	% Passing	03/06/21 10:10	1

Eurofins Lancaster Laboratories Env, LLC

Project/Site: APG PFAS S1

Client Sample ID: APG-BAF-A1-1-SO-(0-2)-030221

Date Collected: 03/02/21 11:05 Date Received: 03/03/21 15:31 Lab Sample ID: 410-31048-1

Matrix: Solid

Percent Solids: 77.8

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
1.18 mm	99.6		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.6 mm	99.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.3 mm	95.6		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.15 mm	92.1		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.075 mm	90.1		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.064 mm	87.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.05 mm	80.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.02 mm	51.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.005 mm	23.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.002 mm	5.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.001 mm	9.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1

Client Sample ID: APG-BAF-A1-1-GW-030221

Date Collected: 03/02/21 13:00 Date Received: 03/03/21 15:31

Perfluorotetradecanoic acid

Perfluorotridecanoic acid

Perfluoroundecanoic acid

Lab Sample ID: 410-31048-2

Analyzed

03/10/21 01:45 03/10/21 01:45

03/10/21 01:45

03/10/21 01:45

03/10/21 01:45

Matrix: Water

Dil Fac

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D
6:2 Fluorotelomer sulfonic acid	17		5.0	4.0	4.0	ng/L	
8:2 Fluorotelomer sulfonic acid	<2.0		3.0	2.0	2.0	ng/L	03
NEtFOSAA	<1.0		3.0	1.0	1.0	ng/L	03
NMeFOSAA	<1.2		2.0	1.2	1.2	ng/L	03
Perfluorobutanesulfonic acid	14		2.0	1.0	1.0	ng/L	03

<1.0

<10

<1.0

03/10/21 01:45 03/10/21 01:45 03/10/21 01:45 Perfluorobutanoic acid 5.0 4.0 4.0 ng/L 03/10/21 01:45 6.2 Perfluorodecanoic acid <1.0 2.0 1.0 1.0 ng/L 03/10/21 01:45 Perfluorododecanoic acid 2.0 <1.0 1.0 1.0 ng/L 03/10/21 01:45 Perfluoroheptanoic acid 14 2.0 1.0 1.0 ng/L 03/10/21 01:45 1.0 ng/L Perfluorohexanesulfonic acid 71 2.0 1.0 03/10/21 01:45 Perfluorohexanoic acid 16 2.0 1.0 1.0 ng/L 03/10/21 01:45 2.0 1.0 1.0 ng/L 03/10/21 01:45 Perfluorononanoic acid 4.7 2.0 Perfluorooctanesulfonic acid 330 1.0 1.0 ng/L 03/10/21 01:45 120 2.0 1.0 1.0 ng/L 03/10/21 01:45 Perfluorooctanoic acid 2.0 1.0 1.0 ng/L 03/10/21 01:45 Perfluoropentanoic acid 8.4

2.0

2.0

2.0

1.0

1.0

1.0

1.0 ng/L

1.0 ng/L

1.0 ng/L

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	86	50 - 150	03/09/21 07:19	03/10/21 01:45	1
M2-8:2 FTS	66	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C2 PFTeDA	50	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C3 PFBS	71	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C4 PFBA	77	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C4 PFHpA	82	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C5 PFPeA	80	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C8 PFOA	79	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C8 PFOS	68	50 - 150	03/09/21 07:19	03/10/21 01:45	1
d3-NMeFOSAA	66	50 - 150	03/09/21 07:19	03/10/21 01:45	1
d5-NEtFOSAA	65	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C2-PFDoDA	76	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C3 PFHxS	76	50 - 150	03/09/21 07:19	03/10/21 01:45	1

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Job ID: 410-31048-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-BAF-A1-1-GW-030221

Date Collected: 03/02/21 13:00

Lab Sample ID: 410-31048-2

Matrix: Water

Date Received: 03/03/21 15:31

Method: EPA 537(Mod)	- PFAS for QSM 5.3, Table B	-15 (Continued)			
Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C5 PFHxA	80	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C6 PFDA	68	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C7 PFUnA	77	50 - 150	03/09/21 07:19	03/10/21 01:45	1
13C9 PFNA	72	50 - 150	03/09/21 07:19	03/10/21 01:45	1

Client Sample ID: APG-BAF-A1-2-GW-030221 Lab Sample ID: 410-31048-3

Date Collected: 03/02/21 14:15 Matrix: Water

Date Received: 03/03/21 15:31

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	240		5.1	4.1	4.1	ng/L		03/05/21 21:30	1
8:2 Fluorotelomer sulfonic acid	170		3.0	2.0	2.0	ng/L		03/05/21 21:30	1
NEtFOSAA	<1.0	M	3.0	1.0	1.0	ng/L		03/05/21 21:30	1
NMeFOSAA	5.8	I M MJN	2.0	1.2	1.2	ng/L		03/05/21 21:30	1
Perfluorobutanesulfonic acid	37		2.0	1.0	1.0	ng/L		03/05/21 21:30	1
Perfluorobutanoic acid	60		5.1	4.1	4.1	ng/L		03/05/21 21:30	1
Perfluorodecanoic acid	8.7	M	2.0	1.0	1.0	ng/L		03/05/21 21:30	1
Perfluorododecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/05/21 21:30	1
Perfluoroheptanoic acid	76		2.0	1.0	1.0	ng/L		03/05/21 21:30	1
Perfluorohexanoic acid	260		2.0	1.0	1.0	ng/L		03/05/21 21:30	1
Perfluorononanoic acid	99		2.0	1.0	1.0	ng/L		03/05/21 21:30	1
Perfluoropentanoic acid	170		2.0	1.0	1.0	ng/L		03/05/21 21:30	1
Perfluorotetradecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/05/21 21:30	1
Perfluorotridecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/05/21 21:30	1
Perfluoroundecanoic acid	45		2.0	1.0	1.0	ng/L		03/05/21 21:30	1

Pernuoroundecanoic acid	4	40	2.0	1.0	1.0 TIG/L	03/03/21 21.30	ı
Isotope Dilution	%Recovery	Qualifier	Limits		Prepared	Analyzed	Dil Fac
M2-6:2 FTS	111		50 - 150		03/04/21 08:40	03/05/21 21:30	1
M2-8:2 FTS	112		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C2 PFTeDA	97		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C3 PFBS	104		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C4 PFBA	103		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C4 PFHpA	100		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C5 PFPeA	107		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C8 PFOA	97		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C8 PFOS	76		50 - 150		03/04/21 08:40	03/05/21 21:30	1
d3-NMeFOSAA	125		50 - 150		03/04/21 08:40	03/05/21 21:30	1
d5-NEtFOSAA	127		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C2-PFDoDA	125		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C3 PFHxS	102		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C5 PFHxA	107		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C6 PFDA	102		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C7 PFUnA	111		50 - 150		03/04/21 08:40	03/05/21 21:30	1
13C9 PFNA	79		50 - 150		03/04/21 08:40	03/05/21 21:30	1

Method: EPA 5	37(Mod) - I	PFAS for OS	:М 5 3 Тар	NA R-15 - DI

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	1100	D	20	10	10	ng/L		03/09/21 09:22	10
Perfluorooctanoic acid	700	D M	20	10	10	ng/L		03/09/21 09:22	10

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3

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15

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31048-1 Project/Site: APG PFAS S1

Client Sample ID: APG-BAF-A1-2-GW-030221

Perfluorooctanesulfonic acid

Lab Sample ID: 410-31048-3

3900 D

Date Collected: 03/02/21 14:15 **Matrix: Water** Date Received: 03/03/21 15:31

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C8 PFOA	106		50 - 150	03/04/21 08:40	03/09/21 09:22	10
13C3 PFHxS	105		50 - 150	03/04/21 08:40	03/09/21 09:22	10

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Method: EPA 537(Mod) - PFAS for	r QSM 5.3 , 1	Table B-15	· DL2					
13C3 PFHxS	105	50	0 - 150			03/04/21 08:40	03/09/21 09:22	10
13C0 PFOA	106	30	J - 150			03/04/21 06.40	03/09/21 09.22	10

Isotope Dilution %Recovery Qualifier Limits Prepared Analyzed Dil Fac 13C8 PFOS 112 50 - 150 03/04/21 08:40 03/09/21 09:33 100

200

100

100 ng/L

Client Sample ID: APG-BAF-A1-2-SO-(0-2)-030221 Lab Sample ID: 410-31048-4

Date Collected: 03/02/21 13:15 **Matrix: Solid** Date Received: 03/03/21 15:31 Percent Solids: 80.1

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil	Fac
6:2 Fluorotelomer sulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	☼	03/05/21 18:30		1
8:2 Fluorotelomer sulfonic acid	<0.0019	0.0035	0.0019	0.0019	mg/Kg	☼	03/05/21 18:30		1
NEIFOSAA	<0.00047	0.0024	0.00047	0.00047	mg/Kg	☆	03/05/21 18:30	R	1
NMeFOSAA	<0.00047	0.0024	0.00047	0.00047	mg/Kg	<u> </u>	03/05/21 18:30	R	1
Perfluorobutanesulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	☼	03/05/21 18:30		1
Perfluorobutanoic acid	<0.0019 N	0.0024	0.0019	0.0019	mg/Kg	☼	03/05/21 18:30		1
Perfluorodecanoic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	₩	03/05/21 18:30		1
Perfluorododecanoic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	☼	03/05/21 18:30		1
Perfluoroheptanoic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	☼	03/05/21 18:30		1
Perfluorohexanesulfonic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	☼	03/05/21 18:30		1
Perfluorohexanoic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	☼	03/05/21 18:30		1
Perfluorononanoic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	☼	03/05/21 18:30		1
Perfluorooctanesulfonic acid	0.0036	0.00071	0.00047	0.00047	mg/Kg	☼	03/05/21 18:30		1
Perfluorooctanoic acid	0.0012 M	0.00071	0.00047	0.00047	mg/Kg	☼	03/05/21 18:30		1
Perfluoropentanoic acid	<0.00047 M	0.00071	0.00047	0.00047	mg/Kg	☼	03/05/21 18:30		1
Perfluorotetradecanoic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	☼	03/05/21 18:30		1
Perfluorotridecanoic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	☼	03/05/21 18:30		1
Perfluoroundecanoic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	÷Ö÷	03/05/21 18:30		1

	0.00011	0.000.	0.000	0.000	00/00/2: 10:00	•
Isotope Dilution	%Recovery Qualifier	Limits		Prepared	Analyzed	Dil Fac
M2-6:2 FTS	72	50 - 150		03/04/21 07:17	03/05/21 18:30	1
M2-8:2 FTS	63	50 - 150		03/04/21 07:17	03/05/21 18:30	1
13C2 PFTeDA	79	50 - 150		03/04/21 07:17	03/05/21 18:30	1
13C3 PFBS	88	50 ₋ 150		03/04/21 07:17	03/05/21 18:30	1
13C4 PFBA	60	50 - 150		03/04/21 07:17	03/05/21 18:30	1
13C4 PFHpA	71	50 - 150		03/04/21 07:17	03/05/21 18:30	1
13C5 PFPeA	63	50 - 150		03/04/21 07:17	03/05/21 18:30	1
13C8 PFOA	74	50 - 150		03/04/21 07:17	03/05/21 18:30	1
13C8 PFOS	96	50 - 150		03/04/21 07:17	03/05/21 18:30	1
d3-NMeFOSAA	11 *5-	50 - 150		03/04/21 07:17	03/05/21 18:30	1
d5-NEtFOSAA	13 *5-	50 - 150		03/04/21 07:17	03/05/21 18:30	1
13C2-PFDoDA	85	50 - 150		03/04/21 07:17	03/05/21 18:30	1
13C3 PFHxS	96	50 - 150		03/04/21 07:17	03/05/21 18:30	1
13C5 PFHxA	66	50 ₋ 150		03/04/21 07:17	03/05/21 18:30	1
13C6 PFDA	73	50 - 150		03/04/21 07:17	03/05/21 18:30	1
13C7 PFUnA	79	50 - 150		03/04/21 07:17	03/05/21 18:30	1
13C9 PFNA	73	50 - 150		03/04/21 07:17	03/05/21 18:30	1

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03/09/21 09:33

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Lab Sample ID: 410-31048-4

Client Sample ID: APG-BAF-A1-2-SO-(0-2)-030221 Date Collected: 03/02/21 13:15 Matrix: Solid Date Received: 03/03/21 15:31

Percent Solids: 80.1

Job ID: 410-31048-1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0020		0.0025	0.0020	0.0020	mg/Kg	03/09/21 16:46	1
8:2 Fluorotelomer sulfonic acid	<0.0020		0.0037	0.0020	0.0020	mg/Kg	© 03/09/21 16:46	1
NEtFOSAA	< 0.00049		0.0025	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
NMeFOSAA	<0.00049		0.0025	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Perfluorobutanesulfonic acid	<0.0020		0.0025	0.0020	0.0020	mg/Kg	© 03/09/21 16:46	1
Perfluorobutanoic acid	<0.0020	M	0.0025	0.0020	0.0020	mg/Kg	© 03/09/21 16:46	1
Perfluorodecanoic acid	<0.00049		0.00074	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Perfluorododecanoic acid	< 0.00049		0.00074	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Perfluoroheptanoic acid	<0.00049		0.00074	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Perfluorohexanesulfonic acid	<0.00049		0.00074	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Perfluorohexanoic acid	<0.00049		0.00074	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Perfluorononanoic acid	< 0.00049		0.00074	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Perfluorooctanesulfonic acid	0.0038		0.00074	0.00049	0.00049	mg/Kg	03/09/21 16:46	1
Perfluorooctanoic acid	0.0012	W	0.00074	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Perfluoropentanoic acid	< 0.00049		0.00074	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Perfluorotetradecanoic acid	<0.00049		0.00074	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Perfluorotridecanoic acid	< 0.00049	·	0.00074	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Perfluoroundecanoic acid	<0.00049		0.00074	0.00049	0.00049	mg/Kg	© 03/09/21 16:46	1
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	57		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
M2-8:2 FTS	52		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C2 PFTeDA	67		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C3 PFBS	91		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C4 PFBA	59		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C4 PFHpA	64		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C5 PFPeA	63		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C8 PFOA	66		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C8 PFOS	94		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
d3-NMeFOSAA	8 *5	-	50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
d5-NEtFOSAA	11 *5	-	50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C2-PFDoDA	72		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C3 PFHxS	94		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C5 PFHxA	63		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C6 PFDA	67		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C7 PFUnA	67		50 - 150			03/08/21 23:2	4 03/09/21 16:46	1
13C9 PFNA	65		50 ₋ 150			02/00/21 22:0	4 03/09/21 16:46	

General	I Chemistry

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
Percent Moisture	19.9	1.0		1.0 %		03/04/21 09:05	1
Percent Solids	80.1	1.0		1.0 %		03/04/21 09:05	1

Client Sample ID: APG-FTA-M09-030221

Date Collected: 03/02/21 14:50 Date Received: 03/03/21 15:31

Lab Sample ID: 410-31048-5 **Matrix: Water**

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
8:2 Fluorotelomer sulfonic acid	13		2.5	1.7	1.7	ng/L		03/05/21 21:40	1
NEtFOSAA	<0.84		2.5	0.84	0.84	ng/L		03/05/21 21:40	1

Eurofins Lancaster Laboratories Env, LLC

Job ID: 410-31048-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Date Received: 03/03/21 15:31

13C5 PFHxA

Client Sample ID: APG-FTA-M09-030221

Date Collected: 03/02/21 14:50

Lab Sample ID: 410-31048-5

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L	03/05/21 21:40	1
Perfluorobutanesulfonic acid	55		1.7	0.84	0.84	ng/L	03/05/21 21:40	1
Perfluorobutanoic acid	110		4.2	3.3	3.3	ng/L	03/05/21 21:40	1
Perfluorodecanoic acid	1.2	J	1.7	0.84	0.84	ng/L	03/05/21 21:40	1
Perfluorododecanoic acid	<0.84		1.7	0.84	0.84	ng/L	03/05/21 21:40	1
Perfluoroheptanoic acid	130		1.7	0.84	0.84	ng/L	03/05/21 21:40	1
Perfluorononanoic acid	210		1.7	0.84	0.84	ng/L	03/05/21 21:40	1
Perfluoropentanoic acid	290		1.7	0.84	0.84	ng/L	03/05/21 21:40	1
Perfluorotetradecanoic acid	<0.84		1.7	0.84	0.84	ng/L	03/05/21 21:40	1
Perfluorotridecanoic acid	<0.84		1.7	0.84	0.84	ng/L	03/05/21 21:40	1
Perfluoroundecanoic acid	<0.84		1.7	0.84	0.84	ng/L	03/05/21 21:40	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	82		50 - 150			03/04/21 08:40	03/05/21 21:40	1
M2-8:2 FTS	115		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C2 PFTeDA	85		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C3 PFBS	97		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C4 PFBA	97		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C4 PFHpA	86		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C5 PFPeA	96		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C8 PFOA	75		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C8 PFOS	60		50 - 150			03/04/21 08:40	03/05/21 21:40	1
d3-NMeFOSAA	113		50 - 150			03/04/21 08:40	03/05/21 21:40	1
d5-NEtFOSAA	106		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C2-PFDoDA	99		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C3 PFHxS	88		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C5 PFHxA	93		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C6 PFDA	97		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C7 PFUnA	95		50 - 150			03/04/21 08:40	03/05/21 21:40	1
13C9 PFNA	57		50 - 150			03/04/21 08:40	03/05/21 21:40	1
- Method: EPA 537(Mod) - PFA	S for QSM 5.3,	Table B-	15 - DL					
Analyte	•	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	340	D	42	33	33	ng/L	03/08/21 15:17	10

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	340	D		42	33	33	ng/L	03/08/21 15:17	10
Perfluorohexanesulfonic acid	1700	D		17	8.4	8.4	ng/L	03/08/21 15:17	10
Perfluorohexanoic acid	480	D		17	8.4	8.4	ng/L	03/08/21 15:17	10
Perfluorooctanoic acid	1100	D M		17	8.4	8.4	ng/L	03/08/21 15:17	10
Isotope Dilution	%Recovery Qu	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	101		50 - 150				03/04/21 08:40	03/08/21 15:17	10
13C8 PFOA	91		50 - 150				03/04/21 08:40	03/08/21 15:17	10
13C3 PFHxS	92		50 - 150				03/04/21 08:40	03/08/21 15:17	10

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - DL2										
Analyte	Result Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac			
Perfluorooctanesulfonic acid	11000 D	170	84	84	ng/L	03/09/21 09:54	100			
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac			
13C8 PFOS	100	50 - 150			03/04/21 08:40	03/09/21 09:54	100			

50 - 150

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03/04/21 08:40 03/08/21 15:17

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Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Job ID: 410-31048-1

Client Sample ID: APG-FTA-M10-030221

Date Collected: 03/02/21 15:20 Date Received: 03/03/21 15:31 Lab Sample ID: 410-31048-6

Matrix: Water

Method: EPA 537(Mod) - PFA Analyte	•	Qualifier	LC	Q	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	10			1.3	3.4	3.4	ng/L	03/05/21 21:51	1
8:2 Fluorotelomer sulfonic acid	<1.7		2	2.6	1.7	1.7	ng/L	03/05/21 21:51	1
NEtFOSAA	<0.86		2	2.6	0.86	0.86	ng/L	03/05/21 21:51	1
NMeFOSAA	<1.0		1	1.7	1.0	1.0	ng/L	03/05/21 21:51	1
Perfluorobutanesulfonic acid	41		1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Perfluorobutanoic acid	40		4	1.3	3.4	3.4	ng/L	03/05/21 21:51	1
Perfluorodecanoic acid	<0.86		1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Perfluorododecanoic acid	<0.86		1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Perfluoroheptanoic acid	95		1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Perfluorohexanoic acid	140		1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Perfluorononanoic acid	<0.86		1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Perfluorooctanesulfonic acid	14	M	1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Perfluorooctanoic acid	49		1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Perfluoropentanoic acid	130		1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Perfluorotetradecanoic acid	<0.86		1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Perfluorotridecanoic acid	<0.86		1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Perfluoroundecanoic acid	<0.86		1	1.7	0.86	0.86	ng/L	03/05/21 21:51	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
MO C.O ETO	110		FO 4FO				00/04/04 00:40	00/05/04 04:54	

remuoroundecanoic acid	\0.00	1.	.7 0.00	0.00 Tig/L		03/03/21 21.31	'
Isotope Dilution	%Recovery Q	ualifier Limits		P	repared	Analyzed	Dil Fac
M2-6:2 FTS	110	50 - 150		03/0	4/21 08:40	03/05/21 21:51	1
M2-8:2 FTS	96	50 ₋ 150		03/0	4/21 08:40	03/05/21 21:51	1
13C2 PFTeDA	83	50 ₋ 150		03/0	4/21 08:40	03/05/21 21:51	1
13C3 PFBS	88	50 ₋ 150		03/0	4/21 08:40	03/05/21 21:51	1
13C4 PFBA	95	50 ₋ 150		03/0	4/21 08:40	03/05/21 21:51	1
13C4 PFHpA	77	50 - 150		03/0	4/21 08:40	03/05/21 21:51	1
13C5 PFPeA	99	50 ₋ 150		03/0	4/21 08:40	03/05/21 21:51	1
13C8 PFOA	97	50 ₋ 150		03/0	4/21 08:40	03/05/21 21:51	1
13C8 PFOS	90	50 ₋ 150		03/0	4/21 08:40	03/05/21 21:51	1
d3-NMeFOSAA	104	50 ₋ 150		03/0	4/21 08:40	03/05/21 21:51	1
d5-NEtFOSAA	102	50 - 150		03/0	4/21 08:40	03/05/21 21:51	1
13C2-PFDoDA	98	50 ₋ 150		03/0	4/21 08:40	03/05/21 21:51	1
13C3 PFHxS	77	50 - 150		03/0	4/21 08:40	03/05/21 21:51	1
13C5 PFHxA	91	50 ₋ 150		03/0	4/21 08:40	03/05/21 21:51	1
13C6 PFDA	90	50 - 150		03/0	4/21 08:40	03/05/21 21:51	1
13C7 PFUnA	90	50 - 150		03/0	4/21 08:40	03/05/21 21:51	1
13C9 PFNA	92	50 - 150		03/0	4/21 08:40	03/05/21 21:51	1

Method: EPA 537(Mod) - PFA	S for QSM 5.3,	Table B-	15 - DL					
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	2500	D	17	8.6	8.6	ng/L	03/08/21 15:28	10
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac
13C3 PFHxS	96		50 - 150			03/04/21 08:40	03/08/21 15:28	10

Client Sample ID: APG-BAF-B-1-SO-(0-2)-030221 Lab Sample ID: 410-31048-7

Method: EPA 537(Mod) - PFAS fo	r QSM 5.3, Table B-15						
Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019	0.0023	0.0019	0.0019 mg/Kg	*	03/05/21 18:41	1
8:2 Fluorotelomer sulfonic acid	<0.0019	0.0035	0.0019	0.0019 mg/Kg	₩	03/05/21 18:41	1

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Job ID: 410-31048-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-BAF-B-1-SO-(0-2)-030221

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Lab Sample ID: 410-31048-7 Date Collected: 03/02/21 15:00 **Matrix: Solid**

Date Received: 03/03/21 15:31 Percent Solids: 80.6

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit I	O Analyzed	Dil Fac
NEtFOSAA	<0.00046		0.0023	0.00046	0.00046	mg/Kg		1
NMeFOSAA	<0.00046	UJ	0.0023	0.00046	0.00046	mg/Kg		1
Perfluorobutanesulfonic acid	<0.0019		0.0023	0.0019	0.0019	mg/Kg	≎ 03/05/21 18:41	1
Perfluorobutanoic acid	< 0.0019		0.0023	0.0019	0.0019	mg/Kg	≎ 03/05/21 18:41	1
Perfluorodecanoic acid	0.00085		0.00070	0.00046	0.00046	mg/Kg		1
Perfluorododecanoic acid	< 0.00046		0.00070	0.00046	0.00046	mg/Kg	≎ 03/05/21 18:41	1
Perfluoroheptanoic acid	0.0015		0.00070	0.00046	0.00046	mg/Kg	≎ 03/05/21 18:41	1
Perfluorohexanesulfonic acid	0.0019		0.00070	0.00046	0.00046	mg/Kg		1
Perfluorohexanoic acid	0.0011		0.00070	0.00046	0.00046	mg/Kg	≎ 03/05/21 18:41	1
Perfluorononanoic acid	0.0026		0.00070	0.00046	0.00046	mg/Kg	≎ 03/05/21 18:41	1
Perfluorooctanesulfonic acid	0.030		0.00070	0.00046	0.00046	mg/Kg	≎ 03/05/21 18:41	1
Perfluorooctanoic acid	0.0023	M	0.00070	0.00046	0.00046	mg/Kg	≎ 03/05/21 18:41	1
Perfluoropentanoic acid	0.0023		0.00070	0.00046	0.00046	mg/Kg	≎ 03/05/21 18:41	1
Perfluorotetradecanoic acid	<0.00046		0.00070	0.00046	0.00046	mg/Kg	≎ 03/05/21 18:41	1
Perfluorotridecanoic acid	<0.00046		0.00070	0.00046	0.00046	mg/Kg	≎ 03/05/21 18:41	1
Perfluoroundecanoic acid	0.00067	J	0.00070	0.00046	0.00046	mg/Kg	≎ 03/05/21 18:41	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	107		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
M2-8:2 FTS	106		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
13C2 PFTeDA	93		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
13C3 PFBS	92		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
13C4 PFBA	80		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
13C4 PFHpA	90		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
13C5 PFPeA	81		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
13C8 PFOA	91		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
13C8 PFOS	98		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
d3-NMeFOSAA	43 *5	•	50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
d5-NEtFOSAA	51		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
13C2-PFDoDA	103		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
13C3 PFHxS	102		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
13C5 PFHxA	82		50 - 150			03/04/21 07:1	7 03/05/21 18:41	1
			E0 4E0			03/04/21 07:1	7 03/05/21 18:41	1
13C6 PFDA	100		50 - 150				7 00/00/21 10.41	-
13C6 PFDA 13C7 PFUnA	100 97		50 - 150 50 - 150				7 03/05/21 18:41	1

Analyte	Result Q	(ualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	*	03/09/21 16:57	1
8:2 Fluorotelemer sulfonic acid	< 0.0019		0.0035	0.0019	0.0019	mg/Kg	₩	03/09/21 16:57	1
NEtFOSAA	< 0.00047		0.0024	0.00047	0.00047	mg/Kg	₽	03/09/21 16:57	1
NMeFOSAA	<0.00047		0.0024	0.00047	0.00047	mg/Kg	₩	03/09/21 16:57	1
Perfluorobutanesulfonic acid	< 0.0019	_	0.0024	0.0019	0.0019	mg/Kg	₽	03/09/21 16:57	1
Perfluorobutanoic acid	<0.0019 M		0.0024	0.0019	0.0019	mg/Kg	₽	03/09/21 16:57	1
Perfluorodecanoic acid	0.00057 J	0	.00071	0.00047	0.00047	mg/Kg	₩	03/09/21 16:57	1
Perfluorododecanoic acid	< 0.00047	0	.00071	0.00047	0.00047	mg/Kg	₽	03/09/21 16:57	1
Perfluoroheptanoic acid	0.0011	0	.00071	0.00047	0.00047	mg/Kg	₩	03/09/21 16:57	1
Perfluorohexanesulfonic acid	0.0020	0	.00071	0.00047	0.00047	mg/Kg	*	03/09/21 16:57	1
Perfluorohexanoic acid	0.00081	0	.00071	0.00047	0.00047	mg/Kg	₽	03/09/21 16:57	1
Perfluorononanoic acid	0.0017	0	.00071	0.00047	0.00047	mg/Kg	₩	03/09/21 16:57	

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31048-1 Project/Site: APG PFAS S1

Client Sample ID: APG-BAF-B-1-SO-(0-2)-030221

Lab Sample ID: 410-31048-7 Date Collected: 03/02/21 15:00 **Matrix: Solid**

Date Received: 03/03/21 15:31 Percent Solids: 80.6

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit E	Analyzed	Dil Fac
Perfluorooctanesulfonic acid	0.019		0.00071	0.00047	0.00047			1
Perfluorooctanoic acid	0.0017	M	0.00071	0.00047	0.00047		03/09/21 16:57	1
Perfluoropentanoic acid	0.0017		0.00071	0.00047	0.00047		03/09/21 16:57	1
Perfluorotetradecanoic acid	<0.00047		0.00071	0.00047	0.00047		03/09/21 16:57	1
Perfluorotridecanoic acid	< 0.00047		0.00071	0.00047	0.00047		03/09/21 16:57	1
Perfluoroundecanoic acid	0.00048	J	0.00071	0.00047	0.00047		03/09/21 16:57	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	83		50 - 150				03/09/21 16:57	
M2-8:2 FTS	79		50 - 150				1 03/09/21 16:57	1
13C2 PFTeDA	74		50 ₋ 150				1 03/09/21 16:57	1
13C3 PFBS	87		50 - 150				1 03/09/21 16:57	
13C4 PFBA	73		50 - 150				1 03/09/21 16:57	1
13C4 PFHpA	73 78		50 - 150				1 03/09/21 16:57	1
13C5 PFPeA	78		50 - 150				03/09/21 16:57	
13C8 PFOA	70 81		50 - 150 50 - 150				1 03/09/21 16:57	1
13C8 PFOS	93		50 - 150 50 - 150				1 03/09/21 16:57	1
d3-NMeFOSAA	19 *5		50 - 150 50 - 150				03/09/21 16:57	
d5-NEtFOSAA	79 5 24 *5		50 - 150 50 - 150				1 03/09/21 16:57	1
		-	50 - 150 50 - 150				1 03/09/21 16:57	1
13C2-PFDoDA	83							
13C3 PFHxS	92		50 ₋ 150				03/09/21 16:57	1
13C5 PFHxA	75		50 - 150				03/09/21 16:57	1
13C6 PFDA	81		50 - 150				03/09/21 16:57	1
13C7 PFUnA	78		50 - 150				03/09/21 16:57	1
13C9 PFNA	79		50 - 150			03/08/21 23:24	1 03/09/21 16:57	
General Chemistry								
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit E	Analyzed	Dil Fac
Total Organic Carbon	8500	J+	2540	1700	848	mg/Kg	03/13/21 14:54	6.84
Percent Moisture	19.4		1.0		1.0	%	03/04/21 09:05	1
Percent Solids	80.6		1.0		1.0	%	03/04/21 09:05	1
Company Champioton Colubba								
General Chemistry - Soluble Analyte	Result	Qualifier	LOQ	LOD	DI	Unit D) Analyzed	Dil Fac
pH	6.7	.l	0.01	0.01	0.01		03/08/21 15:05	1
Temperature	20.2	· ·	0.01	0.01		Degrees C	03/08/21 15:05	1
Tomporataro	20.2		0.0 .	0.0.	0.0.	209.0000	00,00,21 10.00	
Method: D422 - Grain Size								
Analyte		Qualifier	LOQ	LOD		Unit E	. <u> </u>	Dil Fac
Gravel	<1.0		1.0	1.0	1.0		03/06/21 10:10	1
Sand	7.1		1.0	1.0	1.0		03/06/21 10:10	1
Silt	76.9		1.0	1.0	1.0		03/06/21 10:10	1
Clay	16.0		1.0	1.0	1.0	%	03/06/21 10:10	1
75 mm	100.0		1.0	1.0	1.0	% Passing	03/06/21 10:10	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing	03/06/21 10:10	1
19 mm	100		1.0	1.0	1.0	% Passing	03/06/21 10:10	1
4.75 mm	100		1.0	1.0	1.0	% Passing	03/06/21 10:10	1

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03/06/21 10:10

03/06/21 10:10

03/06/21 10:10

03/06/21 10:10

1.0 % Passing

1.0 % Passing

1.0 % Passing

1.0 % Passing

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

99.9

99.9

99.8

99.0

3.35 mm

2.36 mm

1.18 mm

0.6 mm

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31048-1 Project/Site: APG PFAS S1

Client Sample ID: APG-BAF-B-1-SO-(0-2)-030221

Lab Sample ID: 410-31048-7 Date Collected: 03/02/21 15:00 **Matrix: Solid**

Date Received: 03/03/21 15:31 Percent Solids: 80.6

Method: D422 - Grain Size (Continued)									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
0.3 mm	96.4		1.0	1.0	1.0	% Passing	_	03/06/21 10:10	1
0.15 mm	94.5		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.075 mm	92.9		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.064 mm	89.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.05 mm	81.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.02 mm	47.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.005 mm	16.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.002 mm	6.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.001 mm	<1.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1



Aberdeen Proving Ground - Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDG # 410-31280-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report #41124R1

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-31280-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

			Sample		Aı	nalysis	
Sample ID	Lab ID	Matrix	Collection Date	Parent Sample	PFAS	тос	рН
APG-BAF-D-1-SO-(0-2)-030321	410-31280-1	Soil	3/3/2021		Х	Х	Χ
APG-BAF-D-1-GW-030321	410-31280-2	Water	3/3/2021		Х		
APG-BAF-E-1-SO-(0-2)-030321	410-31280-3	Soil	3/3/2021		Х	Х	Χ
APG-BAF-E-1-GW-030321	410-31280-4	Water	3/3/2021		Х		
APG-BLDG-1059-1-SO-(0-2)-030321	410-31280-5	Soil	3/3/2021		Х	Х	Χ
APG-BLDG-1059-1-GW-030321	410-31280-6	Water	3/3/2021		Х		
APG-BLDG-1065-1-SO-(0-2)-030321	410-31280-7	Soil	3/3/2021		Х	Х	Χ
APG-BLDG-1065-1-GW-030321	410-31280-8	Water	3/3/2021		Х		
APG-FB-01-030321	410-31280-9	Water	3/3/2021		Х		
APG-EB-01-030321	410-31280-10	Water	3/3/2021		Х		
APG-SB-01-030321	410-31280-11	Water	3/3/2021		Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-BLDG-1059-1-GW-030321.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was not performed on sample location associated with this SDG.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Rep	Reported		mance ptable	Not
Items Reviewed	No	Yes	No	Yes	Required
Sample receipt condition		Х		X	
2. Requested analyses and sample results		Х		X	
Master tracking list		Х		X	
4. Methods of analysis		Х		X	
5. Reporting limits		Х		X	
6. Sample collection date		Х		X	
7. Laboratory sample received date		Х		X	
8. Sample preservation verification (as applicable)		Х		X	
9. Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		X	
11. Narrative summary of QA or sample problems provided		Х		X	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

1. The chain of custody states that 2 containers were submitted, whereas the laboratory received 3 containers for the following samples.

Lab ID	Sample ID	
410-31280-2	APG-BAF-D-1-GW-030321	
410-31280-4	APG-BAF-E-1-GW-030321	
410-31280-6	APG-BLDG-1059-1-GW-030321	
410-31280-8	APG-BLDG-1065-1-GW-030321	
410-31280-9	APG-FB-01-030321	
410-31280-10	APG-EB-01-030321	
410-31280-11	APG-SB-01-030321	

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - JN The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
ADO DAE D 4 00 (0.0) 000004	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
APG-BAF-D-1-SO-(0-2)-030321	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
ADO DAE E 4 00 (0.0) 000004	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 20%
APG-BAF-E-1-SO-(0-2)-030321	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 20%
APG-BLDG-1059-1-SO-(0-2)-	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
030321	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 50% but > 20%
APG-BLDG-1059-1-GW- 030321	M2-6:2 FTS	6:2 Fluorotelomer sulfonic acid	> 150%	> 150%
APG-BLDG-1059-1-GW- 030321 DL	13C8 PFOS	Perfluorooctanesulfonic acid	> 150%	NA
APG-BLDG-1065-1-SO-(0-2)-	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
030321	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
APG-BLDG-1065-1-GW- 030321 DL	13C8 PFOS	Perfluorooctanesulfonic acid	> 150%	NA

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
4500/	Non-detect	No Action
> 150%	Detect	J-
500/ 1 / 000/	Non-detect	UJ
< 50% but > 20%	Detect	J+
	Non-detect	UX
< 20%	Detect	Χ

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be ≤ 30%.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

The MS/MSD analysis was not performed on sample location associated with this SDG.

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

A field duplicate was not collected for a sample location associated with this SDG.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

Samples associated with ion ratios outside of the control limits of \pm 50 percent from the target value are presented in the following table.

Sample ID	Compounds	Ion Ratio %R
APG-BLDG-1059-1-SO-(0-2)-030321	NMeFOSAA	1013%

In the case of an ion ratio deviation, the sample results are qualified as documented in the table below.

Control limit	Sample Result	Qualification
<50% or > 150%	Detect	J
Gross Exceedance	Detect	JN

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
APG-BAF-D-1-GW-030321	Perfluorohexanesulfonic acid		760	760 D
	6:2 Fluorotelomer sulfonic acid		4100	4100 D
	8:2 Fluorotelomer sulfonic acid		620	620 D
	Perfluorobutanesulfonic acid		230	230 D
	Perfluorobutanoic acid		1100	1100 D
	Perfluorodecanoic acid		30	30 D
	Perfluoroheptanoic acid		2100	2100 D
	Perfluorohexanoic acid		3800	3800 D
	Perfluorononanoic acid		990	990 D
	Perfluorooctanoic acid		3600	3600 D
	Perfluoropentanoic acid		3900	3900 D
	Perfluorohexanesulfonic acid		15000	15000 D
	Perfluorooctanesulfonic acid		42000	42000 D
	6:2 Fluorotelomer sulfonic acid		3700	3700 D
	8:2 Fluorotelomer sulfonic acid		450	450 D
	Perfluorobutanesulfonic acid		410	410 D
APG-BLDG-1065-1-GW-	Perfluorobutanoic acid		1000	1000 D
	Perfluorodecanoic acid		19 J	19 DJ
	Perfluoroheptanoic acid		1500	1500 D
	Perfluorohexanoic acid		3700	3700 D
	Perfluorononanoic acid		690	690 D

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
	Perfluorooctanoic acid		2300	2300 D
	Perfluoropentanoic acid		3400	3400 D
	Perfluorohexanesulfonic acid		12000	12000 D
	Perfluorooctanesulfonic acid		19000	19000 D

Note: the lab didn't report the original analysis; only the diluted result.

The samples APG-BLDG-1059-1-GW-030321 and APG-BLDG-1065-1-GW-030321 were analyzed at 10-fold and 100-fold dilution due to interference from sample matrix. An undiluted analysis was not performed. Therefore, detection limits are elevated for all target compounds.

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification
Diluted sample result within calibration range	D

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

As noted in Section 5.1, N-EtFOSAA and N-MeFOSAA results were qualified "X" for sample locations APG-BAF-D-1-SO-(0-2)-030321 and APG-BLDG-1065-1-SO-(0-2)-030321. This was due to EIS recoveries less than 20%. After review with the project team and USACE chemist, the results were rejected, and the final qualifier has been revised from "X" to "R" on December 14, 2021.

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Reported		Performance Acceptable		Not Required	
	No	Yes	No	Yes	Required	
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC	/MS/MS)				
Stage 2 Validation						
Holding times		Х		Х		
Reporting limits (units)		Х		Х		
Blanks						
A. Method blanks		Х		Х		
B. Equipment blanks		Х		Х		
C. Field blanks / Source blanks		Х		Х		
Laboratory Control Sample (LCS) %R		Х		Х		
Laboratory Control Sample Duplicate(LCSD) %R		Х		Х		
LCS/LCSD Precision (RPD)		Х		Х		
Matrix Spike (MS) %R	Х				Х	
Matrix Spike Duplicate(MSD) %R	Х				X	
MS/MSD Precision (RPD)	Х				Х	
Field Duplicate (RPD)	Х				X	
Extracted Internal Standard %R		Х	Х			
Injection Internal Standard %R		Х		Х		
Dilution Factor		Х		Х		
Moisture Content		Х		Х		
Stage 3/4 Validation						
Instrument tune and performance check		Х		Х		
Initial calibration %RSDs		Х		Х		
Continuing calibration %Ds		Х		Х		
Instrument sensitivity check		Х		Х		
Ion transitions used		Х		Х		
Compound identification and quantitation						
A. Reconstructed ion chromatograms		Х		Х		
B. Quantitation Reports		Х		Х		
C. RT of sample compounds within the established RT windows		Х		х		

PFAS: 537M/DoD QSM 5.3		Reported		mance ptable	Not Required		
	No	Yes	No	Yes	Required		
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)							
D. Ion Ratio %R		Х	Х				
E. Transcription/calculations acceptable		Х		Х			
F. Reporting limits adjusted to reflect sample dilutions		Х		Х			

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

Concentration (C) Qualifiers

- U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
- J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).

Quantitation (Q) Qualifiers

E The compound was quantitated above the calibration range.

• Validation Qualifiers

- J The reported result was an estimated value with an unknown bias.
- J+ The result was an estimated quantity, but the result may be biased high.
- J- The result was an estimated quantity, but the result may be biased low.
- UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
- UB Analyte considered non-detect at the listed value due to associated blank contamination.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria
APG-BAF-E-1-SO-(0-2)-030321	6 days from collection; 5 days from receipt	24 hours of receipt at
APG-BAF-D-1-SO-(0-2)-030321 APG-BLDG-1059-1-SO-(0-2)-030321 APG-BLDG-1065-1-SO-(0-2)-030321	5 days from collection; 4 days from receipt	< 24 hours of receipt at the laboratory

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

Criteria	Qualification
Criteria	Detected Analytes
Analysis completed past the holding time	J

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analytes	Standard Recovery
APG-BAF-D-1-SO-(0-2)-030321			
APG-BAF-E-1-SO-(0-2)-030321			
APG-BLDG-1059-1-SO-(0-2)-030321	CCV	TOC	120%
APG-BLDG-1065-1-SO-(0-2)-030321			

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	75% to 89% 111% to 125%	Sample Result	Qualification
TOC	750/ 1 200/	Non-detect	UJ
	75% to 89%	Detect	J-
		Non-detect	No Action
	111% to 125%	Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

A MS analysis was not performed for TOC.

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

A laboratory duplicate analysis was not performed on sample location associated with this SDG.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within \pm 0.05 S.U. of the true value.

All LCS recoveries were within control limits.

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Rep	orted	Performance Acceptable		Not	
	No	Yes	No	Yes	Required	
Miscellaneous Instrumentation						
Stage 2 Validation						
Holding times		X	X			
Reporting limits (units)		X		X		
Blanks						
A. Method blanks		X		х		
B. Equipment blanks	Х				Х	
Laboratory Control Sample (LCS) %R		Х		Х		
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х	
LCS/LCSD Precision (RPD)	Х				Х	
Matrix Spike (MS) %R	Х				Х	
Matrix Spike Duplicate (MSD) %R	Х				Х	
MS/MSD Precision (RPD)	Х				Х	
Lab Duplicate (RPD)	Х				Х	
Field Duplicate (RPD)	Х				Х	
Dilution Factor		Х		Х		
Moisture Content		Х		Х		
Stage 3/4 Validation						
Initial calibration correlation coefficient (TOC)		X		Х		
Continuing calibration %R		Х	Х			
Raw Data		Х		Х		
Transcription/calculations acceptable		X		Х		

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE:

DATE: April 27, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 7, 2021

Stage 3 / 4 **PFAS Calibration Standards**

SDG #: 410-31280-1 Date: 4/26/2021 Lab: Eurofins Lancaster Page: 1 Project:

Aberdeen Proving Ground SPR Validated by:

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 29347

PFBA 3/05/2021 Calibration

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	,				. 466 755			=			
Cal Conc					Calculated		Calc		Calculated	Reported	
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D	
0.2	76737	4041718	10	0.018986	0.9493117	0.8751	0.216961	0.2	8.480	8.5	
0.5	176646	4038069	10	0.043745	0.8749033	0.8751	0.499888	0.5	-0.022	0	
2	793768	4082481	10	0.194433	0.9721637	0.8751	2.221835	2	11.092	11.1	
8	2677850	3885912	10	0.689118	0.8613969	0.8751	7.874729	8	-1.566	-1.6	
20	6830316	3935411	10	1.735604	0.8678021	0.8751	19.83321	20	-0.834	-0.8	
50	16406435	3931630	10	4.172935	0.8345869	0.8751	47.68523	50	-4.630	-4.6	
100	28464329	3717120	10	7.65763	0.765763	0.8751	87.50577	100	-12.494	-12.5	

Match Match Match Match Match Match

Match

Avg RF = 0.8751325 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-31280-1Date:4/26/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-100111/9 3/05/2021 13:32

Page 1053 - 1058 of SDG 410-31280-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	637595	3676346	10	0.1734	0.8751	1.982	2	-0.91	-0.9
Perfluoropentanoic acid	619100	3259175	10	0.1900	1.0370	1.832	2	-8.41	-8.5
Perfluorobutanesulfonic acid	739077	3444531	9.36	0.2146	1.0960	1.832	2	3.53	3.6
Perfluorohexanoic acid	711372	3890288	10	0.1829	0.9115	2.006	2	0.31	0.3
Perfluoroheptanoic acid	818242	3882972	10	0.2107	1.0960	1.923	2	-3.87	-3.9
Perfluorohexanesulfonic acid	674978	3439888	9.46	0.1962	1.0510	1.766	2	-6.55	-6.6
Perfluorooctanesulfonic acid	736490	3830413	9.57	0.1923	1.1010	1.671	2	-12.50	-12.7

Match Match Match Match Match Match Match

CCV 410-100974/72 3/9/2021 22:45

Page 1190 - 1195 of SDG 410-31280-1

	Analyte					Calc		Calculated	Reported	
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D	
Perfluorobutanoic acid	751777	3802071	10	0.1977	0.8751	2.259	2.0	12.97	13	Match
Perfluoropentanoic acid	831389	3502847	10	0.2373	1.0370	2.289	2.0	14.44	14.4	Match
Perfluorobutanesulfonic acid	996171	4246763	9.36	0.2346	1.0960	2.003	1.8	13.18	13.1	Match
Perfluorohexanoic acid	839046	4239405	10	0.1979	0.9115	2.171	2.0	8.57	8.6	Match
Perfluoroheptanoic acid	1010160	4041759	10	0.2499	1.0960	2.280	2.0	14.02	14	Match
Perfluorohexanesulfonic acid	835022	3603151	9.46	0.2317	1.0510	2.086	1.8	14.61	14.4	Match
Perfluorooctanesulfonic acid	945304	4039821	9.57	0.2340	1.1010	2.034	1.9	9.94	9.8	Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 SDG #:
 410-31280-1
 Date:
 4/26/2021

 Lab:
 Eurofins Lancaster
 Page:
 3

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-100543/2-A

Page 1467 - 1472 of SDG 410-31280-1

Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported	
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	2222467	3921104	10	0.566796	0.8751	25.91	25.600	101.20	101	Match
Perfluoropentanoic acid	2293048	3658313	10	0.626805	1.0370	24.18	25.600	94.44	94	Match
Perfluorobutanesulfonic acid	2867331	4105204	9.36	0.698462	1.0960	23.86	22.600	105.57	105	Match
Perfluorohexanoic acid	2448931	4262973	10	0.574466	0.9115	25.21	25.600	98.48	98	Match
Perfluoroheptanoic acid	2940929	4335308	10	0.678367	1.0960	24.76	25.600	96.71	97	Match
Perfluorohexanesulfonic acid	2504221	3827012	9.46	0.654354	1.0510	23.56	24.200	97.35	97	Match
Perfluorooctanesulfonic acid	2959064	4334695	9.57	0.682646	1.1010	23.73	24.500	96.88	97	Match

LCSD 410-100543/3-A

Page 1532 - 1528 of SDG 410-31280-1

Sample volume = 250 ml

Final volume = 1ml

						Calculated		Calculated	Reported	
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	1941014	3506508	10	0.553546	0.8751	25.30	25.600	98.84	99	Match
Perfluoropentanoic acid	1999943	3254331	10	0.614548	1.0370	23.70	25.600	92.60	93	Match
Perfluorobutanesulfonic acid	2645538	3938923	9.36	0.67164	1.0960	22.94	22.600	101.52	101	Match
Perfluorohexanoic acid	2183796	3940485	10	0.554195	0.9115	24.32	25.600	95.00	95	Match
Perfluoroheptanoic acid	2584954	3903339	10	0.662242	1.0960	24.17	25.600	94.41	94	Match
Perfluorohexanesulfonic acid	2273489	3700433	9.46	0.614385	1.0510	22.12	24.200	91.41	91	Match
Perfluorooctanesulfonic acid	2721270	4213285	9.57	0.645878	1.1010	22.46	24.500	91.66	92	Match

Calculated Amount ng/L = ((Peak area ratio/Avg RF) x EIS concentration)/Sample volume)*1000

				Reported	
	LCS Calc	LCSD Calc	LCS/LCSD	LCS/LCSD	
Compounds	Amount	Amount	Calc RPD	RPD	
Perfluorobutanoic acid	25.91	25.30	2.4	2	Match
Perfluoropentanoic acid	24.18	23.70	2.0	2	Match
Perfluorobutanesulfonic acid	23.86	22.94	3.9	4	Match
Perfluorohexanoic acid	25.21	24.32	3.6	4	Match
Perfluoroheptanoic acid	24.76	24.17	2.4	2	Match
Perfluorohexanesulfonic acid	23.56	22.12	6.3	6	Match
Perfluorooctanesulfonic acid	23.73	22.46	5.5	6	Match

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-31280-1
 Date:
 4/26/2021

 Lab:
 Eurofins Lancaster
 Page:
 4

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-BLDG-1059-1-GW-030321 Lab ID: 410-31280-6 Page 672 - 676 of SDG 410-31280-1

						Calculated	Final		Final	Reported	
						Amount	Volume	Sample	Calculated	Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	7118598	354577	10	20.07631	0.8751	229.42	1	202.9	1130.7	1100	Mat
Perfluoropentanoic acid	26411076	319235	10	82.73239	1.0370	797.81	1	202.9	3932.0	3900	Mat
Perfluorobutanesulfonic acid	2176914	390981	9.36	5.567826	1.0960	47.55	1	202.9	234.4	230	Mat
Perfluorohexanoic acid	26102803	371328	10	70.29581	0.9115	771.21	1	202.9	3800.9	3800	Mat
Perfluoroheptanoic acid	16873753	357441	10	47.2071	1.0960	430.72	1	202.9	2122.8	2100	Mat
Perfluorohexanesulfonic acid	12599133	37519	9.46	335.8067	1.0510	3022.58	1	202.9	14896.9	15000	Mat
Perfluorooctanesulfonic acid	76010119	77621	9.57	979.2468	1.1010	8511.71	1	202.9	41950.3	42000	Mat

Calculated amount $ng/L = (Peak area \ ratio/Avg \ RF) \ x \ DF \ x \ EIS \ conc \ ng/L$ Final Calculated amount $ng/L = ((calculated \ ng/L \ x \ Final \ Volume \ mls) \ / \ sample \ volume \ mls)$ Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

SDG #:410-31280-1Date:4/26/2021Lab:Eurofins LancasterPage:5Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-BLDG-1059-1-GW-030321 Lab ID: 410-31280-6

EIS <u>13C4 PFBA</u>
REPORTED EIS %R 90

 $%R = \frac{100 * EIS Concentration}{EIS TV}$

EIS Concentration 8.99 ng/ml Page 674 of 410-31280-1
EIS TV 10.0

%R 89.9 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental Analysis Request

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For Eurofins Lar

Lancaster Laboratories Acct. # _____ Group #



410-31280 Chain of Custody

COC #616527

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Environmental Analysis Request/Chain of Custody

Project Name: Arct A 0 1 5 Arct A 0 1 5 Project Name: Arct A 0 1 5 Arct A 0 1 5 Project Name: Ar	Lancaster Laboratories Environmental	Acct. #	300 100				ncaster Labo				nental	use o	nly		1 10			CC	C#	616	528
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Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-31280-1

Project/Site: Aberdeen Proving Ground

Qualifiers

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_	u	IVI	•

Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
*5+	Isotope dilution analyte is outside acceptance limits, high biased.
D	The reported value is from a dilution.
1	Value is EMPC (estimated maximum possible concentration).
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
M	Manual integrated compound.

Manual integrated compound.
These commonly used abbreviations may or may not be present in this report.
Listed under the "D" column to designate that the result is reported on a dry weight basis
Percent Recovery
Result is from the primary column on a dual-column method.
Result is from the confirmation column on a dual-column method.
Contains Free Liquid
Colony Forming Unit
Contains No Free Liquid
Duplicate Error Ratio (normalized absolute difference)
Dilution Factor
Detection Limit (DoD/DOE)
Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
Decision Level Concentration (Radiochemistry)
Estimated Detection Limit (Dioxin)
Limit of Detection (DoD/DOE)
Limit of Quantitation (DoD/DOE)
EPA recommended "Maximum Contaminant Level"
Minimum Detectable Activity (Radiochemistry)
Minimum Detectable Concentration (Radiochemistry)

MDL MLMPN

Method Detection Limit Minimum Level (Dioxin) Most Probable Number Method Quantitation Limit MQL Not Calculated

NC

ND Not Detected at the reporting limit (or MDL or EDL if shown)

NEG Negative / Absent POS Positive / Present

PQL **Practical Quantitation Limit**

PRES Presumptive QC **Quality Control**

RER Relative Error Ratio (Radiochemistry)

RLReporting Limit or Requested Limit (Radiochemistry)

RPD Relative Percent Difference, a measure of the relative difference between two points

TEF Toxicity Equivalent Factor (Dioxin) Toxicity Equivalent Quotient (Dioxin) **TEQ**

TNTC Too Numerous To Count

Client Sample ID: APG-BAF-D-1-SO-(0-2)-030321

Lab Sample ID: 410-31280-1 Date Collected: 03/03/21 09:15 **Matrix: Solid**

Date Received: 03/04/21 16:47 Percent Solids: 82.9

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	— —	03/06/21 14:59	1
8:2 Fluorotelomer sulfonic acid	<0.0018	0.0034	0.0018	0.0018	mg/Kg	₩	03/06/21 14:59	1
NEtFOSAA	<0.00045	0.0023	0.00045	0.00045	mg/Kg	☆	03/06/21 14:59	R 1
NMeFOSAA	<0.00045	0.0023	0.00045	0.00045	mg/Kg	`	03/06/21 14:59	R 1
Perfluorobutanesulfonic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	₩	03/06/21 14:59	1
Perfluorobutanoic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	₩	03/06/21 14:59	1
Perfluorodecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/06/21 14:59	1
Perfluorododecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/06/21 14:59	1
Perfluoroheptanoic acid	< 0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/06/21 14:59	1
Perfluorohexanesulfonic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/06/21 14:59	1
Perfluorohexanoic acid	< 0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/06/21 14:59	1
Perfluorononanoic acid	< 0.00045	0.00068	0.00045	0.00045		₩	03/06/21 14:59	1
Perfluorooctanesulfonic acid	0.0025	0.00068	0.00045	0.00045	mg/Kg		03/06/21 14:59	1
Perfluorooctanoic acid	0.00079 M	0.00068	0.00045	0.00045	mg/Kg	₩	03/06/21 14:59	1
Perfluoropentanoic acid	< 0.00045	0.00068	0.00045	0.00045		₩	03/06/21 14:59	1
Perfluorotetradecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg		03/06/21 14:59	1
Perfluorotridecanoic acid	< 0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/06/21 14:59	1
Perfluoroundecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/06/21 14:59	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepare	ed	Analyzed	Dil Fac
M2-6:2 FTS	67	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
M2-8:2 FTS	67	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
13C2 PFTeDA	72	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
13C3 PFBS	85	50 - 150			03/05/21 2	0:35	03/06/21 14:59	1
13C4 PFBA	66	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
13C4 PFHpA	75	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
13C5 PFPeA	72	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
13C8 PFOA	77	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
13C8 PFOS	86	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
d3-NMeFOSAA	15 *5-	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
d5-NEtFOSAA	17 *5-	50 ₋ 150			03/05/21 2	20:35	03/06/21 14:59	1
13C2-PFDoDA	83	50 ₋ 150					03/06/21 14:59	1
13C3 PFHxS	87	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
13C5 PFHxA	73	50 ₋ 150			03/05/21 2	20:35	03/06/21 14:59	1
13C6 PFDA	77	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
13C7 PFUnA	74	50 - 150			03/05/21 2	20:35	03/06/21 14:59	1
13C9 PFNA	75	50 - 150					03/06/21 14:59	1
Company Champinton								
General Chemistry	Result Qualifier	LOQ	LOD	יח	Unit	D	Analyzod	Dil Fac
Analyte	Result Qualifier	LUQ	LOD	DL	UIIIL	ט	Analyzed	באן ווע
	2220	1200	006	026	malka	*	02/12/21 15:07	2 0 4
Total Organic Carbon Percent Moisture	3320 J+ 17.1	1390 1.0	926	926 1.0	mg/Kg %	⇔	03/13/21 15:07 03/05/21 11:44	3.84

Analyte	Result	Qualifier	LOQ	LOD	DL (Unit	D	Analyzed	Dil Fac
Total Organic Carbon	3320	J+	1390	926	926	mg/Kg	₩	03/13/21 15:07	3.84
Percent Moisture	17.1		1.0		1.0	%		03/05/21 11:44	1
Percent Solids	82.9		1.0		1.0	%		03/05/21 11:44	1

General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	8.6	J	0.01	0.01	0.01	S.U.	_	03/08/21 15:05	1
Temperature	18.5		0.01	0.01	0.01	Degrees C		03/08/21 15:05	1

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31280-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BAF-D-1-SO-(0-2)-030321

Lab Sample ID: 410-31280-1 Date Collected: 03/03/21 09:15 **Matrix: Solid** Date Received: 03/04/21 16:47 Percent Solids: 82.9

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%	_	03/06/21 10:10	1
Sand	35.1		1.0	1.0	1.0	%		03/06/21 10:10	1
Silt	45.8		1.0	1.0	1.0	%		03/06/21 10:10	1
Clay	19.0		1.0	1.0	1.0	%		03/06/21 10:10	1
75 mm	100.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
19 mm	100		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
4.75 mm	100		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
3.35 mm	99.9		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
2.36 mm	99.9		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
1.18 mm	99.8		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.6 mm	90.7		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.3 mm	72.8		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.15 mm	66.8		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.075 mm	64.8		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.064 mm	63.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.05 mm	56.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.02 mm	38.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.005 mm	19.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.002 mm	14.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.001 mm	10.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1

Client Sample ID: APG-BAF-D-1-GW-030321

Lab Sample ID: 410-31280-2 Date Collected: 03/03/21 10:00 **Matrix: Water** Date Received: 03/04/21 16:47

Analyte	Result	Qualifier I	_OQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<4.3		5.4	4.3	4.3	ng/L	03/09/21 11:08	1
8:2 Fluorotelomer sulfonic acid	<2.2		3.2	2.2	2.2	ng/L	03/09/21 11:08	1
NEtFOSAA	<1.1		3.2	1.1	1.1	ng/L	03/09/21 11:08	1
NMeFOSAA	<1.3		2.2	1.3	1.3	ng/L	03/09/21 11:08	1
Perfluorobutanesulfonic acid	27		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Perfluorobutanoic acid	10		5.4	4.3	4.3	ng/L	03/09/21 11:08	1
Perfluorodecanoic acid	<1.1		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Perfluorododecanoic acid	<1.1		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Perfluoroheptanoic acid	18		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Perfluorohexanoic acid	54		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Perfluorononanoic acid	3.7		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Perfluorooctanesulfonic acid	86		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Perfluorooctanoic acid	23		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Perfluoropentanoic acid	32		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Perfluorotetradecanoic acid	<1.1		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Perfluorotridecanoic acid	<1.1		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Perfluoroundecanoic acid	<1.1		2.2	1.1	1.1	ng/L	03/09/21 11:08	1
Isotope Dilution	%Recovery Qua	alifier Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	114	50 - 150	_			03/08/21 08:30	03/09/21 11:08	1
M2-8:2 FTS	107	50 - 150				03/08/21 08:30	03/09/21 11:08	1
13C2 PFTeDA	65	50 - 150				03/08/21 08:30	03/09/21 11:08	1
13C3 PFBS	96	50 - 150				03/08/21 08:30	03/09/21 11:08	1

Eurofins Lancaster Laboratories Env, LLC

Client: ARCADIS U.S., Inc.

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BAF-D-1-GW-030321

Date Collected: 03/03/21 10:00 Date Received: 03/04/21 16:47 Lab Sample ID: 410-31280-2

Matrix: Water

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-	15 (Continued)
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Isotope Dilution	%Recovery Quality	fier Limits	Prepared	Analyzed	Dil Fac
13C4 PFBA	101	50 - 150	03/08/21 08:30	03/09/21 11:08	1
13C4 PFHpA	102	50 ₋ 150	03/08/21 08:30	03/09/21 11:08	1
13C5 PFPeA	104	50 - 150	03/08/21 08:30	03/09/21 11:08	1
13C8 PFOA	102	50 ₋ 150	03/08/21 08:30	03/09/21 11:08	1
13C8 PFOS	100	50 ₋ 150	03/08/21 08:30	03/09/21 11:08	1
d3-NMeFOSAA	103	50 - 150	03/08/21 08:30	03/09/21 11:08	1
d5-NEtFOSAA	94	50 ₋ 150	03/08/21 08:30	03/09/21 11:08	1
13C2-PFDoDA	94	50 ₋ 150	03/08/21 08:30	03/09/21 11:08	1
13C3 PFHxS	101	50 ₋ 150	03/08/21 08:30	03/09/21 11:08	1
13C5 PFHxA	100	50 ₋ 150	03/08/21 08:30	03/09/21 11:08	1
13C6 PFDA	98	<i>50 - 150</i>	03/08/21 08:30	03/09/21 11:08	1
13C7 PFUnA	95	50 ₋ 150	03/08/21 08:30	03/09/21 11:08	1
13C9 PFNA	99	50 ₋ 150	03/08/21 08:30	03/09/21 11:08	1

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - DL

Analyte	Result	Qualifier	LC	QC	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	760	D	_	22	11	11	ng/L	03/09/21 23:28	10
Isotope Dilution	%Recovery Qu	ıalifier	Limits				Prepared	Analyzed	Dil Fac
13C3 PEHxS	101		50 - 150				03/08/21 08:30	03/09/21 23:28	10

Client Sample ID: APG-BAF-E-1-SO-(0-2)-030321

Date Collected: 03/03/21 10:30

Date Received: 03/04/21 16:47

Lab Sample ID: 410-31280-3

Matrix: Solid Percent Solids: 86.6

Method: EPA 537(N	Mod) - PFAS for	QSM 5.3, Table B-15
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Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	03/06/21 15:09	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0034	0.0018	0.0018	mg/Kg	₩	03/06/21 15:09	1
NEtFOSAA	<0.00046	UJ	0.0023	0.00046	0.00046	mg/Kg	☼	03/06/21 15:09	1
NMeFOSAA	<0.00046	UJ	0.0023	0.00046	0.00046	mg/Kg	₩	03/06/21 15:09	1
Perfluorobutanesulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	03/06/21 15:09	1
Perfluorobutanoic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	03/06/21 15:09	1
Perfluorodecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	⊅	03/06/21 15:09	1
Perfluorododecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/06/21 15:09	1
Perfluoroheptanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/06/21 15:09	1
Perfluorohexanesulfonic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/06/21 15:09	1
Perfluorohexanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/06/21 15:09	1
Perfluorononanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/06/21 15:09	1
Perfluorooctanesulfonic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₽	03/06/21 15:09	1
Perfluorooctanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/06/21 15:09	1
Perfluoropentanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/06/21 15:09	1
Perfluorotetradecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₽	03/06/21 15:09	1
Perfluorotridecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/06/21 15:09	1
Perfluoroundecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	≎	03/06/21 15:09	1
Isotope Dilution	%Recovery Qu	ıalifier	Limits			Prepa	red	Analyzed	Dil Fac

isotope Dilation	701 GCOVET y	Qualifier Liffits	rrepared	Allalyzea	Diriac
M2-6:2 FTS	90	50 - 150	03/05/21 20:35	03/06/21 15:09	1
M2-8:2 FTS	84	50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C2 PFTeDA	75	50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C3 PFBS	86	50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C4 PFBA	85	50 - 150	03/05/21 20:35	03/06/21 15:09	1

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31280-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BAF-E-1-SO-(0-2)-030321 Lab Sample ID: 410-31280-3

Date Collected: 03/03/21 10:30

Matrix: Solid

Date Received: 03/04/21 16:47

Percent Solids: 86.6

Mothod: FPA 537/Mod) - D	FAS for OSM 5.3.1	Table R-1	15 (Continued)					
Method: EPA 537(Mod) - Postope Dilution	%Recovery Qui		Limits			Prepared	Analyzed	Dil F
13C4 PFHpA	86		50 - 150				03/06/21 15:09	
13C5 PFPeA	88		50 - 150				5 03/06/21 15:09	
13C8 PFOA	93		50 - 150				5 03/06/21 15:09	
3C8 PFOS	91		50 - 150				5 03/06/21 15:09	
3-NMeFOSAA	39 *5-		50 - 150				5 03/06/21 15:09	
I5-NEtFOSAA	43 *5-		50 - 150				5 03/06/21 15:09	
3C2-PFDoDA	89		50 - 150				5 03/06/21 15:09	
3C3 PFHxS	89		50 - 150				5 03/06/21 15:09	
3C5 PFHxA	87		50 - 150				5 03/06/21 15:09	
3C6 PFDA	86		50 - 150				5 03/06/21 15:09	
3C7 PFUnA	84		50 - 150				5 03/06/21 15:09	
I3C9 PFNA	88		50 - 150 50 - 150				5 03/06/21 15:09	
	00		50 - 150			03/03/21 20.33	03/00/21 13.09	
General Chemistry	Pagult	Qualifier	1.00	LOD	DI	Unit [Analyzad	Dil F
nalyte			_ <u>LOQ</u>	LOD				
otal Organic Carbon	2170	J+	1330	887	1.0	0 0	03/13/21 15:20 03/05/21 11:44	3.
ercent Moisture	13.4		1.0					
ercent Solids	86.6		1.0		1.0	%	03/05/21 11:44	
ieneral Chemistry - Solub								
nalyte		Qualifier	LOQ	LOD		Unit		Dil F
Н	6.4	J	0.01	0.01		S.U.	03/09/21 19:45	
emperature	20.3		0.01	0.01	0.01	Degrees C	03/09/21 19:45	
nalyte	Result	Qualifier	LOQ	LOD		Unit [Dil F
nalyte	Result <1.0	Qualifier	1.0	1.0	1.0	%	03/06/21 10:10	Dil F
nalyte ravel and	Result <1.0 28.8	Qualifier	1.0 1.0	1.0 1.0	1.0 1.0	% %		Dil F
nalyte ravel and	Result <1.0	Qualifier	1.0	1.0	1.0	% %	03/06/21 10:10	Dil F
nalyte ravel and ilt	Result <1.0 28.8	Qualifier	1.0 1.0	1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0	% % %	03/06/21 10:10 03/06/21 10:10	Dil F
nalyte ravel and ilt lay	Result <1.0 28.8 51.2	Qualifier	1.0 1.0 1.0	1.0 1.0 1.0	1.0 1.0 1.0 1.0	% % %	03/06/21 10:10 03/06/21 10:10 03/06/21 10:10	Dil F
nalyte ravel and ilt lay 5 mm	Result <1.0 28.8 51.2 20.0	Qualifier	1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0	% % %	03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10	Dil F
nalyte ravel and ilt lay 5 mm 7.5 mm	Result <1.0 28.8 51.2 20.0 100.0	Qualifier	1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0	% % % % % Passing	03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10	_Dil F
nalyte ravel and ilt lay 5 mm 7.5 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0	Qualifier	1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0	% % % % Passing % Passing	03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10	<u>Dil F</u>
nalyte ravel and ilt lay 5 mm 7.5 mm 9 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing	03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10	Dil F
nalyte ravel and iilt lay 5 mm 7.5 mm 9 mm .75 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0 100.0 100	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % % Passing % Passing % Passing % Passing % Passing	03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10	Dil F
nalyte ravel and iilt lay 5 mm 7.5 mm 9 mm .75 mm .35 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0 100.0 99.9	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing	03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10	Dil F
nalyte ravel and iit lay 5 mm 7.5 mm 9 mm 75 mm 35 mm 36 mm .18 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0 100.0 99.9	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing	03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10 03/06/21 10:10	DilF
nalyte ravel and ilt lay 5 mm 7.5 mm 9 mm 75 mm 35 mm 36 mm 18 mm 6 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0 100.0 99.9 99.8 99.5	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing	03/06/21 10:10 03/06/21 10:10	DilF
nalyte ravel and ilt lay 5 mm 7.5 mm 9 mm .75 mm .35 mm .36 mm .18 mm .6 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0 100 99.9 99.8 99.5 90.8	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing	03/06/21 10:10 03/06/21 10:10	Dil F
nalyte ravel and ilt lay 5 mm 7.5 mm 9 mm .75 mm .35 mm .36 mm .18 mm .6 mm .3 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0 100.0 99.9 99.8 99.8 99.5 90.8 78.7	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing	03/06/21 10:10 03/06/21 10:10	Dil F
nalyte ravel and iit lay 5 mm 7.5 mm 9 mm .75 mm .35 mm .36 mm .18 mm .6 mm .3 mm .15 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0 100.0 99.9 99.8 99.5 90.8 78.7 73.7 71.2	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing	03/06/21 10:10 03/06/21 10:10	Dil F
nalyte ravel and iit lay 5 mm 7.5 mm 9 mm .75 mm .35 mm .36 mm .18 mm .6 mm .3 mm .15 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0 100.0 99.9 99.8 99.5 90.8 78.7 73.7 71.2 69.0	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing	03/06/21 10:10 03/06/21 10:10	DilF
analyte Gravel G	Result <1.0 28.8 51.2 20.0 100.0 100.0 100.0 99.9 99.8 99.5 90.8 78.7 73.7 71.2 69.0 63.0	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing	03/06/21 10:10 03/06/21 10:10	Dil F
analyte Gravel Grand Gilt Clay 5 mm 7.5 mm 9 mm .75 mm .35 mm .36 mm .18 mm .6 mm .1 mm .075 mm .075 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0 100.0 99.9 99.8 99.5 90.8 78.7 73.7 71.2 69.0 63.0 40.0	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % % Passing	03/06/21 10:10 03/06/21 10:10	Dil F
Method: D422 - Grain Size chalyte Gravel Gand Gilt Glay S mm 7.5 mm 9 mm75 mm35 mm36 mm18 mm6 mm9 mm075 mm075 mm075 mm075 mm	Result <1.0 28.8 51.2 20.0 100.0 100.0 100.0 99.9 99.8 99.5 90.8 78.7 73.7 71.2 69.0 63.0	Qualifier	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing	03/06/21 10:10 03/06/21 10:10	Dil F

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Client: ARCADIS U.S., Inc. Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BAF-E-1-GW-030321

Date Collected: 03/03/21 11:15 Date Received: 03/04/21 16:47

Lab Sample ID: 410-31280-4

Matrix: Water

Method: EPA 537(Mod) - PFA	AS for QSM 5.3,	Table B-	15						
Analyte	Result	Qualifier	L	.oq	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.8			4.8	3.8	3.8	ng/L	03/09/21 11:18	1
8:2 Fluorotelomer sulfonic acid	<1.9			2.9	1.9	1.9	ng/L	03/09/21 11:18	1
NEtFOSAA	<0.96			2.9	0.96	0.96	ng/L	03/09/21 11:18	1
NMeFOSAA	<1.2			1.9	1.2	1.2	ng/L	03/09/21 11:18	1
Perfluorobutanesulfonic acid	<0.96	M		1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluorobutanoic acid	<3.8	M		4.8	3.8	3.8	ng/L	03/09/21 11:18	1
Perfluorodecanoic acid	<0.96			1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluorododecanoic acid	<0.96			1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluoroheptanoic acid	1.3	J		1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluorohexanesulfonic acid	5.6			1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluorohexanoic acid	2.3	M		1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluorononanoic acid	<0.96			1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluorooctanesulfonic acid	11			1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluorooctanoic acid	2.3	M		1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluoropentanoic acid	2.0			1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluorotetradecanoic acid	<0.96			1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluorotridecanoic acid	<0.96			1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Perfluoroundecanoic acid	<0.96			1.9	0.96	0.96	ng/L	03/09/21 11:18	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	116		50 - 150	-			03/08/21 08:30	03/09/21 11:18	1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	116	50 - 150	03/08/21 08:30	03/09/21 11:18	1
M2-8:2 FTS	100	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C2 PFTeDA	86	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C3 PFBS	98	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C4 PFBA	91	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C4 PFHpA	98	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C5 PFPeA	95	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C8 PFOA	101	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C8 PFOS	102	50 - 150	03/08/21 08:30	03/09/21 11:18	1
d3-NMeFOSAA	97	50 - 150	03/08/21 08:30	03/09/21 11:18	1
d5-NEtFOSAA	95	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C2-PFDoDA	101	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C3 PFHxS	104	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C5 PFHxA	95	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C6 PFDA	91	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C7 PFUnA	88	50 - 150	03/08/21 08:30	03/09/21 11:18	1
13C9 PFNA	96	50 - 150	03/08/21 08:30	03/09/21 11:18	1

Client Sample ID: APG-BLDG-1059-1-SO-(0-2)-030321

Date Collected: 03/03/21 12:00

Date Received: 03/04/21 16:47

Lab Sample ID: 410-31280-5

Matrix: Solid Percent Solids: 80.9

Method: EPA 537(Mod) - PFAS 1	for QSM 5.3, Table	9 B-15						
Analyte	Result Quali	fier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	☆	03/06/21 15:20	1
8:2 Fluorotelomer sulfonic acid	<0.0019	0.0035	0.0019	0.0019	mg/Kg	☆	03/06/21 15:20	1
NEtFOSAA	<0.00047 UJ	0.0024	0.00047	0.00047	mg/Kg	≎	03/06/21 15:20	1
NMeFOSAA	0.00067 J-M-I	MJN 0.0024	0.00047	0.00047	mg/Kg	☆	03/06/21 15:20	1
Perfluorobutanesulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	☆	03/06/21 15:20	1
Perfluorobutanoic acid	<0.0019 M	0.0024	0.0019	0.0019	mg/Kg	≎	03/06/21 15:20	1
Perfluorodecanoic acid	0.0030	0.00071	0.00047	0.00047	mg/Kg	₩	03/06/21 15:20	1

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31280-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-1059-1-SO-(0-2)-030321 Lab Sample ID: 410-31280-5

Date Collected: 03/03/21 12:00

Matrix: Solid

Date Received: 03/04/21 16:47

Percent Solids: 80.9

Method: EPA 537(Mod) - PFA: Analyte		Qualifier	LOQ	LOD	DI	Unit D	Analyzed	Dil Fa
Perfluorododecanoic acid	<0.00047	<u> </u>	0.00071	0.00047	0.00047			
Perfluoroheptanoic acid	<0.00047		0.00071	0.00047	0.00047			
Perfluorohexanesulfonic acid	0.0037		0.00071	0.00047	0.00047			
Perfluoronexanoic acid	0.00053		0.00071	0.00047	0.00047			
Perfluoronexamoic acid	0.0005	J	0.00071	0.00047	0.00047	0 0		
Perfluorooctanesulfonic acid	0.0016		0.00071	0.00047	0.00047		03/06/21 15:20	
		N.4	0.00071	0.00047	0.00047	0 0		
Perfluorooctanoic acid	0.0012		0.00071	0.00047	0.00047			
Perfluoropentanoic acid	0.00065	J W			0.00047			
Perfluorotetradecanoic acid	<0.00047		0.00071	0.00047	0.00047			
Perfluorotridecanoic acid	<0.00047		0.00071	0.00047				
erfluoroundecanoic acid	0.0017	M	0.00071	0.00047	0.00047	mg/Kg :	03/06/21 15:20	
sotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil F
12-6:2 FTS	95		50 - 150				03/06/21 15:20	
12-8:2 FTS	88		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C2 PFTeDA	85		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C3 PFBS	88		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C4 PFBA	85		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C4 PFHpA	90		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C5 PFPeA	91		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C8 PFOA	94		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C8 PFOS	93		50 - 150			03/05/21 20:35	03/06/21 15:20	
3-NMeFOSAA	23 *5	-	50 - 150			03/05/21 20:35	03/06/21 15:20	
5-NEtFOSAA	28 *5	-	50 - 150			03/05/21 20:35	03/06/21 15:20	
3C2-PFDoDA	99		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C3 PFHxS	94		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C5 PFHxA	89		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C6 PFDA	92		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C7 PFUnA	90		50 - 150			03/05/21 20:35	03/06/21 15:20	
3C9 PFNA	89		50 - 150			03/05/21 20:35	03/06/21 15:20	
General Chemistry								
nalyte		Qualifier	LOQ	LOD		Unit D	·	Dil F
otal Organic Carbon	6090	J+	2650	1770	1770	0 0		7.
ercent Moisture	19.1		1.0		1.0		03/05/21 11:44	
ercent Solids	80.9		1.0		1.0	%	03/05/21 11:44	
General Chemistry - Soluble	Deculé	Ouglifier	1.00	LOD	DI	IImia D	Analyzad	Dile
nalyte		Qualifier	_ LOQ	0.01 -		Unit S.U.	Analyzed 03/08/21 15:05	Dil F
H	7.1	J					03/08/21 15:05	
emperature	20.4		0.01	0.01	0.01	Degrees C	03/06/21 15:05	
lethod: D422 - Grain Size nalyte	Rosult	Qualifier	LOQ	LOD	וח	Unit D	Analyzed	Dil F
ravel	<1.0	- Guainiti	1.0	1.0	1.0		03/06/21 10:10	2111
and			1.0	1.0	1.0		03/06/21 10:10	
	5.6		1.0	1.0	1.0		03/06/21 10:10	
ilt	72.4							
lay	22.0		1.0	1.0	1.0		03/06/21 10:10	
5 mm	100.0		1.0	1.0		% Passing	03/06/21 10:10	
37.5 mm	100.0		1.0	1.0		% Passing	03/06/21 10:10	
19 mm	100		1.0	1.0	1.0	% Passing	03/06/21 10:10	

Eurofins Lancaster Laboratories Env, LLC

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Lab Sample ID: 410-31280-5

Matrix: Solid

Percent Solids: 80.9

Job ID: 410-31280-1

Client Sample	ID: APG-BLDG-1059-	1-SO-(0-2)-030321

Date Collected: 03/03/21 12:00 Date Received: 03/04/21 16:47

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
4.75 mm	100		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
3.35 mm	100		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
2.36 mm	100		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
1.18 mm	99.7		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.6 mm	99.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.3 mm	96.8		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.15 mm	95.5		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.075 mm	94.4		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.064 mm	91.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.05 mm	84.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.02 mm	53.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.005 mm	22.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.002 mm	12.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.001 mm	5.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1

Client Sample ID: APG-BLDG-1059-1-GW-030321

Date Collected: 03/03/21 12:30 Date Received: 03/04/21 16:47

Lab Sample ID: 410-31280-6

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	4100	₽ DJ-	62	49	49	ng/L		03/09/21 23:38	10
8:2 Fluorotelomer sulfonic acid	620	D	37	25	25	ng/L		03/09/21 23:38	10
NEtFOSAA	<12		37	12	12	ng/L		03/09/21 23:38	10
NMeFOSAA	<15		25	15	15	ng/L		03/09/21 23:38	10
Perfluorobutanesulfonic acid	230	D	25	12	12	ng/L		03/09/21 23:38	10
Perfluorobutanoic acid	1100	D	62	49	49	ng/L		03/09/21 23:38	10
Perfluorodecanoic acid	30	D	25	12	12	ng/L		03/09/21 23:38	10
Perfluorododecanoic acid	<12		25	12	12	ng/L		03/09/21 23:38	10
Perfluoroheptanoic acid	2100	D	25	12	12	ng/L		03/09/21 23:38	10
Perfluorohexanoic acid	3800	D	25	12	12	ng/L		03/09/21 23:38	10
Perfluorononanoic acid	990	D	25	12	12	ng/L		03/09/21 23:38	10
Perfluorooctanoic acid	3600	D M	25	12	12	ng/L		03/09/21 23:38	10
Perfluoropentanoic acid	3900	D	25	12	12	ng/L		03/09/21 23:38	10
Perfluorotetradecanoic acid	<12		25	12	12	ng/L		03/09/21 23:38	10
Perfluorotridecanoic acid	<12		25	12	12	ng/L		03/09/21 23:38	10
Perfluoroundecanoic acid	<12		25	12	12	ng/L		03/09/21 23:38	10

Isotope Dilution	%Recovery Qualifier	Limits	Prepared Analyzed	Dil Fac
M2-6:2 FTS	153 *5+	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10
M2-8:2 FTS	108	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10
13C2 PFTeDA	83	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10
13C3 PFBS	94	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10
13C4 PFBA	90	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10
13C4 PFHpA	86	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10
13C5 PFPeA	91	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10
13C8 PFOA	91	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10
13C8 PFOS	119	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10
d3-NMeFOSAA	100	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10
d5-NEtFOSAA	100	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10
13C2-PFDoDA	97	50 - 150	03/08/21 08:30 03/09/21 23:3	8 10

Job ID: 410-31280-1

Client: ARCADIS U.S., Inc.

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-1059-1-GW-030321

Lab Sample ID: 410-31280-6 Date Collected: 03/03/21 12:30 **Matrix: Water**

Date Received: 03/04/21 16:47

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 PFHxS	95	50 - 150	03/08/21 08:30	03/09/21 23:38	10
13C5 PFHxA	88	50 - 150	03/08/21 08:30	03/09/21 23:38	10
13C6 PFDA	97	50 - 150	03/08/21 08:30	03/09/21 23:38	10
13C7 PFUnA	91	50 - 150	03/08/21 08:30	03/09/21 23:38	10
13C9 PFNA	63	50 - 150	03/08/21 08:30	03/09/21 23:38	10
13C7 PFUnA	97 91 63	50 - 150	03/08/	21 08:30	/21 08:30 03/09/21 23:38 /21 08:30 03/09/21 23:38 /21 08:30 03/09/21 23:38 /21 08:30 03/09/21 23:38

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac	
Perfluorohexanesulfonic acid	15000	D	250	120	120	ng/L	03/09/21 23:49	100	
Perfluorooctanesulfonic acid	42000	D J-	250	120	120	ng/L	03/09/21 23:49	100	
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac	
13C8 PFOS	185 *5	+	50 - 150			03/08/21 08:30	03/09/21 23:49	100	
13C3 PFHxS	102		50 - 150			03/08/21 08:30	03/09/21 23:49	100	

Client Sample ID: APG-BLDG-1065-1-SO-(0-2)-030321

Date Collected: 03/03/21 13:20

Date Received: 03/04/21 16:47

Lab Sample ID: 410-31280-7

Matrix: Solid

Percent Solids: 84.2

Method: EPA 537(Mod) - PFAS	for QSM 5.3, Table B	-15						
Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	*	03/06/21 15:30	1
8:2 Fluorotelomer sulfonic acid	<0.0018	0.0034	0.0018	0.0018	mg/Kg	☼	03/06/21 15:30	1
NEIFOSAA	<0.00045	0.0022	0.00045	0.00045	mg/Kg	; ‡	03/06/21 15.30	R 1
NMcFOSAA	<0.00045	0.0022	0.00045	0.00045	mg/Kg	*	03/06/21 15:30	R 1
Perfluorobutanesulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	☼	03/06/21 15:30	1
Perfluorobutanoic acid	<0.0018 M	0.0022	0.0018	0.0018	mg/Kg	☼	03/06/21 15:30	1
Perfluorodecanoic acid	0.00048 J	0.00067	0.00045	0.00045	mg/Kg	⊅	03/06/21 15:30	1
Perfluorododecanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/06/21 15:30	1
Perfluoroheptanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/06/21 15:30	1
Perfluorohexanesulfonic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	₽	03/06/21 15:30	1
Perfluorohexanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/06/21 15:30	1
Perfluorononanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/06/21 15:30	1
Perfluorooctanesulfonic acid	0.0042	0.00067	0.00045	0.00045	mg/Kg	☼	03/06/21 15:30	1
Perfluorooctanoic acid	<0.00045 M	0.00067	0.00045	0.00045	mg/Kg	☼	03/06/21 15:30	1
Perfluoropentanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/06/21 15:30	1
Perfluorotetradecanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/06/21 15:30	1
Perfluorotridecanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/06/21 15:30	1
Perfluoroundecanoic acid	<0.00045 M	0.00067	0.00045	0.00045	mg/Kg	☼	03/06/21 15:30	1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared Analyzed	Dil Fac
M2-6:2 FTS	86	50 - 150	03/05/21 20:35 03/06/21 15:3	0 1
M2-8:2 FTS	88	50 - 150	03/05/21 20:35 03/06/21 15:3	0 1
13C2 PFTeDA	82	50 - 150	03/05/21 20:35 03/06/21 15:3	0 1
13C3 PFBS	86	50 - 150	03/05/21 20:35 03/06/21 15:3	0 1
13C4 PFBA	80	50 - 150	03/05/21 20:35 03/06/21 15:3	0 1
13C4 PFHpA	83	50 - 150	03/05/21 20:35 03/06/21 15:3	0 1
13C5 PFPeA	83	50 - 150	03/05/21 20:35 03/06/21 15:3	0 1
13C8 PFOA	89	50 - 150	03/05/21 20:35 03/06/21 15:3	0 1
13C8 PFOS	90	50 - 150	03/05/21 20:35 03/06/21 15:3	0 1
d3-NMeFOSAA	11 *5-	50 - 150	03/05/21 20:35 03/06/21 15:3	0 1
d5-NEtFOSAA	14 *5-	50 ₋ 150	03/05/21 20:35 03/06/21 15:3	0 1

Date Received: 03/04/21 16:47

Lab Sample ID: 410-31280-7

Client Sample ID: APG-BLDG-1065-1-SO-(0-2)-030321 Date Collected: 03/03/21 13:20 **Matrix: Solid**

Percent Solids: 84.2

Job ID: 410-31280-1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2-PFDoDA	91	50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C3 PFHxS	94	50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C5 PFHxA	84	50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C6 PFDA	87	50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C7 PFUnA	87	50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C9 PFNA	83	50 - 150	03/05/21 20:35	03/06/21 15:30	1

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	5970	J+	2360	1570	1570	mg/Kg	*	03/13/21 15:45	6.62
Percent Moisture	15.8		1.0		1.0	%		03/05/21 11:44	1
Percent Solids	84.2		1.0		1.0	%		03/05/21 11:44	1

General Chemistry - Soluble

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	7.2	J	0.01	0.01	0.01	S.U.		03/08/21 15:05	1
Temperature	19.2		0.01	0.01	0.01	Degrees C		03/08/21 15:05	1

Method: D422 - Grain Size Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0		- =	03/12/21 11:54	1
Sand	20.5		1.0	1.0	1.0	%		03/12/21 11:54	1
Silt	63.5		1.0	1.0	1.0	%		03/12/21 11:54	1
Clay	16.0		1.0	1.0	1.0	%		03/12/21 11:54	1
75 mm	100.0		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
19 mm	100.0		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
4.75 mm	100		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
3.35 mm	99.9		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
2.36 mm	99.8		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
1.18 mm	99.4		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
0.6 mm	95.9		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
0.3 mm	88.2		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
0.15 mm	82.9		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
0.075 mm	79.5		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
0.064 mm	76.0		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
0.05 mm	68.0		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
0.02 mm	43.0		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
0.005 mm	16.0		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
0.002 mm	10.0		1.0	1.0	1.0	% Passing		03/12/21 11:54	1
0.001 mm	8.0		1.0	1.0	1.0	% Passing		03/12/21 11:54	1

Client Sample ID: APG-BLDG-1065-1-GW-030321

Date Collected: 03/03/21 14:00

Date Received: 03/04/21 16:47

Lab Samp	le ID: 41	10-31280-8
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Matrix: Water

Method: EPA 537((Mod) - PFAS for QSM 5.3,	Table B-15
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	J. 40 0.0,								
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	3700	D	54	44	44	ng/L		03/09/21 23:59	10
8:2 Fluorotelomer sulfonic acid	450	D	33	22	22	ng/L		03/09/21 23:59	10
NEtFOSAA	<11		33	11	11	ng/L		03/09/21 23:59	10

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-1065-1-GW-030321

Date Collected: 03/03/21 14:00

Date Received: 03/04/21 16:47

Client: ARCADIS U.S., Inc.

Lab Sample ID: 410-31280-8

Matrix: Water

Analyte	Result	Qualifier	L	_OQ	LOD	DL	Unit	D	Analyzed	Dil Fac
NMeFOSAA	<13			22	13	13	ng/L	_	03/09/21 23:59	10
Perfluorobutanesulfonic acid	410	D		22	11	11	ng/L		03/09/21 23:59	10
Perfluorobutanoic acid	1000	D		54	44	44	ng/L		03/09/21 23:59	10
Perfluorodecanoic acid	19	JDM		22	11	11	ng/L		03/09/21 23:59	10
Perfluorododecanoic acid	<11			22	11	11	ng/L		03/09/21 23:59	10
Perfluoroheptanoic acid	1500	D		22	11	11	ng/L		03/09/21 23:59	10
Perfluorohexanoic acid	3700	D		22	11	11	ng/L		03/09/21 23:59	10
Perfluorononanoic acid	690	D		22	11	11	ng/L		03/09/21 23:59	10
Perfluorooctanoic acid	2300	D M		22	11	11	ng/L		03/09/21 23:59	10
Perfluoropentanoic acid	3400	D		22	11	11	ng/L		03/09/21 23:59	10
Perfluorotetradecanoic acid	<11			22	11	11	ng/L		03/09/21 23:59	10
Perfluorotridecanoic acid	<11			22	11	11	ng/L		03/09/21 23:59	10
Perfluoroundecanoic acid	<11			22	11	11	ng/L		03/09/21 23:59	10
lastone Dilution	9/ Passyary O		Limito				Dronoro	.	Analyzad	Dil Ess

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	136	50 - 150	03/08/21 08:30	03/09/21 23:59	10
M2-8:2 FTS	86	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C2 PFTeDA	77	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C3 PFBS	88	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C4 PFBA	85	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C4 PFHpA	82	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C5 PFPeA	88	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C8 PFOA	91	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C8 PFOS	169 *5+	50 - 150	03/08/21 08:30	03/09/21 23:59	10
d3-NMeFOSAA	93	50 - 150	03/08/21 08:30	03/09/21 23:59	10
d5-NEtFOSAA	88	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C2-PFDoDA	90	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C3 PFHxS	89	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C5 PFHxA	82	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C6 PFDA	88	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C7 PFUnA	83	50 - 150	03/08/21 08:30	03/09/21 23:59	10
13C9 PFNA	74	50 - 150	03/08/21 08:30	03/09/21 23:59	10

Method: EPA 537(Mod) - PFA	S for QSM 5.3, Table B	-15 - DL					
Analyte	Result Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	12000 D	220	110	110	ng/L	03/10/21 00:10	100
Perfluorooctanesulfonic acid	19000 🗗 DJ-	220	110	110	ng/L	03/10/21 00:10	100
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
13C8 PFOS	189 *5+	50 - 150			03/08/21 08:30	03/10/21 00:10	100
13C3 PFHxS	86	50 - 150			03/08/21 08:30	03/10/21 00:10	100

Client Sample ID: APG-FB-01-030321

Lab Sample ID: 410-31280-9 Date Collected: 03/03/21 15:00 Date Received: 03/04/21 16:47

Method: EPA 537(Mod) - PFAS	for QSM 5.3, Table B-15					
Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5	4.3	3.5	3.5 ng/L	03/09/21 11:50	1
8:2 Fluorotelomer sulfonic acid	<1.7	2.6	1.7	1.7 ng/L	03/09/21 11:50	1
NEtFOSAA	<0.87	2.6	0.87	0.87 ng/L	03/09/21 11:50	1
NMeFOSAA	<1.0	1.7	1.0	1.0 ng/L	03/09/21 11:50	1

Eurofins Lancaster Laboratories Env, LLC

Matrix: Water

Job ID: 410-31280-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-FB-01-030321

Date Collected: 03/03/21 15:00 Date Received: 03/04/21 16:47

Client: ARCADIS U.S., Inc.

Lab Sample ID: 410-31280-9

Matrix: Water

Analyte	Result	Qualifier	L	.OQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorobutanesulfonic acid	<0.87			1.7	0.87	0.87	ng/L	_	03/09/21 11:50	1
Perfluorobutanoic acid	<3.5			4.3	3.5	3.5	ng/L		03/09/21 11:50	1
Perfluorodecanoic acid	<0.87			1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Perfluorododecanoic acid	<0.87			1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Perfluoroheptanoic acid	<0.87			1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Perfluorohexanesulfonic acid	<0.87			1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Perfluorohexanoic acid	<0.87			1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Perfluorononanoic acid	<0.87			1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Perfluorooctanesulfonic acid	<0.87	N		1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Perfluorooctanoic acid	<0.87			1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Perfluoropentanoic acid	<0.87	Μ		1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Perfluorotetradecanoic acid	<0.87			1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Perfluorotridecanoic acid	<0.87			1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Perfluoroundecanoic acid	<0.87			1.7	0.87	0.87	ng/L		03/09/21 11:50	1
Isotope Dilution	%Recovery Qu	ualifier	Limits				Prepared	1	Analyzed	Dil Fac

			· · · · · · · · · · · · · · · · · · ·		
Isotope Dilution	%Recovery Qual	lifier Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	112	50 - 150	03/08/21 08:30	03/09/21 11:50	1
M2-8:2 FTS	99	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C2 PFTeDA	85	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C3 PFBS	93	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C4 PFBA	89	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C4 PFHpA	97	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C5 PFPeA	95	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C8 PFOA	98	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C8 PFOS	98	50 - 150	03/08/21 08:30	03/09/21 11:50	1
d3-NMeFOSAA	93	50 - 150	03/08/21 08:30	03/09/21 11:50	1
d5-NEtFOSAA	87	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C2-PFDoDA	95	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C3 PFHxS	98	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C5 PFHxA	93	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C6 PFDA	91	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C7 PFUnA	84	50 - 150	03/08/21 08:30	03/09/21 11:50	1
13C9 PFNA	95	50 - 150	03/08/21 08:30	03/09/21 11:50	1

Client Sample ID: APG-EB-01-030321

Date Collected: 03/03/21 15:15 Date Received: 03/04/21 16:47

Lab Sample ID: 410-31280-10

Matrix: Water

Analyte	Result Qual	ifier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5	4.3	3.5	3.5	ng/L		03/09/21 12:00	1
8:2 Fluorotelomer sulfonic acid	<1.7	2.6	1.7	1.7	ng/L		03/09/21 12:00	1
NEtFOSAA	<0.86	2.6	0.86	0.86	ng/L		03/09/21 12:00	1
NMeFOSAA	<1.0	1.7	1.0	1.0	ng/L		03/09/21 12:00	1
Perfluorobutanesulfonic acid	<0.86	1.7	0.86	0.86	ng/L		03/09/21 12:00	1
Perfluorobutanoic acid	<3.5	4.3	3.5	3.5	ng/L		03/09/21 12:00	1
Perfluorodecanoic acid	<0.86	1.7	0.86	0.86	ng/L		03/09/21 12:00	1
Perfluorododecanoic acid	<0.86	1.7	0.86	0.86	ng/L		03/09/21 12:00	1
Perfluoroheptanoic acid	<0.86	1.7	0.86	0.86	ng/L		03/09/21 12:00	1
Perfluorohexanesulfonic acid	<0.86	1.7	0.86	0.86	ng/L		03/09/21 12:00	1
Perfluorohexanoic acid	<0.86	1.7	0.86	0.86	ng/L		03/09/21 12:00	1

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Client Sample ID: APG-EB-01-030321

Date Collected: 03/03/21 15:15 Date Received: 03/04/21 16:47 Lab Sample ID: 410-31280-10

Matrix: Water

Method: EPA 537(Mod) - PFAS for QSM 5.3,	Table B-15	(Continued)
A a b . d .	B 14	0	1.00

Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
<0.86		1.7	0.86	0.86	ng/L		03/09/21 12:00	1
<0.86	M	1.7	0.86	0.86	ng/L		03/09/21 12:00	1
<0.86	N	1.7	0.86	0.86	ng/L		03/09/21 12:00	1
<0.86	1	1.7	0.86	0.86	ng/L		03/09/21 12:00	1
<0.86		1.7	0.86	0.86	ng/L		03/09/21 12:00	1
<0.86		1.7	0.86	0.86	ng/L		03/09/21 12:00	1
<0.86		1.7	0.86	0.86	ng/L		03/09/21 12:00	1
	<0.86 <0.86 <0.86 <0.86 <0.86	<0.86 M <0.86 M <0.86 <0.86	<0.86 1.7 <0.86 M 1.7 <0.86 M 1.7 <0.86 1.7 <0.86 1.7 <0.86 1.7 <0.86 1.7	<0.86	<0.86	<0.86	<0.86	<0.86 1.7 0.86 0.86 ng/L 03/09/21 12:00 <0.86

		-	 		•
Isotope Dilution	%Recovery	Qualifier Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	100	50 - 150	03/08/21 08:30	03/09/21 12:00	1
M2-8:2 FTS	93	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C2 PFTeDA	84	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C3 PFBS	88	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C4 PFBA	79	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C4 PFHpA	84	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C5 PFPeA	81	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C8 PFOA	86	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C8 PFOS	91	50 - 150	03/08/21 08:30	03/09/21 12:00	1
d3-NMeFOSAA	85	50 - 150	03/08/21 08:30	03/09/21 12:00	1
d5-NEtFOSAA	83	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C2-PFDoDA	91	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C3 PFHxS	93	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C5 PFHxA	79	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C6 PFDA	81	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C7 PFUnA	82	50 - 150	03/08/21 08:30	03/09/21 12:00	1
13C9 PFNA	84	50 - 150	03/08/21 08:30	03/09/21 12:00	1

Client Sample ID: APG-SB-01-030321

Date Collected: 03/03/21 15:30 Date Received: 03/04/21 16:47 Lab Sample ID: 410-31280-11

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5		4.4	3.5	3.5	ng/L		03/09/21 12:11	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.6	1.7	1.7	ng/L		03/09/21 12:11	1
NEtFOSAA	<0.87		2.6	0.87	0.87	ng/L		03/09/21 12:11	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L		03/09/21 12:11	1
Perfluorobutanesulfonic acid	<0.87		1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluorobutanoic acid	<3.5		4.4	3.5	3.5	ng/L		03/09/21 12:11	1
Perfluorodecanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluorododecanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluoroheptanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluorohexanesulfonic acid	<0.87		1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluorohexanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluorononanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluorooctanesulfonic acid	<0.87	M	1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluorooctanoic acid	<0.87	M	1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluoropentanoic acid	<0.87	\	1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluorotetradecanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluorotridecanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/09/21 12:11	1
Perfluoroundecanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/09/21 12:11	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31280-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-SB-01-030321

Date Collected: 03/03/21 15:30 Date Received: 03/04/21 16:47 Lab Sample ID: 410-31280-11

Matrix: Water

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	114	50 - 150	03/08/21 08:30	03/09/21 12:11	1
M2-8:2 FTS	94	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C2 PFTeDA	78	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C3 PFBS	89	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C4 PFBA	94	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C4 PFHpA	97	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C5 PFPeA	99	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C8 PFOA	97	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C8 PFOS	93	50 - 150	03/08/21 08:30	03/09/21 12:11	1
d3-NMeFOSAA	94	50 - 150	03/08/21 08:30	03/09/21 12:11	1
d5-NEtFOSAA	93	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C2-PFDoDA	89	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C3 PFHxS	94	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C5 PFHxA	96	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C6 PFDA	91	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C7 PFUnA	87	50 - 150	03/08/21 08:30	03/09/21 12:11	1
13C9 PFNA	93	50 - 150	03/08/21 08:30	03/09/21 12:11	1

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Aberdeen Proving Ground - Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDG # 410-31453-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report #41156R

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-31453-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

Occupied ID	11.15	B.B. advides	Sample Collection	D	Aı	nalysis	
Sample ID	Lab ID	Matrix	Date	Parent Sample	PFAS	тос	рН
APG-ABR6-1-GW-030521	410-31453-1	Water	3/5/2021		Х		
APG-ABR6-1-SO-(0-2)-030521	410-31453-2	Soil	3/5/2021		Х	Х	Х
APG-ABR6-2-SO-(0-2)-030521	410-31453-3	Soil	3/5/2021		X		
APG-ABR7-1-SO-(0-2)-030521	410-31453-4	Soil	3/5/2021		Х	Х	Х
APG-ABR7-1-GW-030521	410-31453-5	Water	3/5/2021		Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-ABR6-1-GW-030521.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was not performed on sample location associated with this SDG.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Rep	orted		rmance ptable	Not
Items Reviewed	No	Yes	No	Yes	Required
Sample receipt condition		Х		Х	
2. Requested analyses and sample results		Х		Х	
Master tracking list		Х		Х	
4. Methods of analysis		Х		Х	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		Х	
11. Narrative summary of QA or sample problems provided		Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

1. The chain of custody states that 2 containers were submitted, whereas the laboratory received 3 containers for the following samples.

Lab ID	Sample ID
410-31453-1	APG-ABR6-1-GW-030521
410-31453-5	APG-ABR7-1-GW-030521

The container label for the sample APG-ABR7-1-GW-030521 did not match the information on the COC.
 The container labels list 03/05/21 13:45, while the COC does not list a time. Hence, the sample collection time considered from the container label.

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
ADO ADDO 4 00 (0.0) 000504	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 20%
APG-ABR6-1-SO-(0-2)-030521	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 20%
	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
APG-ABR6-2-SO-(0-2)-030521	d5-NEtFOSAA	NEtFOSAA	AC	< 50% but > 20%
	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
APG-ABR7-1-SO-(0-2)-030521	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 50% but > 20%

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
- 450%	Non-detect	No Action
> 150%	Detect	J-
. 500/ 1 . 1 . 600/	Non-detect	UJ
< 50% but > 20%	Detect	J+
< 20%	Non-detect	UX

Control Limit	Sample Result	Qualification
	Detect	Х

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be ≤ 30%.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

The MS/MSD analysis was not performed on sample location associated with this SDG.

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

A field duplicate was not collected for a sample location associated with this SDG.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

All identified compounds met method criteria.

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compound	Original Analysis	Diluted Analysis	Reported Analysis
APG-ABR6-1-GW-030521	Perfluorooctanesulfonic acid		14000	14000 D

Note: the lab didn't report the original analysis; only the diluted result.

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification
Diluted sample result within calibration range	D

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3		oorted	Performance Acceptable		Not Required
	No	Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC	MS/MS)			
Stage 2 Validation					
Holding times		X		Х	
Reporting limits (units)		Х		Х	
Blanks			·		
A. Method blanks		X		Х	
B. Equipment blanks	Х				Х
C. Field blanks / Source blanks	Х				Х
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate(LCSD) %R		Х		Х	
LCS/LCSD Precision (RPD)		Х		Х	
Matrix Spike (MS) %R	Х				Х
Matrix Spike Duplicate(MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				Х
Field Duplicate (RPD)	Х				Х
Extracted Internal Standard %R		Х	Х		
Injection Internal Standard %R		Х		Х	
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation		ı			
Instrument tune and performance check		Х		Х	
Initial calibration %RSDs		Х		Х	
Continuing calibration %Ds		Х		Х	
Instrument sensitivity check		Х		Х	
lon transitions used		Х		Х	
Compound identification and quantitation	1	ı	1	1	1
A. Reconstructed ion chromatograms		Х		Х	
B. Quantitation Reports		X		Х	
C. RT of sample compounds within the established RT windows		Х		Х	

PFAS: 537M/DoD QSM 5.3	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
D. Ion Ratio %R		Х		Х	
E. Transcription/calculations acceptable		Х		Х	
F. Reporting limits adjusted to reflect sample dilutions		х		Х	

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Analyte considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria
APG-ABR6-1-SO-(0-2)-030521	3 days from collection; 3 days	< 24 hours of receipt at
APG-ABR7-1-SO-(0-2)-030521	from receipt	the laboratory

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

	Qualification		
Criteria	Detected Analytes		
Analysis completed past the holding time	J		

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analytes	Standard Recovery
APG-ABR6-1-SO-(0-2)-030521 APG-ABR7-1-SO-(0-2)-030521	CCV	TOC	130%

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Control Limit	Sample Result	Qualification
	75% 4- 00%	Non-detect	UJ
TOC	75% to 89%	Detect	J-
	4440/ 1 4050/	Non-detect	No Action
	111% to 125%	Detect	J+
	Gross Exceedance >125%	Non-detect	No Action
	Gloss exceedance > 125%	Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

A MS analysis was not performed for TOC.

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

A laboratory duplicate analysis was not performed on sample location associated with this SDG.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within ± 0.05 S.U. of the true value.

All LCS recoveries were within control limits.

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Reported		Performance Acceptable		Not
	No	Yes	No	Yes	Required
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks	Х				Х
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х
LCS/LCSD Precision (RPD)	Х				Х
Matrix Spike (MS) %R	Х				Х
Matrix Spike Duplicate (MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				Х
Lab Duplicate (RPD)	Х				Х
Field Duplicate (RPD)	Х				Х
Dilution Factor		X		Х	
Moisture Content		X		Х	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		Х	
Continuing calibration %R		Х	Х		
Raw Data		Х		Х	
Transcription/calculations acceptable		Х		Х	

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE: R n sm

DATE: April 30, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 7, 2021

Stage 3 / 4 **PFAS Calibration Standards**

SDG #: 410-31453-1 Date: 4/29/2021 Lab: Eurofins Lancaster Page: 1 Project:

Aberdeen Proving Ground SPR Validated by:

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 29347

PFBA 3/05/2021 Calibration

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				Calculated		Calc		Calculated	Reported
Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D
76737	4041718	10	0.018986	0.9493117	0.8751	0.216961	0.2	8.480	8.5
176646	4038069	10	0.043745	0.8749033	0.8751	0.499888	0.5	-0.022	0
793768	4082481	10	0.194433	0.9721637	0.8751	2.221835	2	11.092	11.1
2677850	3885912	10	0.689118	0.8613969	0.8751	7.874729	8	-1.566	-1.6
6830316	3935411	10	1.735604	0.8678021	0.8751	19.83321	20	-0.834	-0.8
16406435	3931630	10	4.172935	0.8345869	0.8751	47.68523	50	-4.630	-4.6
28464329	3717120	10	7.65763	0.765763	0.8751	87.50577	100	-12.494	-12.5
	Std Area 76737 176646 793768 2677850 6830316 16406435	Std Area EIS Area 76737 4041718 176646 4038069 793768 4082481 2677850 3885912 6830316 3935411 16406435 3931630	Std Area EIS Area EIS Conc 76737 4041718 10 176646 4038069 10 793768 4082481 10 2677850 3885912 10 6830316 3935411 10 16406435 3931630 10	Std Area EIS Area EIS Conc Area Ratio 76737 4041718 10 0.018986 176646 4038069 10 0.043745 793768 4082481 10 0.194433 2677850 3885912 10 0.689118 6830316 3935411 10 1.735604 16406435 3931630 10 4.172935	Std Area EIS Area EIS Conc Area Ratio RF 76737 4041718 10 0.018986 0.9493117 176646 4038069 10 0.043745 0.8749033 793768 4082481 10 0.194433 0.9721637 2677850 3885912 10 0.689118 0.8613969 6830316 3935411 10 1.735604 0.8678021 16406435 3931630 10 4.172935 0.8345869	Std Area EIS Area EIS Conc Area Ratio RF Avg RF 76737 4041718 10 0.018986 0.9493117 0.8751 176646 4038069 10 0.043745 0.8749033 0.8751 793768 4082481 10 0.194433 0.9721637 0.8751 2677850 3885912 10 0.689118 0.8613969 0.8751 6830316 3935411 10 1.735604 0.8678021 0.8751 16406435 3931630 10 4.172935 0.8345869 0.8751	Std Area EIS Area EIS Conc Area Ratio RF Calculated Avg RF Awg RF Amount 76737 4041718 10 0.018986 0.9493117 0.8751 0.216961 176646 4038069 10 0.043745 0.8749033 0.8751 0.499888 793768 4082481 10 0.194433 0.9721637 0.8751 2.221835 2677850 3885912 10 0.689118 0.8613969 0.8751 7.874729 6830316 3935411 10 1.735604 0.8678021 0.8751 19.83321 16406435 3931630 10 4.172935 0.8345869 0.8751 47.68523	Std Area EIS Area EIS Conc Area Ratio RF Avg RF Amount Tvalue 76737 4041718 10 0.018986 0.9493117 0.8751 0.216961 0.2 176646 4038069 10 0.043745 0.8749033 0.8751 0.499888 0.5 793768 4082481 10 0.194433 0.9721637 0.8751 2.221835 2 2677850 3885912 10 0.689118 0.8613969 0.8751 7.874729 8 6830316 3935411 10 1.735604 0.8678021 0.8751 19.83321 20 16406435 3931630 10 4.172935 0.8345869 0.8751 47.68523 50	Std Area EIS Area EIS Conc Area Ratio RF Avg RF Amount Amount Amount Amount Tvalue Calculated % D 76737 4041718 10 0.018986 0.9493117 0.8751 0.216961 0.2 8.480 176646 4038069 10 0.043745 0.8749033 0.8751 0.499888 0.5 -0.022 793768 4082481 10 0.194433 0.9721637 0.8751 2.221835 2 11.092 2677850 3885912 10 0.689118 0.8613969 0.8751 7.874729 8 -1.566 6830316 3935411 10 1.735604 0.8678021 0.8751 19.83321 20 -0.834 16406435 3931630 10 4.172935 0.8345869 0.8751 47.68523 50 -4.630

Match Match Match Match Match Match

Match

Avg RF = 0.8751325 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-31453-1Date:4/29/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-100111/9 3/05/2021 13:32

Page 973 - 978 of SDG 410-31453-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	637595	3676346	10	0.1734	0.8751	1.982	2	-0.91	-0.9
Perfluoropentanoic acid	619100	3259175	10	0.1900	1.0370	1.832	2	-8.41	-8.5
Perfluorobutanesulfonic acid	739077	3444531	9.36	0.2146	1.0960	1.832	2	3.53	3.6
Perfluorohexanoic acid	711372	3890288	10	0.1829	0.9115	2.006	2	0.31	0.3
Perfluoroheptanoic acid	818242	3882972	10	0.2107	1.0960	1.923	2	-3.87	-3.9
Perfluorohexanesulfonic acid	674978	3439888	9.46	0.1962	1.0510	1.766	2	-6.55	-6.6
Perfluorooctanesulfonic acid	736490	3830413	9.57	0.1923	1.1010	1.671	2	-12.50	-12.7

Match Match Match Match Match

Match Match

CCV 410-100974/8 3/9/2021 10:15

Page 1003 - 1008 of SDG 410-31453-1

	Analyte					Calc		Calculated	Reported	
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D	
Perfluorobutanoic acid	756275	3898594	10	0.1940	0.8751	2.217	2.0	10.84	10.8	Mat
Perfluoropentanoic acid	817389	3617827	10	0.2259	1.0370	2.179	2.0	8.94	8.9	Mat
Perfluorobutanesulfonic acid	969877	4387418	9.36	0.2211	1.0960	1.888	1.8	6.66	6.6	Mat
Perfluorohexanoic acid	846335	4114386	10	0.2057	0.9115	2.257	2.0	12.84	12.8	Mat
Perfluoroheptanoic acid	1048894	4143912	10	0.2531	1.0960	2.309	2.0	15.47	15.5	Mat
Perfluorohexanesulfonic acid	837045	3589156	9.46	0.2332	1.0510	2.099	1.8	15.34	15.1	Mat
Perfluorooctanesulfonic acid	932826	4172967	9.57	0.2235	1.1010	1.943	1.9	5.03	4.9	Mat

Match Match Match Match Match Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 $\begin{array}{c|cccc} \text{SDG \#} & 410\text{-}31453\text{-}1 & \text{Date:} & 4/29/2021 \\ \text{Lab:} & & \text{Eurofins Lancaster} & \text{Page:} & 3 \\ \hline \text{Project:} & \text{Aberdeen Proving Ground} & \text{Validated by:} & \text{SPR} \\ \end{array}$

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-100543/2-A

Page 1303 - 1308 of SDG 410-31453-1

Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported	1
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	2222467	3921104	10	0.566796	0.8751	25.91	25.600	101.20	101	Match
Perfluoropentanoic acid	2293048	3658313	10	0.626805	1.0370	24.18	25.600	94.44	94	Match
Perfluorobutanesulfonic acid	2867331	4105204	9.36	0.698462	1.0960	23.86	22.600	105.57	105	Match
Perfluorohexanoic acid	2448931	4262973	10	0.574466	0.9115	25.21	25.600	98.48	98	Match
Perfluoroheptanoic acid	2940929	4335308	10	0.678367	1.0960	24.76	25.600	96.71	97	Match
Perfluorohexanesulfonic acid	2504221	3827012	9.46	0.654354	1.0510	23.56	24.200	97.35	97	Match
Perfluorooctanesulfonic acid	2959064	4334695	9.57	0.682646	1.1010	23.73	24.500	96.88	97	Match

LCSD 410-100543/3-A

Page 1345 - 1350 of SDG 410-31453-1

Sample volume = 250 ml

Final volume = 1ml

						Calculated		Calculated	Reported	
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	1941014	3506508	10	0.553546	0.8751	25.30	25.600	98.84	99	Match
Perfluoropentanoic acid	1999943	3254331	10	0.614548	1.0370	23.70	25.600	92.60	93	Match
Perfluorobutanesulfonic acid	2645538	3938923	9.36	0.67164	1.0960	22.94	22.600	101.52	101	Match
Perfluorohexanoic acid	2183796	3940485	10	0.554195	0.9115	24.32	25.600	95.00	95	Match
Perfluoroheptanoic acid	2584954	3903339	10	0.662242	1.0960	24.17	25.600	94.41	94	Match
Perfluorohexanesulfonic acid	2273489	3700433	9.46	0.614385	1.0510	22.12	24.200	91.41	91	Match
Perfluorooctanesulfonic acid	2721270	4213285	9.57	0.645878	1.1010	22.46	24.500	91.66	92	Match

Calculated Amount ng/L = ((Peak area ratio/Avg RF) x EIS concentration)/Sample volume)*1000

				Reported	
	LCS Calc	LCSD Calc	LCS/LCSD	LCS/LCSD	
Compounds	Amount	Amount	Calc RPD	RPD	
Perfluorobutanoic acid	25.91	25.30	2.4	2	Match
Perfluoropentanoic acid	24.18	23.70	2.0	2	Match
Perfluorobutanesulfonic acid	23.86	22.94	3.9	4	Match
Perfluorohexanoic acid	25.21	24.32	3.6	4	Match
Perfluoroheptanoic acid	24.76	24.17	2.4	2	Match
Perfluorohexanesulfonic acid	23.56	22.12	6.3	6	Match
Perfluorooctanesulfonic acid	23.73	22.46	5.5	6	Match

Stage 3 / 4 PFAS Sample Concentration

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-ABR6-1-GW-030521 Lab ID: 410-31453-1 Page 579 - 583 of SDG 410-31453-1

						Calculated	Final		Final	Reported]
						Amount	Volume	Sample	Calculated	Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	1626876	3623332	10	0.449	0.8751	5.13	1	221.3	23.2	23	Matc
Perfluoropentanoic acid	4572093	3577150	10	1.278138	1.0370	12.33	1	221.3	55.7	56	Matc
Perfluorobutanesulfonic acid	818229	4115382	9.36	0.198822	1.0960	1.70	1	221.3	7.7	7.7	Matc
Perfluorohexanoic acid	6615964	3985073	10	1.660186	0.9115	18.21	1	221.3	82.3	82	Matc
Perfluoroheptanoic acid	3085740	4065371	10	0.75903	1.0960	6.93	1	221.3	31.3	31	Matc
Perfluorohexanesulfonic acid	17226164	3730801	9.46	4.617283	1.0510	41.56	1	221.3	187.8	190	Matc
Perfluorooctanesulfonic acid	16629222	45293	9.57	367.1477	1.1010	3191.28	1	221.3	14420.6	14000	Matc

Calculated amount $ng/L = (Peak area \ ratio/Avg \ RF) \ x \ DF \ x \ EIS \ conc \ ng/L$ Final Calculated amount $ng/L = ((calculated \ ng/L \ x \ Final \ Volume \ mls) \ / \ sample \ volume \ mls)$ Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

 SDG #:
 410-31453-1
 Date:
 4/29/2021

 Lab:
 Eurofins Lancaster
 Page:
 5

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-ABR6-1-GW-030521 Lab ID: 410-31453-1

EIS 13C5 PFPeA

REPORTED EIS %R 102

%R = 100 * EIS ConcentrationEIS TV

EIS Concentration 10.2 ng/ml Page 581 of 410-31453-1

EIS TV 10.0

%R 102.0 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental Analysis Req

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Lancaster Laboratories

410-31453 Chain of Custody

Pg 1 of

COC #616529

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APG PFAS SI						ĮĔ	ng rgr		4									H=HCI	T=T	hiosulfate
Project Manager:	P.O. #						ତ ଉ		G			3						N=HNO ₃		NaOH
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Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • FOR HELP COMPLETING FORM CHECK OUT https://www.eurofinsus.com/coc The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client.

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-31453-1

Project/Site: APG PFAS S1

Qualifiers

1	\sim	N/A	C
ш	U	IV	J

Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
D	The reported value is from a dilution.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
M	Manual integrated compound.

Glossary	
Abbreviation	These commonly used abbreviations may or may not be present in this report.
a	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)

MDL Method Detection Limit ML Minimum Level (Dioxin) MPN Most Probable Number MQL Method Quantitation Limit

NC Not Calculated

ND Not Detected at the reporting limit (or MDL or EDL if shown)

NEG Negative / Absent POS Positive / Present

PQL **Practical Quantitation Limit**

PRES Presumptive QC **Quality Control**

Relative Error Ratio (Radiochemistry) RER

RL Reporting Limit or Requested Limit (Radiochemistry)

RPD Relative Percent Difference, a measure of the relative difference between two points

TEF Toxicity Equivalent Factor (Dioxin) **TEQ** Toxicity Equivalent Quotient (Dioxin)

TNTC Too Numerous To Count

Page 4 of 45

Job ID: 410-31453-1

Client: ARCADIS U.S., Inc.

Project/Site: APG PFAS S1

Client Sample ID: APG-ABR6-1-GW-030521

Date Collected: 03/05/21 09:30 Date Received: 03/05/21 19:28

Lab Sample ID: 410-31453-1

Matrix: Water

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	250			5.6	4.5	4.5	ng/L	03/09/21 12:22	1
8:2 Fluorotelomer sulfonic acid	39			3.4	2.3	2.3	ng/L	03/09/21 12:22	1
NEtFOSAA	<1.1			3.4	1.1	1.1	ng/L	03/09/21 12:22	1
NMeFOSAA	<1.4			2.3	1.4	1.4	ng/L	03/09/21 12:22	1
Perfluorobutanesulfonic acid	7.7			2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Perfluorobutanoic acid	23			5.6	4.5	4.5	ng/L	03/09/21 12:22	1
Perfluorodecanoic acid	<1.1	M		2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Perfluorododecanoic acid	<1.1	1		2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Perfluoroheptanoic acid	31			2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Perfluorohexanesulfonic acid	190			2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Perfluorohexanoic acid	82			2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Perfluorononanoic acid	45			2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Perfluorooctanoic acid	110	M		2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Perfluoropentanoic acid	56			2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Perfluorotetradecanoic acid	<1.1			2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Perfluorotridecanoic acid	<1.1			2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Perfluoroundecanoic acid	<1.1			2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac

Perfluoroundecanoic acid	<1	1.1	2.3	1.1	1.1	ng/L	03/09/21 12:22	1
Isotope Dilution	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	110		50 - 150			03/08/21 08:30	03/09/21 12:22	1
M2-8:2 FTS	101		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C2 PFTeDA	72		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C3 PFBS	99		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C4 PFBA	92		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C4 PFHpA	98		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C5 PFPeA	102		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C8 PFOA	98		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C8 PFOS	45	*5-	50 - 150			03/08/21 08:30	03/09/21 12:22	1
d3-NMeFOSAA	92		50 - 150			03/08/21 08:30	03/09/21 12:22	1
d5-NEtFOSAA	84		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C2-PFDoDA	93		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C3 PFHxS	101		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C5 PFHxA	95		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C6 PFDA	98		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C7 PFUnA	88		50 - 150			03/08/21 08:30	03/09/21 12:22	1
13C9 PFNA	52		50 - 150			03/08/21 08:30	03/09/21 12:22	1

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - DL										
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac		
Perfluorooctanesulfonic acid	14000	D	230	110	110	ng/L	03/10/21 12:28	100		
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac		
13C8 PFOS	108		50 - 150			03/08/21 08:30	03/10/21 12:28	100		

Client Sample ID: APG-ABR6-1-SO-(0-2)-030521 Lab Sample ID: 410-31453-2

Date Received: 03/05/21 19:28

Date Collected: 03/05/21 09:15 **Matrix: Solid** Percent Solids: 74.7

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0020		0.0025	0.0020	0.0020	mg/Kg	₩	03/08/21 21:28	1
8:2 Fluorotelomer sulfonic acid	<0.0020		0.0037	0.0020	0.0020	mg/Kg	≎	03/08/21 21:28	1

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Client: ARCADIS U.S., Inc. Job ID: 410-31453-1 Project/Site: APG PFAS S1

Client Sample ID: APG-ABR6-1-SO-(0-2)-030521

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Lab Sample ID: 410-31453-2 Date Collected: 03/05/21 09:15 **Matrix: Solid**

Date Received: 03/05/21 19:28 Percent Solids: 74.7

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit E	Analyzed	Dil Fac
NEtFOSAA	<0.00049	UJ	0.0025	0.00049	0.00049	mg/Kg	03/08/21 21:28	1
NMeFOSAA	<0.00049	UJ	0.0025	0.00049	0.00049	mg/Kg ☆	03/08/21 21:28	1
Perfluorobutanesulfonic acid	<0.0020		0.0025	0.0020	0.0020	mg/Kg ☆	03/08/21 21:28	1
Perfluorobutanoic acid	<0.0020		0.0025	0.0020	0.0020	mg/Kg ∷	03/08/21 21:28	1
Perfluorodecanoic acid	0.0020		0.00074	0.00049	0.00049	mg/Kg ☆	03/08/21 21:28	1
Perfluorododecanoic acid	< 0.00049		0.00074	0.00049	0.00049	mg/Kg ∷	03/08/21 21:28	1
Perfluoroheptanoic acid	0.0019		0.00074	0.00049	0.00049	mg/Kg ∷	03/08/21 21:28	1
Perfluorohexanesulfonic acid	0.010		0.00074	0.00049	0.00049	mg/Kg ☆	03/08/21 21:28	1
Perfluorohexanoic acid	0.0013		0.00074	0.00049	0.00049	mg/Kg ∷	03/08/21 21:28	1
Perfluorononanoic acid	0.0075		0.00074	0.00049	0.00049	mg/Kg ☆	03/08/21 21:28	1
Perfluorooctanesulfonic acid	0.061		0.00074	0.00049	0.00049	mg/Kg ☆	03/08/21 21:28	1
Perfluorooctanoic acid	0.0060	M	0.00074	0.00049	0.00049	mg/Kg ∷	03/08/21 21:28	1
Perfluoropentanoic acid	0.0012	M	0.00074	0.00049	0.00049	mg/Kg ∷	03/08/21 21:28	1
Perfluorotetradecanoic acid	<0.00049		0.00074	0.00049	0.00049	mg/Kg ☆	03/08/21 21:28	1
Perfluorotridecanoic acid	< 0.00049		0.00074	0.00049	0.00049	mg/Kg ∷	03/08/21 21:28	1
Perfluoroundecanoic acid	0.00051	J	0.00074	0.00049	0.00049	mg/Kg ∜	03/08/21 21:28	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	93		50 - 150			03/08/21 09:53	03/08/21 21:28	1
M2-8:2 FTS	100		50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
13C2 PFTeDA	81		50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
13C3 PFBS	78		50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
13C4 PFBA	67		50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
13C4 PFHpA	75		50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
13C5 PFPeA	74		50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
13C8 PFOA	78		50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
13C8 PFOS	87		50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
d3-NMeFOSAA	20 *5	- -	50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
d5-NEtFOSAA	26 *5	-	50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
13C2-PFDoDA	82		50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
13C3 PFHxS	86		50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
13C5 PFHxA	75		50 - 150			03/08/21 09:53	3 03/08/21 21:28	1
4000 BED 4						03/08/21 09:53	3 03/08/21 21:28	1
13C6 PFDA	84		50 - 150			00/00/21 00.00	05/00/21 21.20	
13C6 PFDA 13C7 PFUnA	84 89		50 - 150 50 - 150				3 03/08/21 21:28	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0021		0.0026	0.0021	0.0021	mg/Kg	☼	03/10/21 13:21	1
8:2 Fluorotelomer sulfonic acid	<0.0021		0.0039	0.0021	0.0021	mg/Kg	☼	03/10/21 13:21	1
NEtFOSAA	<0.00053		0.0026	0.00053	0.00053	mg/Kg	☼	03/10/21 13:21	1
NMeFOSAA	<0.00053		0.0026	0.00053	0.00053	mg/Kg	☼	03/10/21 13:21	1
Perfluorobutanesulfonic acid	<0.0021		0.0026	0.0021	0.0021	mg/Kg	☼	03/10/21 13:21	1
Perfluorobutanoic acid	<0.0021	М	0.0026	0.0021	0.0021	mg/Kg	☼	03/10/21 13:21	1
Perfluorodecanoic acid	0.0018		0.00079	0.00053	0.00053	mg/Kg	☼	03/10/21 13:21	1
Perfluorododecanoic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/10/21 13:21	1
Perfluoroheptanoic acid	0.0024		0.00079	0.00053	0.00053	mg/Kg	☼	03/10/21 13:21	1
Perfluorohexanesulfonic acid	0.015		0.00079	0.00053	0.00053	mg/Kg	Ç	03/10/21 13:21	1
Perfluorohexanoic acid	0.0016		0.00079	0.00053	0.00053	mg/Kg	☼	03/10/21 13.21	1
Perfluorononanoic acid	0.0080		0.00079	0.00053	0.00053	mg/Kg	₽	03/10/21 13:21	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31453-1

Project/Site: APG PFAS S1

Client Sample ID: APG-ABR6-1-SO-(0-2)-030521

Lab Sample ID: 410-31453-2 Date Collected: 03/05/21 09:15 **Matrix: Solid** Date Received: 03/05/21 19:28 Percent Solids: 74.7

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Rerfluorooctanesulfonic acid	0.063	0.00079	0.00053	0.00053	mg/Kg	-	03/10/21 13:21	1
Perfluorooctanoic acid	0.0074	0.00079	0.00053	0.00053	mg/Kg	₽	03/10/21 13:21	1
Perfluoropentanoic acid	0.0013	0.00079	0.00053	0.00053	mg/Kg	☆	03/10/21 13:21	1
Perfluorotetradecanoic acid	<0.00053	0.00079	0.00053	0.00053	mg/Kg	₽	03/10/21 13:21	1
Perfluorotridecanoic acid	<0.00053	0.00079	0.00053	0.00053	mg/Kg	☆	03/10/21 13:21	1
Perfluoroundecanoic acid	<0.00053	0.00079	0.00053	0.00053	mg/Kg	₩	03/10/21 13:21	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepa	red	Analyzed	Dil Fac
M2-6:2 FTS	71	50 - 150			03/09/21	22:10	03/10/21 13:21	1
M2-8:2 FTS	69	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C2 PFTeDA	76	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C3 PFBS	88	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C4 PFBA	83	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C4 PFHpA	86	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C5 PFPeA	85	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C8 PFOA	87	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C8 PFOS	93	50 - 150			03/09/21	22:10	03/10/21 13:21	1
d3-NMeFOSAA	14 *5-	50 - 150			03/09/21	22:10	03/10/21 13:21	1
d5-NEtFOSAA	<i>15 *5-</i>	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C2-PFDoDA	85	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C3 PFHxS	93	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C5 PFHxA	86	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C6 PFDA	83	50 - 150			03/09/21	22:10	03/10/21 13:21	1
13C7 PFUnA	81	50 - 150			03/09/21	22:10	03/10/21 13:21	1
_13C9 PFNA	82	50 - 150			03/09/21	22:10	03/10/21 13:21	*
General Chemistry								
Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac

General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	5190	J+	2420	1620	1620	mg/Kg	₽	03/13/21 16:22	6.03
Percent Moisture	25.3		1.0		1.0	%		03/08/21 20:10	1
Percent Solids	74.7		1.0		1.0	%		03/08/21 20:10	1

General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	6.9		0.01	0.01	0.01	S.U.	_	03/08/21 15:05	1
Temperature	20.3		0.01	0.01	0.01	Degrees C		03/08/21 15:05	1

Method: D422 - Grain Size									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	2.3		1.0	1.0	1.0	%		03/10/21 19:00	1
Sand	35.9		1.0	1.0	1.0	%		03/10/21 19:00	1
Silt	48.8		1.0	1.0	1.0	%		03/10/21 19:00	1
Clay	13.0		1.0	1.0	1.0	%		03/10/21 19:00	1
75 mm	100.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
19 mm	100.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
4.75 mm	97.8		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
3.35 mm	96.3		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
2.36 mm	94.7		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
1.18 mm	92.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.6 mm	87.2		1.0	1.0	1.0	% Passing		03/10/21 19:00	1

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Job ID: 410-31453-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-ABR6-1-SO-(0-2)-030521

Lab Sample ID: 410-31453-2 Date Collected: 03/05/21 09:15 **Matrix: Solid** Date Received: 03/05/21 19:28 Percent Solids: 74.7

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
0.3 mm	73.3		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.15 mm	64.9		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.075 mm	61.8		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.064 mm	58.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.05 mm	50.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.02 mm	30.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.005 mm	13.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.002 mm	9.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.001 mm	7.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1

Client Sample ID: APG-ABR6-2-SO-(0-2)-030521

Lab Sample ID: 410-31453-3 Date Collected: 03/05/21 10:00 **Matrix: Solid** Date Received: 03/05/21 19:28 Percent Solids: 85.0

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		0.0022	0.0017	0.0017	mg/Kg	<u></u>	03/08/21 21:39	1
8:2 Fluorotelomer sulfonic acid	<0.0017		0.0032	0.0017	0.0017	mg/Kg	₩	03/08/21 21:39	1
NEtFOSAA	< 0.00043		0.0022	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
NMeFOSAA	<0.00043	UJ	0.0022	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluorobutanesulfonic acid	<0.0017		0.0022	0.0017	0.0017	mg/Kg	₩	03/08/21 21:39	1
Perfluorobutanoic acid	< 0.0017		0.0022	0.0017	0.0017	mg/Kg	₩	03/08/21 21:39	1
Perfluorodecanoic acid	0.0014		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluorododecanoic acid	0.00080	M	0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluoroheptanoic acid	0.00045	J	0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluorohexanesulfonic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluorohexanoic acid	< 0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluorononanoic acid	0.0010		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluorooctanesulfonic acid	0.0028		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluorooctanoic acid	0.00056	J M	0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluoropentanoic acid	0.00048	J M	0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluorotetradecanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluorotridecanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
Perfluoroundecanoic acid	0.0028		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 21:39	1
						_			

Isotope Dilution	%Recovery (Qualifier Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	125	50 - 150	03/08/21 09:53	03/08/21 21:39	1
M2-8:2 FTS	129	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C2 PFTeDA	98	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C3 PFBS	94	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C4 PFBA	75	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C4 PFHpA	91	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C5 PFPeA	80	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C8 PFOA	95	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C8 PFOS	112	50 - 150	03/08/21 09:53	03/08/21 21:39	1
d3-NMeFOSAA	48 *	*5- 50 ₋ 150	03/08/21 09:53	03/08/21 21:39	1
d5-NEtFOSAA	61	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C2-PFDoDA	100	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C3 PFHxS	106	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C5 PFHxA	84	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C6 PFDA	100	50 - 150	03/08/21 09:53	03/08/21 21:39	1

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3/19/2021

Client Sample Results

Client: ARCADIS U.S., Inc.

Project/Site: APG PFAS S1

Job ID: 410-31453-1

Client Sample ID: APG-ABR6-2-SO-(0-2)-030521

Percent Solids

0521 Lab Sample ID: 410-31453-3

Date Collected: 03/05/21 10:00 Matrix: Solid
Date Received: 03/05/21 19:28 Percent Solids: 85.0

Method: EPA 537(Mod) - PFAS	for QSM 5.3, Table	B-15 (Continu	ed)		
Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C7 PFUnA	102	50 - 150	03/08/21 09:53	03/08/21 21:39	1
13C9 PFNA	99	50 - 150	03/08/21 09:53	03/08/21 21:39	1

Analyte	Result Q	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	<u></u>	03/10/21 13:31	
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0033	0.0018	0.0018	mg/Kg	☆	03/10/21 13:31	
NEtFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg	≎	03/10/21 13:31	
NMeFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg	₩	03/10/21 13:31	
Perfluorobutanesulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	☆	03/10/21 13:31	
Perfluorobutanoic acid	<0.0018 M	1	0.0022	0.0018	0.0018	mg/Kg	☆	03/10/21 13:31	
Perfluorodecanoic acid	0.0023		0.00066	0.00044	0.00044	mg/Kg	₩	03/10/21 13:31	
Perfluorododecanoic acid	0.0014		0.00066	0.00044	0.00044	mg/Kg	☆	03/10/21 13:31	
Perfluoroheptanoic acid	0.0010		0.00066	0.00044	0.00044	mg/Kg	₩	03/10/21 13:31	
Perfluorohexanesulfonic acid	0.00054 J		0.00066	0.00044	0.00044	mg/Kg	☆	03/10/21 13:31	
Perfluorohexanoic acid	0.00058 J		0.00066	0.00044	0.00044	mg/Kg	☆	03/10/21 13:31	
Perfluorononanoic acid	0.0017		0.00066	0.00044	0.00044	mg/Kg	☆	03/10/21 13:31	
Perfluorooctanesulfonic acid	0.0050		0.00066	0.00044	0.00044	mg/Kg	₩	03/10/21 13:31	
Perfluorooctanoic acid	0.00090 M	L	0.00066	0.00044	0.00044	mg/Kg	☆	03/10/21 13:31	
Perfluoropentanoic acid	0.0010		0.00066	0.00044	0.00044	mg/Kg	☆	03/10/21 13:31	
Perfluorotetradecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	
Perfluorotridecanoic acid	0.00044 J		0.00066	0.00044	0.00044	mg/Kg	☆	03/10/21 13:31	
Perfluoroundecanoic acid	0.0044		0.00066	0.00044	0.00044	mg/Kg	☆	03/10/21 13:31	
Isotope Dilution	%Recovery Qual	lifier	Limits			Prepa	ared	Analyzed	Dil Fa
M2-6:2 FTS	96		50 - 150			03/09/21	1 22:10	03/10/21 13:31	
M2-8:2 FTS	88		50 - 150			03/09/21	1 22:10	03/10/21 13:31	
13C2 PFTeDA	87		50 - 150			03/09/21	1 22:10	03/10/21 13:31	
13C3 PFBS	96		50 - 150			03/09/21	22:10	03/10/21 13:31	
13C4 PFBA	94		50 - 150			03/09/21	1 22:10	03/10/21 13:31	
13C4 PFHpA	97		50 - 150			03/09/21	1 22:10	03/10/21 13:31	
13C5 PFPeA	98		50 - 150			03/09/21	22:10	03/10/21 13:31	
13C8 PFOA	99		50 - 150			03/09/21	1 22:10	03/10/21 13:31	
13C8 PFOS	100		50 - 150			03/09/21	22:10	03/10/21 13:31	
d3-NMeFOSAA	41 *5-		50 - 150			03/09/21	22:10	03/10/21 13:31	
d5-NEtFOSAA	48 *5-		50 - 150			03/09/21	1 22:10	03/10/21 13:31	
13C2-PFDoDA	103		50 - 150			03/09/21	1 22:10	03/10/21 13:31	
13C3 PFHxS	99		50 - 150			03/09/21	22:10	03/10/21 13:31	
13C5 PFHxA	97		50 - 150			03/09/21	1 22:10	03/10/21 13:31	
13C6 PFDA	96		50 - 150			03/09/21	1 22:10	03/10/21 13:31	
13C7 PFUnA	93		50 - 150			03/09/21	22:10	03/10/21 13:31	
13C9 PFNA	96		50 - 150			03/09/21	22:10	03/10/21 13:31	
General Chemistry									
Analyte	Result Q	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
		•			1.0				

03/08/21 20:10

1.0 %

1.0

85.0

2

3

10

12

14

15

nico Env, EEO

Job ID: 410-31453-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-ABR7-1-SO-(0-2)-030521

Date Collected: 03/05/21 10:30

Date Received: 03/05/21 19:28

Lab Sample ID: 410-31453-4 **Matrix: Solid** Percent Solids: 89.7

Method: EPA 537(Mod) - PF Analyte	•	Qualifier	LOQ	LOD		Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg		03/08/21 21:50	1
8:2 Fluorotelomer sulfonic acid	< 0.0017		0.0032	0.0017	0.0017	mg/Kg	≎	03/08/21 21:50	1
NEtFOSAA	<0.00042	UJ	0.0021	0.00042	0.00042	mg/Kg	₽	03/08/21 21:50	1
NMeFOSAA	<0.00042	UJ	0.0021	0.00042	0.00042	mg/Kg	₽	03/08/21 21:50	1
Perfluorobutanesulfonic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg	₽	03/08/21 21:50	1
Perfluorobutanoic acid	<0.0017	M	0.0021	0.0017	0.0017	mg/Kg	₽	03/08/21 21:50	1
Perfluorodecanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	₽	03/08/21 21:50	1
Perfluorododecanoic acid	< 0.00042		0.00063	0.00042	0.00042	mg/Kg	≎	03/08/21 21:50	1
Perfluoroheptanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	₽	03/08/21 21:50	1
Perfluorohexanesulfonic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	₽	03/08/21 21:50	1
Perfluorohexanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	☆	03/08/21 21:50	1
Perfluorononanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	₽	03/08/21 21:50	1
Perfluorooctanesulfonic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	₽	03/08/21 21:50	1
Perfluorooctanoic acid	<0.00042	N	0.00063	0.00042	0.00042	mg/Kg	☆	03/08/21 21:50	1
Perfluoropentanoic acid	<0.00042	1	0.00063	0.00042	0.00042	mg/Kg	☆	03/08/21 21:50	1
Perfluorotetradecanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	₩	03/08/21 21:50	1
Perfluorotridecanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	₩	03/08/21 21:50	1
Perfluoroundecanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	₩	03/08/21 21:50	1
Isotope Dilution	%Recovery Qu	ıalifier	Limits			Prep	ared	Analyzed	Dil Fac
M2-6:2 FTS	91		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
M2-8:2 FTS	95		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
13C2 PFTeDA	82		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
13C3 PFBS	83		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
13C4 PFBA	74		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
13C4 PFHpA	78		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
13C5 PFPeA	77		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
13C8 PFOA	85		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
13C8 PFOS	97		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
d3-NMeFOSAA	33 *5-	•	50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
d5-NEtFOSAA	41 *5-		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
13C2-PFDoDA	89		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
13C3 PFHxS	92		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
13C5 PFHxA	80		50 - 150			03/08/2	1 09:53	03/08/21 21:50	1
			EO 1EO			03/08/2	1 09.53	03/08/21 21:50	1
13C6 PFDA	83		50 - 150				, 00.00	00,00,21,21.00	
13C6 PFDA 13C7 PFUnA	83 87		50 - 150 50 - 150					03/08/21 21:50	1

Method: EPA 537(N	Mod) - PFAS for QSM {	5.3, Table B-15 - RE
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Method: Li A oor (Mod) - i i A	o ioi woin o.o, i	Idble D-13	/ - IXL						
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		0.0022	0.0017	0.0017	mg/Kg	*	03/10/21 13:42	1
8:2 Fluorotelomer sulfonic acid	<0.0017		0.0032	0.0017	0.0017	mg/Kg	₽	03/10/21 13:42	1
NEtFOSAA	<0.00043		0.0022	0.00043	0.00043	mg/Kg	₩	03/10/21 13:42	1
NMeFOSAA	< 0.00043		0.0022	0.00043	0.00043	mg/Kg	₽	03/10/21 13:42	1
Perfluorobutanesulfonic acid	<0.0017		0.0022	0.0017	0.0017	mg/Kg	₩	03/10/21 13:42	1
Perfluorobutanoic acid	<0.0017		0.0022	0.0017	0.0017	mg/Kg	₽	03/10/21 13:42	1
Perfluorodecanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/10/21 13:42	1
Perfluorododecanoic acid	< 0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/10/21 13:42	1
Perfluoroheptanoic acid	< 0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/10/21 13:42	1
Perfluorohexanesulfonic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	₽	03/10/21 13:42	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31453-1 Project/Site: APG PFAS S1

Client Sample ID: APG-ABR7-1-SO-(0-2)-030521

Lab Sample ID: 410-31453-4 Date Collected: 03/05/21 10:30 **Matrix: Solid**

Date Received: 03/05/21 19:28 Percent Solids: 89.7

Method: EPA 537(Mod) - PFAS Analyte	•	Qualifier	LOQ	Inuea) LOD	וח	Unit	D	Analyzed	Dil Fa
Perfluorohexanoic acid	<0.00043	Qualifier	0.00065	0.00043	0.00043		_ `	03/10/21 13:42	DII Fa
Perfluorononanoic acid	<0.00043		0.00065	0.00043	0.00043		₩	03/10/21 13:42	
Perfluorooctanesulfonic acid	<0.00043		0.00065	0.00043	0.00043		¥. ∵	03/10/21 13:42	
		M	0.00065	0.00043				03/10/21 13:42	
Perfluerementancia acid	<0.00043	IVI			0.00043		φ.		
Perfluoropentanoic acid	<0.00043		0.00065	0.00043	0.00043	7 7	. .	03/10/21 13:42	
Perfluorotetradecanoic acid	<0.00043		0.00065	0.00043	0.00043			03/10/21 13:42	
Perfluorotridecanoic acid	<0.00043		0.00065	0.00043	0.00043		\$	03/10/21 13:42	
Perfluoroundecanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	☆	03/10/21 13:42	
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepare		Analyzed	Dil Fa
M2-6:2 FTS	69		50 - 150					03/10/21 13:42	
M2-8:2 FTS	68		50 - 150			03/09/21 2	22:10	03/10/21 13:42	
13C2 PFTeDA	74		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
13C3 PFBS	86		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
13C4 PFBA	85		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
13C4 PFHpA	90		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
13C5 PFPeA	89		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
13C8 PFOA	87		50 - 150			03/09/21 2	22:10	03/10/21 13:42	
13C8 PFOS	91		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
d3-NMeFOSAA	26 *5	•	50 - 150			03/09/21 2	2:10	03/10/21 13:42	
d5-NEtFOSAA	29 *5	-	50 - 150			03/09/21 2	2:10	03/10/21 13:42	
13C2-PFDoDA	87		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
13C3 PFHxS	92		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
13C5 PFHxA	87		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
13C6 PFDA	81		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
13C7 PFUnA	79		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
13C9 PFNA	85		50 - 150			03/09/21 2	2:10	03/10/21 13:42	
General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD		Unit	_ D	Analyzed	Dil Fa
Total Organic Carbon	979	J+	435	290	290	mg/Kg	₩	03/13/21 16:34	1.
Percent Moisture	10.3		1.0		1.0			03/08/21 20:10	
Percent Solids	89.7		1.0		1.0	%		03/08/21 20:10	
General Chemistry - Soluble							_		
Analyte		Qualifier	LOQ	LOD		Unit	_ <u>D</u>	Analyzed	Dil Fa
pH	9.9	J	0.01	0.01		S.U.		03/08/21 15:05	
Temperature	20.3		0.01	0.01	0.01	Degrees C		03/08/21 15:05	
Method: D422 - Grain Size	D 16	0	1.00		ъ.	1124	_	A	D.1 E.
Analyte		Qualifier	LOQ -	LOD -		Unit	_ <u>D</u>	Analyzed	Dil Fa
Gravel	3.7		1.0	1.0	1.0			03/10/21 19:00	
Sand	60.7		1.0	1.0	1.0			03/10/21 19:00	
Silt 	28.6		1.0	1.0	1.0			03/10/21 19:00	
Clay	7.0		1.0	1.0	1.0			03/10/21 19:00	
75 mm	100.0		1.0	1.0		% Passing		03/10/21 19:00	
37.5 mm	100.0		1.0	1.0		% Passing		03/10/21 19:00	
19 mm	100.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	
4.75 mm	96.3		1.0	1.0	1.0	% Passing		03/10/21 19:00	
3.35 mm	94.2		1.0	1.0	1.0	% Passing		03/10/21 19:00	
2.36 mm	91.5		1.0	1.0	1.0	% Passing		03/10/21 19:00	

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Job ID: 410-31453-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-ABR7-1-SO-(0-2)-030521

Date Collected: 03/05/21 10:30 Matrix: Solid Date Received: 03/05/21 19:28 Percent Solids: 89.7

Mothod: D422 Grain Size (Continued)

Method: D422 - Grain S	Size (Continued)								
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
1.18 mm	87.4		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.6 mm	81.6		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.3 mm	60.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.15 mm	45.1		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.075 mm	35.6		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.064 mm	32.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.05 mm	24.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.02 mm	15.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.005 mm	7.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.002 mm	4.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.001 mm	<1.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1

Client Sample ID: APG-ABR7-1-GW-030521

Date Received: 03/05/21 19:28

Lab Sample ID: 410-31453-5 Date Collected: 03/05/21 13:45 **Matrix: Water**

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 Result Qualifier LOQ LOD Analyte DL Unit Analyzed Dil Fac 6:2 Fluorotelomer sulfonic acid <4.4 5.5 4.4 4.4 ng/L 03/09/21 12:43 8:2 Fluorotelomer sulfonic acid <2.2 3.3 2.2 2.2 ng/L 03/09/21 12:43 **NEtFOSAA** <1.1 3.3 1.1 1.1 ng/L 03/09/21 12:43 **NMeFOSAA** <13 2.2 13 1.3 ng/L 03/09/21 12:43 Perfluorobutanesulfonic acid 1.1 ng/L 03/09/21 12:43 4.2 1.1 5.5 4.4 4.4 ng/L 03/09/21 12:43 Perfluorobutanoic acid 21 Perfluorodecanoic acid 2.2 1.1 1.1 ng/L 03/09/21 12:43 2.2 Perfluorododecanoic acid 1.1 ng/L 03/09/21 12:43 <1.1 1.1 Perfluoroheptanoic acid 15 2.2 1.1 1.1 ng/L 03/09/21 12:43 Perfluorohexanesulfonic acid 92 22 1.1 1.1 ng/L 03/09/21 12:43 Perfluorohexanoic acid 35 2.2 1.1 1.1 ng/L 03/09/21 12:43 Perfluorononanoic acid <1.1 2.2 1.1 1.1 ng/L 03/09/21 12:43 2.2 Perfluorooctanesulfonic acid 1.1 ng/L 03/09/21 12:43 2.2 1.1 1.1 ng/L 03/09/21 12:43 Perfluorooctanoic acid 60 22 1.1 ng/L 03/09/21 12:43 Perfluoropentanoic acid 23 M 1.1 Perfluorotetradecanoic acid 03/09/21 12:43 <1.1 2.2 1.1 1.1 ng/L Perfluorotridecanoic acid <11 22 1 1 1.1 ng/L 03/09/21 12:43 Perfluoroundecanoic acid <1.1 2.2 1.1 1.1 ng/L 03/09/21 12:43

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	114	50 - 150	03/08/21 08:30	03/09/21 12:43	1
M2-8:2 FTS	101	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C2 PFTeDA	66	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C3 PFBS	98	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C4 PFBA	86	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C4 PFHpA	104	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C5 PFPeA	95	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C8 PFOA	98	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C8 PFOS	97	50 - 150	03/08/21 08:30	03/09/21 12:43	1
d3-NMeFOSAA	84	50 - 150	03/08/21 08:30	03/09/21 12:43	1
d5-NEtFOSAA	81	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C2-PFDoDA	95	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C3 PFHxS	104	50 - 150	03/08/21 08:30	03/09/21 12:43	1

Eurofins Lancaster Laboratories Env, LLC

Lab Sample ID: 410-31453-4

Client Sample Results

Client: ARCADIS U.S., Inc.

Job ID: 410-31453-1

Project/Site: APG PFAS S1

Client Sample ID: APG-ABR7-1-GW-030521 Lab Sample ID: 410-31453-5

Date Collected: 03/05/21 13:45

Date Received: 03/05/21 19:28

Matrix: Water

Method: EPA 537(Mod) - PEAS for QSM 5.3. Table B-15 (Continued)

Wethou. EPA 557 (Wou) - PFA5	101 Q3W 3.3, 1a	ible B-15 (Collultueu)			
Isotope Dilution	%Recovery Qual	ifier Limits	Prepared	Analyzed	Dil Fac
13C5 PFHxA	98	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C6 PFDA	91	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C7 PFUnA	83	50 - 150	03/08/21 08:30	03/09/21 12:43	1
13C9 PFNA	96	50 - 150	03/08/21 08:30	03/09/21 12:43	1

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Aberdeen Proving Ground - Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDG # 410-31454-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report #41184R1

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-31454-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

			Sample Collection		Ar	nalysis	
Sample ID	Lab ID	Lab ID Matrix		Parent Sample	PFAS	тос	рН
APG-LOADING-PAD-1-SO-(0-2)-030421	410-31454-1	Soil	3/4/2021		Х	Х	X
APG-LOADING-PAD-1-GW-030421	410-31454-2	Water	3/4/2021		X		
APG-HANGER-1060-1-SO-(0-2)-030421	410-31454-3	Soil	3/4/2021		Х	Х	Х
APG-HANGER-1060-1-GW-030421	410-31454-4	Water	3/4/2021		Х		
APG-FB-02-030421	410-31454-5	Water	3/4/2021		Х		
APG-EB-02-030421	410-31454-6	Water	3/4/2021		Х		
APG-MFR1-1-SO-(8-10)-030421	410-31454-7	Soil	3/4/2021		Х		
APG-DUP-01-030421	410-31454-8	Soil	3/4/2021	APG-MFR1-1-SO- (8-10)-030421	Х		
APG-MFR1-1-GW-030421	410-31454-9	Water	3/4/2021		Х		
APG-MFR1-2-SO-(8-10)-030421	410-31454-10	Soil	3/4/2021		Х	Х	Х
APG-MFR1-2-GW-030421	410-31454-11	Water	3/4/2021		Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-MFR1-1-GW-030421.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was performed on sample APG-MFR1-1-SO-(8-10)-030421.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Reported		Performance Acceptable		Not
Items Reviewed		Yes	No	Yes	Required
Sample receipt condition		Х		Х	
2. Requested analyses and sample results		Х		Х	
Master tracking list		Х		Х	
4. Methods of analysis		Х		Х	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		Х	
11. Narrative summary of QA or sample problems provided		Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

1. The chain of custody states that 2 containers were submitted, whereas the laboratory received 3 containers for the following samples.

Lab ID	Sample ID
410-31454-2	APG-LOADING-PAD-1-GW-030421
410-31454-4	APG-HANGER-1060-1-GW-030421
410-31454-9	APG-MFR1-1-GW-030421
410-31454-11	APG-MFR1-2-GW-030421

2. The COC lists that 2 containers were submitted for PFAS analysis, Whereas the laboratory received 4 containers along with TOC and pH analysis for the sample APG-MFR1-2-SO-(8-10)-030421 (410-31454-10).

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
APG-LOADING-PAD-1-SO-	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
(0-2)-030421	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 50% but > 20%
APG-HANGER-1060-1-SO-	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
(0-2)-030421	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20% (MS / MSD)
APG-MFR1-1-SO-(8-10)- 030421	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 50% but > 20% (MS/MSD)
	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 20%
APG-DUP-01-030421	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 20%
	13C4 PFBA	Perfluorobutanoic acid	< 50% but > 20%	AC
APG-MFR1-2-SO-(8-10)- 030421	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%

Note:

AC Acceptable

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
4500/	Non-detect	No Action
> 150%	Detect	J-
500/ 1 / 000/	Non-detect	UJ
< 50% but > 20%	Detect	J+
	Non-detect	UX
< 20%	Detect	Χ

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be ≤ 30%.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

MS/MSD analysis was performed on sample APG-MFR1-1-SO-(8-10)-030421. The MS/MSD exhibited acceptable recoveries and RPD between MS/MSD recoveries.

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

Results for field duplicate samples are summarized in the following table.

Sample ID / Duplicate ID	Compounds	Sample Result	Duplicate Result	RPD
APG-MFR1-1-SO-(8-10)-030421 / APG-DUP-01-030421	Perfluorooctanesulfonic acid	0.00045 U	0.00067 J	AC

Note:

AC Acceptable

The results between the parent sample and field duplicate were acceptable.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

All identified compounds met method criteria.

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
APG-HANGER-1060-1-GW-	Perfluorohexanesulfonic acid		540	540 D
030421	Perfluorooctanesulfonic acid		1200	1200 D

Note: the lab didn't report the original analysis; only the diluted result.

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification
Diluted sample result within calibration range	D

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

As noted in Section 5.1, N-EtFOSAA and/or N-MeFOSAA results were qualified "X" for sample locations APG-Hanger-1060-1-SO-(0-2)-030421, APG-MFR1-1-SO-(8-10)-030421, and APG-MFR1-2-SO-(8-10)-030421. This was due to EIS recoveries less than 20%. After review with the project team and USACE chemist, the results were rejected, and the final qualifier has been revised from "X" to "R" on December 14, 2021.

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3		Reported		mance ptable	Not Required
		Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC/	MS/MS)			
Stage 2 Validation					
Holding times		Х		Х	
Reporting limits (units)		Х		Х	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks		Х		X	
C. Field blanks		Х		Х	
Laboratory Control Sample (LCS) %R		Х		X	
Laboratory Control Sample Duplicate(LCSD) %R		Х		Х	
LCS/LCSD Precision (RPD)		Х		Х	
Matrix Spike (MS) %R		Х		X	
Matrix Spike Duplicate(MSD) %R		Х		Х	
MS/MSD Precision (RPD)		Х		Х	
Field Duplicate (RPD)		Х		Х	
Extracted Internal Standard %R		Х	Х		
Injection Internal Standard %R		Х		Х	
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation			·		
Instrument tune and performance check		Х		Х	
Initial calibration %RSDs		Х		Х	
Continuing calibration %Ds		Х		Х	
Instrument sensitivity check		Х		Х	
Ion transitions used		Х		Х	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		Х		Х	
B. Quantitation Reports		Х		Х	
C. RT of sample compounds within the established RT windows		Х		х	

PFAS: 537M/DoD QSM 5.3		Reported		mance ptable	Not Required	
		Yes	No	Yes	Required	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)						
D. Ion Ratio %R		Х		Х		
E. Transcription/calculations acceptable		Х		Х		
F. Reporting limits adjusted to reflect sample dilutions		Х		Х		

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

Concentration (C) Qualifiers

- U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
- J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).

• Quantitation (Q) Qualifiers

E The compound was quantitated above the calibration range.

Validation Qualifiers

- J The reported result was an estimated value with an unknown bias.
- J+ The result was an estimated quantity, but the result may be biased high.
- J- The result was an estimated quantity, but the result may be biased low.
- UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
- UB Analyte considered non-detect at the listed value due to associated blank contamination.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria
APG-LOADING-PAD-1-SO-(0-2)-030421		
APG-HANGER-1060-1-SO-(0-2)-030421	4 days from collection; 3 days from receipt	< 24 hours of receipt at the laboratory
APG-MFR1-2-SO-(8-10)-030421		and laboratory

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

	Qualification
Criteria	Detected Analytes
Analysis completed past the holding time	J

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analytes	Standard Recovery
APG-LOADING-PAD-1-SO-(0-2)-030421 APG-HANGER-1060-1-SO-(0-2)-030421 APG-MFR1-2-SO-(8-10)-030421	CCV	TOC	130%

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Control Limit	Sample Result	Qualification
	750/ 1 000/	Non-detect	UJ
TOC	75% to 89%	Detect	J-
	4440/ 1- 4050/	Non-detect	No Action
	111% to 125%	Detect	J+
	Gross Exceedance >125%	Non-detect	No Action
	GIUSS EXCEEUALICE > 125%	Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

A MS analysis was not performed for TOC.

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

A laboratory duplicate analysis was not performed on sample location associated with this SDG.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within \pm 0.05 S.U. of the true value.

All LCS recoveries were within control limits.

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Rep	orted	Perfor Acce	Not	
	No	Yes	No	Yes	Required
Miscellaneous Instrumentation					
Stage 2 Validation			_		
Holding times		X	Х		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	Х				Х
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х
LCS/LCSD Precision (RPD)	Х				Х
Matrix Spike (MS) %R	Х				Х
Matrix Spike Duplicate (MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				X
Lab Duplicate (RPD)	X				X
Field Duplicate (RPD)	Х				Х
Dilution Factor		X		Х	
Moisture Content		X		Х	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		Х		X	
Continuing calibration %R		X	Х		
Raw Data		Х		Х	
Transcription/calculations acceptable		Х		Х	

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE:

DATE: May 3, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 07, 2021

Stage 3 / 4 PFAS Calibration Standards

SDG #:410-31454-1Date:5/3/2021Lab:Eurofins LancasterPage:1Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 29347

PFBA 3/05/2021 Calibration

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Match Match Match Match Match Match Match

11 DA 3/03/2021 CUINTUUM										
Cal Conc					Calculated		Calc		Calculated	Reported
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D
0.2	76737	4041718	10	0.018986	0.9493117	0.8751	0.216961	0.2	8.480	8.5
0.5	176646	4038069	10	0.043745	0.8749033	0.8751	0.499888	0.5	-0.022	0
2	793768	4082481	10	0.194433	0.9721637	0.8751	2.221835	2	11.092	11.1
8	2677850	3885912	10	0.689118	0.8613969	0.8751	7.874729	8	-1.566	-1.6
20	6830316	3935411	10	1.735604	0.8678021	0.8751	19.83321	20	-0.834	-0.8
50	16406435	3931630	10	4.172935	0.8345869	0.8751	47.68523	50	-4.630	-4.6
100	28464329	3717120	10	7.65763	0.765763	0.8751	87.50577	100	-12.494	-12.5
	· ·	·	·	·	·	·	·	·		·

Avg RF = 0.8751325 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-31454-1Date:5/3/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-100111/9 3/05/2021 13:32

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	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	637595	3676346	10	0.1734	0.8751	1.982	2	-0.91	-0.9
Perfluoropentanoic acid	619100	3259175	10	0.1900	1.0370	1.832	2	-8.41	-8.5
Perfluorobutanesulfonic acid	739077	3444531	9.36	0.2146	1.0960	1.832	2	3.53	3.6
Perfluorohexanoic acid	711372	3890288	10	0.1829	0.9115	2.006	2	0.31	0.3
Perfluoroheptanoic acid	818242	3882972	10	0.2107	1.0960	1.923	2	-3.87	-3.9
Perfluorohexanesulfonic acid	674978	3439888	9.46	0.1962	1.0510	1.766	2	-6.55	-6.6
Perfluorooctanesulfonic acid	736490	3830413	9.57	0.1923	1.1010	1.671	2	-12.50	-12.7

Match Match Match Match Match Match

Match

CCV 410-100974/28 3/9/2021 12:32

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	Analyte					Calc		Calculated	Reported	
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D	
Perfluorobutanoic acid	2732589	4083349	10	0.6692	0.8751	7.647	8.0	-4.41	-4.4	Match
Perfluoropentanoic acid	2863800	3623586	10	0.7903	1.0370	7.621	8.0	-4.73	-4.8	Match
Perfluorobutanesulfonic acid	3494499	4401401	9.36	0.7940	1.0960	6.780	7.1	-4.23	-4.3	Match
Perfluorohexanoic acid	2887421	4202683	10	0.6870	0.9115	7.537	8.0	-5.78	-5.8	Match
Perfluoroheptanoic acid	3588693	4076660	10	0.8803	1.0960	8.032	8.0	0.40	0.4	Match
Perfluorohexanesulfonic acid	2864049	3707064	9.46	0.7726	1.0510	6.954	7.3	-4.74	-4.7	Match
Perfluorooctanesulfonic acid	3364798	4226897	9.57	0.7960	1.1010	6.919	7.4	-6.50	-6.6	Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-100543/2-A

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Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported	
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	2222467	3921104	10	0.566796	0.8751	25.91	25.600	101.20	101	Match
Perfluoropentanoic acid	2293048	3658313	10	0.626805	1.0370	24.18	25.600	94.44	94	Match
Perfluorobutanesulfonic acid	2867331	4105204	9.36	0.698462	1.0960	23.86	22.600	105.57	105	Match
Perfluorohexanoic acid	2448931	4262973	10	0.574466	0.9115	25.21	25.600	98.48	98	Match
Perfluoroheptanoic acid	2940929	4335308	10	0.678367	1.0960	24.76	25.600	96.71	97	Match
Perfluorohexanesulfonic acid	2504221	3827012	9.46	0.654354	1.0510	23.56	24.200	97.35	97	Match
Perfluorooctanesulfonic acid	2959064	4334695	9.57	0.682646	1.1010	23.73	24.500	96.88	97	Match

LCSD 410-100543/3-A

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Sample volume = 250 ml

Final volume = 1ml

						Calculated		Calculated	Reported	
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	1941014	3506508	10	0.553546	0.8751	25.30	25.600	98.84	99	Match
Perfluoropentanoic acid	1999943	3254331	10	0.614548	1.0370	23.70	25.600	92.60	93	Match
Perfluorobutanesulfonic acid	2645538	3938923	9.36	0.67164	1.0960	22.94	22.600	101.52	101	Match
Perfluorohexanoic acid	2183796	3940485	10	0.554195	0.9115	24.32	25.600	95.00	95	Match
Perfluoroheptanoic acid	2584954	3903339	10	0.662242	1.0960	24.17	25.600	94.41	94	Match
Perfluorohexanesulfonic acid	2273489	3700433	9.46	0.614385	1.0510	22.12	24.200	91.41	91	Match
Perfluorooctanesulfonic acid	2721270	4213285	9.57	0.645878	1.1010	22.46	24.500	91.66	92	Match

Calculated Amount ng/L = ((Peak area ratio/Avg RF) x EIS concentration)/Sample volume)*1000

				Reported	
	LCS Calc	LCSD Calc	LCS/LCSD	LCS/LCSD	
Compounds	Amount	Amount	Calc RPD	RPD	
Perfluorobutanoic acid	25.91	25.30	2.4	2	Match
Perfluoropentanoic acid	24.18	23.70	2.0	2	Match
Perfluorobutanesulfonic acid	23.86	22.94	3.9	4	Match
Perfluorohexanoic acid	25.21	24.32	3.6	4	Match
Perfluoroheptanoic acid	24.76	24.17	2.4	2	Match
Perfluorohexanesulfonic acid	23.56	22.12	6.3	6	Match
Perfluorooctanesulfonic acid	23.73	22.46	5.5	6	Match

Stage 3 / 4 PFAS MS/MSD

SDG #:410-31454-1Date:5/3/2021Lab:Eurofins LancasterPage:4Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID APG-MFR1-1-SO-(8-10)-030421 Page 554 - 555 SDG 410-31454-1

ANALYTE Perfluorobutanoic acid

REPORTED MS %R 91
REPORTED MSD %R 91
REPORTED RPD 2

%R = 100 * (MS Conc - Sample Conc) RPD = 100 * | MS %R - MSD %R MS TV Average of MS MSD %R

 Sample Concentration
 0

 MS Concentration
 0.0267
 MS %R
 91.44 MATCH

 MSD Concentration
 0.0261
 MSD %R
 90.94 MATCH

 MS TV
 0.0292
 RPD
 2.27 MATCH

 MSD TV
 0.0287

Differences in %R may be due to rounding of the true value

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-31454-1
 Date:
 5/3/2021

 Lab:
 Eurofins Lancaster
 Page:
 5

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-MFR1-1-GW-030421 Lab ID: 410-31454-9 Page 742 - 746 of SDG 410-31454-1

						Calculated	Final		Final	Reported	1
						Amount	Volume	Sample	Calculated	Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	1092577	3543106	10	0.308367	0.8751	3.52	1	222.7	15.8	16	Matcl
Perfluoropentanoic acid	2701991	3256263	10	0.829783	1.0370	8.00	1	222.7	35.9	36	Matcl
Perfluorobutanesulfonic acid	6070445	3702392	9.36	1.639601	1.0960	14.00	1	222.7	62.9	63	Matc
Perfluorohexanoic acid	4808143	3856468	10	1.246774	0.9115	13.68	1	222.7	61.4	61	Matc
Perfluoroheptanoic acid	2163447	3868433	10	0.559257	1.0960	5.10	1	222.7	22.9	23	Matc
Perfluorohexanesulfonic acid	21577852	3526849	9.46	6.118167	1.0510	55.07	1	222.7	247.3	250	Matc
Perfluorooctanesulfonic acid	24070076	3763213	9.57	6.39615	1.1010	55.60	1	222.7	249.6	250	Matcl

Calculated amount $ng/L = (Peak area ratio/Avg RF) \times DF \times EIS conc ng/L$ Final Calculated amount $ng/L = ((calculated ng/L \times Final Volume mls) / sample volume mls)$ Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

SDG #:410-31454-1Date:5/3/2021Lab:Eurofins LancasterPage:6Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-MFR1-1-GW-030421 Lab ID: 410-31454-9

EIS 13C5 PFPeA
REPORTED EIS %R 93

%R = 100 * EIS Concentration EIS TV

EIS Concentration 9.31 ng/ml Page 744 of 410-31454-1
EIS TV 10.0
%R 93.1 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental An



ain of Custody

aboratories Environmental use only

1052

COC #617023

eurofins		
	Lancaster Laboratories	1111111

	Environmental		110-31454	Chain of Cu	stody				S	ample	#								O.		OTI	023
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APG PFAS Project Manager:	51						įΞ	Ground		100	-				İ		-			H=HCI		Thiosulfate
			P.O. #:	- 0-			-11-1	a a		ဖွာ		1	73							N=HNO ₃		NaOH
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ARG- FB-02-				1205	×			GW		2					X		-					
APG- EB-02	-030421			1210	×		100	GW		2					X							
APG-MFR1-1-	0-(8-10)-030	421/ms/msD		1215		X	50			6	×		- 1						1			
APG-DUP-				1200		×	50			2	X	. 1		/						-		
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Environmental Analysis Request/Chain of Custody

eurofins	Lancaster Laborato	ories	Acct. #					ncaster Labo		ies Env ample		nental	use o	nly		Z of	2		COC	#61	7018
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7044 0919 3/19/202**W**

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-31454-1

Project/Site: APG PFAS S1

Qualifiers

LCMS
Qualifier

*5-	Isotope dilution analyte is outside acceptance limits. low biased.
()=	ISULUDE UIIULIUH AHAIVLE IS UULSIUE ALLEDIAHLE IIIHILS. IUW DIASEU.

D The reported value is from a dilution.

Qualifier Description

Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Μ Manual integrated compound.

General Chemistry

Qualifier	Qualifier Description
-----------	-----------------------

Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation These commonly used abbreviations may or may not be present in this
--

¤ Listed under the "D" column to designate that the result is reported on a dry weight basis

%R Percent Recovery

1C Result is from the primary column on a dual-column method. Result is from the confirmation column on a dual-column method. 2C

CFL Contains Free Liquid **CFU** Colony Forming Unit CNF Contains No Free Liquid

DER Duplicate Error Ratio (normalized absolute difference)

Dil Fac **Dilution Factor**

DL Detection Limit (DoD/DOE)

DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample

Decision Level Concentration (Radiochemistry) DLC

Estimated Detection Limit (Dioxin) **EDL** LOD Limit of Detection (DoD/DOE) LOQ Limit of Quantitation (DoD/DOE)

MCL EPA recommended "Maximum Contaminant Level" MDA Minimum Detectable Activity (Radiochemistry) MDC Minimum Detectable Concentration (Radiochemistry)

MDL Method Detection Limit ML Minimum Level (Dioxin) MPN Most Probable Number MQL Method Quantitation Limit

NC Not Calculated

ND Not Detected at the reporting limit (or MDL or EDL if shown)

NEG Negative / Absent POS Positive / Present

Practical Quantitation Limit PQL

PRES Presumptive QC **Quality Control**

RER Relative Error Ratio (Radiochemistry)

Reporting Limit or Requested Limit (Radiochemistry) RI

RPD Relative Percent Difference, a measure of the relative difference between two points

Toxicity Equivalent Factor (Dioxin) **TEF TEQ** Toxicity Equivalent Quotient (Dioxin)

TNTC Too Numerous To Count

Job ID: 410-31454-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Loading-PAD-1-SO-(0-2)-030421

Lab Sample ID: 410-31454-1 Date Collected: 03/04/21 09:00 Matrix: Solid Date Received: 03/05/21 19:28 Percent Solids: 86.9

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 LOD Analyte Result Qualifier LOQ DL Unit D Analyzed Dil Fac 6:2 Fluorotelomer sulfonic acid <0.0018 0.0022 0.0018 0.0018 mg/Kg 03/08/21 22:01 8:2 Fluorotelomer sulfonic acid <0.0018 0.0033 0.0018 0.0018 mg/Kg 03/08/21 22:01 **NEtFOSAA** <0.00044 UJ 0.0022 0.00044 0.00044 mg/Kg 03/08/21 22:01 **NMeFOSAA** mg/Kg <0.00044 UJ 0.0022 0.00044 0.00044 03/08/21 22:01 Perfluorobutanesulfonic acid < 0.0018 0.0022 0.0018 0.0018 mg/Kg 03/08/21 22:01 03/08/21 22:01 Perfluorobutanoic acid <0.0018 0.0022 0.0018 0.0018 mg/Kg Perfluorodecanoic acid < 0.00044 0.00066 0.00044 0.00044 mg/Kg 03/08/21 22:01 Perfluorododecanoic acid 0.00044 0.00044 03/08/21 22:01 < 0.00044 0.00066 mg/Kg Perfluoroheptanoic acid < 0.00044 0.00066 0.00044 0.00044 mg/Kg 03/08/21 22:01 Perfluorohexanesulfonic acid 0.00066 0.00044 0.00044 mg/Kg 03/08/21 22:01 0.0020 Perfluorohexanoic acid <0.00044 M 0.00066 0.00044 0.00044 mg/Kg 03/08/21 22:01 Perfluorononanoic acid < 0.00044 0.00066 0.00044 0.00044 mg/Kg 03/08/21 22:01 1 Perfluorooctanesulfonic acid 0.0022 0.00066 0.00044 0.00044 mg/Kg 03/08/21 22:01 0.00066 0.00044 0.00044 mg/Kg 03/08/21 22:01 Perfluorooctanoic acid 0.00062 JM 0.00044 0.00044 mg/Kg 03/08/21 22:01 Perfluoropentanoic acid <0.00044 M 0.00066 0.00044 Perfluorotetradecanoic acid < 0.00044 0.00066 0.00044 mg/Kg 03/08/21 22:01 Perfluorotridecanoic acid < 0.00044 0.00066 0.00044 0.00044 mg/Kg 03/08/21 22:01 Perfluoroundecanoic acid < 0.00044 0.00066 0.00044 0.00044 mg/Kg 03/08/21 22:01 Isotope Dilution %Recovery Qualifier Limits Prepared Analyzed Dil Fac 03/08/21 09:53 03/08/21 22:01 M2-6:2 FTS 123 50 - 150 M2-8:2 FTS 126 50 - 150 03/08/21 09:53 03/08/21 22:01 13C2 PFTeDA 103 50 - 150 03/08/21 09:53 03/08/21 22:01 03/08/21 09:53 03/08/21 22:01 13C3 PFBS 98 50 - 150 13C4 PFBA 89 50 - 150 03/08/21 09:53 03/08/21 22:01 13C4 PFHpA 97 50 - 150 03/08/21 09:53 03/08/21 22:01 13C5 PFPeA 95 50 - 150 03/08/21 09:53 03/08/21 22:01 13C8 PFOA 100 50 - 150 03/08/21 09:53 03/08/21 22:01 03/08/21 09:53 03/08/21 22:01 13C8 PFOS 113 50 - 150 d3-NMeFOSAA 34 *5-50 - 150 03/08/21 09:53 03/08/21 22:01 d5-NEtFOSAA 42 *5-50 - 150 03/08/21 09:53 03/08/21 22:01 03/08/21 09:53 03/08/21 22:01 13C2-PFDoDA 106 50 - 150 03/08/21 09:53 03/08/21 22:01 13C3 PFHxS 114 50 - 150 13C5 PFHxA 98 50 - 150 03/08/21 09:53 03/08/21 22:01 03/08/21 09:53 03/08/21 22:01 13C6 PFDA 98 50 - 150 13C7 PFUnA 107 50 - 150 03/08/21 09:53 03/08/21 22:01

103

13C9 PFNA

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg	₩	03/10/21 13:52	1
8:2 Fluorotelomer sulfonic acid	<0.0017		0.0032	0.0017	0.0017	mg/Kg	₩	03/10/21 13:52	1
NEtFOSAA	<0.00043		0.0021	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	1
NMeFOSAA	< 0.00043		0.0021	0.00043	0.00043	mg/Kg	₩	03/10/21 13:52	1
Perfluorobutanesulfonic acid	< 0.0017		0.0021	0.0017	0.0017	mg/Kg	☼	03/10/21 13:52	1
Perfluorobutanoic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg	☼	03/10/21 13:52	1
Perfluorodecanoic acid	< 0.00043		0.00064	0.00043	0.00043	mg/Kg	₩	03/10/21 13:52	1
Perfluorododecanoic acid	< 0.00043		0.00064	0.00043	0.00043	mg/K g	₩	03/10/21 13:52	1
Perfluoroheptanoic acid	< 0.00043		0.00064	0.00043	0.00043	mg/Kg	₩	03/10/21 13:52	1
Perfluorohexanesulfonic acid	0.0018		0.00064	0.00043	0.00043	mg/Kg	₩	03/10/21 13:52	1

50 - 150

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Page 10 of 61

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03/08/21 09:53 03/08/21 22:01

Client: ARCADIS U.S., Inc.

Project/Site: APG PFAS S1

Job ID: 410-31454-1

Client Sample ID: APG-Loading-PAD-1-SO-(0-2)-030421 Lab Sample ID: 410-31454-1

Date Collected: 03/04/21 09:00

Matrix: Solid

Date Received: 03/05/21 19:28

Percent Solids: 86.9

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
Perfluorohexanoic acid	<0.00043	M	0.00064	0.00043	0.00043	mg/Kg	₽	03/10/21 13:52	
Perfluorononanoic acid	< 0.00043		0.00064	0.00043	0.00043	mg/Kg	₽	03/10/21 13:52	
Perfluorooctanesulfonic acid	0.0028		0.00064	0.00043	0.00043	mg/Kg	₽	03/10/21 13:52	
Perfluorooctanoic acid	0.00059	J M	0.00064	0.00043	0.00043	mg/Kg	₩	03/10/21 13:52	
Perfluoropentanoic acid	< 0.00043		0.00064	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	
Perfluorotetradecanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	
Perfluorotridecanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	
Perfluoroundecanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg	☆	03/10/21 13:52	
sotope Dilution	%Recovery Q	ualifier	Limits			Prepare	d	Analyzed	Dil Fa
M2-6:2 FTS	76		50 - 150					03/10/21 13:52	
M2-8:2 FTS	74		50 ₋ 150			03/09/21 22	2:10	03/10/21 13:52	
13C2 PFTeDA	77		50 - 150			03/09/21 22	2:10	03/10/21 13:52	
13C3 PFBS	89		50 - 150			03/09/21 22	2:10	03/10/21 13:52	
13C4 PFBA	86		50 ₋ 150			03/09/21 22	2:10	03/10/21 13:52	
13C4 PFHpA	90		50 - 150			03/09/21 22	2:10	03/10/21 13:52	
13C5 PFPeA	92		50 - 150			03/09/21 22	2:10	03/10/21 13:52	
13C8 PFOA	89		50 - 150			03/09/21 22	2:10	03/10/21 13:52	
13C8 PFOS	94		50 ₋ 150			03/09/21 22	2:10	03/10/21 13:52	
d3-NMeFOSAA	27 *5		50 - 150			03/09/21 22	2:10	03/10/21 13:52	
d5-NEtFOSAA	29 *5	_	50 ₋ 150			03/09/21 22	2:10	03/10/21 13:52	
13C2-PFDoDA	86		50 ₋ 150			03/09/21 22	:10	03/10/21 13:52	
13C3 PFHxS	94		50 - 150			03/09/21 22	2:10	03/10/21 13:52	
13C5 PFHxA	85		50 - 150			03/09/21 22	2:10	03/10/21 13:52	
13C6 PFDA	83		50 ₋ 150			03/09/21 22	2:10	03/10/21 13:52	
13C7 PFUnA	81		50 - 150			03/09/21 22	2:10	03/10/21 13:52	/
13C9 PFNA	87		50 - 150			03/09/21 22	2:10	03/10/21 13:52	
General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
Total Organic Carbon	6200	J+	2130	1420	1420	mg/Kg	₽	03/13/21 16:47	6.
Percent Moisture	13.1		1.0		1.0	%		03/08/21 15:30	
Percent Solids	86.9		1.0		1.0	%		03/08/21 15:30	
General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil F
oH	7.5	J	0.01	0.01		S.U.	-	03/08/21 15:05	
Temperature	20.0		0.01	0.01		Degrees C		03/08/21 15:05	
•						-			
Method: D422 - Grain Size Analyte	Recult	Qualifier	LOQ	LOD	וח	Unit	D	Analyzed	Dil Fa
Gravel		- Qualifier	1.0	1.0	1.0		_	03/10/21 19:00	םוו רי
	10.5		1.0	1.0	1.0			03/10/21 19:00	
Sand	38.7								
Silt	34.9		1.0	1.0	1.0	70		03/10/21 19:00	

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03/10/21 19:00

03/10/21 19:00

03/10/21 19:00

03/10/21 19:00

03/10/21 19:00

03/10/21 19:00

03/10/21 19:00

1.0

1.0

1.0

1.0

1.0

1.0

1.0

16.0

100.0

100.0

96.5

89.5

88.1

85.5

Clay

75 mm

19 mm

37.5 mm

4.75 mm

3.35 mm

2.36 mm

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0 %

1.0 % Passing

1.0 % Passing1.0 % Passing

1.0 % Passing

1.0 % Passing

% Passing

2

3

6

8

10

12

14

3/19/2021

Job ID: 410-31454-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Loading-PAD-1-SO-(0-2)-030421

Lab Sample ID: 410-31454-1 Date Collected: 03/04/21 09:00 **Matrix: Solid** Date Received: 03/05/21 19:28 Percent Solids: 86.9

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
1.18 mm	82.4		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.6 mm	74.9		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.3 mm	60.6		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.15 mm	53.7		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.075 mm	50.9		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.064 mm	49.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.05 mm	45.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.02 mm	29.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.005 mm	16.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.002 mm	10.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.001 mm	5.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1

Client Sample ID: APG-Loading-PAD-1-GW-030421

Date Collected: 03/04/21 09:50

Date Received: 03/05/21 19:28

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.7		4.6	3.7	3.7	ng/L		03/09/21 12:53	1
8:2 Fluorotelomer sulfonic acid	<1.8		2.8	1.8	1.8	ng/L		03/09/21 12:53	1
NEtFOSAA	<0.92		2.8	0.92	0.92	ng/L		03/09/21 12:53	1
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L		03/09/21 12:53	1
Perfluorobutanesulfonic acid	<0.92		1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluorobutanoic acid	<3.7		4.6	3.7	3.7	ng/L		03/09/21 12:53	1
Perfluorodecanoic acid	<0.92		1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluorododecanoic acid	< 0.92		1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluoroheptanoic acid	<0.92		1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluorohexanesulfonic acid	<0.92	M	1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluorohexanoic acid	<0.92	N	1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluorononanoic acid	<0.92		1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluorooctanesulfonic acid	5.7		1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluorooctanoic acid	< 0.92	M	1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluoropentanoic acid	< 0.92	M	1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluorotetradecanoic acid	<0.92		1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluorotridecanoic acid	<0.92		1.8	0.92	0.92	ng/L		03/09/21 12:53	1
Perfluoroundecanoic acid	< 0.92		1.8	0.92	0.92	ng/L		03/09/21 12:53	1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	123	50 - 150	03/08/21 08:30	03/09/21 12:53	1
M2-8:2 FTS	105	50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C2 PFTeDA	85	50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C3 PFBS	99	50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C4 PFBA	91	50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C4 PFHpA	110	50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C5 PFPeA	105	50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C8 PFOA	109	50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C8 PFOS	100	50 - 150	03/08/21 08:30	03/09/21 12:53	1
d3-NMeFOSAA	90	50 - 150	03/08/21 08:30	03/09/21 12:53	1
d5-NEtFOSAA	91	50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C2-PFDoDA	118	50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C3 PFHxS	107	50 - 150	03/08/21 08:30	03/09/21 12:53	1

Eurofins Lancaster Laboratories Env, LLC

Lab Sample ID: 410-31454-2

Matrix: Water

Client: ARCADIS U.S., Inc. Job ID: 410-31454-1 Project/Site: APG PFAS S1

Client Sample ID: APG-Loading-PAD-1-GW-030421

Lab Sample ID: 410-31454-2 Date Collected: 03/04/21 09:50 **Matrix: Water**

Date Received: 03/05/21 19:28

Method: EPA 537(Mod)	- PFAS for QSM 5.3,	Table B-15 (Continued)
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Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C5 PFHxA	102		50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C6 PFDA	98		50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C7 PFUnA	94		50 - 150	03/08/21 08:30	03/09/21 12:53	1
13C9	101		50 - 150	03/08/21 08:30	03/09/21 12:53	1

Client Sample ID: APG-Hanger-1060-1-SO-(0-2)-030421 Lab Sample ID: 410-31454-3

Date Collected: 03/04/21 10:40 **Matrix: Solid** Date Received: 03/05/21 19:28 Percent Solids: 84.5

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		0.0022	0.0017	0.0017	mg/Kg	₩	03/08/21 22:12	1
8:2 Fluorotelomer sulfonic acid	< 0.0017		0.0033	0.0017	0.0017	mg/Kg	₩	03/08/21 22:12	1
NETFOSAA	<0.00043		0.0022	0.00043	0.00043	mg/Kg	*	03/08/21 22:12	R 1
NMeFOSAA	<0.00043		0.0022	0.00043	0.00043	mg/Kg	*	03/08/21 22:12	R 1
Perfluorobutanesulfonic acid	< 0.0017		0.0022	0.0017	0.0017	mg/Kg	₩	03/08/21 22:12	1
Perfluorobutanoic acid	< 0.0017		0.0022	0.0017	0.0017	mg/Kg	₩	03/08/21 22:12	1
Perfluorodecanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 22:12	1
Perfluorododecanoic acid	< 0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 22:12	1
Perfluoroheptanoic acid	< 0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 22:12	1
Perfluorohexanesulfonic acid	0.00049	J	0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 22:12	1
Perfluorohexanoic acid	< 0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 22:12	1
Perfluorononanoic acid	0.00062	J	0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 22:12	1
Perfluorooctanesulfonic acid	0.013		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 22:12	1
Perfluorooctanoic acid	0.00060	J M	0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 22:12	1
Perfluoropentanoic acid	0.00061	J M	0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 22:12	1
Perfluorotetradecanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 22:12	1
Perfluorotridecanoic acid	< 0.00043		0.00065	0.00043	0.00043	mg/Kg	₩	03/08/21 22:12	1
Perfluoroundecanoic acid	< 0.00043		0.00065	0.00043	0.00043	ma/Ka	ά÷	03/08/21 22:12	1

<0.00043	3	0.00065	0.00043	0.00043	mg/kg ⇔	03/08/21 22:12	1
%Recovery 0	Qualifier	Limits			Prepared	Analyzed	Dil Fac
86		50 - 150			03/08/21 09:53	03/08/21 22:12	1
96		50 - 150			03/08/21 09:53	03/08/21 22:12	1
87		50 - 150			03/08/21 09:53	03/08/21 22:12	1
93		50 - 150			03/08/21 09:53	03/08/21 22:12	1
71		50 - 150			03/08/21 09:53	03/08/21 22:12	1
77		50 - 150			03/08/21 09:53	03/08/21 22:12	1
74		50 - 150			03/08/21 09:53	03/08/21 22:12	1
82		50 - 150			03/08/21 09:53	03/08/21 22:12	1
104		50 - 150			03/08/21 09:53	03/08/21 22:12	1
13 *	*5-	50 - 150			03/08/21 09:53	03/08/21 22:12	1
16 *	*5-	50 - 150			03/08/21 09:53	03/08/21 22:12	1
89		50 - 150			03/08/21 09:53	03/08/21 22:12	1
103		50 - 150			03/08/21 09:53	03/08/21 22:12	1
81		50 - 150			03/08/21 09:53	03/08/21 22:12	1
87		50 - 150			03/08/21 09:53	03/08/21 22:12	1
95		50 - 150			03/08/21 09:53	03/08/21 22:12	1
86		50 - 150			03/08/21 09:53	03/08/21 22:12	1
	%Recovery 6 86 96 87 93 71 77 74 82 104 13 16 89 103 81 87	96 87 93 71 77 74 82 104 13 *5- 16 *5- 89 103 81 87	%Recovery Qualifier Limits 86 50 - 150 96 50 - 150 87 50 - 150 93 50 - 150 71 50 - 150 77 50 - 150 82 50 - 150 104 50 - 150 13 *5 - 50 - 150 16 *5 - 50 - 150 89 50 - 150 103 50 - 150 81 50 - 150 87 50 - 150 95 50 - 150	%Recovery Qualifier Limits 86 50 - 150 96 50 - 150 87 50 - 150 93 50 - 150 71 50 - 150 77 50 - 150 82 50 - 150 104 50 - 150 13 *5 - 50 - 150 16 *5 - 50 - 150 89 50 - 150 81 50 - 150 87 50 - 150 95 50 - 150	%Recovery Qualifier Limits 86 50 - 150 96 50 - 150 87 50 - 150 93 50 - 150 71 50 - 150 77 50 - 150 82 50 - 150 104 50 - 150 13 *5 - 50 - 150 16 *5 - 50 - 150 89 50 - 150 81 50 - 150 87 50 - 150 95 50 - 150	%Recovery Qualifier Limits Prepared 86 50 - 150 03/08/21 09:53 96 50 - 150 03/08/21 09:53 87 50 - 150 03/08/21 09:53 93 50 - 150 03/08/21 09:53 71 50 - 150 03/08/21 09:53 74 50 - 150 03/08/21 09:53 82 50 - 150 03/08/21 09:53 104 50 - 150 03/08/21 09:53 13 *5 - 50 - 150 03/08/21 09:53 16 *5 - 50 - 150 03/08/21 09:53 89 50 - 150 03/08/21 09:53 81 50 - 150 03/08/21 09:53 87 50 - 150 03/08/21 09:53 95 50 - 150 03/08/21 09:53	%Recovery Qualifier Limits Prepared Analyzed 86 50 - 150 03/08/21 09:53 03/08/21 22:12 96 50 - 150 03/08/21 09:53 03/08/21 22:12 87 50 - 150 03/08/21 09:53 03/08/21 22:12 93 50 - 150 03/08/21 09:53 03/08/21 22:12 71 50 - 150 03/08/21 09:53 03/08/21 22:12 77 50 - 150 03/08/21 09:53 03/08/21 22:12 74 50 - 150 03/08/21 09:53 03/08/21 22:12 82 50 - 150 03/08/21 09:53 03/08/21 22:12 104 50 - 150 03/08/21 09:53 03/08/21 22:12 16 *5 - 50 - 150 03/08/21 09:53 03/08/21 22:12 103 50 - 150 03/08/21 09:53 03/08/21 22:12 103 50 - 150 03/08/21 09:53 03/08/21 22:12 81 50 - 150 03/08/21 09:53 03/08/21 22:12 87 50 - 150 03/08/21 09:53 03/08/21 09:53 03/08/21 22:12 87

Client: ARCADIS U.S., Inc.

Project/Site: APG PFAS S1

Job ID: 410-31454-1

Date Collected: 03/04/21 10:40

Matrix: Solid

Date Received: 03/05/21 19:28

Percent Solids: 84.5

Method: EPA 537(Mod) - PFA Analyte	Result Qualifier		LOD	DL	Unit	D	Analyzed	Dil Fa
2 Fluorotelomer sulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	<u></u>	03/10/21 14:03	
3:2 Fluorotelomer sulfonic acid	< 0.0019	0.0035	0.0019		mg/Kg	☼	03/10/21 14:03	
NEtFOSAA	<0.00047	0.0024	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	
NMeFOSAA	<0.00047	0.0024	0.00047	0.00047	mg/Kg	₽	03/10/21 14:03	
Perfluorobutanesulfonic acid	< 0.0019	0.0024	0.0019	0.0019	mg/Kg	☼	03/10/21 14:03	
Perfluorobutanoic acid	<0.0019 M	0.0024	0.0019	0.0019	mg/Kg	₩	03/10/21 14:03	
Perfluorodecanoic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	₩	03/10/21 14:03	
Perfluorododecanoic acid	<0.00047	0.00071	0.00047	0.00047		₩	03/10/21 14:03	
Perfluoroheptanoic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	
Perfluorohexanesulfonic acid	<0.00047	0.00071	0.00047	0.00047	mg/Kg	 ф	03/10/21 14:03	
Perfluorohexanoic acid	<0.00047 M	0.00071	0.00047	0.00047		₽	03/10/21 14:03	
Perfluorononanoic acid	0.00059 J	0.00071	0.00047	0.00047		₽	03/10/21 14:03	
Perfluorooctanesulfonic acid	0.812	0.00071	0.00047	0.00047		 .⇔	03/10/21 14:03	
Perfluorooctanoic acid	0.00053 J M	0.00071	0.00047	0.00047		₩	03/10/21 14:03	
Perfluoropentanoic acid	0.00051 J	0.00071	0.00047	0.00047		₽	03/10/21 14:03	
Perfluorotetradecanoic acid	<0.00047	0.00071	0.00047	0.00047			03/10/21 14:03	
Perfluorotridecanoic acid	<0.00047	0.00071	0.00047	0.00047		☆	03/10/21 14:03	
Perfluoroundecanoic acid	<0.00047	0.00071	0.00047	0.00047		₽	03/10/21 14:03	
sotope Dilution	%Recovery Qualifier	Limits			Prepa	red	Analyzed	Dil Fa
M2-6:2 FTS	62	50 - 150			03/09/21			- Diri u
M2-8:2 FTS	53	50 - 150 50 - 150					03/10/21 14:03	
13C2 PFTeDA	63	50 - 150					03/10/21 14:03	
13C3 PFBS	80	50 - 150 50 - 150					03/10/21 14:03	
13C4 PFBA	70	50 - 150					03/10/21 14:03	
13C4 PFHpA	72	50 - 150 50 - 150					03/10/21 14:03	
13C5 PFPeA	73	50 - 150					03/10/21 14:03	
13C8 PFOA	75 75	50 - 150					03/10/21 14:03	
13C8 PFOS	75 85	50 - 150 50 - 150					03/10/21 14:03	
d3-NMeFOSAA	9 *5-	50 - 150 50 - 150					03/10/21 14:03	
d5-NEtFOSAA	9 5- 11 *5-	50 - 150 50 - 150					03/10/21 14:03	
13C2-PFDoDA	76	50 - 150 50 - 150					03/10/21 14:03	
13C3 PFHxS	85	50 - 150					03/10/21 14:03	
							03/10/21 14:03	
13C5 PFHxA	71	50 ₋ 150						
13C6 PFDA	70	50 - 150					03/10/21 14:03	
13C7 PFUnA	67	50 ₋ 150					03/10/21 14:03	
13C9 PFNA	72	50 - 150			03/09/21	22:10	03/10/21 14:03	
General Chemistry								
Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
Total Organic Carbon	3760 J+	2230	1490	1490	mg/Kg	-	03/13/21 17:00	6.29
Percent Moisture	15.5	1.0		1.0			03/08/21 15:30	
Percent Solids	84.5	1.0		1.0	%		03/08/21 15:30	
General Chemistry - Soluble			1.00	ъ.	l lmit	_	A mal: : -!	DU E-
Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa

Eurofins Lancaster Laboratories Env, LLC

0.01

0.01

6.9

20.2

0.01

0.01

0.01 S.U.

0.01 Degrees C

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Temperature

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<u>5</u>

6

8

10

12

14

15

03/08/21 15:05

03/08/21 15:05

Job ID: 410-31454-1

Project/Site: APG PFAS S1

Client: ARCADIS U.S., Inc.

Client Sample ID: APG-Hanger-1060-1-SO-(0-2)-030421

Lab Sample ID: 410-31454-3 Date Collected: 03/04/21 10:40 **Matrix: Solid**

Date Received: 03/05/21 19:28 Percent Solids: 84.5

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%		03/10/21 19:00	1
Sand	8.9		1.0	1.0	1.0	%		03/10/21 19:00	1
Silt	71.9		1.0	1.0	1.0	%		03/10/21 19:00	1
Clay	19.0		1.0	1.0	1.0	%		03/10/21 19:00	1
75 mm	100.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
19 mm	100.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
4.75 mm	99.8		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
3.35 mm	99.4		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
2.36 mm	98.6		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
1.18 mm	96.9		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.6 mm	95.3		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.3 mm	93.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.15 mm	91.7		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.075 mm	90.9		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.064 mm	89.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.05 mm	84.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.02 mm	44.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.005 mm	19.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.002 mm	14.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.001 mm	11.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1

Client Sample ID: APG-Hanger-1060-1-GW-030421

Lab Sample ID: 410-31454-4 Date Collected: 03/04/21 11:30 **Matrix: Water**

Data Bassiyadı 02/05/24 40:20

Method: EPA 537(Mod) - PFA Analyte		It Qualifier		oq	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid		0		6.0	4.8	4.8	ng/L	03/09/21 13:04	1
8:2 Fluorotelomer sulfonic acid	9	9	;	3.6	2.4	2.4	ng/L	03/09/21 13:04	1
NEtFOSAA	<1	.2	;	3.6	1.2	1.2	ng/L	03/09/21 13:04	1
NMeFOSAA	<1	.4		2.4	1.4	1.4	ng/L	03/09/21 13:04	1
Perfluorobutanesulfonic acid	2	.7	:	2.4	1.2	1.2	ng/L	03/09/21 13:04	1
Perfluorobutanoic acid	5	6	(6.0	4.8	4.8	ng/L	03/09/21 13:04	1
Perfluorodecanoic acid	<1	.2 M	:	2.4	1.2	1.2	ng/L	03/09/21 13:04	1
Perfluorododecanoic acid	<1	.2	:	2.4	1.2	1.2	ng/L	03/09/21 13:04	1
Perfluoroheptanoic acid	10	0	:	2.4	1.2	1.2	ng/L	03/09/21 13:04	1
Perfluorohexanoic acid	14	0	:	2.4	1.2	1.2	ng/L	03/09/21 13:04	1
Perfluorononanoic acid	3	3	:	2.4	1.2	1.2	ng/L	03/09/21 13:04	1
Perfluorooctanoic acid	11	0 M	:	2.4	1.2	1.2	ng/L	03/09/21 13:04	1
Perfluoropentanoic acid	16	0	:	2.4	1.2	1.2	ng/L	03/09/21 13:04	1
Perfluorotetradecanoic acid	<1	.2	:	2.4	1.2	1.2	ng/L	03/09/21 13:04	1
Perfluorotridecanoic acid	<1	.2		2.4	1.2	1.2	ng/L	03/09/21 13:04	1
Perfluoroundecanoic acid	<1	.2	:	2.4	1.2	1.2	ng/L	03/09/21 13:04	1
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	128		50 - 150				03/08/21 08:30	03/09/21 13:04	1
M2-8-2 FTS	105		50 - 150				03/08/21 08:30	03/09/21 13:04	1

M2-8:2 FTS 105 50 - 150 03/08/21 08:30 03/09/21 13:04 13C2 PFTeDA 50 - 150 83 03/08/21 08:30 03/09/21 13:04 13C3 PFBS 101 50 - 150 03/08/21 08:30 03/09/21 13:04 13C4 PFBA 03/08/21 08:30 03/09/21 13:04 50 - 150 90

Client: ARCADIS U.S., Inc. Job ID: 410-31454-1 Project/Site: APG PFAS S1

Client Sample ID: APG-Hanger-1060-1-GW-030421

Lab Sample ID: 410-31454-4 Date Collected: 03/04/21 11:30 **Matrix: Water**

Date Received: 03/05/21 19:28

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued	Method: EPA 537	(Mod) - PFAS for QSM 5.3	, Table B-15 (Continued)
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Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFHpA	95		50 - 150	03/08/21 08:30	03/09/21 13:04	1
13C5 PFPeA	94		50 - 150	03/08/21 08:30	03/09/21 13:04	1
13C8 PFOA	99		50 - 150	03/08/21 08:30	03/09/21 13:04	1
13C8 PFOS	104		50 - 150	03/08/21 08:30	03/09/21 13:04	1
d3-NMeFOSAA	101		50 - 150	03/08/21 08:30	03/09/21 13:04	1
d5-NEtFOSAA	93		50 - 150	03/08/21 08:30	03/09/21 13:04	1
13C2-PFDoDA	95		50 - 150	03/08/21 08:30	03/09/21 13:04	1
13C3 PFHxS	107		50 - 150	03/08/21 08:30	03/09/21 13:04	1
13C5 PFHxA	93		50 - 150	03/08/21 08:30	03/09/21 13:04	1
13C6 PFDA	99		50 - 150	03/08/21 08:30	03/09/21 13:04	1
13C7 PFUnA	90		50 - 150	03/08/21 08:30	03/09/21 13:04	1
13C9 PFNA	93		50 ₋ 150	03/08/21 08:30	03/09/21 13:04	1

Method: EPA	537(Mod).	- PFAS for	OSM 5.3	Table R	-15 - DI

Analyte	Result	Qualifier	LO	Q	LOD	DL	Unit I	D Analyzed	Dil Fac
Perfluorohexanesulfonic acid	540	D		24	12	12	ng/L	03/10/21 00:31	10
Perfluorooctanesulfonic acid	1200	D		24	12	12	ng/L	03/10/21 00:31	10
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	DII Fac
13C8 PFOS	102		50 - 150	03/08/21 08:30	03/10/21 00:31	10
_13C3 PFHxS	98		50 - 150	03/08/21 08:30	03/10/21 00:31	10

Client Sample ID: APG-FB-02-030421

Date Collected: 03/04/21 12:05

Date Received: 03/05/21 19:28

Lab Sample ID: 410-31454-5

Matrix: Water

Method: EPA	.537(Mod) -	PFAS for QSI	M 5.3. Table B-15

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5		4.4	3.5	3.5	ng/L		03/09/21 13:14	1
8:2 Fluorotelomer sulfonic acid	<1.8		2.6	1.8	1.8	ng/L		03/09/21 13:14	1
NEtFOSAA	<0.88		2.6	0.88	0.88	ng/L		03/09/21 13:14	1
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L		03/09/21 13:14	1
Perfluorobutanesulfonic acid	<0.88		1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluorobutanoic acid	<3.5		4.4	3.5	3.5	ng/L		03/09/21 13:14	1
Perfluorodecanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluorododecanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluoroheptanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluorohexanesulfonic acid	<0.88		1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluorohexanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluorononanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluorooctanesulfonic acid	<0.88	M	1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluorooctanoic acid	<0.88	'	1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluoropentanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluorotetradecanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluorotridecanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/09/21 13:14	1
Perfluoroundecanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/09/21 13:14	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	119		50 - 150	03/08/21 08:30	03/09/21 13:14	1
M2-8:2 FTS	105		50 - 150	03/08/21 08:30	03/09/21 13:14	1
13C2 PFTeDA	81		50 - 150	03/08/21 08:30	03/09/21 13:14	1
13C3 PFBS	101		50 - 150	03/08/21 08:30	03/09/21 13:14	1

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Client: ARCADIS U.S., Inc. Job ID: 410-31454-1 Project/Site: APG PFAS S1

Client Sample ID: APG-FB-02-030421

Lab Sample ID: 410-31454-5 Date Collected: 03/04/21 12:05

Matrix: Water Date Received: 03/05/21 19:28

Method: EPA 537(Mod) - PFA	NS for QSIVI 5.3, Table B	-15 (Continued)
Isotope Dilution	%Recovery Qualifier	Limits

Isotope Dilution	%Recovery Qualifier	· Limits	Prepared	Analyzed	Dil Fac
13C4 PFBA	99	50 - 150	03/08/21 08:30	03/09/21 13:14	1
13C4 PFHpA	105	50 ₋ 150	03/08/21 08:30	03/09/21 13:14	1
13C5 PFPeA	102	50 - 150	03/08/21 08:30	03/09/21 13:14	1
13C8 PFOA	106	50 ₋ 150	03/08/21 08:30	03/09/21 13:14	1
13C8 PFOS	107	50 ₋ 150	03/08/21 08:30	03/09/21 13:14	1
d3-NMeFOSAA	99	50 - 150	03/08/21 08:30	03/09/21 13:14	1
d5-NEtFOSAA	97	50 ₋ 150	03/08/21 08:30	03/09/21 13:14	1
13C2-PFDoDA	103	50 - 150	03/08/21 08:30	03/09/21 13:14	1
13C3 PFHxS	108	50 - 150	03/08/21 08:30	03/09/21 13:14	1
13C5 PFHxA	100	50 ₋ 150	03/08/21 08:30	03/09/21 13:14	1
13C6 PFDA	97	50 - 150	03/08/21 08:30	03/09/21 13:14	1
13C7 PFUnA	92	50 - 150	03/08/21 08:30	03/09/21 13:14	1
13C9 PFNA	101	50 ₋ 150	03/08/21 08:30	03/09/21 13:14	1

Lab Sample ID: 410-31454-6 Client Sample ID: APG-EB-02-030421

Date Collected: 03/04/21 12:10 **Matrix: Water** Date Received: 03/05/21 19:28

Analyte	Result C	Qualifier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.4	4.2	3.4	3.4	ng/L		03/09/21 13:25	1
8:2 Fluorotelomer sulfonic acid	<1.7	2.5	1.7	1.7	ng/L		03/09/21 13:25	1
NEtFOSAA	<0.84	2.5	0.84	0.84	ng/L		03/09/21 13:25	1
NMeFOSAA	<1.0	1.7	1.0	1.0	ng/L		03/09/21 13:25	1
Perfluorobutanesulfonic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluorobutanoic acid	<3.4	4.2	3.4	3.4	ng/L		03/09/21 13:25	1
Perfluorodecanoic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluorododecanoic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluoroheptanoic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluorohexanesulfonic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluorohexanoic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluorononanoic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluorooctanesulfonic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluorooctanoic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluoropentanoic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluorotetradecanoic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluorotridecanoic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1
Perfluoroundecanoic acid	<0.84	1.7	0.84	0.84	ng/L		03/09/21 13:25	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	130		50 - 150	03/08/21 08:30	03/09/21 13:25	1
M2-8:2 FTS	112		50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C2 PFTeDA	94		50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C3 PFBS	105		50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C4 PFBA	98		50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C4 PFHpA	105		50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C5 PFPeA	105		50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C8 PFOA	107		50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C8 PFOS	107		50 - 150	03/08/21 08:30	03/09/21 13:25	1
d3-NMeFOSAA	107		50 - 150	03/08/21 08:30	03/09/21 13:25	1
d5-NEtFOSAA	101		50 - 150	03/08/21 08:30	03/09/21 13:25	1

Eurofins Lancaster Laboratories Env, LLC

Client: ARCADIS U.S., Inc. Job ID: 410-31454-1 Project/Site: APG PFAS S1

Client Sample ID: APG-EB-02-030421

Lab Sample ID: 410-31454-6

Date Collected: 03/04/21 12:10 **Matrix: Water** Date Received: 03/05/21 19:28

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2-PFDoDA	101	50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C3 PFHxS	111	50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C5 PFHxA	102	50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C6 PFDA	100	50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C7 PFUnA	96	50 - 150	03/08/21 08:30	03/09/21 13:25	1
13C9 PFNA	103	50 - 150	03/08/21 08:30	03/09/21 13:25	1

Client Sample ID: APG-MFR1-1-SO-(8-10)-030421 Lab Sample ID: 410-31454-7

Date Collected: 03/04/21 12:15 **Matrix: Solid** Date Received: 03/05/21 19:28 Percent Solids: 80.7

Analyte	Result Q	ualifier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	☼	03/08/21 22:23	1
8:2 Fluorotelomer sulfonic acid	<0.0018	0.0034	0.0018	0.0018	mg/Kg	☼	03/08/21 22:23	1
NEtFOSAA	<0.00045 U	J 0.0023	0.00045	0.00045	mg/Kg	☼	03/08/21 22:23	1
NMeFOSAA	<0.00045	0.0023	0.00045	0.00045	mg/Kg	Ϋ	03/08/21 22:23	R 1
Perfluorobutanesulfonic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	☼	03/08/21 22:23	1
Perfluorobutanoic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	₩	03/08/21 22:23	1
Perfluorodecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	☼	03/08/21 22:23	1
Perfluorododecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	☼	03/08/21 22:23	1
Perfluoroheptanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/08/21 22:23	1
Perfluorohexanesulfonic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/08/21 22:23	1
Perfluorohexanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/08/21 22:23	1
Perfluorononanoic acid	< 0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/08/21 22:23	1
Perfluorooctanesulfonic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/08/21 22:23	1
Perfluorooctanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/08/21 22:23	1
Perfluoropentanoic acid	< 0.00045	0.00068	0.00045	0.00045	mg/Kg	☼	03/08/21 22:23	1
Perfluorotetradecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/08/21 22:23	1
Perfluorotridecanoic acid	< 0.00045	0.00068	0.00045	0.00045	mg/Kg	☼	03/08/21 22:23	1
Perfluoroundecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	₩	03/08/21 22:23	1
Isotone Dilution	%Recovery Qual	lifier l imits			Prena	red	Analyzed	Dil Fac

Isotope Dilution	%Recovery	Qualifier Limi	ts	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	63	50 -	150	03/08/21 09:53	03/08/21 22:23	1
M2-8:2 FTS	65	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C2 PFTeDA	70	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C3 PFBS	92	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C4 PFBA	57	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C4 PFHpA	62	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C5 PFPeA	58	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C8 PFOA	65	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C8 PFOS	111	50 -	150	03/08/21 09:53	03/08/21 22:23	1
d3-NMeFOSAA	13	*5- 50 -	150	03/08/21 09:53	03/08/21 22:23	1
d5-NEtFOSAA	20	*5- 50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C2-PFDoDA	75	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C3 PFHxS	107	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C5 PFHxA	59	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C6 PFDA	72	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C7 PFUnA	76	50 -	150	03/08/21 09:53	03/08/21 22:23	1
13C9 PFNA	69	50 -	150	03/08/21 09:53	03/08/21 22:23	1

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Client: ARCADIS U.S., Inc. Job ID: 410-31454-1 Project/Site: APG PFAS S1

Client Sample ID: APG-MFR1-1-SO-(8-10)-030421

Lab Sample ID: 410-31454-7 Date Collected: 03/04/21 12:15 **Matrix: Solid** Date Received: 03/05/21 19:28 Percent Solids: 80.7

General Chemistry LOQ LOD Analyzed Analyte Result Qualifier DL Unit Dil Fac 1.0 % 03/08/21 15:30 **Percent Moisture** 1.0 19.3 **Percent Solids** 1.0 % 03/08/21 15:30 80.7 1.0

Client Sample ID: APG-DUP-01-030421

Analyte

NEtFOSAA

13C6 PFDA

13C7 PFUnA

13C9 PFNA

6:2 Fluorotelomer sulfonic acid

8:2 Fluorotelomer sulfonic acid

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15

Lab Sample ID: 410-31454-8 Date Collected: 03/04/21 12:00 **Matrix: Solid** Date Received: 03/05/21 19:28 Percent Solids: 81.4

LOQ

0.0024

0.0036

0.0024

LOD

0.0019

0.0019

0.00048

DL Unit

0.0019 mg/Kg

0.0019 mg/Kg

0.00048 mg/Kg

D

Analyzed

03/08/21 22:56

☼ 03/08/21 22:56

Result Qualifier

UJ

<0.0019

<0.0019

<0.00048

TILLI OOTU	·0.000+0 00	0.002	0.000-0	0.00040	111g/11g ~	00/00/21 22.00	•
NMeFOSAA	<0.00048 UJ	0.0024	0.00048	0.00048	mg/Kg ☆	03/08/21 22:56	1
Perfluorobutanesulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg ☆	03/08/21 22:56	1
Perfluorobutanoic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg ☆	03/08/21 22:56	1
Perfluorodecanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg ⇔	03/08/21 22:56	1
Perfluorododecanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg ⇔	03/08/21 22:56	1
Perfluoroheptanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg 🌣	03/08/21 22:56	1
Perfluorohexanesulfonic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg ☆	03/08/21 22:56	1
Perfluorohexanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg ⇔	03/08/21 22:56	1
Perfluorononanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg ☆	03/08/21 22:56	1
Perfluorooctanesulfonic acid	0.00067 J	0.00072	0.00048	0.00048	mg/Kg ☆	03/08/21 22:56	1
Perfluorooctanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg ☆	03/08/21 22:56	1
Perfluoropentanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg ☆	03/08/21 22:56	1
Perfluorotetradecanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg ☆	03/08/21 22:56	1
Perfluorotridecanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg ☆	03/08/21 22:56	1
Perfluoroundecanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg ☆	03/08/21 22:56	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	98	50 - 150			03/08/21 09:53	03/08/21 22:56	1
M2-8:2 FTS	96	50 - 150			03/08/21 09:53	03/08/21 22:56	1
13C2 PFTeDA	101	50 - 150			03/08/21 09:53	03/08/21 22:56	1
13C3 PFBS	100	50 - 150			03/08/21 09:53	03/08/21 22:56	1
13C4 PFBA	85	50 - 150			03/08/21 09:53	03/08/21 22:56	1
13C4 PFHpA	87	50 - 150			03/08/21 09:53	03/08/21 22:56	1
13C5 PFPeA					00/00/04 00:50	03/08/21 22:56	1
	88	50 - 150			03/08/21 09:53	03/00/21 22.30	1
13C8 PFOA	88 94	50 - 150 50 - 150				03/08/21 22:56	1
					03/08/21 09:53		•
13C8 PFOA 13C8 PFOS d3-NMeFOSAA	94	50 - 150			03/08/21 09:53 03/08/21 09:53	03/08/21 22:56	•
13C8 PFOS d3-NMeFOSAA	94 116	50 - 150 50 - 150			03/08/21 09:53 03/08/21 09:53 03/08/21 09:53	03/08/21 22:56 03/08/21 22:56	1
13C8 PFOS d3-NMeFOSAA d5-NEtFOSAA	94 116 34 *5-	50 - 150 50 - 150 50 - 150			03/08/21 09:53 03/08/21 09:53 03/08/21 09:53 03/08/21 09:53	03/08/21 22:56 03/08/21 22:56 03/08/21 22:56	1
13C8 PFOS	94 116 34 *5- 49 *5-	50 - 150 50 - 150 50 - 150 50 - 150			03/08/21 09:53 03/08/21 09:53 03/08/21 09:53 03/08/21 09:53 03/08/21 09:53	03/08/21 22:56 03/08/21 22:56 03/08/21 22:56 03/08/21 22:56	1 1 1 1
13C8 PFOS d3-NMeFOSAA d5-NEtFOSAA 13C2-PFDoDA	94 116 34 *5- 49 *5- 100	50 - 150 50 - 150 50 - 150 50 - 150 50 - 150			03/08/21 09:53 03/08/21 09:53 03/08/21 09:53 03/08/21 09:53 03/08/21 09:53	03/08/21 22:56 03/08/21 22:56 03/08/21 22:56 03/08/21 22:56 03/08/21 22:56	1 1 1 1

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - RE

92

100

94

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019	0.0024	0.0019	0.0019 mg/Kg	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	1
8:2 Fluorotelomer sulfonic acid	<0.0019	0.0036	0.0019	0.0019 mg/Kg		1

50 - 150

50 - 150

50 - 150

03/08/21 09:53 03/08/21 22:56

03/08/21 09:53 03/08/21 22:56

03/08/21 09:53 03/08/21 22:56

6

Dil Fac

1

Eurofins Lancaster Laboratories Env, LLC

Job ID: 410-31454-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-DUP-01-030421

Lab Sample ID: 410-31454-8 Date Collected: 03/04/21 12:00 **Matrix: Solid** Date Received: 03/05/21 19:28 Percent Solids: 81.4

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - RE (Continued) Analyte LOD Result Qualifier LOQ DL Unit D Analyzed Dil Fac NETEOSAA 0.0024 0.00048 0.00048 03/10/21 14:13 < 0.00048 mg/Kg NMeFOSAA 0.00048 0.00048 mg/Kg 03/10/21 14:13 <0.00048 0.0024 Perfluorobutanesulfonic acid <0.0019 0.0024 0.0019 0.0019 mg/Kg 03/10/21 14:13 Perfluorobutanoic acid 0.0019 0.0019 mg/Kg < 0.0019 0.0024 03/10/21 14:13 Perfluorodecanoic acid <0.00048 0.00072 0.00048 0.00048 mg/Kg 03/10/21 14:13 Perfluorododecanoic acid 03/10/21 14:13 <0.00048 0.00072 0.00048 0.00048 mg/Kg Perfluoroheptanoic acid <0.00048 0.00072 0.00048 0.00048 mg/Kg 03/10/21 14:13 Perfluorohexanesulfonic acid <0.00048 0.00048 0.00048 mg/Kg 03/10/21 14:13 0.00072 Perfluorohexanoic acid <0.00048 0.00072 0.00048 0.00048 mg/Kg 03/10/21 14:13 Perfluorononanoic acid <0.00048 0.00072 0.00048 0.00048 mg/Kg 03/10/21 14:13 0.00048 mg/Kg Perfluorooctanesulfonic acid 0.00093 0.00072 0.00048 03/10/21 14:13 <0.00048 M Perfluorooctanoic acid 0.00072 0.00048 0.00048 mg/Kg 03/10/21 14:13 Perfluoropentanoic acid < 0.00048 0.00072 0.00048 0.00048 mg/Kg 03/10/21 14:13 Perfluorotetradecanoic acid < 0.00048 0.00072 0.00048 0.00048 mg/Kg 03/10/21 14:13 0.00048 0.00048 mg/Kg Perfluorotridecanoic acid <0.00048 0.00072 03/10/21 14:13 Perfluoroundecanoic acid <0.00048 0.00072 0.00048 0.00048 mg/Kg 03/10/21 14:13

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	48	*5-	50 - 150	03/09/21 22:10	03/10/21 14:13	1
M2-8:2 FTS	47	*5-	50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C2 PFTeDA	56		50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C3 PFBS	76		50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C4 PFBA	61		50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C4 PFHpA	69		50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C5 PFPeA	65		50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C8 PFOA	66		50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C8 PFOS	82		50 - 150	03/09/21 22:10	03/10/21 14:13	1
d3-NMeFOSAA	11	*5-	50 - 150	03/09/21 22:10	03/10/21 14:13	1
d5-NEtFOSAA	15	*5-	50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C2-PFDoDA	67		50 - 150	03/09/21 22:10	03/19/21 14:13	1
13C3 PFHxS	83		50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C5 PFHxA	63		50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C6 PFDA	62		50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C7 PFUnA	61		50 - 150	03/09/21 22:10	03/10/21 14:13	1
13C9 PFNA	67		50 - 150	03/09/21 22:10	03/10/21 14:13	1

General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	18.6		1.0		1.0	%		03/08/21 15:30	1
Percent Solids	81.4		1.0		1.0	%		03/08/21 15:30	1

Lab Sample ID: 410-31454-9 Client Sample ID: APG-MFR1-1-GW-030421

Date Collected: 03/04/21 13:00 **Matrix: Water** Date Received: 03/05/21 19:28

Method: EPA 537(Mod) - PFAS	for QSM 5.3, Table B-15	5				
Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<4.5	5.6	4.5	4.5 ng/L	03/09/21 13:35	1
8:2 Fluorotelomer sulfonic acid	<2.2	3.4	2.2	2.2 ng/L	03/09/21 13:35	1
NEtFOSAA	<1.1	3.4	1.1	1.1 ng/L	03/09/21 13:35	1
NMeFOSAA	<1.3	2.2	1.3	1.3 ng/L	03/09/21 13:35	1

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3/19/2021

Job ID: 410-31454-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-MFR1-1-GW-030421

Lab Sample ID: 410-31454-9 Date Collected: 03/04/21 13:00 **Matrix: Water**

Date Received: 03/05/21 19:28

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorobutanesulfonic acid	63		2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluorobutanoic acid	16		5.6	4.5	4.5	ng/L		03/09/21 13:35	1
Perfluorodecanoic acid	1.8	JM	2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluorododecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluoroheptanoic acid	23		2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluorohexanesulfonic acid	250		2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluorohexanoic acid	61		2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluorononanoic acid	17		2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluorooctanesulfonic acid	250		2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluorooctanoic acid	28	M	2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluoropentanoic acid	36	M	2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluorotetradecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluorotridecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/09/21 13:35	1
Perfluoroundecanoic acid	<1.1	N <mark>/</mark> 1	2.2	1.1	1.1	ng/L		03/09/21 13:35	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	121		50 - 150	03/08/21 08:30	03/09/21 13:35	1
M2-8:2 FTS	91		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C2 PFTeDA	76		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C3 PFBS	89		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C4 PFBA	90		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C4 PFHpA	93		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C5 PFPeA	93		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C8 PFOA	94		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C8 PFOS	90		50 - 150	03/08/21 08:30	03/09/21 13:35	1
d3-NMeFOSAA	93		50 - 150	03/08/21 08:30	03/09/21 13:35	1
d5-NEtFOSAA	91		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C2-PFDoDA	90		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C3 PFHxS	95		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C5 PFHxA	92		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C6 PFDA	86		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C7 PFUnA	86		50 - 150	03/08/21 08:30	03/09/21 13:35	1
13C9 PFNA	86		50 ₋ 150	03/08/21 08:30	03/09/21 13:35	1

Client Sample ID: APG-MFR1-2-SO-(8-10)-030421	Lab Sample ID: 410-31454-10
Date Collected: 03/04/21 13:45	Matrix: Solid
Date Received: 03/05/21 19:28	Percent Solids: 82.1

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	☆	03/08/21 23:07	1
8:2 Fluorotelomer sulfonic acid	<0.0019	0.0035	0.0019	0.0019	mg/Kg	₩	03/08/21 23:07	1
NEtFOSAA	<0.00047	0.0023	0.00047	0.00047	mg/Kg	\tau	03/08/21 23:07	R 1
NMeFOSAA	<0.00047	0.0023	0.00047	0.00047	mg/Kg	*	03/08/21 23:07	R 1
Perfluorobutanesulfonic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	₩	03/08/21 23:07	1
Perfluorobutanoic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	#	03/08/21 23.07	1
Perfluorodecanoic acid	<0.00047	0.00070	0.00047	0.00047	mg/Kg	₩	03/08/21 23:07	1
Perfluorododecanoic acid	<0.00047	0.00070	0.00047	0.00047	mg/Kg	₩	03/08/21 23:07	1
Perfluoroheptanoic acid	<0.00047	0.00070	0.00047	0.00047	mg/Kg	₩	03/08/21 23:07	1
Perfluorohexanesulfonic acid	<0.00047	0.00070	0.00047	0.00047	mg/Kg	₩	03/08/21 23:07	1
Perfluorohexanoic acid	<0.00047	0.00070	0.00047	0.00047	mg/Kg	₩	03/08/21 23:07	1

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Client: ARCADIS U.S., Inc. Job ID: 410-31454-1 Project/Site: APG PFAS S1

Client Sample ID: APG-MFR1-2-SO-(8-10)-030421

M2-8:2 FTS

Lab Sample ID: 410-31454-10 Date Collected: 03/04/21 13:45 **Matrix: Solid**

Date Received: 03/05/21 19:28 Percent Solids: 82.1

Analyte	Result Q	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorononanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg 🕏	03/08/21 23:07	1
Perfluorooctanesulfonic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg ☆	03/08/21 23:07	1
Perfluorooctanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg ≎	03/08/21 23:07	1
Perfluoropentanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg ☆	03/08/21 23:07	1
Perfluorotetradecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg ☆	03/08/21 23:07	1
Perfluorotridecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg ≎	03/08/21 23:07	1
Perfluoroundecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg ≎	03/08/21 23:07	1
Isotope Dilution	%Recovery Qual	lifier Lin	nits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	62	50	- 150			03/08/21 09:53	03/08/21 23:07	1
M2-8:2 FTS	73	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C2 PFTeDA	68	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C3 PFBS	86	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C4 PFBA	49 *5-	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C4 PFHpA	54	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C5 PFPeA	50	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C8 PFOA	59	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C8 PFOS	103	50	- 150			03/08/21 09:53	03/08/21 23:07	1
d3-NMeFOSAA	14 *5-	50	- 150			03/08/21 09:53	03/08/21 23:07	1
d5-NEtFOSAA	19 *5-	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C2-PFDoDA	70	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C3 PFHxS	99	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C5 PFHxA	53	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C6 PFDA	68	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C7 PFUnA	71	50	- 150			03/08/21 09:53	03/08/21 23:07	1
13C9 PFNA	63	50	₋ 150			03/08/21 09:53	03/08/21 23:07	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	— -	03/10/21 14:24	1
8:2 Fluorotelomer sulfonic acid	<0.0019		0.0036	0.0019	0.0019	mg/Kg	₩	03/10/21 14:24	1
NEtFOSAA	<0.00048		0.0024	0.00048	0.00048	mg/Kg	₩	03/10/21 14:24	1
NMeFOSAA	<0.00048		0.0024	0.00048	0.00048	mg/Kg	₩	03/10/21 14:24	1
Perfluorobutanesulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	¢	03/10/21 14:24	1
Perfluorobutanoic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	₩	03/10/21 14:24	1
Perflueredecaneic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	÷	03/10/21 14:24	1
Perfluorododecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₩	03/10/21 14:24	1
Perfluoroheptanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☆	03/10/21 14:24	1
Perfluorohexanesulfonic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₩	03/10/21 14:24	1
Perfluorohexanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☆	03/10/21 14:24	1
Perfluorononanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₩	03/10/21 14:24	1
Perfluorooctanesulfonic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₩	03/10/21 14:24	1
Perfluorooctanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₩	03/10/21 14:24	1
Perfluoropentanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₩	03/10/21 14:24	1
Perfluorotetradecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	- \$2	03/10/21 14:24	1
Perfluorotridecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₩	03/10/21 14.24	1
Perfluoroundecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	≎	03/10/21 14:24	1
Isotope Dilution	%Recovery Qu	alifier	Limits			Prepa	ared	Analyzed	Dil Fac
M2-6:2 FTS	41 *5-		50 - 150			03/09/2	1 22:10	03/10/21 14:24	1

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03/09/21 22:10 03/10/21 14:24

Client: ARCADIS U.S., Inc.

Project/Site: APG PFAS S1

Job ID: 410-31454-1

Date Collected: 03/04/21 13:45

Date Received: 03/05/21 19:28

Matrix: Solid

Percent Solids: 82.1

Method: EPA 537(Mod) - F Isotope Dilution	%Recovery Q		Limits	•		Prepare	d	Analyzed	Dil Fa
13C2 PFTeDA	53		50 - 150					03/10/21 14:24	
13C3 PFBS	73		50 - 150			03/09/21 2	2:10	03/10/21 14:24	
13C4 PFBA	50		50 - 150			03/09/21 2	2:10	03/10/21 14:24	
13C4 PFHpA	58		50 ₋ 150			03/09/21 2	2:10	03/10/21 14:24	
13C5 PFPeA	53		50 - 150					03/10/21 14:24	
13C8 PFOA	57		50 - 150			03/09/21 2	2:10	03/10/21 14:24	
13C8 PFOS	78		50 - 150					03/10/21 14:24	
d3-NMeFOSAA	8 *5		50 - 150					03/10/21 14:24	
d5-NEtFOSAA	11 *5		50 - 150					03/10/21 14:24	
13C2-PFDoDA	58		50 - 150 50 - 150					03/10/21 14:24	
13C3 PFHxS	81		50 - 150					03/10/21 14:24	
13C5 PFHxA	54		50 - 150 50 - 150					03/10/21 14:24	
13C6 PFDA	55		50 - 150 50 - 150					03/10/21 14:24	
13C7 PFUnA	52 56		50 ₋ 150					03/10/21 14:24	
13C9 PFNA	56		50 - 150			03/09/21 2	2.70	03/10/21 14:24	
General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
Total Organic Carbon	979	J+ J+	1200	801	801	mg/Kg	☼	03/13/21 17:12	3.2
Percent Moisture	17.9		1.0		1.0	%		03/08/21 15:30	
Percent Solids	82.1		1.0		1.0	%		03/08/21 15:30	
General Chemistry - Solu		0		1.00	ъ.	1114	_	A	D!! F-
Analyte		Qualifier	_ <u>LOQ</u> _	LOD _		Unit	_ D	Analyzed	Dil Fa
oH	5.3	J	0.01	0.01		S.U.		03/08/21 15:05	
emperature	20.7		0.01	0.01	0.01	Degrees C		03/08/21 15:05	
Method: D422 - Grain Size	<u> </u>								
Analyte		Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
Gravel	1.8		1.0	1.0	1.0	%		03/10/21 19:00	
Sand	48.0		1.0	1.0	1.0			03/10/21 19:00	
Silt	29.2		1.0	1.0	1.0			03/10/21 19:00	
Clay	21.0		1.0	1.0	1.0			03/10/21 19:00	
'5 mm	100.0		1.0	1.0		% Passing		03/10/21 19:00	
7.5 mm	100.0		1.0	1.0		% Passing		03/10/21 19:00	
9 mm	100.0		1.0	1.0		% Passing		03/10/21 19:00	
.75 mm	98.2		1.0	1.0		% Passing		03/10/21 19:00	
			1.0	1.0		% Passing		03/10/21 19:00	
3.35 mm	96.6								
2.36 mm	94.4		1.0	1.0		% Passing		03/10/21 19:00	
.18 mm	90.0		1.0	1.0		% Passing		03/10/21 19:00	
.6 mm	81.2		1.0	1.0		% Passing		03/10/21 19:00	
2 mm	58.7		1.0	1.0		% Passing		03/10/21 19:00	
			1.0	1.0		% Passing		03/10/21 19:00	
.15 mm	51.9			1.0	1.0	% Passing		03/10/21 19:00	
0.15 mm 0.075 mm	51.9 50.2		1.0						
0.15 mm 0.075 mm 0.064 mm	50.2 49.0		1.0	1.0		% Passing		03/10/21 19:00	
0.15 mm 0.075 mm 0.064 mm	50.2 49.0 44.0		1.0 1.0	1.0 1.0	1.0	% Passing		03/10/21 19:00	
0.15 mm 0.075 mm 0.064 mm 0.05 mm	50.2 49.0		1.0	1.0	1.0 1.0	% Passing % Passing			
0.15 mm 0.075 mm 0.064 mm 0.05 mm 0.02 mm	50.2 49.0 44.0		1.0 1.0	1.0 1.0	1.0 1.0	% Passing		03/10/21 19:00	
0.3 mm 0.15 mm 0.075 mm 0.064 mm 0.05 mm 0.02 mm 0.005 mm	50.2 49.0 44.0 32.0		1.0 1.0 1.0	1.0 1.0 1.0	1.0 1.0 1.0	% Passing % Passing		03/10/21 19:00 03/10/21 19:00	

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ioo Liiv, LLO

Client: ARCADIS U.S., Inc. Job ID: 410-31454-1

Project/Site: APG PFAS S1

Client Sample ID: APG-MFR1-2-GW-030421

Lab Sample ID: 410-31454-11 Date Collected: 03/04/21 14:30 **Matrix: Water**

Date Received: 03/05/21 19:28

Analyte	Result	Qualifier	L	OQ	LOD		Unit [Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<4.4		_	5.5	4.4	4.4	ng/L	03/09/21 13:46	1
8:2 Fluorotelomer sulfonic acid	<2.2			3.3	2.2	2.2	ng/L	03/09/21 13:46	1
NEtFOSAA	<1.1			3.3	1.1	1.1	ng/L	03/09/21 13:46	1
NMeFOSAA	<1.3			2.2	1.3	1.3	ng/L	03/09/21 13:46	1
Perfluorobutanesulfonic acid	15	M		2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluorobutanoic acid	31			5.5	4.4	4.4	ng/L	03/09/21 13:46	1
Perfluorodecanoic acid	<1.1			2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluorododecanoic acid	<1.1			2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluoroheptanoic acid	56			2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluorohexanesulfonic acid	150			2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluorohexanoic acid	67			2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluorononanoic acid	<1.1	M		2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluorooctanesulfonic acid	41			2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluorooctanoic acid	8.9			2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluoropentanoic acid	97			2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluorotetradecanoic acid	<1.1			2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluorotridecanoic acid	<1.1			2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Perfluoroundecanoic acid	<1.1			2.2	1.1	1.1	ng/L	03/09/21 13:46	1
Isotope Dilution	%Recovery Qu	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	123		50 - 150				03/08/21 08:30	03/09/21 13:46	1
M2-8:2 FTS	99		50 - 150				03/08/21 08:30	03/09/21 13:46	1
13C2 PFTeDA	84		50 - 150				03/08/21 08:30	03/09/21 13:46	1
13C3 PFBS	103		50 - 150				03/08/21 08:30	03/09/21 13:46	1
13C4 PFBA	81		50 - 150				03/08/21 08:30	03/09/21 13:46	1
13C4 PFHpA	90		50 - 150				03/08/21 08:30	03/09/21 13:46	1
13C5 PFPeA	87		50 - 150				03/08/21 08:30	03/09/21 13:46	1
13C8 PFOA	90		50 - 150				03/08/21 08:30	03/09/21 13:46	1
13C8 PFOS	102		50 - 150				03/08/21 08:30	03/09/21 13:46	1
d3-NMeFOSAA	98		50 - 150				03/08/21 08:30	0 03/09/21 13:46	1
d5-NEtFOSAA	94		50 - 150				03/08/21 08:30	03/09/21 13:46	1
13C2-PFDoDA	96		50 - 150				03/08/21 08:30	03/09/21 13:46	1
13C3 PFHxS	105		50 - 150				03/08/21 08:30	0 03/09/21 13:46	1
13C5 PFHxA	84		50 - 150				03/08/21 08:30	0 03/09/21 13:46	1
13C6 PFDA	88		50 - 150				03/08/21 08:30	0 03/09/21 13:46	1
13C7 PFUnA	88		50 - 150				03/08/21 08:30	0 03/09/21 13:46	1
13C9 PFNA	90		50 ₋ 150				03/08/21 08:30	03/09/21 13:46	1



Aberdeen Proving Ground - Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDG # 410-31764-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report #41202R1

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-31764-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

0.15			Sample	- 10 1	A	nalysis	;
Sample ID	Lab ID	Matrix	Collection Date	Parent Sample	PFAS	тос	рН
APG-ABR3-1-(0-2)-030821	410-31764-1	Soil	3/8/2021		Х	Х	Х
APG-ABR3-1-GW-030821	410-31764-2	Water	3/8/2021		Х		
APG-BONEYARD-5-SO-(0-2)-030821	410-31764-3	Soil	3/8/2021		Х		
APG-BONEYARD-5-GW-030821	410-31764-4	Water	3/8/2021		Х		
APG-BONEYARD-2-SO-(0-2)-030821	410-31764-5	Soil	3/8/2021		Х		
APG-BONEYARD-2-GW-030821	410-31764-6	Water	3/8/2021		Х		
APG-BONEYARD-3-SO-(0-2)-030821	410-31764-7	Soil	3/8/2021		Х		
APG-BONEYAD-3-GW-030821	410-31764-8	Water	3/8/2021		Х		
APG-BONEYARD-4-SO-(0-2)-030821	410-31764-9	Soil	3/8/2021		Х		
APG-BONEYARD-4-GW-030821	410-31764-10	Water	3/8/2021		Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-ABR3-1-(0-2)-030821.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was not performed on sample location associated with this SDG.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Reported		Performance Acceptable		Not
Items Reviewed	No	Yes	No	Yes	Required
Sample receipt condition		Х		Х	
2. Requested analyses and sample results		Х		Х	
Master tracking list		Х		Х	
4. Methods of analysis		Х		Х	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
9. Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		Х	
11. Narrative summary of QA or sample problems provided		Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

1. The chain of custody states that 2 containers were submitted, whereas the laboratory received 3 containers per sample for the following samples.

Lab ID	Sample ID
410-31764-2	APG-ABR3-1-GW-030821
410-31764-4	APG-BONEYARD-5-GW-030821
410-31764-6	APG-BONEYARD-2-GW-030821
410-31764-8	APG-BONEYAD-3-GW-030821
410-31764-10	APG-BONEYARD-4-GW-030821

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - JN The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
ADO ADDO 4 (0.0) 000004	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
APG-ABR3-1-(0-2)-030821	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 50% but > 20%
	M2- 6:2 FTS	6:2 Fluorotelomer sulfonic acid	< 50% but > 20%	< 50% but > 20%
APG-BONEYARD-5-SO-(0- 2)-030821	M2- 8:2 FTS	8:2 Fluorotelomer sulfonic acid	< 50% but > 20%	< 50% but > 20%
,	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
APG-BONEYARD-2-SO-(0-	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
2)-030821	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
APG-BONEYARD-3-SO-(0-	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
2)-030821	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
APG-BONEYARD-4-SO-(0-	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
2)-030821	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
4500/	Non-detect	No Action
> 150%	Detect	J-
500/ had 900/	Non-detect	UJ
< 50% but > 20%	Detect	J+
000/	Non-detect	UX
< 20%	Detect	X

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be ≤ 30%.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

The MS/MSD analysis was not performed on sample location associated with this SDG.

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

A field duplicate was not collected for a sample location associated with this SDG.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

Samples associated with ion ratios outside of the control limits of \pm 50 percent from the target value are presented in the following table.

Sample ID	Compound	Ion Ratio %R
APG-ABR3-1-GW-030821	NMeFOSAA	1116%

In the case of an ion ratio deviation, the sample results are qualified as documented in the table below.

Control limit	Sample Result	Qualification
<50% or > 150%	Detect	J
Gross Exceedance	Detect	JN

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
	6:2 Fluorotelomer sulfonic acid		330	330 D
	8:2 Fluorotelomer sulfonic acid		1300	1300 D
	NMeFOSAA		15 J	15 DJ
APG-ABR3-1-GW-030821	Perfluorobutanesulfonic acid		140	140 D
	Perfluorobutanoic acid		150	150 D
	Perfluorodecanoic acid		130	130 D
	Perfluoroheptanoic acid		260	260 D
	Perfluorohexanoic acid		1100	1100 D
	Perfluorononanoic acid		320	320 D
	Perfluorooctanoic acid		1700	1700 D
	Perfluoropentanoic acid		330	330 D
	Perfluorohexanesulfonic acid		5900	5900 D
	Perfluorooctanesulfonic acid		17000	17000 D

Note: the lab didn't report the original analysis; only the diluted result.

The sample APG-ABR3-1-GW-030821 was analyzed at 10-fold and 100-fold dilution due to interference from sample matrix. An undiluted analysis was not performed. Therefore, the detection limits are elevated.

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification	
Diluted sample result within calibration range	D	

Reported Sample Results	Qualification	
Diluted sample result less than the calibration range	DJ	

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

As noted in Section 5.1, N-EtFOSAA and N-MeFOSAA results were qualified "X" for sample locations APG-BONEYARD-5-SO-(0-2)-030821, APG-BONEYARD-2-SO-(0-2)-030821, APG-BONEYARD-3-SO-(0-2)-030821, and APG-BONEYARD-4-SO-(0-2)-030821. This was due to EIS recoveries less than 20%. After review with the project team and USACE chemist, the results were rejected, and the final qualifier has been revised from "X" to "R" on December 14, 2021.

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3		Reported		mance ptable	Not	
		Yes	No	Yes	Required	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)						
Stage 2 Validation						
Holding times		X		X		
Reporting limits (units)		Х		Х		
Blanks						
A. Method blanks		X		X		
B. Equipment blanks	X				X	
C. Field blanks / Source blanks	X				X	
Laboratory Control Sample (LCS) %R		X		X		
Laboratory Control Sample Duplicate(LCSD) %R		Х		Х		
LCS/LCSD Precision (RPD)		X		X		
Matrix Spike (MS) %R	Х				X	
Matrix Spike Duplicate(MSD) %R	Х				X	
MS/MSD Precision (RPD)	Х				X	
Field Duplicate (RPD)	Х				X	
Extracted Internal Standard %R		X	Х			
Injection Internal Standard %R		Х		Х		
Dilution Factor		X		X		
Moisture Content		Х		Х		
Stage 3/4 Validation						
Instrument tune and performance check		X		Х		
Initial calibration %RSDs		Х		Х		
Continuing calibration %Ds		Х		Х		
Instrument sensitivity check		Х		Х		
Ion transitions used		Х		Х		
Compound identification and quantitation						
A. Reconstructed ion chromatograms		Х		Х		
B. Quantitation Reports		Х		Х		
C. RT of sample compounds within the established RT windows		Х		Х		

PFAS: 537M/DoD QSM 5.3		Reported		mance ptable	Not Required	
		Yes	No	Yes	Required	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)						
D. Ion Ratio %R		Х	Х			
E. Transcription/calculations acceptable		Х		Х		
F. Reporting limits adjusted to reflect sample dilutions		Х		Х		

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

Concentration (C) Qualifiers

- U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
- J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).

Quantitation (Q) Qualifiers

E The compound was quantitated above the calibration range.

• Validation Qualifiers

- J The reported result was an estimated value with an unknown bias.
- J+ The result was an estimated quantity, but the result may be biased high.
- J- The result was an estimated quantity, but the result may be biased low.
- UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
- UB Analyte considered non-detect at the listed value due to associated blank contamination.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria
APG-ABR3-1-(0-2)-030821	8 days from collection; 7 days from receipt	< 24 hours of receipt at the laboratory

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

	Qualification
Criteria	Detected Analytes
Analysis completed past the holding time	J

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analytes	Standard Recovery
APG-ABR3-1-(0-2)-030821	CCV	TOC	130%

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Control Limit	Sample Result	Qualification
	750/ 1- 000/	Non-detect	UJ
	75% to 89%	Detect	J-
T00	4440/ 4 4050/	Non-detect	No Action
TOC	111% to 125%	Detect	J+
	Cross Evens dans a 1250/	Non-detect	No Action
	Gross Exceedance >125%	Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

A MS analysis was not performed for TOC.

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

A laboratory duplicate analysis was performed on sample APG-ABR3-1-(0-2)-030821 for pH. The results were within the control limits.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within \pm 0.05 S.U. of the true value.

All LCS recoveries were within control limits.

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Rep	orted	Perfor Acce	Not	
	No	Yes	No	Yes	Required
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		Х		X	
B. Equipment blanks	Х				Х
Laboratory Control Sample (LCS) %R		X		Х	
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х
LCS/LCSD Precision (RPD)	Х				Х
Matrix Spike (MS) %R	Х				Х
Matrix Spike Duplicate (MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				Х
Lab Duplicate (RPD)		Х		Х	
Field Duplicate (RPD)	Х				Х
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation	'				
Initial calibration correlation coefficient (TOC)		Х		X	
Continuing calibration %R		Х	Х		
Raw Data		Х		Х	
Transcription/calculations acceptable		Х		X	

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE:

DATE: May 3, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 11, 2021

Stage 3 / 4 PFAS Calibration Standards

SDG #:410-31764-1Date:3/5/2021Lab:Eurofins LancasterPage:1Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 29347

PFOS 3/11/2021 Calibration

Page 883 - 896 of SDG 410-31764-1

	ii, loli camb					1 460 000	030 01 000	0 0	. –	
Cal Conc					Calculated		Calc		Calculated	Reported
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D
0.1851	90922	3663647	9.565	0.024817	1.2824307	1.1097	0.213912	0.1851	15.566	15.6
0.46275	208626	3767520	9.565	0.055375	1.1445939	1.1097	0.477301	0.46275	3.144	3.1
1.851	894594	3877777	9.565	0.230698	1.1921248	1.1097	1.988486	1.851	7.428	7.4
7.404	2982996	3775310	9.565	0.790133	1.0207482	1.1097	6.810507	7.404	-8.016	-8
18.51	7615610	3769615	9.565	2.020262	1.0439658	1.1097	17.41354	18.51	-5.924	-5.9
46.275	19117549	3694267	9.565	5.174923	1.0696519	1.1097	44.60498	46.275	-3.609	-3.6
92.55	35924524	3661311	9.565	9.811929	1.0140584	1.1097	84.5734	92.55	-8.619	-8.6

Match Match Match Match Match Match Match

Avg RF = 1.1096534 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-31764-1Date:3/5/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-101967/9 3/11/2021 19:27

Page 1092 - 1097 of SDG 410-31764-1

	Analyte					Calc		Calculated	Reported
Analyte	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluoropentanoic acid	591092	3010428	10	0.1963	1.0300	1.906	2	-4.69	-4.6
Perfluorohexanoic acid	656265	3578248	10	0.1834	0.9188	1.996	2	-0.19	-0.2
Perfluoroheptanoic acid	751288	3524027	10	0.2132	1.1390	1.872	2	-6.41	-6.4
Perfluorooctanoic acid	694697	3901880	10	0.1780	0.9747	1.827	2	-8.67	-8.7
Perfluorooctanesulfonic acid	667233	3637749	9.57	0.1834	1.1100	1.581	2	-17.21	-17.3
Perfluorononanoic acid	680797	3830388	10	0.1777	0.9315	1.908	2	-4.60	-4.6

Match Match Match Match Match Match

CCV 410-102949/1 3/13/2021 15:14

Page 1164 - 1169 of SDG 410-31764-1

	Analyte					Calc		Calculated	Reported
Analyte	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluoropentanoic acid	171831	3319224	10	0.0518	1.0300	0.503	0.5	0.52	0.6
Perfluorohexanoic acid	184667	4004788	10	0.0461	0.9188	0.502	0.5	0.37	0.4
Perfluoroheptanoic acid	217995	3810197	10	0.0572	1.1390	0.502	0.5	0.46	0.5
Perfluorooctanoic acid	220852	4296806	10	0.0514	0.9747	0.527	0.5	5.47	5.5
Perfluorooctanesulfonic acid	218472	3897860	9.57	0.0560	1.1100	0.483	0.46	4.37	4.4
Perfluorononanoic acid	198696	4189829	10	0.0474	0.9315	0.509	0.5	1.82	1.8

Match Match Match Match Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 $\begin{array}{c|cccc} SDG \# & 410-31764-1 & Date: & 3/5/2021 \\ Lab: & \hline Eurofins Lancaster & Page: & 3 \\ \hline Project: & Aberdeen Proving Ground & Validated by: & SPR \\ \end{array}$

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-102617/2-B Page 1426 - 1431 of SDG 410-31764-1

Final volume = 4ml; Weight = 1.00 gm; TS = 100%

Extract: 2 mls concentrated to 1 ml

	Extract. 2 mis concentrated to 1 mi									_	
						Calculated	Dry Weight		Calculated	Reported	1
						Amount	Value	True Value	Percent	Percent	
Analyte	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mg/kg	mg/kg	Recovery	Recovery	
Perfluoropentanoic acid	3727622	3164807	10	1.177835	1.0300	22.87	0.0229	0.025	91.48	92	Match
Perfluorohexanoic acid	4221789	3830492	10	1.102153	0.9188	23.99	0.0240	0.025	95.96	96	Match
Perfluoroheptanoic acid	4886924	3726339	10	1.311454	1.1390	23.03	0.0230	0.025	92.11	92	Match
Perfluorooctanoic acid	4637539	4131280	10	1.122543	0.9747	23.03	0.0230	0.025	92.13	92	Match
Perfluorooctanesulfonic acid	4332345	3684830	9.57	1.175725	1.1100	20.27	0.0203	0.024	84.83	85	Match
Perfluorononanoic acid	4584122	3947262	10	1.161342	0.9315	24.93	0.0249	0.025	99.74	100	Match

Calculated Amount ng/ml = (Peak area ratio/Avg RF) x DF x EIS concentration Calculated mg/kg = $4 \times (Calc \ amt \ ng/ml \times 0.5)$ / sample weight g) / 1000 Dry Weight Amount = [Calculated mg/kg / (TS/100)]

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-31764-1
 Date:
 3/5/2021

 Lab:
 Eurofins Lancaster
 Page:
 4

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

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Field Sample ID: APG-ABR3-1-(0-2)-030821 Lab ID: 410-31764-1 TS=81.8%, FV= 4ml Sample Weight=1.01 g

Extract: 2 mls concentrated to 1 ml

								Calculated		
						Calculated		Amount Dry	Reported	
	Analyte					Amount	Calculated	Weight	Value	
Analyte	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mg/kg	mg/kg	mg/kg	
Perfluorohexanoic acid	84159	3701763	10	0.022735	0.9188	0.25	0.0005	0.00060	0.00060 J	Match
Perfluorooctanoic acid	197372	4031926	10	0.048952	0.9747	0.50	0.0010	0.00122	0.0012	Match
Perfluorooctanesulfonic acid	18454550	3748615	9.57	4.923032	1.1100	42.44	0.0840	0.10275	0.10	Match
Perfluorononanoic acid	174990	3836492	10	0.045612	0.9315	0.49	0.0010	0.00119	0.0012	Match

Calculated Amount ng/ml = (Peak area ratio/Avg RF) x DF x EIS concentration Calculated mg/kg = $4 \times (Calc \text{ amt ng/ml } \times 0.5)$ / sample weight g) / 1000 Dry Weight Amount = [Calculated mg/kg / (TS/100)]

Stage 3 / 4 PFAS EIS

SDG #:410-31764-1Date:3/5/2021Lab:Eurofins LancasterPage:5Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-ABR3-1-(0-2)-030821 Lab ID: 410-31764-1

EIS 13C8 PFOS

REPORTED EIS %R 100

%R = 100 * EIS ConcentrationEIS TV

EIS Concentration 9.58 ng/ml Page 554 of 410-31764-1

EIS TV 9.57

%R 100.1 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental Analysi



410-31764 Chain of Custody

of Custody

invironmental use only

ele.

Pg 1 of

COC #616530

	1011101	
eurofins		

Lancaster Laboratories
Environmental

Acct. #

Client Information		400	Matrix Analys						sis F	is Requested			For Lab U	For Lab Use Only					
ent:	Acct. #:	-					100	127		Pr	eser	atior	and	Filtratio	n Cod	es	FSC:		1
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oject Name/#:	PWSID #:				Tissue	Ground											Pres	servation C	odes
APG PEAS ST					Ï	Ground	12.27	- 1					1		\times		H=HCI		Thiosulfate
	P.O. #:			- 11	-	Q Q		တ			73	4			1 1		N=HNO ₃		NaOH
Keith Shepherd	Quote #:	16.38XS	0		Ħ			ne.		13		(34	173	>1			S=H ₂ SO ₄ F=Field F	iltered O =0	H₃PO₄ Other
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ate where samples were collected: For Compliance:				-	Sediment	Potable NPDES		Containers	1	Y	5	100	5				4		
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Sample Identification	Date	Time	Grab	So	Soil	Water	Other:	Total		E	S								
APG-ABR3-1-(0-7)-030821	3/8/21	0840	Ť	X	50	1		4	X	X	X	X	plan.	-33 6/1		- (0, == 1)	- 1	of the	
APG-ABR3-1-GW-036821		0930	×			GW		2					X	192	- 1				
A Par- Bone yard-5-50-(0-2)-030821		1000		×	so		-	2	X			10					11 1		
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158050-(5-0)-02-8-mayord-3-50-(0-2)-030821	0 00	1210		X	50	1/2/17		Z	×					-					
Apr-Boneyard-3-6W-030821		1250	×			GW		2		-			X						
Aph-Bayard-4-50-(0-2)-030821		1330		X	50	3 E		2	X	-	. per								
APIT-BOALVEND-4-GW-030821	+	1415	X			COW		2					X		<u>لـــــــــ</u>			le :	-
Turnaround Time (TAT) Requested		ele)	-	quished		1				Date		Time 0+4		Received b	10(Date 3/9/2	Time 16,15
Standard Ri (Rush TAT is subject to laboratory approval and surcharge.	ush			quishe		11/	~			3 n Date	121	Time		Received b				Date	Time
(Hush TAT is subject to laboratory approval and surcharge.	,		1	A	Uh	V				3/9/	21	16:	31					-	-
Requested TAT in business days:		_	Reline	quished	by					Date		Time		Received b	у	-	-	Date	Time
Keith. Shepherd DARCADI																			
-mail address: Matthew, Blow & DARCADIS. Com			Reline	quished	by			/		Date		Time		Received b	y			Date	Time
Data Package Options (circle if re	quired)		Delie	aviah a	d by					Date		Time		Received b				Date	Time
Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data	Only)	Helin	quished	з бу							Time		4		2-2	Sep.	39-21	16:45
Type III (Reduced non-CLP) NJ DKQF	YX.	TRRP-13		/		EDD Res, format: _								UPS_		FedEx		r	5
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3

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The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client.

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-31764-1 Project/Site: APG PFAS S1

Qualifiers

-	_		_
	r	ΝЛ	c
_	v	IVI	J

Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
D	The reported value is from a dilution.
1	Value is EMPC (estimated maximum possible concentration).
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
M	Manual integrated compound.

Glossary	
Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)

MDC	Willimum Detectable Cond
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit

NC Not Calculated

ND Not Detected at the reporting limit (or MDL or EDL if shown)

NEG Negative / Absent POS Positive / Present PQL Practical Quantitation Limit

PRES Presumptive QC **Quality Control**

RER Relative Error Ratio (Radiochemistry)

RL Reporting Limit or Requested Limit (Radiochemistry)

RPD Relative Percent Difference, a measure of the relative difference between two points

TEF Toxicity Equivalent Factor (Dioxin) TEQ Toxicity Equivalent Quotient (Dioxin)

TNTC Too Numerous To Count

Eurofins Lancaster Laboratories Env, LLC

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Job ID: 410-31764-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-ABR3-1-(0-2)-030821

Lab Sample ID: 410-31764-1 Date Collected: 03/08/21 08:40 **Matrix: Solid**

Date Received: 03/09/21 16:45 **Percent Solids: 81.8**

Method: EPA 537(Mod) - PFA Analyte	•	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	<u></u>	03/13/21 16:28	1
8:2 Fluorotelomer sulfonic acid	<0.0019		0.0036	0.0019	0.0019	mg/Kg	₽	03/13/21 16:28	1
NEtFOSAA	<0.00048	UJ	0.0024	0.00048	0.00048	mg/Kg	₽	03/13/21 16:28	1
NMeFOSAA	<0.00048	UJ	0.0024	0.00048	0.00048	mg/Kg	₩	03/13/21 16:28	1
Perfluorobutanesulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	₽	03/13/21 16:28	1
Perfluorobutanoic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	₩	03/13/21 16:28	1
Perfluorodecanoic acid	0.00091	M	0.00073	0.00048	0.00048	mg/Kg	₽	03/13/21 16:28	1
Perfluorododecanoic acid	<0.00048		0.00073	0.00048	0.00048	mg/Kg	₩	03/13/21 16:28	1
Perfluoroheptanoic acid	<0.00048		0.00073	0.00048	0.00048	mg/Kg	₽	03/13/21 16:28	1
Perfluorohexanesulfonic acid	0.0056		0.00073	0.00048	0.00048	mg/Kg	₽	03/13/21 16:28	1
Perfluorohexanoic acid	0.00060	J	0.00073	0.00048	0.00048	mg/Kg	₩	03/13/21 16:28	1
Perfluorononanoic acid	0.0012		0.00073	0.00048	0.00048	mg/Kg	₩	03/13/21 16:28	1
Perfluorooctanesulfonic acid	0.10		0.00073	0.00048	0.00048	mg/Kg	₽	03/13/21 16:28	1
Perfluorooctanoic acid	0.0012	M	0.00073	0.00048	0.00048	mg/Kg	₩	03/13/21 16:28	1
Perfluoropentanoic acid	<0.00048		0.00073	0.00048	0.00048	mg/Kg	₩	03/13/21 16:28	1
Perfluorotetradecanoic acid	<0.00048		0.00073	0.00048	0.00048	mg/Kg	₩	03/13/21 16:28	1
Perfluorotridecanoic acid	<0.00048		0.00073	0.00048	0.00048	mg/Kg	₩	03/13/21 16:28	1
Perfluoroundecanoic acid	0.00098	M	0.00073	0.00048	0.00048	mg/Kg	☼	03/13/21 16:28	1
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepa	ared	Analyzed	Dil Fac
M2-6:2 FTS	102		50 - 150			03/12/21	1 10:01	03/13/21 16:28	1
M2-8:2 FTS	106		50 - 150			03/12/21	1 10:01	03/13/21 16:28	1
13C2 PFTeDA	91		50 - 150			03/12/21	1 10:01	03/13/21 16:28	1
13C3 PFBS	88		50 - 150			03/12/2	1 10:01	03/13/21 16:28	1
13C4 PFBA	96		50 - 150			03/12/21	1 10:01	03/13/21 16:28	1
13C4 PFHpA	102		50 - 150			03/12/21	1 10:01	03/13/21 16:28	1
13C5 PFPeA	97		50 - 150			03/12/2	1 10:01	03/13/21 16:28	1
13C8 PFOA	103		50 - 150			03/12/21	1 10:01	03/13/21 16:28	1
13C8 PFOS	100		50 - 150			03/12/21	1 10:01	03/13/21 16:28	1
d3-NMeFOSAA	29 *5	-	50 - 150			03/12/2	1 10:01	03/13/21 16:28	1
d5-NEtFOSAA	40 *5	-	50 - 150			03/12/21	1 10:01	03/13/21 16:28	1
13C2-PFDoDA	99		50 - 150			03/12/21	1 10:01	03/13/21 16:28	1
13C3 PFHxS	101		50 - 150			03/12/2	1 10:01	03/13/21 16:28	1
13C5 PFHxA	102		50 - 150			03/12/21	1 10:01	03/13/21 16:28	1
13C6 PFDA	100		50 - 150			03/12/21	1 10:01	03/13/21 16:28	1
							111111		
13C7 PFUnA	104		50 - 150			03/12/21	1 10:01	03/13/21 16:28	1

Method: EPA 537(Mod) - PF	AS for QSM 5.3, Table B-15 - RE	
Analyta	Popult Qualifier	

Analyte	Result Qualif	ier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	☆	03/11/21 06:48	1
8:2 Fluorotelomer sulfonic acid	<0.0019	0.0036	0.0019	0.0019	mg/Kg	₩	03/11/21 06:48	1
NEtFOSAA	<0.00048	0.0024	0.00048	0.00048	mg/Kg	₩	03/11/21 06:48	1
NMeFOSAA	<0.00048	0.0024	0.00048	0.00048	mg/Kg	☆	03/11/21 06:48	1
Perfluorobutanesulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	₩	03/11/21 06:48	1
Perfluorobutanoic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	☆	03/11/21 06:48	1
Perfluorodecanoic acid	0.0011 M	0.00072	0.00048	0.00048	mg/Kg	₩	03/11/21 06:48	1
Perfluorododecanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg	₩	03/11/21 06:48	1
Perfluoroheptanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg	☆	03/11/21 06:48	1
Perfluorohexanesulfonic acid	0.011	0.00072	0.00048	0.00048	mg/Kg	₩	03/11/21 06:48	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31764-1 Project/Site: APG PFAS S1

Client Sample ID: APG-ABR3-1-(0-2)-030821

Silt

Clay

75 mm

19 mm

37.5 mm

4.75 mm

3.35 mm

2.36 mm

Lab Sample ID: 410-31764-1 Date Collected: 03/08/21 08:40 **Matrix: Solid** Date Received: 03/09/21 16:45 **Percent Solids: 81.8**

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit I) Analyzed	Dil Fac
Perfluorohexanoic acid	0.00061	J	0.00072	0.00048	0.00048	mg/Kg	03/11/21 06:48	
Perfluorononanoic acid	0.0014		0.00072	0.00048	0.00048	mg/Kg ∃	03/11/21 06:48	•
Perfluorooctanesulfonic acid	0.14		0.00072	0.00048	0.00048	mg/Kg	03/11/21 06:48	
Perfluorooctanoic acid	0.0017	M	0.00072	0.00048	0.00048	mg/Kg ∃	03/11/21 06:48	•
Perfluoropentanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg ∃	03/11/21 06:48	•
Perfluorotetradecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	03/11/21 06:48	
Perfluorotridecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg ∃	03/11/21 06:48	•
Perfluoroundecanoic acid	0.0010		0.00072	0.00048	0.00048	mg/Kg	03/11/21 06:48	•
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fa
M2-6:2 FTS	105		50 - 150			03/10/21 11:3	_ <u> </u>	
M2-8:2 FTS	97		50 ₋ 150			03/10/21 11:3	0 03/11/21 06:48	
13C2 PFTeDA	96		50 - 150			03/10/21 11:3	0 03/11/21 06:48	
13C3 PFBS	110		50 - 150			03/10/21 11:3	0 03/11/21 06:48	
13C4 PFBA	91		50 ₋ 150			03/10/21 11:3	0 03/11/21 06:48	
13C4 PFHpA	100		50 ₋ 150			03/10/21 11:3	0 03/11/21 06:48	
13C5 PFPeA	95		50 - 150			03/10/21 11:3	0 03/11/21 06:48	
13C8 PFOA	106		50 - 150			03/10/21 11:3	0 03/11/21 06:48	
13C8 PFOS	112		50 - 150			03/10/21 11:3	0 03/11/21 06:48	
d3-NMeFOSAA	31 *5		50 - 150			03/10/21 11:3	0 03/11/21 06:48	
d5-NEtFOSAA	37 *5	-	50 - 150			03/10/21 11:3	0 03/11/21 06:48	-
13C2-PFDoDA	111		50 - 150			03/10/21 11:3	03/11/21 06:48	
13C3 PFHxS	113		50 - 150			03/10/21 11:3	0 03/11/21 06:48	
13C5 PFHxA	98		50 - 150			03/10/21 11:3	0 03/11/21 06:48	
13C6 PFDA	107		50 - 150			03/10/21 11:3	0 03/11/21 06:48	
13C7 PFUnA	105		50 - 150			03/10/21 11:3	0 03/11/21 06:48	
13C9 PFNA	99		50 - 150			03/10/21 11:3	0 03/11/21 06:48	
General Chemistry								
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit I	Analyzed	Dil Fac
Total Organic Carbon	18500	J+	2690	1790	1790	mg/Kg	03/13/21 17:25	7.33
Percent Moisture	18.2		1.0		1.0	%	03/10/21 07:58	•
Percent Solids	81.8		1.0		1.0	%	03/10/21 07:58	,
General Chemistry - Soluble								
Analyte		Qualifier	LOQ	LOD			Analyzed	Dil Fac
pH	6.7	J	0.01	0.01	0.01	S.U.	03/16/21 18:12	
Temperature	20.8		0.01	0.01	0.01	Degrees C	03/16/21 18:12	,
Method: D422 - Grain Size								
Analyte		Qualifier	LOQ	LOD		Unit I		Dil Fac
Gravel	3.8		1.0	1.0	1.0	%	03/10/21 19:00	,
Sand	26.8		1.0	1.0	1.0	%	03/10/21 19:00	•

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03/10/21 19:00

03/10/21 19:00

03/10/21 19:00

03/10/21 19:00

03/10/21 19:00

03/10/21 19:00

03/10/21 19:00

03/10/21 19:00

1.0

1.0

1.0

1.0

1.0

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1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0 %

1.0 %

1.0 % Passing

1.0 % Passing 1.0 % Passing

1.0 % Passing

1.0 % Passing

% Passing

60.4

9.0

100.0

100.0

96.4

96.2

96.2

96.2

Client: ARCADIS U.S., Inc. Job ID: 410-31764-1 Project/Site: APG PFAS S1

Client Sample ID: APG-ABR3-1-(0-2)-030821

Lab Sample ID: 410-31764-1 Date Collected: 03/08/21 08:40 **Matrix: Solid** Date Received: 03/09/21 16:45 **Percent Solids: 81.8**

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
1.18 mm	95.6		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.6 mm	91.4		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.3 mm	78.6		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.15 mm	71.6		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.075 mm	69.4		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.064 mm	67.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.05 mm	60.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.02 mm	30.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.005 mm	9.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.002 mm	5.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.001 mm	5.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1

Client Sample ID: APG-ABR3-1-GW-030821

Lab Sample ID: 410-31764-2 Date Collected: 03/08/21 09:30 **Matrix: Water**

Date Received: 03/09/21 16:45

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	330	D	64	51	51	ng/L	03/11/21 23:19	10
8:2 Fluorotelomer sulfonic acid	1300	D	38	26	26	ng/L	03/11/21 23:19	10
NEtFOSAA	<13		38	13	13	ng/L	03/11/21 23:19	10
NMeFOSAA	15	J D M I DMJN	26	15	15	ng/L	03/11/21 23:19	10
Perfluorobutanesulfonic acid	140	D	26	13	13	ng/L	03/11/21 23:19	10
Perfluorobutanoic acid	150	D	64	51	51	ng/L	03/11/21 23:19	10
Perfluorodecanoic acid	130	DM	26	13	13	ng/L	03/11/21 23:19	10
Perfluorododecanoic acid	<13		26	13	13	ng/L	03/11/21 23:19	10
Perfluoroheptanoic acid	260	D	26	13	13	ng/L	03/11/21 23:19	10
Perfluorohexanoic acid	1100	D	26	13	13	ng/L	03/11/21 23:19	10
Perfluorononanoic acid	320	D	26	13	13	ng/L	03/11/21 23:19	10
Perfluorooctanoic acid	1700	D M	26	13	13	ng/L	03/11/21 23:19	10
Perfluoropentanoic acid	330	D	26	13	13	ng/L	03/11/21 23:19	10
Perfluorotetradecanoic acid	<13		26	13	13	ng/L	03/11/21 23:19	10
Perfluorotridecanoic acid	<13		26	13	13	ng/L	03/11/21 23:19	10
Perfluoroundecanoic acid	<13	M	26	13	13	ng/L	03/11/21 23:19	10
Isotono Dilution	%Pocovory O	ualifiar Limi	140			Propared	Analyzod	Dil Esc

Isotope Dilution	%Recovery	Qualifier Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	117	50 - 150	03/10/21 08:44	03/11/21 23:19	10
M2-8:2 FTS	136	50 - 150	03/10/21 08:44	03/11/21 23:19	10
13C2 PFTeDA	92	50 - 150	03/10/21 08:44	03/11/21 23:19	10
13C3 PFBS	102	50 - 150	03/10/21 08:44	03/11/21 23:19	10
13C4 PFBA	103	50 - 150	03/10/21 08:44	03/11/21 23:19	10
13C4 PFHpA	105	50 - 150	03/10/21 08:44	03/11/21 23:19	10
13C5 PFPeA	108	50 - 150	03/10/21 08:44	03/11/21 23:19	10
13C8 PFOA	106	50 - 150	03/10/21 08:44	03/11/21 23:19	10
13C8 PFOS	110	50 - 150	03/10/21 08:44	03/11/21 23:19	10
d3-NMeFOSAA	99	50 - 150	03/10/21 08:44	03/11/21 23:19	10
d5-NEtFOSAA	96	50 - 150	03/10/21 08:44	03/11/21 23:19	10
13C2-PFDoDA	104	50 ₋ 150	03/10/21 08:44	03/11/21 23:19	10
13C3 PFHxS	108	50 - 150	03/10/21 08:44	03/11/21 23:19	10
13C5 PFHxA	104	50 ₋ 150	03/10/21 08:44	03/11/21 23:19	10
13C6 PFDA	108	50 ₋ 150	03/10/21 08:44	03/11/21 23:19	10

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31764-1 Project/Site: APG PFAS S1

Client Sample ID: APG-ABR3-1-GW-030821

Lab Sample ID: 410-31764-2 Date Collected: 03/08/21 09:30

Matrix: Water

Date Received: 03/09/21 16:45

Method: EPA 537(Mod) - PFAS	for QSM 5.3, Table B	-15 (Continued)			
Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C7 PFUnA	105	50 - 150	03/10/21 08:44	03/11/21 23:19	10
13C9 PFNA	92	50 - 150	03/10/21 08:44	03/11/21 23:19	10

Method: EPA 537(Mod) - PFA Analyte	•	Qualifier	15 - DL LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	5900	D	260	130	130	ng/L	03/12/21 12:44	100
Perfluorooctanesulfonic acid	17000	D	260	130	130	ng/L	03/12/21 12:44	100
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac
13C8 PFOS	127		50 - 150			03/10/21 08:44	03/12/21 12:44	100
13C3 PFHxS	109		50 - 150			03/10/21 08:44	03/12/21 12:44	100

Client Sample ID: APG-Boneyard-5-SO-(0-2)-030821

Lab Sample ID: 410-31764-3 Date Collected: 03/08/21 10:00 **Matrix: Solid** Date Received: 03/09/21 16:45 Percent Solids: 83.1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019	UJ	0.0024	0.0019	0.0019	mg/Kg		03/13/21 16:38	1
8:2 Fluorotelomer sulfonic acid	< 0.0019	UJ	0.0036	0.0019	0.0019	mg/Kg	₽	03/13/21 16:38	1
NEtFOSAA	<0.00048		0.0024	0.00048	0.00048	mg/Kg		03/13/21 16:38	R 1
NMeFOSAA	<0.00048		0.0024	0.00048	0.00048	mg/Kg	Ϋ	03/13/21 16:38	R 1
Perfluorobutanesulfonic acid	< 0.0019		0.0024	0.0019	0.0019	mg/Kg	₽	03/13/21 16:38	1
Perfluorobutanoic acid	< 0.0019		0.0024	0.0019	0.0019	mg/Kg	₽	03/13/21 16:38	1
Perfluorodecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₽	03/13/21 16:38	1
Perfluorododecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₽	03/13/21 16:38	1
Perfluoroheptanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₽	03/13/21 16:38	1
Perfluorohexanesulfonic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₽	03/13/21 16:38	1
Perfluorohexanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₽	03/13/21 16:38	1
Perfluorononanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₽	03/13/21 16:38	1
Perfluorooctanesulfonic acid	0.0052		0.00072	0.00048	0.00048	mg/Kg	₽	03/13/21 16:38	1
Perfluorooctanoic acid	0.00064	J M	0.00072	0.00048	0.00048	mg/Kg	₽	03/13/21 16:38	1
Perfluoropentanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₽	03/13/21 16:38	1
Perfluorotetradecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₽	03/13/21 16:38	1
Perfluorotridecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	₽	03/13/21 16:38	1
Perfluoroundecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/13/21 16:38	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Pre	pared	Analyzed	Dil Fac

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	46	*5-	50 - 150	03/12/21 10:01	03/13/21 16:38	1
M2-8:2 FTS	48	*5-	50 - 150	03/12/21 10:01	03/13/21 16:38	1
13C2 PFTeDA	61		50 - 150	03/12/21 10:01	03/13/21 16:38	1
13C3 PFBS	80		50 - 150	03/12/21 10:01	03/13/21 16:38	1
13C4 PFBA	57		50 - 150	03/12/21 10:01	03/13/21 16:38	1
13C4 PFHpA	65		50 - 150	03/12/21 10:01	03/13/21 16:38	1
13C5 PFPeA	59		50 - 150	03/12/21 10:01	03/13/21 16:38	1
13C8 PFOA	64		50 - 150	03/12/21 10:01	03/13/21 16:38	1
13C8 PFOS	88		50 - 150	03/12/21 10:01	03/13/21 16:38	1
d3-NMeFOSAA	4	*5-	50 - 150	03/12/21 10:01	03/13/21 16:38	1
d5-NEtFOSAA	6	*5-	50 - 150	03/12/21 10:01	03/13/21 16:38	1
13C2-PFDoDA	69		50 - 150	03/12/21 10:01	03/13/21 16:38	1
13C3 PFHxS	90		50 - 150	03/12/21 10:01	03/13/21 16:38	1
13C5 PFHxA	63		50 - 150	03/12/21 10:01	03/13/21 16:38	1

Eurofins Lancaster Laboratories Env, LLC

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31764-1 Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-5-SO-(0-2)-030821

Lab Sample ID: 410-31764-3 Date Collected: 03/08/21 10:00 **Matrix: Solid**

Date Received: 03/09/21 16:45 Percent Solids: 83.1

Method: EPA 537(Mod) - PFAS	S for QSM 5.3, Table B	-15 (Continued)	
Isotope Dilution	%Recovery Qualifier	Limits	Prepared
13C6 PFDA	63	50 - 150	03/12/21 10:0

ı	13C6 PFDA	63	50 - 750	03/12/21 10:01	03/13/21 16:38	1
	13C7 PFUnA	68	50 - 150	03/12/21 10:01	03/13/21 16:38	1
ı	13C9 PFNA	63	50 - 150	03/12/21 10:01	03/13/21 16:38	1

Method: EPA 537		1 f OOM F 0	Table D 46 DE
I Mathod: FPA 53/1	IVIONI - PEAS	TOP USING 5 4	IANIA K-15 - RE

modifical Elizabor (mod) i i zio	, ioi doin oio,	I GOIO D I O							
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019		0.0023	0.0019	0.0019	mg/Kg	☼	03/11/21 06:58	1
8:2 Fluorotelomer sulfonic acid	<0.0019		0.0035	0.0019	0.0019	mg/Kg	☼	03/11/21 06:58	1
NEtFOSAA	< 0.00047		0.0023	0.00047	0.00047	mg/Kg	☼	03/11/21 06:58	1
NMeFOSAA	<0.00047		0.0023	0.00047	0.00047	mg/Kg	₩	03/11/21 06:58	1
Perfluorobutanesulfonic acid	<0.0019		0.0023	0.0019	0.0019	mg/Kg	☼	03/11/21 06:58	1
Perfluorobutanoic acid	<0.0019		0.0023	0.0019	0.0019	mg/Kg	☼	03/11/21 06:58	1
Perfluorodecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	₩	03/11/21 06:58	1
Perfluorododecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/11/21 06:58	1
Perfluoroheptanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	₩	03/11/21 06:58	1
Perfluorohexanesulfonic acid	0.00047		0.00070	0.00047	0.00047	mg/Kg	₩	03/11/21 06:58	1
Perfluorohexanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	₩	03/11/21 06:58	1
Perfluorononanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	₩	03/11/21 06:58	1
Perfluorooctanesulfonic acid	0.0054		0.00070	0.00047	0.00047	mg/Kg	₩	03/11/21 06:58	1
Perfluorooctanoic acid	0.00070	М	0.00070	0.00047	0.00047	mg/Kg	₩	03/11/21 06:58	1
Perfluoropentanoic acid	< 0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/11/21 06:58	1
Perfluorotetradecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	₩	03/11/21 06:58	1
Perfluorotridecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	₩	03/11/21 06:58	1
D 0 1 1 11									

Perfluoroundecanoic acid	<0.000	47	0.00070	0.00047	0.00047	mg/Kg □	03/11/21 06:58	1
Isotope Dilution	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	42	*5-	50 - 150			03/10/21 11:30	03/11/21 06:58	1
M2-8:2 FTS	40	*5-	50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C2 PFTeDA	60		50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C3 PFBS	89		50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C4 PFBA	54		50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C4 PFHpA	63		50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C5 PFPeA	60		50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C8 PFOA	62		50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C8 PFOS	97		50 - 150			03/10/21 11:30	03/11/21 06:58	1
d3-NMeFOSAA	5	*5-	50 - 150			03/10/21 11:30	03/11/21 06:58	1
d5-NEtFOSAA	7	*5-	50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C2-PFDoDA	66		50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C3 PFHxS	98		50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C5 PFHxA	61		50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C6 PFDA	62		50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C7 PFUnA	62		50 - 150			03/10/21 11:30	03/11/21 06:58	1
13C9 PFNA	64		50 - 150			03/10/21 11:30	03/11/21 06:58	1

General	Chemi	stry

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
Percent Moisture	16.9	1.0		1.0 %		03/10/21 07:58	1
Percent Solids	83.1	1.0		1.0 %		03/10/21 07:58	1

Eurofins Lancaster Laboratories Env, LLC

Dil Fac

Analyzed

Job ID: 410-31764-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-5-GW-030821

Lab Sample ID: 410-31764-4 Date Collected: 03/08/21 10:35 **Matrix: Water**

Date Received: 03/09/21 16:45

13C8 PFOS

d3-NMeFOSAA

d5-NEtFOSAA

13C2-PFDoDA

13C3 PFHxS

13C5 PFHxA

13C6 PFDA

13C7 PFUnA

13C9 PFNA

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	11			4.9	3.9	3.9	ng/L	03/11/21 02:34	1
8:2 Fluorotelomer sulfonic acid	2.0	J		3.0	2.0	2.0	ng/L	03/11/21 02:34	1
NEtFOSAA	<0.99			3.0	0.99	0.99	ng/L	03/11/21 02:34	1
NMeFOSAA	<1.2			2.0	1.2	1.2	ng/L	03/11/21 02:34	1
Perfluorobutanesulfonic acid	3.5	M		2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluorobutanoic acid	6.4			4.9	3.9	3.9	ng/L	03/11/21 02:34	1
Perfluorodecanoic acid	<0.99			2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluorododecanoic acid	<0.99			2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluoroheptanoic acid	4.2			2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluorohexanesulfonic acid	100			2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluorohexanoic acid	15			2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluorononanoic acid	1.4	J		2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluorooctanesulfonic acid	92			2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluorooctanoic acid	35	M		2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluoropentanoic acid	7.8	M		2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluorotetradecanoic acid	<0.99			2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluorotridecanoic acid	<0.99			2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Perfluoroundecanoic acid	<0.99			2.0	0.99	0.99	ng/L	03/11/21 02:34	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	92		50 - 150				03/10/21 08:44	03/11/21 02:34	1
M2-8:2 FTS	84		50 - 150				03/10/21 08:44	03/11/21 02:34	1
13C2 PFTeDA	71		50 - 150				03/10/21 08:44	03/11/21 02:34	1
13C3 PFBS	85		50 - 150				03/10/21 08:44	03/11/21 02:34	1
13C4 PFBA	78		50 - 150				03/10/21 08:44	03/11/21 02:34	1
13C4 PFHpA	82		50 - 150				03/10/21 08:44	03/11/21 02:34	1
13C5 PFPeA	84		50 - 150				03/10/21 08:44	03/11/21 02:34	1
13C8 PFOA	81		50 ₋ 150				03/10/21 08:44	03/11/21 02:34	1

Client Sample ID: APG-Boneyard-2-SO-(0-2)-030821

82

75

70

88

90

82

77

78

78

Lab Sample ID: 410-31764-5 Date Collected: 03/08/21 11:10 **Matrix: Solid**

Date Received: 03/09/21 16:45 **Percent Solids: 85.5**

50 - 150

50 - 150

50 - 150

50 - 150

50 - 150

50 - 150

50 - 150

50 - 150

50 - 150

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	<u></u>	03/13/21 16:49	1
8:2 Fluorotelomer sulfonic acid	<0.0019	0.0035	0.0019	0.0019	mg/Kg	₩	03/13/21 16:49	1
NEIFOSAA	<0.00046	0.0023	0.00046	0.00046	mg/Kg	- ×	03/13/21 16:49	R 1
NMeFOSAA	<0.00046	0.0023	0.00046	0.00046	mg/Kg	*	03/13/21 16:49	R 1
Perfluorobutanesulfonic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	₩	03/13/21 16:49	1
Perfluorobutanoic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	₩	03/13/21 16:49	1
Perfluorodecanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	₩	03/13/21 16:49	1

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03/10/21 08:44 03/11/21 02:34

03/10/21 08:44 03/11/21 02:34

03/10/21 08:44 03/11/21 02:34

03/10/21 08:44 03/11/21 02:34

03/10/21 08:44 03/11/21 02:34

03/10/21 08:44 03/11/21 02:34

03/10/21 08:44 03/11/21 02:34

03/10/21 08:44 03/11/21 02:34

03/10/21 08:44 03/11/21 02:34

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3/19/2021

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31764-1 Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-2-SO-(0-2)-030821

Lab Sample ID: 410-31764-5 Date Collected: 03/08/21 11:10 **Matrix: Solid**

Date Received: 03/09/21 16:45 Percent Solids: 85.5

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorododecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	03/13/21 16:49	1
Perfluoroheptanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg ☆	03/13/21 16:49	1
Perfluorohexanesulfonic acid	<0.00046	M	0.00069	0.00046	0.00046	mg/Kg ☆	03/13/21 16:49	1
Perfluorohexanoic acid	0.00051	jм	0.00069	0.00046	0.00046	mg/Kg ☆	03/13/21 16:49	1
Perfluorononanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg ⇔	03/13/21 16:49	1
Perfluorooctanesulfonic acid	0.0023		0.00069	0.00046	0.00046	mg/Kg ♯	03/13/21 16:49	1
Perfluorooctanoic acid	0.00074	M	0.00069	0.00046	0.00046	mg/Kg ☆	03/13/21 16:49	1
Perfluoropentanoic acid	<0.00046	Ŋ	0.00069	0.00046	0.00046	mg/Kg ⇔	03/13/21 16:49	1
Perfluorotetradecanoic acid	<0.00046	*	0.00069	0.00046	0.00046	mg/Kg ☆	03/13/21 16:49	1
Perfluorotridecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg ⇔	03/13/21 16:49	1
Perfluoroundecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg ⇔	03/13/21 16:49	1
Isotope Dilution	%Recovery Qu	ıalifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	85		50 - 150			03/12/21 10:01	03/13/21 16:49	1
M2-8:2 FTS	76		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C2 PFTeDA	87		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C3 PFBS	85		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C4 PFBA	85		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C4 PFHpA	92		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C5 PFPeA	85		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C8 PFOA	91		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C8 PFOS	99		50 - 150			03/12/21 10:01	03/13/21 16:49	1
d3-NMeFOSAA	12 *5-	•	50 - 150			03/12/21 10:01	03/13/21 16:49	1
d5-NEtFOSAA	17 *5-	-	50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C2-PFDoDA	88		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C3 PFHxS	97		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C5 PFHxA	91		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C6 PFDA	92		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C7 PFUnA	99		50 - 150			03/12/21 10:01	03/13/21 16:49	1
13C9 PFNA	91		50 - 150			03/12/21 10:01	03/13/21 16:49	1

Method: FPA	537(Mod)	- PFAS for QSM 5.3	Table R-15 - RF
MELITOU. LI		· I I AO IOI GOIN J.J	. Table D-13 - IL

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₽	03/11/21 07:09	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0034	0.0018	0.0018	mg/Kg	☼	03/11/21 07:09	1
NEtFOSAA	< 0.00046		0.0023	0.00046	0.00046	mg/Kg	☼	03/11/21 07:09	1
NMeFOSAA	<0.00046		0.0023	0.00046	0.00046	mg/Kg	₽	03/11/21 07:09	1
Perfluorobutanesulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₩	03/11/21 07:09	1
Perfluorobutanoic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	03/11/21 07:09	1
Perfluorodecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₽	03/11/21 07:09	1
Perfluorododecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/11/21 07:09	1
Perfluoroheptanoic acid	< 0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/11/21 07:09	1
Perfluorohexanesulfonic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	⊅	03/11/21 07:09	1
Perfluorohexanoic acid	0.00047	J M	0.00069	0.00046	0.00046	mg/Kg	☼	03/11/21 07:09	1
Perfluorononanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/11/21 07:09	1
Perfluorooctanesulfonic acid	0.0020		0.00069	0.00046	0.00046	mg/Kg	₩	03/11/21 07:09	1
Perfluorooctanoic acid	0.00063	J M	0.00069	0.00046	0.00046	mg/Kg	*	03/11/21 07:09	1
Perfluoropentanoic acid	< 0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/11/21 07:09	1
Perfluorotetradecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₽	03/11/21 07:09	1
Perfluorotridecanoic acid	< 0.00046		0.00069	0.00046	0.00046	mg/Kg	₽	03/11/21 07:09	1

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Job ID: 410-31764-1

Client Sample ID: APG-Boneyard-2-SO-(0-2)-030821

Client: ARCADIS U.S., Inc.

Project/Site: APG PFAS S1

Lab Sample ID: 410-31764-5 Date Collected: 03/08/21 11:10 **Matrix: Solid** Date Received: 03/09/21 16:45 Percent Solids: 85.5

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - RE (Continued) LOD Analyte Result Qualifier LOQ DL Unit D Analyzed Dil Fac 0.00046 mg/Kg Perfluoroundecanoic acid <0.00046 0.00069 0.00046 03/11/21 07:09 Isotope Dilution %Recovery Qualifier Limits Analyzed Dil Fac Prepared M2-6:2 FTS 68 50 - 150 03/10/21 11:30 03/11/21 07:09 M2-8:2 FTS 62 50 - 150 03/10/21 11:30 03/11/21 07:09 13C2 PFTeDA 75 50 - 150 03/10/21 11:30 03/11/21 07:09 13C3 PFBS 92 03/10/21 11:30 03/11/21 07:09 50 - 150 13C4 PFBA 62 03/10/21 11:30 03/11/21 07:09 50 - 150 74 03/10/21 11:30 03/11/21 07:09 13C4 PFHpA 50 - 150 13C5 PFPeA 67 50 - 150 03/10/21 11:30 03/11/21 07:09 13C8 PFOA 80 50 - 150 03/10/21 11:30 03/11/21 07:09 13C8 PFOS 97 50 - 150 03/10/21 11:30 03/11/21 07:09 d3-NMeFOSAA 9 *5-50 - 150 03/10/21 11:30 03/11/21 07:09 d5-NEtFOSAA 12 *5-50 - 150 03/10/21 11:30 03/11/21 07:09 13C2-PFDoDA 84 50 - 150 03/10/21 11:30 03/11/21 07:09 50 - 150 03/10/21 11:30 03/11/21 07:09 13C3 PFHxS 96 03/10/21 11:30 03/11/21 07:09 13C5 PFHxA 70 50 - 150 13C6 PFDA 50 - 150 03/10/21 11:30 03/11/21 07:09 81 13C7 PFUnA 78 50 - 150 03/10/21 11:30 03/11/21 07:09 13C9 PFNA 77 50 - 150 03/10/21 11:30 03/11/21 07:09

General Chemistry						
Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
Percent Moisture	14.5	1.0		1.0 %	03/10/21 07:58	1
Percent Solids	85.5	1.0		1.0 %	03/10/21 07:58	1

Client Sample ID: APG-Boneyard-2-GW-030821 Lab Sample ID: 410-31764-6

Date Collected: 03/08/21 11:40 **Matrix: Water** Date Received: 03/09/21 16:45

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	3.9	J	4.9	3.9	3.9	ng/L		03/11/21 02:56	1
8:2 Fluorotelomer sulfonic acid	<1.9		2.9	1.9	1.9	ng/L		03/11/21 02:56	1
NEtFOSAA	<0.97		2.9	0.97	0.97	ng/L		03/11/21 02:56	1
NMeFOSAA	<1.2		1.9	1.2	1.2	ng/L		03/11/21 02:56	1
Perfluorobutanesulfonic acid	6.1		1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluorobutanoic acid	<3.9		4.9	3.9	3.9	ng/L		03/11/21 02:56	1
Perfluorodecanoic acid	<0.97		1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluorododecanoic acid	< 0.97		1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluoroheptanoic acid	7.7		1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluorohexanesulfonic acid	250		1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluorohexanoic acid	17		1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluorononanoic acid	1.4	J	1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluorooctanesulfonic acid	110		1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluorooctanoic acid	84	M	1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluoropentanoic acid	5.9	M	1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluorotetradecanoic acid	<0.97		1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluorotridecanoic acid	< 0.97		1.9	0.97	0.97	ng/L		03/11/21 02:56	1
Perfluoroundecanoic acid	< 0.97		1.9	0.97	0.97	ng/L		03/11/21 02:56	1

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Client: ARCADIS U.S., Inc. Job ID: 410-31764-1 Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-2-GW-030821

Lab Sample ID: 410-31764-6 Date Collected: 03/08/21 11:40 **Matrix: Water**

Date Received: 03/09/21 16:45

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	102		50 - 150	03/10/21 08:44	03/11/21 02:56	1
M2-8:2 FTS	98		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C2 PFTeDA	62		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C3 PFBS	99		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C4 PFBA	98		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C4 PFHpA	103		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C5 PFPeA	104		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C8 PFOA	102		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C8 PFOS	100		50 - 150	03/10/21 08:44	03/11/21 02:56	1
d3-NMeFOSAA	93		50 - 150	03/10/21 08:44	03/11/21 02:56	1
d5-NEtFOSAA	89		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C2-PFDoDA	91		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C3 PFHxS	104		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C5 PFHxA	103		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C6 PFDA	96		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C7 PFUnA	88		50 - 150	03/10/21 08:44	03/11/21 02:56	1
13C9 PFNA	96		50 - 150	03/10/21 08:44	03/11/21 02:56	1

Lab Sample ID: 410-31764-7 Client Sample ID: APG-Boneyard-3-SO-(0-2)-030821

Date Collected: 03/08/21 12:10 **Matrix: Solid** Date Received: 03/09/21 16:45 Percent Solids: 82.6

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	<u></u>	03/13/21 16:59	1
8:2 Fluorotelomer sulfonic acid	<0.0018	0.0034	0.0018	0.0018	mg/Kg	☼	03/13/21 16:59	1
NEtFOSAA	<0.00045	0.0022	0.00045	0.00045	mg/Kg	☆	03/13/21 16:59	R 1
NMeFOSAA	<0.00045	0.0022	0.00045	0.00045	mg/Kg	*	03/13/21 16:59	R 1
Perfluorobutanesulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	☼	03/13/21 16:59	1
Perfluorobutanoic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	☼	03/13/21 16:59	1
Perfluorodecanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	₩	03/13/21 16:59	1
Perfluorododecanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/13/21 16:59	1
Perfluoroheptanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/13/21 16:59	1
Perfluorohexanesulfonic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/13/21 16:59	1
Perfluorohexanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/13/21 16:59	1
Perfluorononanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/13/21 16:59	1
Perfluorooctanesulfonic acid	0.00060 J	0.00067	0.00045	0.00045	mg/Kg	☼	03/13/21 16:59	1
Perfluorooctanoic acid	<0.00045 M	0.00067	0.00045	0.00045	mg/Kg	☼	03/13/21 16:59	1
Perfluoropentanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/13/21 16:59	1
Perfluorotetradecanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/13/21 16:59	1
Perfluorotridecanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☼	03/13/21 16:59	1
Perfluoroundecanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	₩	03/13/21 16:59	1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared Analyzed Dil	Fac
M2-6:2 FTS	56	50 - 150	03/12/21 10:01 03/13/21 16:59	1
M2-8:2 FTS	57	50 - 150	03/12/21 10:01 03/13/21 16:59	1
13C2 PFTeDA	76	50 - 150	03/12/21 10:01 03/13/21 16:59	1
13C3 PFBS	85	50 - 150	03/12/21 10:01 03/13/21 16:59	1
13C4 PFBA	67	50 - 150	03/12/21 10:01 03/13/21 16:59	1
13C4 PFHpA	74	50 - 150	03/12/21 10:01 03/13/21 16:59	1
13C5 PFPeA	70	50 - 150	03/12/21 10:01 03/13/21 16:59	1
13C8 PFOA	72	50 - 150	03/12/21 10:01 03/13/21 16:59	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31764-1 Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-3-SO-(0-2)-030821 Lab Sample ID: 410-31764-7

Date Collected: 03/08/21 12:10 **Matrix: Solid** Date Received: 03/09/21 16:45 Percent Solids: 82.6

Isotope Dilution	%Recovery Qualif	ier Limits	Prepared	Analyzed	Dil Fac
13C8 PFOS	95	50 - 150	03/12/21 10:01	03/13/21 16:59	1
d3-NMeFOSAA	7 *5-	50 - 150	03/12/21 10:01	03/13/21 16:59	1
d5-NEtFOSAA	10 *5-	50 - 150	03/12/21 10:01	03/13/21 16:59	1
13C2-PFDoDA	78	50 ₋ 150	03/12/21 10:01	03/13/21 16:59	1
13C3 PFHxS	94	50 - 150	03/12/21 10:01	03/13/21 16:59	1
13C5 PFHxA	74	50 - 150	03/12/21 10:01	03/13/21 16:59	1
13C6 PFDA	74	50 - 150	03/12/21 10:01	03/13/21 16:59	1
13C7 PFUnA	77	50 - 150	03/12/21 10:01	03/13/21 16:59	1
13C9 PFNA	73	50 ₋ 150	03/12/21 10:01	03/13/21 16:59	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	<u></u>	03/11/21 07:30	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0034	0.0018	0.0018	mg/Kg	₩	03/11/21 07:30	1
NEtFOSAA	< 0.00045		0.0023	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
NMeFOSAA	<0.00045		0.0023	0.00045	0.00045	mg/Kg	₽	03/11/21 07:30	1
Perfluorobutanesulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₩	03/11/21 07:30	1
Perfluorobutanoic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₩	03/11/21 07:30	1
Perfluorodecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
Perfluorododecanoic acid	< 0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
Perfluoroheptanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
Perfluorohexanesulfonic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
Perfluorohexanoic acid	<0.00045	M	0.00068	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
Perfluorononanoic acid	0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
Perfluorooctanesulfonic acid	0.00066	J	0.00068	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
Perfluorooctanoic acid	<0.00045	M	0.00068	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
Perfluoropentanoic acid	< 0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
Perfluorotetradecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
Perfluorotridecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/11/21 07:30	1
Perfluoroundecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	☼	03/11/21 07:30	1
lastone Dilution	% Bookson, O	olifior	Limite			Dror	arad	Analyzod	Dil Esc

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	61		50 - 150	03/10/21 11:30	03/11/21 07:30	1
M2-8:2 FTS	57		50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C2 PFTeDA	79		50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C3 PFBS	96		50 - 150	 03/10/21 11:30	03/11/21 07:30	1
13C4 PFBA	61		50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C4 PFHpA	74		50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C5 PFPeA	67		50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C8 PFOA	76		50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C8 PFOS	100		50 - 150	03/10/21 11:30	03/11/21 07:30	1
d3-NMeFOSAA	9	*5-	50 - 150	03/10/21 11:30	03/11/21 07:30	1
d5-NEtFOSAA	12	*5-	50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C2-PFDoDA	81		50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C3 PFHxS	100		50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C5 PFHxA	68		50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C6 PFDA	78		50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C7 PFUnA	77		50 - 150	03/10/21 11:30	03/11/21 07:30	1
13C9 PFNA	74		50 - 150	03/10/21 11:30	03/11/21 07:30	7

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Client Sample Results

Client: ARCADIS U.S., Inc.

Job ID: 410-31764-1

Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-3-SO-(0-2)-030821

Lab Sample ID: 410-31764-7

Date Collected: 03/08/21 12:10
Date Received: 03/09/21 16:45
Perceived: 03/09/21 16:45

Matrix: Solid Percent Solids: 82.6

General Chemistry								
Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	17.4	1.0		1.0	%		03/10/21 07:58	1
Percent Solids	82.6	1.0		1.0	%		03/10/21 07:58	1

Client Sample ID: APG-Boneyad-3-GW-030821 Lab Sample ID: 410-31764-8

Date Collected: 03/08/21 12:50 Matrix: Water

Date Received: 03/09/21 16:45

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<4.0		5.0	4.0	4.0	ng/L		03/11/21 03:06	1
8:2 Fluorotelomer sulfonic acid	<2.0		3.0	2.0	2.0	ng/L		03/11/21 03:06	1
NEtFOSAA	<1.0		3.0	1.0	1.0	ng/L		03/11/21 03:06	1
NMeFOSAA	<1.2		2.0	1.2	1.2	ng/L		03/11/21 03:06	1
Perfluorobutanesulfonic acid	2.9		2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluorobutanoic acid	6.6		5.0	4.0	4.0	ng/L		03/11/21 03:06	1
Perfluorodecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluorododecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluoroheptanoic acid	9.7		2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluorohexanesulfonic acid	59		2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluorohexanoic acid	12		2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluorononanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluorooctanesulfonic acid	48		2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluorooctanoic acid	23	M	2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluoropentanoic acid	12		2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluorotetradecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluorotridecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/11/21 03:06	1
Perfluoroundecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/11/21 03:06	1

i ciliadi dallacdariolo adia	-1.0	2.0	1.0	1.0 Tig/L	00/11/21 00:00	
Isotope Dilution	%Recovery Qualifier	Limits		Prepared	Analyzed	Dil Fac
M2-6:2 FTS	93	50 - 150		03/10/21 08:44	03/11/21 03:06	1
M2-8:2 FTS	79	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C2 PFTeDA	52	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C3 PFBS	84	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C4 PFBA	85	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C4 PFHpA	88	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C5 PFPeA	90	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C8 PFOA	90	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C8 PFOS	86	50 - 150		03/10/21 08:44	03/11/21 03:06	1
d3-NMeFOSAA	83	50 - 150		03/10/21 08:44	03/11/21 03:06	1
d5-NEtFOSAA	78	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C2-PFDoDA	78	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C3 PFHxS	87	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C5 PFHxA	89	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C6 PFDA	86	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C7 PFUnA	84	50 - 150		03/10/21 08:44	03/11/21 03:06	1
13C9 PFNA	88	50 - 150		03/10/21 08:44	03/11/21 03:06	1
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Job ID: 410-31764-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-4-SO-(0-2)-030821

Lab Sample ID: 410-31764-9 Date Collected: 03/08/21 13:30 **Matrix: Solid**

Date Received: 03/09/21 16:45 Percent Solids: 86.6

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	₩	03/13/21 17:10	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0033	0.0018	0.0018	mg/Kg	₩	03/13/21 17:10	1
NEtFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg	₩	03/13/21 17.10	R 1
NMeFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg	∺	03/13/21 17:10	R 1
Perfluorobutanesulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	₩	03/13/21 17:10	1
Perfluorobutanoic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	₩	03/13/21 17:10	1
Perfluorodecanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Perfluorododecanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Perfluoroheptanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Perfluorohexanesulfonic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Perfluorohexanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Perfluorononanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Perfluorooctanesulfonic acid	<0.00044	Ŋ	0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Perfluorooctanoic acid	<0.00044	M	0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Perfluoropentanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Perfluorotetradecanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Perfluorotridecanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Perfluoroundecanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/13/21 17:10	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared		Analyzed	Dil Fac
M2-6:2 FTS	82		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
M2-8:2 FTS	88		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C2 PFTeDA	91		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C3 PFBS	88		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C4 PFBA	81		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C4 PFHpA	88		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C5 PFPeA	82		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C8 PFOA	89		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C8 PFOS	97		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
d3-NMeFOSAA	10 *5	-	50 - 150			03/12/21 10:	01	03/13/21 17:10	1
d5-NEtFOSAA	15 *5	-	50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C2-PFDoDA	89		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C3 PFHxS	98		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C5 PFHxA	86		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C6 PFDA	86		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C7 PFUnA	94		50 - 150			03/12/21 10:	01	03/13/21 17:10	1
13C9 PFNA	87		50 ₋ 150			03/12/21 10	01	03/13/21 17:10	1

Method: EPA 537(Mod) - PFAS for QSM 5.3	3, Table B-15 - RE
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	Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
	6:2 Fluorotelomer sulfonic acid	<0.0017		0.0022	0.0017	0.0017	mg/Kg	≎	03/11/21 07:40	1
	8:2 Fluorotelomer sulfonic acid	<0.0017		0.0033	0.0017	0.0017	mg/Kg	₽	03/11/21 07:40	1
	NEtFOSAA	< 0.00044	_	0.0022	0.00044	0.00044	mg/Kg	₽	03/11/21 07:40	1
	NMeFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg	₩	03/11/21 07:40	1
	Perfluorobutanesulfonic acid	< 0.0017		0.0022	0.0017	0.0017	mg/Kg	₽	03/11/21 07:40	1
	Perfluorobutanoic acid	<0.0017		0.0022	0.0017	0.0017	mg/Kg	₩	03/11/21 07:40	1
	Perfluorodecanoic acid	<0.00044		0.00065	0.00044	0.00044	mg/Kg	₽	03/11/21 07:40	1
	Perfluorododecanoic acid	<0.00044		0.00065	0.00044	0.00044	mg/Kg	*	03/11/21 07:40	1
	Perfluoroheptanoic acid	<0.00044		0.00065	0.00044	0.00044	mg/Kg	☼	03/11/21 07:40	1
	Perfluorohexanesulfonic acid	<0.00044		0.00065	0.00044	0.00044	mg/Kg	₽	03/11/21 07:40	1

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Job ID: 410-31764-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-4-SO-(0-2)-030821

Lab Sample ID: 410-31764-9 Date Collected: 03/08/21 13:30 **Matrix: Solid** Date Received: 03/09/21 16:45 Percent Solids: 86.6

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanoic acid	<0.00044		0.00065	0.00044	0.00044	mg/Kg		03/11/21 07:40	1
Perfluorononanoic acid	<0.00044		0.00065	0.00044	0.00044	mg/Kg	₽	03/11/21 07:40	1
Perfluorooctanesulfonic acid	<0.00044		0.00065	0.00044	0.00044	mg/Kg	₩	03/11/21 07:40	1
Perfluorooctanoic acid	<0.00044	M	0.00065	0.00044	0.00044	mg/Kg	₽	03/11/21 07:40	1
Perfluoropentanoic acid	<0.00044		0.00065	0.00044	0.00044	mg/Kg	☼	03/11/21 07:40	1
Perfluorotetradecanoic acid	<0.00044		0.00065	0.00044	0.00044	mg/Kg	₽	03/11/21 07:40	1
Perfluorotridecanoic acid	<0.00044		0.00065	0.00044	0.00044	mg/Kg	₽	03/11/21 07:40	1
Perfluoroundecanoic acid	<0.00044		0.00065	0.00044	0.00044	mg/Kg	☼	03/11/21 07:40	1
Isotope Dilution	%Recovery Qu	ıalifier	Limits			Prep	ared	Analyzed	Dil Fac
M2-6:2 FTS	84	_	50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
M2-8:2 FTS	74		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C2 PFTeDA	80		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C3 PFBS	92		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C4 PFBA	61		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C4 PFHpA	77		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C5 PFPeA	68		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C8 PFOA	83		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C8 PFOS	96		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
d3-NMeFOSAA	11 *5-	•	50 - 150			93/10/2	1 11:30	03/11/21 07:40	1
d5-NEtFOSAA	15 *5-	-	50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C2-PFDoDA	96		50 - 150			03/10/2	1 11.30	03/11/21 07:40	1
13C3 PFHxS	96		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C5 PFHxA	69		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C6 PFDA	82		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C7 PFUnA	83		50 - 150			03/10/2	1 11:30	03/11/21 07:40	1
13C9 PFNA	82		50 ₋ 150			03/10/2	1 11.30	03/11/21 07:40	7

General Chemistry Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	13.4		1.0		1.0	%		03/10/21 07:58	1
Percent Solids	86.6		1.0		1.0	%		03/10/21 07:58	1

Client Sample ID: APG-Boneyard-4-GW-030821

Lab Sample ID: 410-31764-10 Date Collected: 03/08/21 14:15 **Matrix: Water** Date Received: 03/09/21 16:45

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	5.2	J	5.4	4.3	4.3	ng/L		03/11/21 03:17	1
8:2 Fluorotelomer sulfonic acid	<2.1		3.2	2.1	2.1	ng/L		03/11/21 03:17	1
NEtFOSAA	<1.1		3.2	1.1	1.1	ng/L		03/11/21 03:17	1
NMeFOSAA	<1.3		2.1	1.3	1.3	ng/L		03/11/21 03:17	1
Perfluorobutanesulfonic acid	<1.1	ľΛ	2.1	1.1	1.1	ng/L		03/11/21 03:17	1
Perfluorobutanoic acid	<4.3		5.4	4.3	4.3	ng/L		03/11/21 03:17	1
Perfluorodecanoic acid	<1.1		2.1	1.1	1.1	ng/L		03/11/21 03:17	1
Perfluorododecanoic acid	<1.1		2.1	1.1	1.1	ng/L		03/11/21 03:17	1
Perfluoroheptanoic acid	3.3		2.1	1.1	1.1	ng/L		03/11/21 03:17	1
Perfluorohexanesulfonic acid	13		2.1	1.1	1.1	ng/L		03/11/21 03:17	1
Perfluorohexanoic acid	4.8		2.1	1.1	1.1	ng/L		03/11/21 03:17	1
Perfluorononanoic acid	<1.1		2.1	1.1	1.1	ng/L		03/11/21 03:17	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31764-1 Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-4-GW-030821

Lab Sample ID: 410-31764-10 Date Collected: 03/08/21 14:15 **Matrix: Water**

Date Received: 03/09/21 16:45

13C9 PFNA

Analyte	Result Qualif	er LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorooctanesulfonic acid	18	2.1	1.1	1.1	ng/L	03/11/21 03:17	1
Perfluorooctanoic acid	6.2	2.1	1.1	1.1	ng/L	03/11/21 03:17	1
Perfluoropentanoic acid	3.9	2.1	1.1	1.1	ng/L	03/11/21 03:17	1
Perfluorotetradecanoic acid	<1.1	2.1	1.1	1.1	ng/L	03/11/21 03:17	1
Perfluorotridecanoic acid	<1.1	2.1	1.1	1.1	ng/L	03/11/21 03:17	1
Perfluoroundecanoic acid	<1.1	2.1	1.1	1.1	ng/L	03/11/21 03:17	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	102	50 - 150			03/10/21 08:44	03/11/21 03:17	1
M2-8:2 FTS	85	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C2 PFTeDA	78	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C3 PFBS	96	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C4 PFBA	88	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C4 PFHpA	94	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C5 PFPeA	91	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C8 PFOA	95	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C8 PFOS	95	50 - 150			03/10/21 08:44	03/11/21 03:17	1
d3-NMeFOSAA	83	50 - 150			03/10/21 08:44	03/11/21 03:17	1
d5-NEtFOSAA	81	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C2-PFDoDA	94	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C3 PFHxS	99	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C5 PFHxA	92	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C6 PFDA	89	50 - 150			03/10/21 08:44	03/11/21 03:17	1
13C7 PFUnA	87	50 - 150			03/10/21 08:44	03/11/21 03:17	1

50 - 150

91

03/10/21 08:44 03/11/21 03:17



Aberdeen Proving Ground – Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS) Analysis SDG # 410-31990-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report #41203R

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-31990-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

0 1 10			Sample	5	Αı	nalysis	
Sample ID	Lab ID	Matrix	Collection Date	Parent Sample	PFAS	тос	рН
APG-BLDG-250-PW-1-1-GW-030921	410-31990-1	Water	3/9/2021		Х		
APG-DUP-02-030921	410-31990-2	Water	3/9/2021	APG-BLDG-250-PW-1-1- GW-030921	x		
APG-BLDG-250-PW-2-1-GW-030921	410-31990-3	Water	3/9/2021		Х		
APG-BLDG-250-PW-3-1-GW-030921	410-31990-4	Water	3/9/2021		Х		
APG-BLDG-250-PW-4-1-GW-030921	410-31990-5	Water	3/9/2021		Х		
APG-BLDG-250-PW-5-1-GW-030921	410-31990-6	Water	3/9/2021		Х		
APG-AA-WWTP-1-EW-030921	410-31990-7	Water	3/9/2021		Х		
APG-WB-MW-11A-030921	410-31990-8	Water	3/9/2021		Х		
APG-WB-MW-14A-030921	410-31990-9	Water	3/9/2021		Х		
APG-EB-03-030921	410-31990-10	Water	3/9/2021		Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-AA-WWTP-1-EW-030921.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was performed on sample APG-BLDG-250-PW-1-1-GW-030921.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Rep	orted		mance ptable	Not
Items Reviewed	No	Yes	No	Yes	Required
Sample receipt condition		Х		Х	
2. Requested analyses and sample results		Х		X	
Master tracking list		Х		X	
4. Methods of analysis		Х		Х	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		Х	
11. Narrative summary of QA or sample problems provided		Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

- The container for the following samples did not match the information listed on the COC: APG-BLDG-250-PW-1-1-GW-030921 (410-31990-1), APG-BLDG-250-PW-1-1-GW-030921 (410-31990-1 MS) and APG-BLDG-250-PW-1-1-GW-030921 (410-31990-1 MSD). The number of received containers was 7, while the COC lists 6.
- 2. The chain of custody states that 2 containers were submitted, whereas the laboratory received 3 containers per sample for the following samples.

Lab ID	Sample ID			
410-31990-8	APG-WB-MW-11A-030921			
410-31990-9	APG-WB-MW-14A-030921			

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified 537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

All EIS recoveries were within control limits.

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be ≤ 30%.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

The MS/MSD analysis was performed on sample APG-BLDG-250-PW-1-1-GW-030921. The MS/MSD exhibited acceptable recoveries and RPD between the MS/MSD recoveries.

7. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The compounds associated with the LCS analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD

between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

Results for field duplicate samples are summarized in the following table.

Sample ID/Duplicate ID	Compound	Sample Result	Duplicate Result	RPD
APG-BLDG-250-PW-1-1-GW-030921 / APG-DUP-02-030921	All target compounds	U	U	AC

Note:

AC Acceptable

The results between parent and field duplicate were acceptable.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

Samples associated with ion ratios outside of the control limits of \pm 50 percent from the target value are presented in the following table.

Sample ID	Compounds	Ion Ratio %R
APG-WB-MW-11A-030921	Perfluorooctanesulfonic acid	151%
APG-WB-MW-14A-030921	Perfluorooctanesulfonic acid	150%

In the case of an ion ratio deviation, the sample results are qualified as documented in the table below.

Control limit	Sample Result	Qualification
<50% or > 150%	Detect	J

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3		Reported		rmance ptable	Not Required	
		Yes	No	Yes	Required	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)						
Stage 2 Validation						
Holding times		Х		Х		
Reporting limits (units)		Х		Х		
Blanks						
A. Method blanks		Х		Х		
B. Equipment blanks		Х		X		
C. Field blanks / Source blanks	Х				Х	
Laboratory Control Sample (LCS) %R		Х		Х		
Laboratory Control Sample Duplicate(LCSD) %R	Х				X	
LCS/LCSD Precision (RPD)	Х				Х	
Matrix Spike (MS) %R		Х		Х		
Matrix Spike Duplicate(MSD) %R		Х		Х		
MS/MSD Precision (RPD)		Х		Х		
Field Duplicate (RPD)		Х		Х		
Extracted Internal Standard %R		Х		Х		
Injection Internal Standard %R		Х		Х		
Dilution Factor		Х		Х		
Moisture Content	Х				X	
Stage 3/4 Validation						
Instrument tune and performance check		X		Х		
Initial calibration %RSDs		Х		Х		
Continuing calibration %Ds		Х		Х		
Instrument sensitivity check		Х		Х		
Ion transitions used		Х		Х		
Compound identification and quantitation						
A. Reconstructed ion chromatograms		Х		Х		
B. Quantitation Reports		Х		Х		
C. RT of sample compounds within the established RT windows		Х		х		

PFAS: 537M/DoD QSM 5.3		Reported		mance ptable	Not	
		Yes	No	Yes	Required	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)						
D. Ion Ratio %R		X	Х			
E. Transcription/calculations acceptable		Х		Х		
F. Reporting limits adjusted to reflect sample dilutions		Х		Х		

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE:

DATE: May 3, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 11, 2021

Stage 3 / 4 PFAS Calibration Standards

SDG #:410-31990-1Date:5/3/2021Lab:Eurofins LancasterPage:1Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

PFOA 3/17/2021 Calibration

Page 685 - 698 of SDG 410-31990-1

Match Match Match Match Match Match Match

1466 000 000 000 0100 110 01000 1											
Cal Conc					Calculated		Calc		Calculated	Reported	
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D	
0.2	141234	6771971	10	0.020856	1.0427836	0.9768	0.21351	0.2	6.755	6.8	
0.5	339917	6639170	10	0.051199	1.0239744	0.9768	0.524147	0.5	4.829	4.8	
2	1428396	6518513	10	0.219129	1.0956456	0.9768	2.243337	2	12.167	12.2	
8	4606305	6241486	10	0.738014	0.9225177	0.9768	7.555427	8	-5.557	-5.6	
20	11353940	6107162	10	1.859119	0.9295594	0.9768	19.03275	20	-4.836	-4.8	
50	26265377	5722106	10	4.590159	0.9180318	0.9768	46.9918	50	-6.016	-6	
100	43121158	4763137	10	9.053101	0.9053101	0.9768	92.68121	100	-7.319	-7.3	
	•					•					

Avg RF = 0.9768318 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-31990-1Date:5/3/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-103929/9 3/17/2021 01:41

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	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	874409	4859351	10	0.1799	0.9055	1.987	2	-0.64	-0.6
Perfluoropentanoic acid	931437	4634587	10	0.2010	1.0900	1.844	2	-7.81	-7.8
Perfluorobutanesulfonic acid	772307	3826669	9.36	0.2018	1.1250	1.679	2	-5.13	-5
Perfluorohexanoic acid	897494	5038802	10	0.1781	0.8906	2.000	2	0.00	0
Perfluoroheptanoic acid	1138680	5302738	10	0.2147	1.1710	1.834	2	-8.31	-8.3
Perfluorohexanesulfonic acid	721897	3684758	9.46	0.1959	1.0560	1.755	2	-7.14	-7.2
Perfluorooctanesulfonic acid	783741	3880536	9.57	0.2020	1.1290	1.712	2	-10.37	-10.5

Match Match Match Match Match Match Match

CCV 410-104674/26 3/18/2021 22:16

Page 937 - 942 of SDG 410-31990-1

	Analyte					Calc		Calculated	Reported	İ
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D	ĺ
Perfluorobutanoic acid	3545496	5116461	10	0.6930	0.9055	7.653	8.0	-4.34	-4.3	Ma
Perfluoropentanoic acid	3749862	4374335	10	0.8572	1.0900	7.865	8.0	-1.69	-1.7	Ma
Perfluorobutanesulfonic acid	3045256	3918892	9.36	0.7771	1.1250	6.465	7.1	-8.68	-8.7	Ma
Perfluorohexanoic acid	3577925	5062036	10	0.7068	0.8906	7.936	8.0	-0.80	-0.8	Ma
Perfluoroheptanoic acid	4739651	5357598	10	0.8847	1.1710	7.555	8.0	-5.57	-5.5	Ma
Perfluorohexanesulfonic acid	2734709	3552064	9.46	0.7699	1.0560	6.897	7.3	-5.52	-5.4	Ma
Perfluorooctanesulfonic acid	3004073	3737618	9.57	0.8037	1.1290	6.813	7.4	-7.93	-8	Ma

Match Match Match Match Match Match Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 SDG #:
 410-31990-1
 Date:
 5/3/2021

 Lab:
 Eurofins Lancaster
 Page:
 3

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-104042/2-A

Page 1125 - 1130 of SDG 410-31990-1

Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported]
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	2769285	5231049	10	0.529394	0.9055	23.39	25.6	91.35	91	Match
Perfluoropentanoic acid	2914332	4592043	10	0.634648	1.0900	23.29	25.6	90.98	91	Match
Perfluorobutanesulfonic acid	2464141	3532704	9.36	0.697523	1.1250	23.21	22.7	102.26	102	Match
Perfluorohexanoic acid	2872167	5390666	10	0.532804	0.8906	23.93	25.6	93.48	93	Match
Perfluoroheptanoic acid	3944869	5601655	10	0.704233	1.1710	24.06	25.6	93.97	94	Match
Perfluorohexanesulfonic acid	2140698	3693579	9.46	0.579573	1.0560	20.77	23.3	89.13	89	Match
Perfluorooctanesulfonic acid	2416138	3750803	9.57	0.644166	1.1290	21.84	23.7	92.16	92	Match

Calculated Amount ng/ml = ((Peak area ratio/Avg RF) x EIS concentration)/Sample volume)*1000

Stage 3 / 4 PFAS MS/MSD

SDG #:410-31990-1Date:5/3/2021Lab:Eurofins LancasterPage:4Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID APG-BLDG-250-PW-1-1-GW-030921 Page 392 - 393 SDG 410-31990-1

ANALYTE Perfluorobutanoic acid

REPORTED MS %R 86
REPORTED MSD %R 89
REPORTED RPD 1

%R = 100 * (MS Conc - Sample Conc) MS TV RPD = 100 * | MS %R - MSD %R Average of MS MSD %R

Sample Concentration 0 MS Concentration 18.6 MS %R 86.51 MATCH MSD Concentration 18.8 88.68 MATCH MSD %R MS TV 21.5 RPD 1.07 MATCH MSD TV 21.2

Differences in %R may be due to rounding of the true value

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-31990-1
 Date:
 5/3/2021

 Lab:
 Eurofins Lancaster
 Page:
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 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-AA-WWTP-1-EW-030921 Lab ID: 410-31990-7 Page 495 - 499 of SDG 410-31990-1

						Calculated	Final		Final	Reported]
						Amount	Volume	Sample	Calculated	Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	1040582	4494060	10	0.231546	0.9055	2.56	1	310.4	8.2	8.2	Matc
Perfluoropentanoic acid	5054077	4326834	10	1.168077	1.0900	10.72	1	310.4	34.5	35.0	Matc
Perfluorobutanesulfonic acid	120925	3487754	9.36	0.034671	1.1250	0.29	1	310.4	0.9	0.93 J	Mato
Perfluorohexanoic acid	2295479	4754627	10	0.482788	0.8906	5.42	1	310.4	17.5	17	Mato
Perfluoroheptanoic acid	2201113	5365567	10	0.410229	1.1710	3.50	1	310.4	11.3	11	Matc
Perfluorohexanesulfonic acid	283393	3498323	9.46	0.081008	1.0560	0.73	1	310.4	2.3	2	Mato
Perfluorooctanesulfonic acid	571867	3522904	9.57	0.162328	1.1290	1.38	1	310.4	4.4	4.4	Matc

Calculated amount $ng/ml = (Peak area ratio/Avg RF) \times DF \times EIS conc ng/ml$ Final Calculated amount $ng/L = ((calculated ng/ml \times Final Volume mls) / sample volume mls) *1000$ Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

SDG #:410-31990-1Date:5/3/2021Lab:Eurofins LancasterPage:6Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-AA-WWTP-1-EW-030921 Lab ID: 410-31990-7

EIS 13C8 PFOS
REPORTED EIS %R 82

 $%R = \frac{100 * EIS Concentration}{EIS TV}$

EIS Concentration 7.87 ng/ml Page 498 of 410-31990-1

EIS TV 9.57

%R 82.2 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental Analysis R

ustody

eurofins

Lancaster Laboratories Environmental

Acct. #

ntal use only

COC #616531

Client Information	1					Mat	rix					Ar	nalys	is R	equested			For Lab Us	e Only	
Client:	Acct. #:							П			Pre				iltration (FSC:		
ARCADIS					L a		ш											SCR#:		
Project Name/#:	PWSID #:				Tissue	Ground	Surface											Preso	ervation T=	Codes Thiosulfate
Project Manager:	P.O. #:					g	Sur					7		-				N=HNO ₃		NaOH
Keith Shepherd	3000199	6.38xs	0		Ш				ers			(33	(AE)	1				S=H ₂ SO ₄	P=	H₃PO₄
Sampler:	Quote #:				ent		니		i i				9	33				F=Field Fil		
Dale Lynch					Sediment	Potable	NPDES		it l	ر مدیا	7	1,7	7	3					Remark	S
State where samples were collected: For Compliance:			- 10	e e	Sed	ota	요ㅣ		ပိ		4	0.1	H	3						
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Sample Identification		ected	Grab	Composite	Soil	Water	4	Other:	Total # of Containers	PF	ω	500	d	Ĩ						
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APG-6101-250-PW-1-1-GW-030921 /ms/mm	317151	0945	Х			GIL	N		6	\vdash			-	X				MS	MISD	
Ap4- bup-02-030921		1200	X						2				-	×						
API BLDG-250-PW-2-1-GW-030921		0950	X				- 4		2	17			_	X				h- p-		
APG-6606-750-PW-2-1-6W-030921		0955	X						2					X						
APG-16LOG-250-PW-4-1-GW-030971		1000	X					1	2					X						
APG-BLPG-250-PW-5-1-GW-030921		1005	X			100			2		=1-	11)		X						
APG- AA- WWTP-1-EW-030921		1045	×						2		1111			X			100			
APG- AA- WWTP-1-EW-030921		1410	X						2					X						
AP6-WB-MW-14A-030921	1	1520	X			1			2		- 0			X						
APG-EB-03-030921	1	1430	×			1	,		2					×					-	
Turnaround Time (TAT) Requested	(please circ	le)	Relinq	uished	by	,	,	7			Date		Гime	F	eceived by	.06			Date	Time
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(Rush TAT is subject to laboratory approval and surcharge.)		Helipq	uished	by (1780	11			2	Date		7:2		eceived by			/	Date	Time
Requested TAT in business days:			Beling	uished	by	Z W	M			$\frac{\circ}{\circ}$	Date		Time	_	eceived by		_		Date	Time
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E-mail address: Keith Shahad Darcadis.			Relinq	uished	by		/	/	1 30		Date	1	Time	F	eceived by	/	-		Date	Time
Data Package Options (circle if re						/	-							211		1	,			1
Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data	Only)	Relinq	uished	by						Date		Time	F	eceived by			3	Date (Only)	Time
Type III (Reduced non-CLP) NJ DKQF	TX T	TRRP-13			If yes	EDD		uirec	1?	Yes	No				Relinquish	ed by Col		cial Carrie		
NYSDEC Category A or B MA MCP	СТ	RCP			te-Sp	ecific (QC (N						No ume.)					n receipt _	2.1	°C

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The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client.

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Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-31990-1

Project/Site: Aberdeen Proving Ground

Qualifiers

1.	N/A	0
ш	V	J

Qualifier	Qualifier Description
*5+	Isotope dilution analyte is outside acceptance limits, high biased.
I	Value is EMPC (estimated maximum possible concentration).
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
M	Manual integrated compound.

Glossary

Ciossaiy	
Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)

EDL Estimated Detection Limit (Dioxin)

LOD Limit of Detection (DoD/DOE)

LOQ Limit of Quantitation (DoD/DOE)

MCL EPA recommended "Maximum Contaminant Level"

MDA Minimum Detectable Activity (Radiochemistry)

MDC Minimum Detectable Concentration (Radiochemistry)

MDL Method Detection Limit
ML Minimum Level (Dioxin)
MPN Most Probable Number
MQL Method Quantitation Limit

NC Not Calculated

ND Not Detected at the reporting limit (or MDL or EDL if shown)

NEG Negative / Absent
POS Positive / Present

PQL Practical Quantitation Limit

PRES Presumptive QC Quality Control

RER Relative Error Ratio (Radiochemistry)

RL Reporting Limit or Requested Limit (Radiochemistry)

RPD Relative Percent Difference, a measure of the relative difference between two points

TEF Toxicity Equivalent Factor (Dioxin)
TEQ Toxicity Equivalent Quotient (Dioxin)

TNTC Too Numerous To Count

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Client: ARCADIS U.S., Inc.

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-250-PW-1-1-GW-030921

Date Collected: 03/09/21 09:45

Date Received: 03/10/21 18:13

Lab Sample ID: 410-31990-1

Matrix: Water

Method: EPA 537(Mod) - PFA	S for QSM 5.3,	Table B-15						
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5		4.4	3.5	3.5	ng/L	03/15/21 18:06	1
8:2 Fluorotelomer sulfonic acid	<1.8		2.6	1.8	1.8	ng/L	03/15/21 18:06	1
NEtFOSAA	<0.88		2.6	0.88	0.88	ng/L	03/15/21 18:06	1
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L	03/15/21 18:06	1
Perfluorobutanesulfonic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluorobutanoic acid	<3.5		4.4	3.5	3.5	ng/L	03/15/21 18:06	1
Perfluorodecanoic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluorododecanoic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluoroheptanoic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluorohexanesulfonic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluorohexanoic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluorononanoic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluorooctanesulfonic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluorooctanoic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluoropentanoic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluorotetradecanoic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluorotridecanoic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Perfluoroundecanoic acid	<0.88		1.8	0.88	0.88	ng/L	03/15/21 18:06	1
Isotope Dilution	%Recovery Qu	ualifier Limits				Prepared	l Analyzed	Dil Fac

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	141	50 - 150	03/12/21 20:41	03/15/21 18:06	1
M2-8:2 FTS	137	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C2 PFTeDA	106	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C3 PFBS	101	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C4 PFBA	108	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C4 PFHpA	116	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C5 PFPeA	113	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C8 PFOA	120	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C8 PFOS	116	50 - 150	03/12/21 20:41	03/15/21 18:06	1
d3-NMeFOSAA	125	50 - 150	03/12/21 20:41	03/15/21 18:06	1
d5-NEtFOSAA	138	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C2-PFDoDA	129	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C3 PFHxS	112	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C5 PFHxA	118	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C6 PFDA	128	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C7 PFUnA	130	50 - 150	03/12/21 20:41	03/15/21 18:06	1
13C9 PFNA	129	50 - 150	03/12/21 20:41	03/15/21 18:06	1

Client Sample ID: APG-DUP-02-030921

Lab Sample ID: 410-31990-2 Date Collected: 03/09/21 12:00 Date Received: 03/10/21 18:13

Method: EPA 537(Mod) - PFAS	for QSM 5.3,	Table B-15							
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.4		4.3	3.4	3.4	ng/L		03/18/21 21:54	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.6	1.7	1.7	ng/L		03/18/21 21:54	1
NEtFOSAA	<0.86		2.6	0.86	0.86	ng/L		03/18/21 21:54	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L		03/18/21 21:54	1
Perfluorobutanesulfonic acid	<0.86		1.7	0.86	0.86	ng/L		03/18/21 21:54	1
Perfluorobutanoic acid	<3.4		4.3	3.4	3.4	ng/L		03/18/21 21:54	1
Perfluorodecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/18/21 21:54	1

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Matrix: Water

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Client: ARCADIS U.S., Inc. Job ID: 410-31990-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-DUP-02-030921

Lab Sample ID: 410-31990-2

Date Collected: 03/09/21 12:00 **Matrix: Water** Date Received: 03/10/21 18:13

Analyte	Result Qualifier	LOQ	LOD	DL	Unit I	D Analyzed	Dil Fac
Perfluorododecanoic acid	<0.86	1.7	0.86	0.86	ng/L	03/18/21 21:54	1
Perfluoroheptanoic acid	<0.86	1.7	0.86	0.86	ng/L	03/18/21 21:54	1
Perfluorohexanesulfonic acid	<0.86	1.7	0.86	0.86	ng/L	03/18/21 21:54	1
Perfluorohexanoic acid	<0.86	1.7	0.86	0.86	ng/L	03/18/21 21:54	1
Perfluorononanoic acid	<0.86	1.7	0.86	0.86	ng/L	03/18/21 21:54	1
Perfluorooctanesulfonic acid	<0.86	1.7	0.86	0.86	ng/L	03/18/21 21:54	1
Perfluorooctanoic acid	<0.86	1.7	0.86	0.86	ng/L	03/18/21 21:54	1
Perfluoropentanoic acid	<0.86	1.7	0.86	0.86	ng/L	03/18/21 21:54	1
Perfluorotetradecanoic acid	<0.86	1.7	0.86	0.86	ng/L	03/18/21 21:54	1
Perfluorotridecanoic acid	<0.86	1.7	0.86	0.86	ng/L	03/18/21 21:54	1
Perfluoroundecanoic acid	<0.86	1.7	0.86	0.86	ng/L	03/18/21 21:54	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	108	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
M2-8:2 FTS	93	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C2 PFTeDA	73	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C3 PFBS	82	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C4 PFBA	98	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C4 PFHpA	101	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C5 PFPeA	94	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C8 PFOA	98	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C8 PFOS	85	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
d3-NMeFOSAA	84	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
d5-NEtFOSAA	91	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C2-PFDoDA	80	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C3 PFHxS	95	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C5 PFHxA	100	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C6 PFDA	92	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C7 PFUnA	89	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1
13C9 PFNA	92	50 - 150			03/17/21 08:2	9 03/18/21 21:54	1

Client Sample ID: APG-BLDG-250-PW-2-1-GW-030921

Lab Sample ID: 410-31990-3 Date Collected: 03/09/21 09:50 **Matrix: Water** Date Received: 03/10/21 18:13

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.4		4.2	3.4	3.4	ng/L		03/15/21 18:50	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.5	1.7	1.7	ng/L		03/15/21 18:50	1
NEtFOSAA	<0.84		2.5	0.84	0.84	ng/L		03/15/21 18:50	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L		03/15/21 18:50	1
Perfluorobutanesulfonic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 18:50	1
Perfluorobutanoic acid	<3.4		4.2	3.4	3.4	ng/L		03/15/21 18:50	1
Perfluorodecanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 18:50	1
Perfluorododecanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 18:50	1
Perfluoroheptanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 18:50	1
Perfluorohexanesulfonic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 18:50	1
Perfluorohexanoic acid	< 0.84		1.7	0.84	0.84	ng/L		03/15/21 18:50	1
Perfluorononanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 18:50	1
Perfluorooctanesulfonic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 18:50	1
Perfluorooctanoic acid	<0.84	M	1.7	0.84	0.84	ng/L		03/15/21 18:50	1

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Client: ARCADIS U.S., Inc. Job ID: 410-31990-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-250-PW-2-1-GW-030921

Lab Sample ID: 410-31990-3 Date Collected: 03/09/21 09:50 **Matrix: Water**

Date Received: 03/10/21 18:13

Analyte	Result Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluoropentanoic acid	<0.84	1.7	0.84	0.84	ng/L	03/15/21 18:50	1
Perfluorotetradecanoic acid	<0.84	1.7	0.84	0.84	ng/L	03/15/21 18:50	1
Perfluorotridecanoic acid	<0.84	1.7	0.84	0.84	ng/L	03/15/21 18:50	1
Perfluoroundecanoic acid	<0.84	1.7	0.84	0.84	ng/L	03/15/21 18:50	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	139	50 - 150			03/12/21 20:41	03/15/21 18:50	1
M2-8:2 FTS	144	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C2 PFTeDA	112	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C3 PFBS	96	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C4 PFBA	106	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C4 PFHpA	112	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C5 PFPeA	109	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C8 PFOA	120	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C8 PFOS	112	50 - 150			03/12/21 20:41	03/15/21 18:50	1
d3-NMeFOSAA	129	50 - 150			03/12/21 20:41	03/15/21 18:50	1
d5-NEtFOSAA	144	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C2-PFDoDA	121	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C3 PFHxS	111	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C5 PFHxA	114	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C6 PFDA	125	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C7 PFUnA	132	50 - 150			03/12/21 20:41	03/15/21 18:50	1
13C9 PFNA	123	50 - 150			03/12/21 20:41	03/15/21 18:50	1

Client Sample ID: APG-BLDG-250-PW-3-1-GW-030921

Date Collected: 03/09/21 09:55

Date Received: 03/10/21 18:13

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.3			4.2	3.3	3.3	ng/L	03/18/21 22:05	1
8:2 Fluorotelomer sulfonic acid	<1.7			2.5	1.7	1.7	ng/L	03/18/21 22:05	1
NEtFOSAA	<0.84			2.5	0.84	0.84	ng/L	03/18/21 22:05	1
NMeFOSAA	<1.0			1.7	1.0	1.0	ng/L	03/18/21 22:05	1
Perfluorobutanesulfonic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluorobutanoic acid	<3.3			4.2	3.3	3.3	ng/L	03/18/21 22:05	1
Perfluorodecanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluorododecanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluoroheptanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluorohexanesulfonic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluorohexanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluorononanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluorooctanesulfonic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluorooctanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluoropentanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluorotetradecanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluorotridecanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Perfluoroundecanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:05	1
Isotope Dilution	%Recovery Qu	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	106		50 - 150	•			03/17/21 08:29	03/18/21 22:05	1

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Lab Sample ID: 410-31990-4

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Matrix: Water

Client: ARCADIS U.S., Inc.

Job ID: 410-31990-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-250-PW-3-1-GW-030921 Lab Sample ID: 410-31990-4

Date Collected: 03/09/21 09:55 Matrix: Water

Date Received: 03/10/21 18:13

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-8:2 FTS	101	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C2 PFTeDA	77	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C3 PFBS	83	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C4 PFBA	96	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C4 PFHpA	101	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C5 PFPeA	92	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C8 PFOA	99	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C8 PFOS	88	50 - 150	03/17/21 08:29	03/18/21 22:05	1
d3-NMeFOSAA	83	50 - 150	03/17/21 08:29	03/18/21 22:05	1
d5-NEtFOSAA	96	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C2-PFDoDA	88	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C3 PFHxS	93	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C5 PFHxA	93	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C6 PFDA	93	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C7 PFUnA	91	50 - 150	03/17/21 08:29	03/18/21 22:05	1
13C9 PFNA	92	<i>50 - 150</i>	03/17/21 08:29	03/18/21 22:05	1

Client Sample ID: APG-BLDG-250-PW-4-1-GW-030921 Lab Sample ID: 410-31990-5

Date Collected: 03/09/21 10:00 Matrix: Water

Date Received: 03/10/21 18:13

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.3		4.1	3.3	3.3	ng/L	03/15/21 19:12	1
8:2 Fluorotelomer sulfonic acid	<1.6		2.5	1.6	1.6	ng/L	03/15/21 19:12	1
NEtFOSAA	<0.82		2.5	0.82	0.82	ng/L	03/15/21 19:12	1
NMeFOSAA	<0.98		1.6	0.98	0.98	ng/L	03/15/21 19:12	1
Perfluorobutanesulfonic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluorobutanoic acid	<3.3		4.1	3.3	3.3	ng/L	03/15/21 19:12	1
Perfluorodecanoic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluorododecanoic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluoroheptanoic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluorohexanesulfonic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluorohexanoic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluorononanoic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluorooctanesulfonic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluorooctanoic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluoropentanoic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluorotetradecanoic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluorotridecanoic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Perfluoroundecanoic acid	<0.82		1.6	0.82	0.82	ng/L	03/15/21 19:12	1
Isotope Dilution	%Recovery Qu	ualifier	limits			Prepared	Analyzed	Dil Fac

Isotope Dilution	%Recovery Qualifier	Limits	Prepared Analyzed	Dil Fac
M2-6:2 FTS	137	50 - 150	03/12/21 20:41 03/15/21 19:	12 1
M2-8:2 FTS	144	50 - 150	03/12/21 20:41 03/15/21 19:	12 1
13C2 PFTeDA	108	50 - 150	03/12/21 20:41 03/15/21 19:	12 1
13C3 PFBS	95	50 - 150	03/12/21 20:41 03/15/21 19:	12 1
13C4 PFBA	106	50 - 150	03/12/21 20:41 03/15/21 19:	12 1
13C4 PFHpA	115	50 - 150	03/12/21 20:41 03/15/21 19:	12 1
13C5 PFPeA	108	50 - 150	03/12/21 20:41 03/15/21 19:	12 1
13C8 PFOA	117	50 - 150	03/12/21 20:41 03/15/21 19:	12 1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31990-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-250-PW-4-1-GW-030921

Lab Sample ID: 410-31990-5 Date Collected: 03/09/21 10:00 **Matrix: Water**

Date Received: 03/10/21 18:13

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	•	Prepared	Analyzed	Dil Fac
13C8 PFOS	111		50 - 150		03/12/21 20:41	03/15/21 19:12	1
d3-NMeFOSAA	125		50 - 150		03/12/21 20:41	03/15/21 19:12	1
d5-NEtFOSAA	141		50 - 150		03/12/21 20:41	03/15/21 19:12	1
13C2-PFDoDA	127		50 - 150		03/12/21 20:41	03/15/21 19:12	1
13C3 PFHxS	111		50 - 150		03/12/21 20:41	03/15/21 19:12	1
13C5 PFHxA	112		50 - 150		03/12/21 20:41	03/15/21 19:12	1
13C6 PFDA	124		50 - 150		03/12/21 20:41	03/15/21 19:12	1
13C7 PFUnA	136		50 - 150		03/12/21 20:41	03/15/21 19:12	1
13C9 PFNA	126		50 - 150		03/12/21 20:41	03/15/21 19:12	1

Client Sample ID: APG-BLDG-250-PW-5-1-GW-030921 Lab Sample ID: 410-31990-6

Date Collected: 03/09/21 10:05 Date Received: 03/10/21 18:13

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.4		4.2	3.4	3.4	ng/L		03/15/21 19:34	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.5	1.7	1.7	ng/L		03/15/21 19:34	1
NEtFOSAA	<0.84		2.5	0.84	0.84	ng/L		03/15/21 19:34	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L		03/15/21 19:34	1
Perfluorobutanesulfonic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluorobutanoic acid	<3.4		4.2	3.4	3.4	ng/L		03/15/21 19:34	1
Perfluorodecanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluorododecanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluoroheptanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluorohexanesulfonic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluorohexanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluorononanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluorooctanesulfonic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluorooctanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluoropentanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluorotetradecanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluorotridecanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1
Perfluoroundecanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 19:34	1

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Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	138	50 - 150			03/12/21 20:41	03/15/21 19:34	1
M2-8:2 FTS	144	50 ₋ 150			03/12/21 20:41	03/15/21 19:34	1
13C2 PFTeDA	104	50 ₋ 150			03/12/21 20:41	03/15/21 19:34	1
13C3 PFBS	99	50 - 150			03/12/21 20:41	03/15/21 19:34	1
13C4 PFBA	105	50 ₋ 150			03/12/21 20:41	03/15/21 19:34	1
13C4 PFHpA	110	50 - 150			03/12/21 20:41	03/15/21 19:34	1
13C5 PFPeA	106	50 ₋ 150			03/12/21 20:41	03/15/21 19:34	1
13C8 PFOA	120	50 - 150			03/12/21 20:41	03/15/21 19:34	1
13C8 PFOS	112	50 ₋ 150			03/12/21 20:41	03/15/21 19:34	1
d3-NMeFOSAA	124	50 - 150			03/12/21 20:41	03/15/21 19:34	1
d5-NEtFOSAA	139	50 - 150			03/12/21 20:41	03/15/21 19:34	1
13C2-PFDoDA	123	50 ₋ 150			03/12/21 20:41	03/15/21 19:34	1
13C3 PFHxS	110	50 - 150			03/12/21 20:41	03/15/21 19:34	1
13C5 PFHxA	112	50 ₋ 150			03/12/21 20:41	03/15/21 19:34	1
13C6 PFDA	125	50 ₋ 150			03/12/21 20:41	03/15/21 19:34	1

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Matrix: Water

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31990-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-250-PW-5-1-GW-030921

Lab Sample ID: 410-31990-6 Date Collected: 03/09/21 10:05

Matrix: Water

Date Received: 03/10/21 18:13

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C7 PFUnA	127		50 - 150	03/12/21 20:41	03/15/21 19:34	1
13C9 PFNA	124		50 - 150	03/12/21 20:41	03/15/21 19:34	1

Lab Sample ID: 410-31990-7 Client Sample ID: APG-AA-WWTP-1-EW-030921

Date Collected: 03/09/21 10:45 Date Received: 03/10/21 18:13

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	23		4.0	3.2	3.2	ng/L		03/18/21 22:27	1
8:2 Fluorotelomer sulfonic acid	<1.6		2.4	1.6	1.6	ng/L		03/18/21 22:27	1
NEtFOSAA	<0.81		2.4	0.81	0.81	ng/L		03/18/21 22:27	1
NMeFOSAA	<0.97		1.6	0.97	0.97	ng/L		03/18/21 22:27	1
Perfluorobutanesulfonic acid	0.93	J M	1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluorobutanoic acid	8.2		4.0	3.2	3.2	ng/L		03/18/21 22:27	1
Perfluorodecanoic acid	8.9		1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluorododecanoic acid	<0.81		1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluoroheptanoic acid	11		1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluorohexanesulfonic acid	2.3		1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluorohexanoic acid	17		1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluorononanoic acid	1.5	J	1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluorooctanesulfonic acid	4.4		1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluorooctanoic acid	10	M	1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluoropentanoic acid	35		1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluorotetradecanoic acid	<0.81		1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluorotridecanoic acid	<0.81		1.6	0.81	0.81	ng/L		03/18/21 22:27	1
Perfluoroundecanoic acid	<0.81		1.6	0.81	0.81	ng/L		03/18/21 22:27	1

Perfluoroundecanoic acid	<0.	.81	1.6	0.81	0.81	ng/L	03/18/21 22:27	1
Isotope Dilution	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	103		50 - 150			03/17/21 08:29	03/18/21 22:27	1
M2-8:2 FTS	94		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C2 PFTeDA	56		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C3 PFBS	80		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C4 PFBA	85		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C4 PFHpA	100		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C5 PFPeA	88		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C8 PFOA	91		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C8 PFOS	82		50 - 150			03/17/21 08:29	03/18/21 22:27	1
d3-NMeFOSAA	86		50 - 150			03/17/21 08:29	03/18/21 22:27	1
d5-NEtFOSAA	95		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C2-PFDoDA	78		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C3 PFHxS	90		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C5 PFHxA	87		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C6 PFDA	96		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C7 PFUnA	80		50 - 150			03/17/21 08:29	03/18/21 22:27	1
13C9 PFNA	89		50 - 150			03/17/21 08:29	03/18/21 22:27	1

3/19/2021

Job ID: 410-31990-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-WB-MW-11A-030921

Lab Sample ID: 410-31990-8 Date Collected: 03/09/21 14:10 **Matrix: Water**

Date Received: 03/10/21 18:13

Client: ARCADIS U.S., Inc.

Analyte	Result	Qualifier	LC	Q	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.4			4.2	3.4	3.4	ng/L	03/18/21 22:38	1
8:2 Fluorotelomer sulfonic acid	<1.7		:	2.5	1.7	1.7	ng/L	03/18/21 22:38	1
NEtFOSAA	<0.84		:	2.5	0.84	0.84	ng/L	03/18/21 22:38	1
NMeFOSAA	<1.0			1.7	1.0	1.0	ng/L	03/18/21 22:38	1
Perfluorobutanesulfonic acid	1.3	J		1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluorobutanoic acid	<3.4			4.2	3.4	3.4	ng/L	03/18/21 22:38	1
Perfluorodecanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluorododecanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluoroheptanoic acid	1.7			1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluorohexanesulfonic acid	7.4			1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluorohexanoic acid	2.1			1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluorononanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluorooctanesulfonic acid	21	/ J		1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluorooctanoic acid	8.1	′		1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluoropentanoic acid	1.5	J M		1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluorotetradecanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluorotridecanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Perfluoroundecanoic acid	<0.84			1.7	0.84	0.84	ng/L	03/18/21 22:38	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	104		50 - 150				03/17/21 08:29	03/18/21 22:38	1
M2-8:2 FTS	98		50 - 150				03/17/21 08:29	03/18/21 22:38	1
13C2 PFTeDA	72		50 - 150				03/17/21 08:29	03/18/21 22:38	1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	104	50 - 150	03/17/21 08:29	03/18/21 22:38	1
M2-8:2 FTS	98	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C2 PFTeDA	72	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C3 PFBS	81	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C4 PFBA	98	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C4 PFHpA	103	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C5 PFPeA	91	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C8 PFOA	96	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C8 PFOS	88	50 - 150	03/17/21 08:29	03/18/21 22:38	1
d3-NMeFOSAA	88	50 - 150	03/17/21 08:29	03/18/21 22:38	1
d5-NEtFOSAA	98	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C2-PFDoDA	83	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C3 PFHxS	96	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C5 PFHxA	95	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C6 PFDA	97	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C7 PFUnA	91	50 - 150	03/17/21 08:29	03/18/21 22:38	1
13C9 PFNA	89	50 - 150	03/17/21 08:29	03/18/21 22:38	1

Client Sample ID: APG-WB-MW-14A-030921

Lab Sample ID: 410-31990-9 Date Collected: 03/09/21 15:20 **Matrix: Water**

Date Received: 03/10/21 18:13

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.4		4.3	3.4	3.4	ng/L		03/15/21 20:07	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.6	1.7	1.7	ng/L		03/15/21 20:07	1
NEtFOSAA	<0.86		2.6	0.86	0.86	ng/L		03/15/21 20:07	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L		03/15/21 20:07	1
Perfluorobutanesulfonic acid	2.5	M	1.7	0.86	0.86	ng/L		03/15/21 20:07	1
Perfluorobutanoic acid	<3.4		4.3	3.4	3.4	ng/L		03/15/21 20:07	1
Perfluorodecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/15/21 20:07	1

Eurofins Lancaster Laboratories Env, LLC

Job ID: 410-31990-1

Project/Site: Aberdeen Proving Ground

Client: ARCADIS U.S., Inc.

Client Sample ID: APG-WB-MW-14A-030921

Lab Sample ID: 410-31990-9 Date Collected: 03/09/21 15:20 **Matrix: Water**

Date Received: 03/10/21 18:13

Analyte	Res	ult Quali	ifier	LOQ	LOD	DL	Unit I	D Analyzed	Dil Fac
Perfluorododecanoic acid	<0.	86		1.7	0.86	0.86	ng/L	03/15/21 20:0	7 1
Perfluoroheptanoic acid	3	3.3		1.7	0.86	0.86	ng/L	03/15/21 20:0)7 1
Perfluorohexanesulfonic acid	;	39		1.7	0.86	0.86	ng/L	03/15/21 20:0)7 1
Perfluorohexanoic acid		14		1.7	0.86	0.86	ng/L	03/15/21 20:0)7 1
Perfluorononanoic acid	<0.	86		1.7	0.86	0.86	ng/L	03/15/21 20:0)7 1
Perfluorooctanesulfonic acid	1	.4 J+M	- JM	1.7	0.86	0.86	ng/L	03/15/21 20:0)7 1
Perfluorooctanoic acid		43 M		1.7	0.86	0.86	ng/L	03/15/21 20:0	7 1
Perfluoropentanoic acid	5	.9 M		1.7	0.86	0.86	ng/L	03/15/21 20:0)7 1
Perfluorotetradecanoic acid	<0.	86		1.7	0.86	0.86	ng/L	03/15/21 20:0)7 1
Perfluorotridecanoic acid	<0.	86		1.7	0.86	0.86	ng/L	03/15/21 20:0)7 1
Perfluoroundecanoic acid	<0.	86		1.7	0.86	0.86	ng/L	03/15/21 20:0)7 1
Isotope Dilution	%Recovery	Qualifier	r Limits	5			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	145		50 - 15	50			03/12/21 20:4	03/15/21 20:0	7 1
M2-8:2 FTS	150		50 - 15	50			03/12/21 20:4	11 03/15/21 20:0	07 1
13C2 PFTeDA	115		50 - 18	50			03/12/21 20:4	11 03/15/21 20:0	07 1
13C3 PFBS	98		50 - 18	50			03/12/21 20:4	1 03/15/21 20:0	7 1
13C4 PFBA	99		50 - 18	50			03/12/21 20:4	11 03/15/21 20:0	07 1
13C4 PFHpA	109		50 - 15	50			03/12/21 20:4	11 03/15/21 20:0	07 1

13C2 PF IeDA	775	50 - 150	03/12/21 20:41 03/15/21 20:07	
13C3 PFBS	98	50 - 150	03/12/21 20:41 03/15/21 20:07	
13C4 PFBA	99	50 - 150	03/12/21 20:41 03/15/21 20:07	
13C4 PFHpA	109	50 - 150	03/12/21 20:41 03/15/21 20:07	
13C5 PFPeA	107	50 - 150	03/12/21 20:41 03/15/21 20:07	
13C8 PFOA	117	50 - 150	03/12/21 20:41 03/15/21 20:07	
13C8 PFOS	115	50 - 150	03/12/21 20:41 03/15/21 20:07	
d3-NMeFOSAA	123	50 - 150	03/12/21 20:41 03/15/21 20:07	
d5-NEtFOSAA	148	50 - 150	03/12/21 20:41 03/15/21 20:07	
13C2-PFDoDA	131	50 - 150	03/12/21 20:41 03/15/21 20:07	
13C3 PFHxS	111	50 - 150	03/12/21 20:41 03/15/21 20:07	•
13C5 PFHxA	112	50 - 150	03/12/21 20:41 03/15/21 20:07	•
13C6 PFDA	124	50 - 150	03/12/21 20:41 03/15/21 20:07	
13C7 PFUnA	131	50 - 150	03/12/21 20:41 03/15/21 20:07	
13C9 PFNA	123	50 - 150	03/12/21 20:41 03/15/21 20:07	

Client Sample ID: APG-EB-03-030921

Lab Sample ID: 410-31990-10 Date Collected: 03/09/21 14:30 **Matrix: Water** Date Received: 03/10/21 18:13

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.4		4.2	3.4	3.4	ng/L		03/15/21 20:18	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.5	1.7	1.7	ng/L		03/15/21 20:18	1
NEtFOSAA	<0.85		2.5	0.85	0.85	ng/L		03/15/21 20:18	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L		03/15/21 20:18	1
Perfluorobutanesulfonic acid	<0.85		1.7	0.85	0.85	ng/L		03/15/21 20:18	1
Perfluorobutanoic acid	<3.4		4.2	3.4	3.4	ng/L		03/15/21 20:18	1
Perfluorodecanoic acid	<0.85		1.7	0.85	0.85	ng/L		03/15/21 20:18	1
Perfluorododecanoic acid	<0.85		1.7	0.85	0.85	ng/L		03/15/21 20:18	1
Perfluoroheptanoic acid	<0.85		1.7	0.85	0.85	ng/L		03/15/21 20:18	1
Perfluorohexanesulfonic acid	<0.85		1.7	0.85	0.85	ng/L		03/15/21 20:18	1
Perfluorohexanoic acid	<0.85		1.7	0.85	0.85	ng/L		03/15/21 20:18	1
Perfluorononanoic acid	<0.85		1.7	0.85	0.85	ng/L		03/15/21 20:18	1
Perfluorooctanesulfonic acid	<0.85		1.7	0.85	0.85	ng/L		03/15/21 20:18	1
Perfluorooctanoic acid	<0.85		1.7	0.85	0.85	ng/L		03/15/21 20:18	1

Eurofins Lancaster Laboratories Env, LLC

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-31990-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-EB-03-030921

Lab Sample ID: 410-31990-10

Date Collected: 03/09/21 14:30 **Matrix: Water** Date Received: 03/10/21 18:13

Analyte	Result Q	ualifier LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluoropentanoic acid	<0.85	1.7	0.85	0.85	ng/L	03/15/21 20:18	1
Perfluorotetradecanoic acid	<0.85	1.7	0.85	0.85	ng/L	03/15/21 20:18	1
Perfluorotridecanoic acid	<0.85	1.7	0.85	0.85	ng/L	03/15/21 20:18	1
Perfluoroundecanoic acid	<0.85	1.7	0.85	0.85	ng/L	03/15/21 20:18	1
Isotope Dilution	%Recovery Qual	ifier Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	135	50 - 150			03/12/21 20:41	03/15/21 20:18	1
M2-8:2 FTS	141	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C2 PFTeDA	111	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C3 PFBS	94	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C4 PFBA	106	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C4 PFHpA	112	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C5 PFPeA	108	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C8 PFOA	121	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C8 PFOS	112	50 - 150			03/12/21 20:41	03/15/21 20:18	1
d3-NMeFOSAA	132	50 - 150			03/12/21 20:41	03/15/21 20:18	1
d5-NEtFOSAA	150	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C2-PFDoDA	125	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C3 PFHxS	108	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C5 PFHxA	114	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C6 PFDA	126	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C7 PFUnA	127	50 - 150			03/12/21 20:41	03/15/21 20:18	1
13C9 PFNA	122	50 - 150			03/12/21 20:41	03/15/21 20:18	1



Aberdeen Proving Ground - Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDG # 410-32109-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report #41204R

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-32109-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

			Sample		Aı	nalysis	
Sample ID	Lab ID	Matrix	Collection Date	Parent Sample	PFAS	тос	рН
APG-EA-WWTP-1-EW-031021	410-32109-1	Water	3/10/2021		Х		
APG-GWTP-1-GW-031021	410-32109-2	Water	3/10/2021		Х		
APG-TANK-FIRE-1-SE-031021	410-32109-3	Sediment	3/10/2021		Х		
APG-TANK-FIRE-1-SW-031021	410-32109-4	Water	3/10/2021		Х		
APG-BLDG-E4081-1-SE-031021	410-32109-5	Sediment	3/10/2021		Х		
APG-BLDG-E4081-1-SW-031021	410-32109-6	Water	3/10/2021		Х		
APG-BLDG-E4081-2-SE-031021	410-32109-7	Sediment	3/10/2021		Х		
APG-BLDG-E4081-2-SW-031021	410-32109-8	Water	3/10/2021		Х		
APG-BLDG-E4081-2-SO-(0-2)-031021	410-32109-9	Soil	3/10/2021		Х		
APG-DUP-03-031021	410-32109-10	Soil	3/10/2021	APG-BLDG-E4081-2- SO-(0-2)-031021	Х		
APG-BLDG-E4081-1-SO-(0-2)-031021	410-32109-11	Soil	3/10/2021		Х	Х	Х
APG-NOBLE-ROAD-1-SO-(0-2)-031021	410-32109-12	Soil	3/10/2021		Х	Х	Х
APG-NOBLE-ROAD-2-SO-(0-2)-031021	410-32109-13	Soil	3/10/2021		Х		
APG-FB-05-031021	410-32109-14	Water	3/10/2021		Х		
APG-CASEY-YARD-1-SO-(0-2)-031021	410-32109-15	Soil	3/10/2021		Х	Х	Х

Notes:

- Stage 4 validation was performed on samples APG-EA-WWTP-1-EW-031021 and APG-BLDG-E4081-2-SW-031021.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was performed on samples APG-BLDG-E4081-2-SO-(0-2)-031021 and APG-BLDG-E4081-1-SO-(0-2)-031021 for PFAS and TOC analysis respectively.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Rep	orted	Performance Acceptable		Not	
Items Reviewed	No	Yes	No	Yes	Required	
Sample receipt condition		Х		Х		
2. Requested analyses and sample results		X		Х		
Master tracking list		X		Х		
4. Methods of analysis		Х		Х		
5. Reporting limits		Х		Х		
6. Sample collection date		Х		Х		
7. Laboratory sample received date		Х		Х		
8. Sample preservation verification (as applicable)		Х		Х		
Sample preparation/extraction/analysis dates		Х		Х		
10. Fully executed Chain-of-Custody (COC) form		Х		Х		
11. Narrative summary of QA or sample problems provided		Х		Х		
12. Data Package Completeness and Compliance		Х		Х		

Note:

QA - Quality Assurance

 The field sample id mismatch observed between chain of custody and results section of the lab report APG-EA-WWTP-1-EW-031021 (410-32109-1). The sample Id per the field sample tracker and lab report are considered and reported.

Lab Sample ID	Sample ID (Sample tracker and lab report)	Sample ID (COC)
410-32109-1	APG-EA-WWTP-1-EW-031021	APG-AA-WWTP-1-EW-031021

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
537 Wa	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

The compound perfluorooctanesulfonic acid (1.42 J ng/L) was detected in the laboratory preparation blank batch 103020. However, the associated sample result was non-detect and qualification was not required.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compound	%R	RE %R
APG-NOBLE-ROAD-1-SO-(0-2)-031021	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
. 4500/	Non-detect	No Action
> 150%	Detect	J-
. 500/ 1. 1. 000/	Non-detect	UJ
< 50% but > 20%	Detect	J+
2004	Non-detect	UX
< 20%	Detect	Х

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint

standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be $\leq 30\%$.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

The MS/MSD analysis was performed on sample APG-BLDG-E4081-2-SO-(0-2)-031021. The MS/MSD exhibited acceptable recoveries and RPD between the MS/MSD recoveries.

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

Results for field duplicate samples are summarized in the following table.

Sample ID/Duplicate ID	Compound	Sample Result	Duplicate Result	RPD
APG-BLDG-E4081-2-SO-(0-2)-031021 / APG-DUP-03-031021	Perfluorohexanoic acid	0.00046 U	0.00076	AC

Note:

AC Acceptable

The result between the parent sample and field duplicate were acceptable.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

All identified compounds met method criteria.

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there

was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Rep	oorted		rmance ptable	Not
	No	Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC	/MS/MS)			
Stage 2 Validation					
Holding times		Х		Х	
Reporting limits (units)		Х		Х	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks	Х				Х
C. Field blanks		Х		Х	
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate(LCSD) %R		Х		Х	
LCS/LCSD Precision (RPD)		Х		Х	
Matrix Spike (MS) %R		Х		Х	
Matrix Spike Duplicate(MSD) %R		Х		Х	
MS/MSD Precision (RPD)		Х		Х	
Field Duplicate (RPD)		Х		Х	
Extracted Internal Standard %R		Х	Х		
Injection Internal Standard %R		Х		Х	
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation		ı		1	ı
Instrument tune and performance check		Х		Х	
Initial calibration %RSDs		Х		Х	
Continuing calibration %Ds		Х		Х	
Instrument sensitivity check		Х		Х	
Ion transitions used		Х		Х	
Compound identification and quantitation	1	I.		ı	1
A. Reconstructed ion chromatograms		Х		Х	
B. Quantitation Reports		X		Х	
C. RT of sample compounds within the established RT windows		Х		х	

PFAS: 537M/DoD QSM 5.3		Reported		mance ptable	Not
		Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
D. Ion Ratio %R		X		Х	
E. Transcription/calculations acceptable		Х		Х	
F. Reporting limits adjusted to reflect sample dilutions		Х		Х	

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Analyte considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria
APG-BLDG-E4081-1-SO-(0-2)-031021		
APG-NOBLE-ROAD-1-SO-(0-2)-031021	6 days from collection; 5 days from receipt	< 24 hours of receipt at the laboratory
APG-CASEY-YARD-1-SO-(0-2)-031021		and lazoratory

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

	Qualification
Criteria	Detected Analytes
Analysis completed past the holding time	J

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analyte	Standard Recovery
APG-BLDG-E4081-1-SO-(0-2)-031021			
APG-NOBLE-ROAD-1-SO-(0-2)-031021	CCV	TOC	73%
APG-CASEY-YARD-1-SO-(0-2)-031021			

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Control Limit	Sample Result	Qualification
	0 5 4 750/	Non-detect	UX
TOC	Gross Exceedance <75%	Detect	J-
	750/ / 000/	Non-detect	UJ
	75% to 89%	Detect	J-
	4440/ 1 4050/	Non-detect	No Action
	111% to 125%	Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

All analytes associated with MS recoveries were within control limits with the exception of the following analytes present in the table below.

Sample ID	Analyte	MS Recovery
APG-BLDG-E4081-1-SO-(0-2)-031021	Total Organic Carbon	47%

The criteria used to evaluate MS recoveries are presented in the following table. In the case of an MS deviation, the sample results are qualified. The qualifications are applied to the parent sample result associated with this SDG.

Control limit	Sample Result	Qualification
MO 1 200/ 1 740/	Non-detect	UJ
MS percent recovery 30% to 74%	Detect	J-
MO	Non-detect	UX
MS percent recovery <30%	Detect	J-
NO	Non-detect	No Action
MS percent recovery >125%	Detect	J+

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

A laboratory duplicate analysis was performed on sample APG-BLDG-E4081-1-SO-(0-2)-031021 for TOC. The results were within the control limits.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within ± 0.05 S.U. of the true value.

All LCS recoveries were within control limits, with the exception of the analytes associated with sample locations, as presented in the following table.

Sample ID	Analyte	LCS Recovery		
APG-BLDG-E4081-1-SO-(0-2)-031021				
APG-NOBLE-ROAD-1-SO-(0-2)-031021	Total Organic Carbon	64%		
APG-CASEY-YARD-1-SO-(0-2)-031021				

The criteria used to evaluate LCS recoveries are presented in the following table. In the case of an LCS deviation, the sample results are qualified.

Control limit	Sample Result	Qualification
0/ Decree of Leave limit of 000/	Non-detect	UJ
% Recovery < lower limit of 80%	Detect	J-
N/ D	Non-detect	No Action
% Recovery > upper limit of 120%	Detect	J+

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Reported		Performance Acceptable		Not
	No	Yes	No	Yes	Required
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	Х		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks	Х				Х
Laboratory Control Sample (LCS) %R		Х	Х		
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х
LCS/LCSD Precision (RPD)	Х				Х
Matrix Spike (MS) %R		Х	Х		
Matrix Spike Duplicate (MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				Х
Lab Duplicate (RPD)		X		Х	
Field Duplicate (RPD)	Х				Х
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		Х	
Continuing calibration %R		Х	Х		
Raw Data		Х		Х	
Transcription/calculations acceptable		Х		Х	

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE:

DATE: May 5, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 11, 2021

Stage 3 / 4 PFAS Calibration Standards

SDG #:410-32109-1Date:5/5/2021Lab:Eurofins LancasterPage:1Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

PFOA 3/11/2021 Calibration

Page 883 - 896 of SDG 410-32109-1

Match Match Match Match Match Match Match

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Cal Conc					Calculated		Calc		Calculated	Reported
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D
0.2	138150	6901684	10	0.020017	1.0008427	0.9699	0.206381	0.2	3.190	3.2
0.5	318787	6286752	10	0.050708	1.0141548	0.9699	0.522814	0.5	4.563	4.6
2	1312850	6304984	10	0.208224	1.0411208	0.9699	2.146862	2	7.343	7.3
8	4676045	6203162	10	0.753816	0.9422705	0.9699	7.772104	8	-2.849	-2.8
20	12198158	6501151	10	1.876307	0.9381537	0.9699	19.34537	20	-3.273	-3.3
50	26668154	5766753	10	4.624466	0.9248932	0.9699	47.67982	50	-4.640	-4.6
100	49469532	5333126	10	9.275898	0.9275898	0.9699	95.63767	100	-4.362	-4.4
•	•	•			•					

Avg RF = 0.9698608 Match

Concentration ng/L = (Peak area ratio/Avg RF) x DF x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-32109-1Date:5/5/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-103116/9 3/11/2021 12:02

Page 1226 - 1231 of SDG 410-32109-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	1034968	5707650	10	0.1813	0.9173	1.977	2	-1.16	-1.2
Perfluoropentanoic acid	1013552	4952024	10	0.2047	1.1070	1.849	2	-7.55	-7.6
Perfluorobutanesulfonic acid	808453	3819560	9.36	0.2117	1.1340	1.747	2	-1.30	-1.2
Perfluorohexanoic acid	976309	5696506	10	0.1714	0.8796	1.948	2	-2.58	-2.6
Perfluoroheptanoic acid	1343450	5905046	10	0.2275	1.1690	1.946	2	-2.69	-2.7
Perfluorohexanesulfonic acid	792080	4118268	9.46	0.1923	1.0280	1.770	2	-6.35	-6.4
Perfluorooctanoic acid	1226755	6440445	10	0.1905	0.9699	1.964	2	-1.81	-1.8

Match Match Match Match Match Match Match

CCV 410-103254/15 3/15/2021 19:23

Page 1257 - 1262 of SDG 410-32109-1

	Analyte					Calc		Calculated	Reported	
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D	
Perfluorobutanoic acid	1173360	5671291	10	0.2069	0.9173	2.255	2.0	12.77	12.8	M
Perfluoropentanoic acid	1206313	5056294	10	0.2386	1.1070	2.155	2.0	7.76	7.7	M
Perfluorobutanesulfonic acid	1005307	4413810	9.36	0.2278	1.1340	1.880	1.8	6.21	6.2	M
Perfluorohexanoic acid	1134572	5979469	10	0.1897	0.8796	2.157	2.0	7.86	7.9	M
Perfluoroheptanoic acid	1601160	6201495	10	0.2582	1.1690	2.209	2.0	10.43	10.5	Ma
Perfluorohexanesulfonic acid	928995	4301387	9.46	0.2160	1.0280	1.987	1.8	9.20	9	Ma
Perfluorooctanoic acid	1505842	6806383	10	0.2212	0.9699	2.281	2.0	14.05	14.1	Ma

Match Match Match Match Match Match Match

Concentration ng/L = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 SDG #:
 410-32109-1
 Date:
 5/5/2021

 Lab:
 Eurofins Lancaster
 Page:
 3

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-102849/2-A Page 1670 - 1675 of SDG 410-32109-1

Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported	1
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	2990336	5755076	10	0.5196	0.9173	22.66	25.6	88.51	89	Match
Perfluoropentanoic acid	3076350	5063932	10	0.607502	1.1070	21.95	25.6	85.75	86	Match
Perfluorobutanesulfonic acid	2759857	4010666	9.36	0.688129	1.1340	22.72	22.7	100.08	100	Match
Perfluorohexanoic acid	3042308	6101773	10	0.498594	0.8796	22.67	25.6	88.57	89	Match
Perfluoroheptanoic acid	4361800	6376093	10	0.684087	1.1690	23.41	25.6	91.44	91	Match
Perfluorohexanesulfonic acid	2660883	4496207	9.46	0.591806	1.0280	21.78	23.3	93.49	93	Match
Perfluorooctanoic acid	4199958	7479411	10	0.561536	0.9699	23.16	25.6	90.46	90	Match

Calculated Amount ng/L = ((Peak area ratio/Avg RF) x EIS concentration)/Sample volume)*1000

Stage 3 / 4 PFAS MS/MSD

SDG #:410-32109-1Date:5/5/2021Lab:Eurofins LancasterPage:4Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID APG-BLDG-E4081-2-SO-(0-2)-031021 Page 514 - 515 SDG 410-32109-1

ANALYTE Perfluorobutanoic acid

REPORTED MS %R 97
REPORTED MSD %R 101
REPORTED RPD 2

%R = 100 * (MS Conc - Sample Conc) RPD = 100 * | MS %R - MSD %R MS TVAverage of MS MSD %R

 Sample Concentration
 0

 MS Concentration
 0.0269
 MS %R
 96.76 MATCH

 MSD Concentration
 0.0275
 MSD %R
 100.73 MATCH

 MS TV
 0.0278
 RPD
 2.21 MATCH

 MSD TV
 0.0273

Differences in %R may be due to rounding of the true value

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-32109-1
 Date:
 5/5/2021

 Lab:
 Eurofins Lancaster
 Page:
 5

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-EA-WWTP-1-EW-031021 Lab ID: 410-32109-1 Page 577 - 581 of SDG 410-32109-1

						Calculated	Final		Final	Reported	
						Amount	Volume	Sample	Calculated	Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	1068338	4877017	10	0.219056	0.9173	2.39	1	292.3	8.2	8.2	Matc
Perfluoropentanoic acid	2443867	4796492	10	0.509511	1.1070	4.60	1	292.3	15.7	16.0	Matc
Perfluorobutanesulfonic acid	430410	4085435	9.36	0.105352	1.1340	0.87	1	292.3	3.0	3.0	Matc
Perfluorohexanoic acid	2248876	5745354	10	0.391425	0.8796	4.45	1	292.3	15.2	15.0	Matc
Perfluoroheptanoic acid	990076	6091631	10	0.162531	1.1690	1.39	1	292.3	4.8	4.8	Matc
Perfluorohexanesulfonic acid	2064078	4472978	9.46	0.461455	1.0280	4.25	1	292.3	14.5	15.0	Matc
Perfluorooctanoic acid	1847118	6835496	10	0.270224	0.9699	2.79	1	292.3	9.5	9.5	Matc

Field Sample ID: APG-BLDG-E4081-2-SW-031021 Lab ID: 410-32109-8 Page 663 - 667 of SDG 410-32109-1

						Calculated	Final		Final	Reported	1
						Amount	Volume	Sample	Calculated	Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	568727	4484690	10	0.126815	0.9173	1.38	1	269.2	5.1	5.1	Matc
Perfluoropentanoic acid	301454	4766134	10	0.063249	1.1070	0.57	1	269.2	2.1	2.1	Matc
Perfluorobutanesulfonic acid	1749469	3911462	9.36	0.447267	1.1340	3.69	1	269.2	13.7	14.0	Matc
Perfluorohexanoic acid	357070	5664399	10	0.063038	0.8796	0.72	1	269.2	2.7	2.7	Matc
Perfluoroheptanoic acid	299826	5820414	10	0.051513	1.1690	0.44	1	269.2	1.6	1.6 J	Matc
Perfluorooctanoic acid	222076	6896592	10	0.032201	0.9699	0.33	1	269.2	1.2	1.2 J	Matcl

Calculated amount ng/ml = (Peak area ratio/Avg RF) x DF x EIS conc ng/ml
Final Calculated amount ng/L = ((calculated ng/ml x Final Volume mls) / sample volume mls) * 1000
Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

SDG #:410-32109-1Date:5/5/2021Lab:Eurofins LancasterPage:6Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-BLDG-E4081-2-SW-031021 Lab ID: 410-32109-8

EIS 13C8 PFOA
REPORTED EIS %R 111

 $%R = \frac{100 * EIS Concentration}{EIS TV}$

EIS Concentration 11.1 ng/ml Page 666 of 410-32109-1

EIS TV 10.00

%R 111 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental Analysis Request/Chain of Custody

eurofins	Lancaster Laboratories Environmental	Acct. #					ncaster Lab					use or	nly	Pg	1 of Z				
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Project Name/#: APH PFAS Project Manager:	\$1	PWSID #:				Tissue	Ground						Name of	Jam Haran	_ 4				hiosulfate
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APG-TANK-E	1RF-1-SW-031021		1040	_			SW	-	2					X					
APG-BLOG- E4	081-1-5E-07071		1120			SE			2	×									
APG-BLD5-E4	081-1-5W-031021		1130			\vdash	SW		2					X					
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Environmental Analysis Request/Chain of Custody

TARAM

eurofins	Lancaster Laboratories Environmental	Acct. #			Eurofir Group		caster Lab		ies En ample		nental	use of	nly	PJ	COC #6			#6 16	533
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3/3

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-32109-1 Project/Site: APG PFAS S1

Qualifiers

LCMS

Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
^c	CCV Recovery is outside acceptance limits.
В	Blank contamination: The analyte was detected above one-half the reporting limit in an associated blank.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
M	Manual integrated compound.

General Chemistry

Qualifier	Qualifier Description
F5	Duplicate RPD exceeds limit, and one or both sample results are less than 5 times RL, and the absolute difference between results is <
	the upper reporting limits for both.

Glossary	
Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)

MDL ML MPN

MCL

MDA

MDC

Method Detection Limit Minimum Level (Dioxin) Most Probable Number MQL Method Quantitation Limit

NC Not Calculated

ND Not Detected at the reporting limit (or MDL or EDL if shown)

EPA recommended "Maximum Contaminant Level"

Minimum Detectable Concentration (Radiochemistry)

Minimum Detectable Activity (Radiochemistry)

NEG Negative / Absent POS Positive / Present PQL **Practical Quantitation Limit**

PRES Presumptive QC **Quality Control**

Relative Error Ratio (Radiochemistry) RER

Reporting Limit or Requested Limit (Radiochemistry) RL

RPD Relative Percent Difference, a measure of the relative difference between two points

TEF Toxicity Equivalent Factor (Dioxin) Toxicity Equivalent Quotient (Dioxin) TEQ

TNTC Too Numerous To Count

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Job ID: 410-32109-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-EA-WWTP-1-EW-031021

Lab Sample ID: 410-32109-1 Date Collected: 03/10/21 09:45 **Matrix: Water**

Date Received: 03/11/21 17:15

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	16			4.3	3.4	3.4	ng/L	03/15/21 20:29	1
8:2 Fluorotelomer sulfonic acid	<1.7	•		2.6	1.7	1.7	ng/L	03/15/21 20:29	1
NEtFOSAA	<0.86	i		2.6	0.86	0.86	ng/L	03/15/21 20:29	1
NMeFOSAA	<1.0			1.7	1.0	1.0	ng/L	03/15/21 20:29	1
Perfluorobutanesulfonic acid	3.0	M		1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluorobutanoic acid	8.2	. M		4.3	3.4	3.4	ng/L	03/15/21 20:29	1
Perfluorodecanoic acid	<0.86			1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluorododecanoic acid	<0.86	i		1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluoroheptanoic acid	4.8	1		1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluorohexanesulfonic acid	15			1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluorohexanoic acid	15	1		1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluorononanoic acid	1.5	J		1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluorooctanesulfonic acid	20)		1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluorooctanoic acid	9.5	M		1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluoropentanoic acid	16	M		1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluorotetradecanoic acid	<0.86			1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluorotridecanoic acid	<0.86	i		1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Perfluoroundecanoic acid	<0.86	;		1.7	0.86	0.86	ng/L	03/15/21 20:29	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	140		50 - 150				03/12/21 20:41	03/15/21 20:29	1
M2-8:2 FTS	140		50 - 150				03/12/21 20:41	03/15/21 20:29	1
4000 DET: D.4	400		FO 4FO				00/40/04 00:44	00/45/04 00:00	

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	140	50 - 150	03/12/21 20:41	03/15/21 20:29	1
M2-8:2 FTS	140	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C2 PFTeDA	108	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C3 PFBS	94	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C4 PFBA	88	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C4 PFHpA	106	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C5 PFPeA	99	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C8 PFOA	111	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C8 PFOS	108	50 - 150	03/12/21 20:41	03/15/21 20:29	1
d3-NMeFOSAA	104	50 - 150	03/12/21 20:41	03/15/21 20:29	1
d5-NEtFOSAA	115	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C2-PFDoDA	113	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C3 PFHxS	109	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C5 PFHxA	104	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C6 PFDA	116	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C7 PFUnA	123	50 - 150	03/12/21 20:41	03/15/21 20:29	1
13C9 PFNA	107	50 - 150	03/12/21 20:41	03/15/21 20:29	1

Client Sample ID: APG-GWTP-1-GW-031021

Lab Sample ID: 410-32109-2 Date Collected: 03/10/21 10:00 **Matrix: Water**

Date Received: 03/11/21 17:15

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.2		4.0	3.2	3.2	ng/L		03/15/21 20:40	1
8:2 Fluorotelomer sulfonic acid	<1.6		2.4	1.6	1.6	ng/L		03/15/21 20:40	1
NEtFOSAA	<0.81		2.4	0.81	0.81	ng/L		03/15/21 20:40	1
NMeFOSAA	<0.97		1.6	0.97	0.97	ng/L		03/15/21 20:40	1
Perfluorobutanesulfonic acid	<0.81		1.6	0.81	0.81	ng/L		03/15/21 20:40	1
Perfluorobutanoic acid	<3.2		4.0	3.2	3.2	ng/L		03/15/21 20:40	1
Perfluorodecanoic acid	<0.81		1.6	0.81	0.81	ng/L		03/15/21 20:40	1

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Client Sample ID: APG-GWTP-1-GW-031021

Lab Sample ID: 410-32109-2 Date Collected: 03/10/21 10:00 **Matrix: Water**

Date Received: 03/11/21 17:15

Analyte	Result	Qualifier	LOQ	!	LOD	DL	Unit	O Analyzed	Dil Fac
Perfluorododecanoic acid	<0.81		1.6		0.81	0.81	ng/L	03/15/21 20:40	1
Perfluoroheptanoic acid	<0.81		1.6	i	0.81	0.81	ng/L	03/15/21 20:40	1
Perfluorohexanesulfonic acid	<0.81		1.6	i	0.81	0.81	ng/L	03/15/21 20:40	1
Perfluorohexanoic acid	1.0	J	1.6	i	0.81	0.81	ng/L	03/15/21 20:40	1
Perfluorononanoic acid	<0.81		1.6	i	0.81	0.81	ng/L	03/15/21 20:40	1
Perfluorooctanesulfonic acid	<0.81		1.6	i	0.81	0.81	ng/L	03/15/21 20:40	1
Perfluorooctanoic acid	<0.81	Ŋĺ	1.6	i	0.81	0.81	ng/L	03/15/21 20:40	1
Perfluoropentanoic acid	1.5	JМ	1.6	i	0.81	0.81	ng/L	03/15/21 20:40	1
Perfluorotetradecanoic acid	<0.81		1.6	;	0.81	0.81	ng/L	03/15/21 20:40	1
Perfluorotridecanoic acid	<0.81		1.6	i	0.81	0.81	ng/L	03/15/21 20:40	1
Perfluoroundecanoic acid	<0.81		1.6	i	0.81	0.81	ng/L	03/15/21 20:40	1
Isotope Dilution	%Recovery Qu	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	137		50 - 150				03/12/21 20:4	03/15/21 20:40	1
M2-8:2 FTS	143		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C2 PFTeDA	110		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C3 PFBS	97		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C4 PFBA	105		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C4 PFHpA	114		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C5 PFPeA	107		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C8 PFOA	118		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C8 PFOS	111		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
d3-NMeFOSAA	135		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
d5-NEtFOSAA	147		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C2-PFDoDA	125		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C3 PFHxS	111		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C5 PFHxA	112		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C6 PFDA	122		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1
13C7 PFUnA	127		50 - 150				03/12/21 20:4	1 03/15/21 20:40	1

Client Sample ID: APG-TANK-FIRE-1-SE-031021

120

13C9 PFNA

Lab Sample ID: 410-32109-3 Date Collected: 03/10/21 10:30 **Matrix: Solid** Date Received: 03/11/21 17:15 Percent Solids: 17.2

50 - 150

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0091	0.011	0.0091	0.0091	mg/Kg	-	03/13/21 17:20	1
8:2 Fluorotelomer sulfonic acid	<0.0091	0.017	0.0091	0.0091	mg/Kg	₩	03/13/21 17:20	1
NEtFOSAA	<0.0023	0.011	0.0023	0.0023	mg/Kg	₩	03/13/21 17:20	1
NMeFOSAA	<0.0023	0.011	0.0023	0.0023	mg/Kg	₩	03/13/21 17:20	1
Perfluorobutanesulfonic acid	<0.0091	0.011	0.0091	0.0091	mg/Kg	₩	03/13/21 17:20	1
Perfluorobutanoic acid	<0.0091	0.011	0.0091	0.0091	mg/Kg	₩	03/13/21 17:20	1
Perfluorodecanoic acid	<0.0023	0.0034	0.0023	0.0023	mg/Kg	₩	03/13/21 17:20	1
Perfluorododecanoic acid	<0.0023	0.0034	0.0023	0.0023	mg/Kg	₩	03/13/21 17:20	1
Perfluoroheptanoic acid	<0.0023	0.0034	0.0023	0.0023	mg/Kg	₩	03/13/21 17:20	1
Perfluorohexanesulfonic acid	<0.0023	0.0034	0.0023	0.0023	mg/Kg	₩	03/13/21 17:20	1
Perfluorohexanoic acid	<0.0023	0.0034	0.0023	0.0023	mg/Kg	₩	03/13/21 17:20	1
Perfluorononanoic acid	<0.0023	0.0034	0.0023	0.0023	mg/Kg	₩	03/13/21 17:20	1
Perfluorooctanesulfonic acid	<0.0023 N	0.0034	0.0023	0.0023	mg/Kg	₩	03/13/21 17:20	1
Perfluorooctanoic acid	<0.0023	0.0034	0.0023	0.0023	mg/Kg	☼	03/13/21 17:20	1

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03/12/21 20:41 03/15/21 20:40

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3/30/2021

Client: ARCADIS U.S., Inc. Job ID: 410-32109-1

Client Sample ID: APG-TANK-FIRE-1-SE-031021

Project/Site: APG PFAS S1

Lab Sample ID: 410-32109-3 Date Collected: 03/10/21 10:30 **Matrix: Solid** Date Received: 03/11/21 17:15 Percent Solids: 17.2

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued) LOD **Analyte** Result Qualifier DL Unit **Analyzed** Dil Fac 0.0034 0.0023 Perfluoropentanoic acid <0.0023 0.0023 mg/Kg 03/13/21 17:20 0.0034 0.0023 0.0023 mg/Kg Perfluorotetradecanoic acid <0.0023 03/13/21 17:20 Perfluorotridecanoic acid < 0.0023 0.0034 0.0023 0.0023 mg/Kg ☼ 03/13/21 17:20 Perfluoroundecanoic acid 0.0023 0.0023 mg/Kg < 0.0023 0.0034 Isotope Dilution %Recovery Qualifier Limits Prepared Analyzed Dil Fac 92 03/12/21 10:01 03/13/21 17:20 M2-6:2 FTS 50 - 150 M2-8:2 FTS 99 50 - 150 03/12/21 10:01 03/13/21 17:20 13C2 PFTeDA 79 50 - 150 03/12/21 10:01 03/13/21 17:20 13C3 PFBS 80 50 - 150 03/12/21 10:01 03/13/21 17:20 13C4 PFBA 90 50 - 150 03/12/21 10:01 03/13/21 17:20 13C4 PFHpA 95 50 - 150 03/12/21 10:01 03/13/21 17:20 13C5 PFPeA 90 50 - 150 03/12/21 10:01 03/13/21 17:20 13C8 PFOA 93 50 - 150 03/12/21 10:01 03/13/21 17:20 13C8 PFOS 89 50 - 150 03/12/21 10:01 03/13/21 17:20 d3-NMeFOSAA 84 50 - 150 03/12/21 10:01 03/13/21 17:20 d5-NEtFOSAA 92 50 - 150 03/12/21 10:01 03/13/21 17:20 13C2-PFDoDA 03/12/21 10:01 03/13/21 17:20 92 50 - 150

General Chemistry

13C3 PFHxS

13C5 PFHxA

13C6 PFDA

13C7 PFUnA

13C9 PFNA

General Chemistry						
Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
Percent Moisture	82.8	1.0		1.0 %	03/12/21 09:52	1
Percent Solids	17.2	1.0		1.0 %	03/12/21 09:52	1

50 - 150

50 - 150

50 - 150

50 - 150

50 - 150

Client Sample ID: APG-TANK-FIRE-1-SW-031021

90

91

93

96

91

Lab Sample ID: 410-32109-4 Date Collected: 03/10/21 10:40 **Matrix: Water** Date Received: 03/11/21 17:15

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.4		4.2	3.4	3.4	ng/L		03/15/21 20:52	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.5	1.7	1.7	ng/L		03/15/21 20:52	1
NEtFOSAA	<0.84		2.5	0.84	0.84	ng/L		03/15/21 20:52	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L		03/15/21 20:52	1
Perfluorobutanesulfonic acid	0.97	J M	1.7	0.84	0.84	ng/L		03/15/21 20:52	1
Perfluorobutanoic acid	4.9		4.2	3.4	3.4	ng/L		03/15/21 20:52	1
Perfluorodecanoic acid	0.87	J	1.7	0.84	0.84	ng/L		03/15/21 20:52	1
Perfluorododecanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 20:52	1
Perfluoroheptanoic acid	3.0		1.7	0.84	0.84	ng/L		03/15/21 20:52	1
Perfluorohexanesulfonic acid	1.3	J	1.7	0.84	0.84	ng/L		03/15/21 20:52	1
Perfluorohexanoic acid	4.4		1.7	0.84	0.84	ng/L		03/15/21 20:52	1
Perfluorononanoic acid	1.9		1.7	0.84	0.84	ng/L		03/15/21 20:52	1
Perfluorooctanesulfonic acid	4.3		1.7	0.84	0.84	ng/L		03/15/21 20:52	1
Perfluorooctanoic acid	2.6	M	1.7	0.84	0.84	ng/L		03/15/21 20:52	1
Perfluoropentanoic acid	4.1	M	1.7	0.84	0.84	ng/L		03/15/21 20:52	1
Perfluorotetradecanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 20:52	1

03/12/21 10:01 03/13/21 17:20

03/12/21 10:01 03/13/21 17:20

03/12/21 10:01 03/13/21 17:20

03/12/21 10:01 03/13/21 17:20

03/12/21 10:01 03/13/21 17:20

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Client Sample ID: APG-TANK-FIRE-1-SW-031021

Lab Sample ID: 410-32109-4 Date Collected: 03/10/21 10:40 **Matrix: Water**

Date Received: 03/11/21 17:15

13C2 PFTeDA

Analyte	Resu	ılt Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorotridecanoic acid	<0.8	34	1.7	0.84	0.84	ng/L	03/15/21 20:52	1
Perfluoroundecanoic acid	<0.8	34	1.7	0.84	0.84	ng/L	03/15/21 20:52	1
Isotope Dilution	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	149		50 - 150			03/12/21 20:41	03/15/21 20:52	1
M2-8:2 FTS	144		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C2 PFTeDA	73		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C3 PFBS	100		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C4 PFBA	86		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C4 PFHpA	112		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C5 PFPeA	107		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C8 PFOA	121		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C8 PFOS	111		50 - 150			03/12/21 20:41	03/15/21 20:52	1
d3-NMeFOSAA	111		50 - 150			03/12/21 20:41	03/15/21 20:52	1
d5-NEtFOSAA	113		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C2-PFDoDA	107		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C3 PFHxS	113		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C5 PFHxA	110		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C6 PFDA	121		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C7 PFUnA	123		50 - 150			03/12/21 20:41	03/15/21 20:52	1
13C9 PFNA	120		50 - 150			03/12/21 20:41	03/15/21 20:52	1

Client Sample ID: APG-BLDG-E4081-1-SE-031021

Lab Sample ID: 410-32109-5 Date Collected: 03/10/21 11:20 **Matrix: Solid** Date Received: 03/11/21 17:15 Percent Solids: 74.4

Analyte	Result Qual	ifier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0021	0.0027	0.0021	0.0021	mg/Kg	☼	03/17/21 19:08	1
8:2 Fluorotelomer sulfonic acid	<0.0021	0.0040	0.0021	0.0021	mg/Kg	₩	03/17/21 19:08	1
NEtFOSAA	<0.00053	0.0027	0.00053	0.00053	mg/Kg	₩	03/17/21 19:08	1
NMeFOSAA	<0.00053	0.0027	0.00053	0.00053	mg/Kg	₩	03/17/21 19:08	1
Perfluorobutanesulfonic acid	<0.0021	0.0027	0.0021	0.0021	mg/Kg	₩	03/17/21 19:08	1
Perfluorobutanoic acid	<0.0021	0.0027	0.0021	0.0021	mg/Kg	₩	03/17/21 19:08	1
Perfluorodecanoic acid	<0.00053	0.00080	0.00053	0.00053	mg/Kg	₽	03/17/21 19:08	1
Perfluorododecanoic acid	< 0.00053	0.00080	0.00053	0.00053	mg/Kg	₽	03/17/21 19:08	1
Perfluoroheptanoic acid	< 0.00053	0.00080	0.00053	0.00053	mg/Kg	₩	03/17/21 19:08	1
Perfluorohexanesulfonic acid	<0.00053	0.00080	0.00053	0.00053	mg/Kg	₽	03/17/21 19:08	1
Perfluorohexanoic acid	< 0.00053	0.00080	0.00053	0.00053	mg/Kg	₩	03/17/21 19:08	1
Perfluorononanoic acid	< 0.00053	0.00080	0.00053	0.00053	mg/Kg	₽	03/17/21 19:08	1
Perfluorooctanesulfonic acid	<0.00053	0.00080	0.00053	0.00053	mg/Kg	₩	03/17/21 19:08	1
Perfluorooctanoic acid	< 0.00053	0.00080	0.00053	0.00053	mg/Kg	₽	03/17/21 19:08	1
Perfluoropentanoic acid	< 0.00053	0.00080	0.00053	0.00053	mg/Kg	₽	03/17/21 19:08	1
Perfluorotetradecanoic acid	<0.00053	0.00080	0.00053	0.00053	mg/Kg	₩	03/17/21 19:08	1
Perfluorotridecanoic acid	< 0.00053	0.00080	0.00053	0.00053	mg/Kg	₽	03/17/21 19:08	1
Perfluoroundecanoic acid	<0.00053	0.00080	0.00053	0.00053	mg/Kg	☼	03/17/21 19:08	1
Isotope Dilution	%Recovery Qualifie	r Limits			Prepared		Analyzed	Dil Fac
M2-6:2 FTS	117	50 - 150			03/16/21 11:	32	03/17/21 19:08	1
M2-8:2 FTS	108	50 - 150			03/16/21 11:	32	03/17/21 19:08	1

50 - 150

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03/16/21 11:32 03/17/21 19:08

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Client Sample ID: APG-BLDG-E4081-1-SE-031021

Lab Sample ID: 410-32109-5 Date Collected: 03/10/21 11:20 **Matrix: Solid** Date Received: 03/11/21 17:15 Percent Solids: 74.4

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 PFBS	88	50 - 150	03/16/21 11:32	03/17/21 19:08	1
13C4 PFBA	97	50 - 150	03/16/21 11:32	03/17/21 19:08	1
13C4 PFHpA	103	50 - 150	03/16/21 11:32	03/17/21 19:08	1
13C5 PFPeA	98	50 - 150	03/16/21 11:32	03/17/21 19:08	1
13C8 PFOA	105	50 - 150	03/16/21 11:32	03/17/21 19:08	1
13C8 PFOS	95	50 - 150	03/16/21 11:32	03/17/21 19:08	1
d3-NMeFOSAA	50	50 - 150	03/16/21 11:32	03/17/21 19:08	1
d5-NEtFOSAA	65	50 - 150	03/16/21 11:32	03/17/21 19:08	1
13C2-PFDoDA	88	50 - 150	03/16/21 11:32	03/17/21 19:08	1
13C3 PFHxS	99	50 - 150	03/16/21 11:32	03/17/21 19:08	1
13C5 PFHxA	101	50 - 150	03/16/21 11:32	03/17/21 19:08	1
13C6 PFDA	105	50 - 150	03/16/21 11:32	03/17/21 19:08	1
13C7 PFUnA	104	50 - 150	03/16/21 11:32	03/17/21 19:08	1
13C9 PFNA	99	50 - 150	03/16/21 11:32	03/17/21 19:08	1

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	25.6		1.0		1.0	%		03/12/21 09:52	1
Percent Solids	74.4		1.0		1.0	%		03/12/21 09:52	1

Client Sample ID: APG-BLDG-E4081-1-SW-031021

Date Collected: 03/10/21 11:30

Date Received: 03/11/21 17:15

Lab Sample ID: 410-32109-6

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<4.3		5.4	4.3	4.3	ng/L		03/15/21 21:03	1
8:2 Fluorotelomer sulfonic acid	<2.2		3.3	2.2	2.2	ng/L		03/15/21 21:03	1
NEtFOSAA	<1.1		3.3	1.1	1.1	ng/L		03/15/21 21:03	1
NMeFOSAA	<1.3		2.2	1.3	1.3	ng/L		03/15/21 21:03	1
Perfluorobutanesulfonic acid	13		2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluorobutanoic acid	9.4		5.4	4.3	4.3	ng/L		03/15/21 21:03	1
Perfluorodecanoic acid	<1.1	M	2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluorododecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluoroheptanoic acid	5.2		2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluorohexanesulfonic acid	2.1	J	2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluorohexanoic acid	9.5		2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluorononanoic acid	2.2		2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluorooctanesulfonic acid	2.4		2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluorooctanoic acid	6.3	M	2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluoropentanoic acid	7.5	M	2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluorotetradecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluorotridecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/15/21 21:03	1
Perfluoroundecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/15/21 21:03	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	140		50 - 150	03/12/21 20:41	03/15/21 21:03	1
M2-8:2 FTS	122		50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C2 PFTeDA	85		50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C3 PFBS	80		50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C4 PFBA	69		50 - 150	03/12/21 20:41	03/15/21 21:03	1

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Client Sample ID: APG-BLDG-E4081-1-SW-031021

Lab Sample ID: 410-32109-6 Date Collected: 03/10/21 11:30 **Matrix: Water**

Date Received: 03/11/21 17:15

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFHpA	98	50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C5 PFPeA	84	50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C8 PFOA	97	50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C8 PFOS	89	50 - 150	03/12/21 20:41	03/15/21 21:03	1
d3-NMeFOSAA	97	50 - 150	03/12/21 20:41	03/15/21 21:03	1
d5-NEtFOSAA	108	50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C2-PFDoDA	93	50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C3 PFHxS	91	50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C5 PFHxA	90	50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C6 PFDA	99	50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C7 PFUnA	99	50 - 150	03/12/21 20:41	03/15/21 21:03	1
13C9 PFNA	102	50 - 150	03/12/21 20:41	03/15/21 21:03	1

Client Sample ID: APG-BLDG-E4081-2-SE-031021

Date Collected: 03/10/21 11:40

Date Received: 03/11/21 17:15

Lab Sample ID: 410-32109-7

Matrix: Solid Percent Solids: 66.1

Method:	FΡΔ	537	(Mod)	- PFAS	for	OSM	5.3	Table	B-15
Metriou.	EFA	001	IVIOU) - FFAC	י וטו י	WOIN	5.5 ,	Iable	D-13

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15									
Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac	
6:2 Fluorotelomer sulfonic acid	<0.0024	0.0030	0.0024	0.0024	mg/Kg	₩	03/13/21 17:52	1	
8:2 Fluorotelomer sulfonic acid	<0.0024	0.0044	0.0024	0.0024	mg/Kg	☆	03/13/21 17:52	1	
NEtFOSAA	<0.00059	0.0030	0.00059	0.00059	mg/Kg	☆	03/13/21 17:52	1	
NMeFOSAA	<0.00059	0.0030	0.00059	0.00059	mg/Kg	≎	03/13/21 17:52	1	
Perfluorobutanesulfonic acid	<0.0024	0.0030	0.0024	0.0024	mg/Kg	≎	03/13/21 17:52	1	
Perfluorobutanoic acid	<0.0024	0.0030	0.0024	0.0024	mg/Kg	≎	03/13/21 17:52	1	
Perfluorodecanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	₩	03/13/21 17:52	1	
Perfluorododecanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	≎	03/13/21 17:52	1	
Perfluoroheptanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	₩	03/13/21 17:52	1	
Perfluorohexanesulfonic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	₽	03/13/21 17:52	1	
Perfluorohexanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	☆	03/13/21 17:52	1	
Perfluorononanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	≎	03/13/21 17:52	1	
Perfluorooctanesulfonic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	₽	03/13/21 17:52	1	
Perfluorooctanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	≎	03/13/21 17:52	1	
Perfluoropentanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	≎	03/13/21 17:52	1	
Perfluorotetradecanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	₩	03/13/21 17:52	1	
Perfluorotridecanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	₩	03/13/21 17:52	1	
Perfluoroundecanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	₩	03/13/21 17:52	1	

M2-6:2 FTS 107 50 - 150 03/12/21 10:01 03/13/21 17:52 M2-8:2 FTS 101 50 - 150 03/12/21 10:01 03/13/21 17:52 13C2 PFTeDA 96 50 - 150 03/12/21 10:01 03/13/21 17:52 13C3 PFBS 84 50 - 150 03/12/21 10:01 03/13/21 17:52 13C4 PFBA 86 50 - 150 03/12/21 10:01 03/13/21 17:52 13C4 PFHpA 93 50 - 150 03/12/21 10:01 03/13/21 17:52 13C5 PFPeA 87 50 - 150 03/12/21 10:01 03/13/21 17:52 13C8 PFOA 97 50 - 150 03/12/21 10:01 03/13/21 17:52	on	Dil Fac
13C2 PFTeDA 96 50 - 150 03/12/21 10:01 03/13/21 17:52 13C3 PFBS 84 50 - 150 03/12/21 10:01 03/13/21 17:52 13C4 PFBA 86 50 - 150 03/12/21 10:01 03/13/21 17:52 13C4 PFHpA 93 50 - 150 03/12/21 10:01 03/13/21 17:52 13C5 PFPeA 87 50 - 150 03/12/21 10:01 03/13/21 17:52 13C8 PFOA 97 50 - 150 03/12/21 10:01 03/13/21 17:52		1
13C3 PFBS 84 50 - 150 03/12/21 10:01 03/13/21 17:52 13C4 PFBA 86 50 - 150 03/12/21 10:01 03/13/21 17:52 13C4 PFHpA 93 50 - 150 03/12/21 10:01 03/13/21 17:52 13C5 PFPeA 87 50 - 150 03/12/21 10:01 03/13/21 17:52 13C8 PFOA 97 50 - 150 03/12/21 10:01 03/13/21 17:52		1
13C4 PFBA 86 50 - 150 03/12/21 10:01 03/13/21 17:52 13C4 PFHpA 93 50 - 150 03/12/21 10:01 03/13/21 17:52 13C5 PFPeA 87 50 - 150 03/12/21 10:01 03/13/21 17:52 13C8 PFOA 97 50 - 150 03/12/21 10:01 03/13/21 17:52		1
13C4 PFHpA 93 50 - 150 03/12/21 10:01 03/13/21 17:52 13C5 PFPeA 87 50 - 150 03/12/21 10:01 03/13/21 17:52 13C8 PFOA 97 50 - 150 03/12/21 10:01 03/13/21 17:52		1
13C5 PFPeA 87 50 - 150 03/12/21 10:01 03/13/21 17:52 13C8 PFOA 97 50 - 150 03/12/21 10:01 03/13/21 17:52		1
13C8 PFOA 97 50 - 150 03/12/21 10:01 03/13/21 17:52		1
		1
4000 PEO 0 00/40/04 40:04 00:04 00:04 47:50		1
13C8 PFOS 97 50 - 150 03/12/21 10:01 03/13/21 17:52		1
d3-NMeFOSAA 56 50 - 150 03/12/21 10:01 03/13/21 17:52	4	1
d5-NEtFOSAA 75 50 - 150 03/12/21 10:01 03/13/21 17:52	ı	1
13C2-PFDoDA 104 50 - 150 03/12/21 10:01 03/13/21 17:52	1	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32109-1 Project/Site: APG PFAS S1

Client Sample ID: APG-BLDG-E4081-2-SE-031021 Lab Sample ID: 410-32109-7 Date Collected: 03/10/21 11:40 **Matrix: Solid**

Date Received: 03/11/21 17:15 Percent Solids: 66.1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 PFHxS	96	50 - 150	03/12/21 10:01	03/13/21 17:52	1
13C5 PFHxA	93	50 - 150	03/12/21 10:01	03/13/21 17:52	1
13C6 PFDA	96	50 - 150	03/12/21 10:01	03/13/21 17:52	1
13C7 PFUnA	104	50 - 150	03/12/21 10:01	03/13/21 17:52	1
13C9 PFNA	97	50 - 150	03/12/21 10:01	03/13/21 17:52	1

General Chemistry

Analyte	Result Qu	ualifier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	33.9	1.0		1.0	%		03/12/21 09:52	1
Percent Solids	66.1	1.0		1.0	%		03/12/21 09:52	1

Client Sample ID: APG-BLDG-E4081-2-SW-031021

Lab Sample ID: 410-32109-8 Date Collected: 03/10/21 11:45 **Matrix: Water**

Date Received: 03/11/21 17:15

Method: EPA 537	(Mod) - PFAS	for QSM 5.3	, Table B-15

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.7		4.6	3.7	3.7	ng/L		03/15/21 21:14	1
8:2 Fluorotelomer sulfonic acid	<1.9		2.8	1.9	1.9	ng/L		03/15/21 21:14	1
NEtFOSAA	<0.93		2.8	0.93	0.93	ng/L		03/15/21 21:14	1
NMeFOSAA	<1.1		1.9	1.1	1.1	ng/L		03/15/21 21:14	1
Perfluorobutanesulfonic acid	14		1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluorobutanoic acid	5.1	M	4.6	3.7	3.7	ng/L		03/15/21 21:14	1
Perfluorodecanoic acid	<0.93		1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluorododecanoic acid	<0.93		1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluoroheptanoic acid	1.6	J M	1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluorohexanesulfonic acid	<0.93	Ŋ	1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluorohexanoic acid	2.7	•	1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluorononanoic acid	<0.93		1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluorooctanesulfonic acid	<0.93		1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluorooctanoic acid	1.2	J M	1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluoropentanoic acid	2.1	M	1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluorotetradecanoic acid	<0.93		1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluorotridecanoic acid	<0.93		1.9	0.93	0.93	ng/L		03/15/21 21:14	1
Perfluoroundecanoic acid	< 0.93		1.9	0.93	0.93	ng/L		03/15/21 21:14	1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	146	50 - 150	03/12/21 20:41	03/15/21 21:14	1
M2-8:2 FTS	138	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C2 PFTeDA	76	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C3 PFBS	90	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C4 PFBA	81	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C4 PFHpA	102	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C5 PFPeA	98	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C8 PFOA	111	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C8 PFOS	106	50 - 150	03/12/21 20:41	03/15/21 21:14	1
d3-NMeFOSAA	110	50 - 150	03/12/21 20:41	03/15/21 21:14	1
d5-NEtFOSAA	119	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C2-PFDoDA	106	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C3 PFHxS	103	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C5 PFHxA	102	50 ₋ 150	03/12/21 20:41	03/15/21 21:14	1

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3/30/2021

Client: ARCADIS U.S., Inc. Job ID: 410-32109-1 Project/Site: APG PFAS S1

Client Sample ID: APG-BLDG-E4081-2-SW-031021

Lab Sample ID: 410-32109-8 Date Collected: 03/10/21 11:45 **Matrix: Water**

Date Received: 03/11/21 17:15

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C6 PFDA	110	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C7 PFUnA	115	50 - 150	03/12/21 20:41	03/15/21 21:14	1
13C9 PFNA	114	50 - 150	03/12/21 20:41	03/15/21 21:14	1

Client Sample ID: APG-BLDG-E4081-2-SO-(0-2)-031021

Date Collected: 03/10/21 12:00

Date Received: 03/11/21 17:15

Lab Sample	ID: 410-32109-9

Matrix: Solid Percent Solids: 86.4

Analyte	Result Qualifie	er LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	-	03/13/21 18:03	1
8:2 Fluorotelomer sulfonic acid	<0.0019	0.0035	0.0019	0.0019	mg/Kg	☼	03/13/21 18:03	1
NEtFOSAA	<0.00046	0.0023	0.00046	0.00046	mg/Kg	≎	03/13/21 18:03	1
NMeFOSAA	<0.00046	0.0023	0.00046	0.00046	mg/Kg	≎	03/13/21 18:03	1
Perfluorobutanesulfonic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	≎	03/13/21 18:03	1
Perfluorobutanoic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	≎	03/13/21 18:03	1
Perfluorodecanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	≎	03/13/21 18:03	1
Perfluorododecanoic acid	< 0.00046	0.00069	0.00046	0.00046	mg/Kg	☼	03/13/21 18:03	1
Perfluoroheptanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	≎	03/13/21 18:03	1
Perfluorohexanesulfonic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	≎	03/13/21 18:03	1
Perfluorohexanoic acid	< 0.00046	0.00069	0.00046	0.00046	mg/Kg	☼	03/13/21 18:03	1
Perfluorononanoic acid	< 0.00046	0.00069	0.00046	0.00046	mg/Kg	☼	03/13/21 18:03	1
Perfluorooctanesulfonic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	☼	03/13/21 18:03	1
Perfluorooctanoic acid	< 0.00046	0.00069	0.00046	0.00046	mg/Kg	☼	03/13/21 18:03	1
Perfluoropentanoic acid	< 0.00046	0.00069	0.00046	0.00046	mg/Kg	☼	03/13/21 18:03	1
Perfluorotetradecanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	☼	03/13/21 18:03	1
Perfluorotridecanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	☼	03/13/21 18:03	1
Perfluoroundecanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	☼	03/13/21 18:03	1

Perliuoroundecanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/kg ⊹	03/13/21 18:03	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	98	50 - 150			03/12/21 10:01	03/13/21 18:03	1
M2-8:2 FTS	86	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C2 PFTeDA	84	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C3 PFBS	83	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C4 PFBA	84	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C4 PFHpA	91	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C5 PFPeA	88	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C8 PFOA	94	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C8 PFOS	91	50 - 150			03/12/21 10:01	03/13/21 18:03	1
d3-NMeFOSAA	56	50 - 150			03/12/21 10:01	03/13/21 18:03	1
d5-NEtFOSAA	71	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C2-PFDoDA	92	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C3 PFHxS	90	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C5 PFHxA	90	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C6 PFDA	92	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C7 PFUnA	95	50 - 150			03/12/21 10:01	03/13/21 18:03	1
13C9 PFNA	90	50 - 150			03/12/21 10:01	03/13/21 18:03	1

General	Chemistry
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Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
Percent Moisture	13.6	1.0		1.0 %		03/12/21 09:52	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32109-1 Project/Site: APG PFAS S1

Client Sample ID: APG-BLDG-E4081-2-SO-(0-2)-031021

Lab Sample ID: 410-32109-9

Date Collected: 03/10/21 12:00 Date Received: 03/11/21 17:15

Matrix: Solid Percent Solids: 86.4

General Chemistry (Continued)

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
Percent Solids	86.4	1.0		1.0 %	03/12/21 09:52	. 1

Client Sample ID: APG-DUP-03-031021

Lab Sample ID: 410-32109-10 **Matrix: Solid**

Date Collected: 03/10/21 12:00 Date Received: 03/11/21 17:15

Percent Solids: 85.6

Method: EPA 537(Mod) - PFAS Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017	0.0021	0.0017	0.0017	mg/Kg	<u></u>	03/13/21 18:34	1
8:2 Fluorotelomer sulfonic acid	<0.0017	0.0032	0.0017	0.0017	mg/Kg	₩	03/13/21 18:34	1
NEtFOSAA	<0.00043	0.0021	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
NMeFOSAA	<0.00043	0.0021	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluorobutanesulfonic acid	<0.0017	0.0021	0.0017	0.0017	mg/Kg	₩	03/13/21 18:34	1
Perfluorobutanoic acid	<0.0017	0.0021	0.0017	0.0017	mg/Kg	₩	03/13/21 18:34	1
Perfluorodecanoic acid	<0.00043	0.00064	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluorododecanoic acid	<0.00043	0.00064	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluoroheptanoic acid	<0.00043	0.00064	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluorohexanesulfonic acid	<0.00043	0.00064	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluorohexanoic acid	0.00076	0.00064	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluorononanoic acid	<0.00043	0.00064	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluorooctanesulfonic acid	<0.00043	0.00064	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluorooctanoic acid	<0.00043	0.00064	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluoropentanoic acid	<0.00043 M	0.00064	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluorotetradecanoic acid	<0.00043	0.00064	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluorotridecanoic acid	<0.00043	0.00064	0.00043	0.00043	mg/Kg	₩	03/13/21 18:34	1
Perfluoroundecanoic acid	<0.00043	0.00064	0.00043	0.00043	ma/Ka	₩	03/13/21 18:34	1

Periluoroundecarioic acid	<0.0004	13	0.00004	0.00043	0.00043	ilig/Ng ∵	03/13/21 10.34	į
Isotope Dilution	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	104		50 - 150			03/12/21 10:01	03/13/21 18:34	1
M2-8:2 FTS	98		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C2 PFTeDA	89		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C3 PFBS	85		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C4 PFBA	92		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C4 PFHpA	101		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C5 PFPeA	94		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C8 PFOA	98		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C8 PFOS	98		50 - 150			03/12/21 10:01	03/13/21 18:34	1
d3-NMeFOSAA	59		50 - 150			03/12/21 10:01	03/13/21 18:34	1
d5-NEtFOSAA	77		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C2-PFDoDA	98		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C3 PFHxS	102		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C5 PFHxA	105		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C6 PFDA	97		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C7 PFUnA	99		50 - 150			03/12/21 10:01	03/13/21 18:34	1
13C9 PFNA	96		50 - 150			03/12/21 10:01	03/13/21 18:34	1

Gei	nei	al	CI	nei	mi	S	try	•
							•	

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
Percent Moisture	14.4	1.0		1.0 %		03/12/21 09:52	1
Percent Solids	85.6	1.0		1.0 %		03/12/21 09:52	1

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Client: ARCADIS U.S., Inc.

Project/Site: APG PFAS S1

Job ID: 410-32109-1

Date Collected: 03/10/21 12:15

Matrix: Solid

Date Received: 03/11/21 17:15

Percent Solids: 73.9

15							Percent Solid	ls: 73.9
•			LOD	DI.	Unit	D	Analyzod	Dil Fa
	gaaiiici							
					0 0			
<0.00053		0.00079	0.00053	0.00053	mg/Kg	₩	03/13/21 18:45	
%Recovery Q	ualifier	Limits			Prepare	ed	Analyzed	Dil Fa
105		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
106		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
96		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
86		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
94		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
101		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
95		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
100		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
96		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
75		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
82		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
101		50 - 150			03/12/21 1	0:01	03/13/21 18:45	
97		50 - 150						
Result	Qualifier	100	LOD	DI	Unit	D	Analyzed	Dil Fa
								6.19
	-		1000			~		0.11
73.9		1.0		1.0	,0		55/ 12/2 T 05.52	
le								
						_ <u>D</u>	Analyzed	Dil Fa
6.1	J	0.01	0.01	0.01	S.U.		03/16/21 18:12	
	Result <0.0021 <0.0021 <0.0021 <0.00053 <0.00053 <0.0021 <0.0021 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00055 <0.00	FAS for QSM 5.3, Table B- Result Qualifier <0.0021 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.00053 <0.0	Color	Color	Color	Color Colo	PAS for QSM 5.3, Table B-15 Result Qualifier LOQ	PAS for QSM 5.3, Table B-15 Result Qualifier LOQ

Eurofins Lancaster Laboratories Env, LLC

03/16/21 18:12

0.01 Degrees C

Temperature

0.01

20.8

0.01

3

5

0

10

12

14

15

Job ID: 410-32109-1

Client Sample ID: APG-BLDG-E4081-1-SO-(0-2)-031021

Client: ARCADIS U.S., Inc.

Project/Site: APG PFAS S1

13C2 PFTeDA

Lab Sample ID: 410-32109-11

Date Collected: 03/10/21 12:15 **Matrix: Solid** Date Received: 03/11/21 17:15 Percent Solids: 73.9

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	9.2		1.0	1.0	1.0	%		03/15/21 13:20	1
Sand	34.8		1.0	1.0	1.0	%		03/15/21 13:20	1
Silt	44.0		1.0	1.0	1.0	%		03/15/21 13:20	1
Clay	12.0		1.0	1.0	1.0	%		03/15/21 13:20	1
75 mm	100.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
19 mm	94.8		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
4.75 mm	90.8		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
3.35 mm	90.7		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
2.36 mm	90.7		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
1.18 mm	90.6		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.6 mm	88.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.3 mm	78.9		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.15 mm	66.2		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.075 mm	56.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.064 mm	55.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.05 mm	52.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.02 mm	26.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.005 mm	12.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.002 mm	6.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.001 mm	4.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1

Client Sample ID: APG-NOBLE-ROAD-1-SO-(0-2)-031021 Lab Sample ID: 410-32109-12

Date Collected: 03/10/21 12:45 **Matrix: Solid** Date Received: 03/11/21 17:15 **Percent Solids: 84.0**

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	□ (03/13/21 18:55	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0035	0.0018	0.0018	mg/Kg	⇔ (03/13/21 18:55	1
NEtFOSAA	<0.00046		0.0023	0.00046	0.00046	mg/Kg	⇔ (03/13/21 18:55	1
NMeFOSAA	<0.00046	UJ	0.0023	0.00046	0.00046	mg/Kg	⇔ (03/13/21 18:55	1
Perfluorobutanesulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	᠅ (03/13/21 18:55	1
Perfluorobutanoic acid	<0.0018	M	0.0023	0.0018	0.0018	mg/Kg	᠅ (03/13/21 18:55	1
Perfluorodecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	᠅ (03/13/21 18:55	1
Perfluorododecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	᠅ (03/13/21 18:55	1
Perfluoroheptanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	᠅ (03/13/21 18:55	1
Perfluorohexanesulfonic acid	0.0015		0.00069	0.00046	0.00046	mg/Kg	⇔ (03/13/21 18:55	1
Perfluorohexanoic acid	0.00049	J M	0.00069	0.00046	0.00046	mg/Kg	᠅ (03/13/21 18:55	1
Perfluorononanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	⇔ (03/13/21 18:55	1
Perfluorooctanesulfonic acid	0.014		0.00069	0.00046	0.00046	mg/Kg	⇔ (03/13/21 18:55	1
Perfluorooctanoic acid	<0.00046	ŊI	0.00069	0.00046	0.00046	mg/Kg	⇔ (03/13/21 18:55	1
Perfluoropentanoic acid	<0.00046	'	0.00069	0.00046	0.00046	mg/Kg	᠅ (03/13/21 18:55	1
Perfluorotetradecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	᠅ (03/13/21 18:55	1
Perfluorotridecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	᠅ (03/13/21 18:55	1
Perfluoroundecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	⇔ (03/13/21 18:55	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared		Analyzed	Dil Fac
M2-6:2 FTS	104		50 - 150			03/12/21 10:0	01 (03/13/21 18:55	1
M2-8:2 FTS	97		50 - 150			03/12/21 10:0	01 (03/13/21 18:55	1

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03/12/21 10:01 03/13/21 18:55

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97

Client: ARCADIS U.S., Inc. Job ID: 410-32109-1 Project/Site: APG PFAS S1

Client Sample ID: APG-NOBLE-ROAD-1-SO-(0-2)-031021 Lab Sample ID: 410-32109-12

Date Collected: 03/10/21 12:45 **Matrix: Solid** Date Received: 03/11/21 17:15 Percent Solids: 84.0

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 PFBS	88	50 - 150	03/12/21 10:01	03/13/21 18:55	1
13C4 PFBA	99	50 - 150	03/12/21 10:01	03/13/21 18:55	1
13C4 PFHpA	103	50 - 150	03/12/21 10:01	03/13/21 18:55	1
13C5 PFPeA	102	50 - 150	03/12/21 10:01	03/13/21 18:55	1
13C8 PFOA	107	50 - 150	03/12/21 10:01	03/13/21 18:55	1
13C8 PFOS	100	50 - 150	03/12/21 10:01	03/13/21 18:55	1
d3-NMeFOSAA	46 *5-	50 - 150	03/12/21 10:01	03/13/21 18:55	1
d5-NEtFOSAA	56	50 - 150	03/12/21 10:01	03/13/21 18:55	1
13C2-PFDoDA	101	50 - 150	03/12/21 10:01	03/13/21 18:55	1
13C3 PFHxS	99	50 - 150	03/12/21 10:01	03/13/21 18:55	1
13C5 PFHxA	98	50 - 150	03/12/21 10:01	03/13/21 18:55	1
13C6 PFDA	103	50 - 150	03/12/21 10:01	03/13/21 18:55	1
13C7 PFUnA	103	50 - 150	03/12/21 10:01	03/13/21 18:55	1
13C9 PFNA	98	50 ₋ 150	03/12/21 10:01	03/13/21 18:55	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	-	03/16/21 15:19	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0035	0.0018	0.0018	mg/Kg	₩	03/16/21 15:19	1
NEtFOSAA	< 0.00046		0.0023	0.00046	0.00046	mg/Kg	₩	03/16/21 15:19	1
NMeFOSAA	<0.00046		0.0023	0.00046	0.00046	mg/Kg	⊅	03/16/21 15:19	1
Perfluorobutanesulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₩	03/16/21 15:19	1
Perfluorobutanoic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	03/16/21 15:19	1
Perfluorodecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	⊅	03/16/21 15:19	1
Perfluorododecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/16/21 15:19	1
Perfluoroheptanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/16/21 15:19	1
Perfluorohexanesulfonic acid	0.00053	J	0.00069	0.00046	0.00046	mg/Kg	⊅	03/16/21 15:19	1
Perfluorohexanoic acid	<0.00046	М	0.00069	0.00046	0.00046	mg/Kg	☼	03/16/21 15:19	1
Perfluorononanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/16/21 15:19	1
Perfluorooctanesulfonic acid	0.0060		0.00069	0.00046	0.00046	mg/Kg	☼	03/16/21 15:19	1
Perfluorooctanoic acid	< 0.00046	М	0.00069	0.00046	0.00046	mg/Kg	☼	03/16/21 15:19	1
Perfluoropentanoic acid	< 0.00046	M	0.00069	0.00046	0.00046	mg/Kg	☼	03/16/21 15:19	1
Perfluorotetradecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/16/21 15:19	1
Perfluorotridecanoic acid	< 0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/16/21 15:19	1
Perfluoroundecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/16/21 15:19	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepa	red	Analyzed	Dil Fac

ізогоре Біншыст	%Recovery Qualifier	Limits	Prepared Analyzed	DII Fac
M2-6:2 FTS	102 ^c	50 - 150	03/15/21 20:40 03/16/21 15:19	1
M2-8:2 FTS	109	50 - 150	03/15/21 20:40 03/16/21 15:19	1
13C2 PFTeDA	109	50 - 150	03/15/21 20:40 03/16/21 15:19	1
13C3 PFBS	88	50 - 150	03/15/21 20:40 03/16/21 15:19	1
13C4 PFBA	93	50 - 150	03/45/21 20:40 03/16/21 15:19	1
13C4 PFHpA	99	50 - 150	03/15/21 20:40 03/16/21 15:19	1
13C5 PFPeA	95	50 - 150	03/15/21 20:40 03/16/21 15:19	1
13C8 PFOA	105	50 - 150	03/15/21 20:40 83/16/21 15:19	1
13C8 PFOS	106	50 - 150	03/15/21 20:40 03/16/21 15:19	1
d3-NMeFOSAA	48 *5-	50 - 150	03/15/21 20:40 03/16/21 15:19	1
d5-NEtFOSAA	59 ^c	50 - 150	03/15/21 20:40 03/16/21 15:19	1
13C2-PFDoDA	118	50 - 150	03/15/21 20:40 03/16/21 15:19	1
13C3 PFHxS	102	50 - 150	03/15/21 20:40 03/16/21 15:19	1

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Client: ARCADIS U.S., Inc.

Project/Site: APG PFAS S1

Job ID: 410-32109-1

Client Sample ID: APG-NOBLE-ROAD-1-SO-(0-2)-031021

Lab Sample ID: 410-32109-12

Date Collected: 03/10/21 12:45

Date Received: 03/11/21 17:15

Matrix: Solid
Percent Solids: 84.0

Method: EPA 537(Mod) - PFA	S for QSM 5.3, Table B	-15 - RE (Conti	nued)		
Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C5 PFHXA	100	50 - 150	03/15/21 20:40	03/16/21 15:19	1
13C6 PFDA	109	<u> 50 - 150</u>	03/15/21 20:40	03/16/21 15:19	1
13C7 PFUnA	117	50 - 150	03/15/21 20:40	03/16/21 15:19	1
13C9 PFNA	111	50 - 150	03/15/21 20:40	03/16/21 15:19	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	5400	J-	1790	1190	1190	mg/Kg	₽	03/18/21 15:49	5
Percent Moisture	16.0		1.0		1.0	%		03/12/21 09:52	1
Percent Solids	84.0		1.0		1.0	%		03/12/21 09:52	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	7.2	J	0.01	0.01	0.01	S.U.		03/16/21 18:12	1
Temperature	20.5		0.01	0.01	0.01	Degrees C		03/16/21 18:12	1
Method: D422 - Grain Size									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac

Method: D422 - Grain Size								
Analyte	Result Qua	alifier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	16.8	1.0	1.0	1.0	%		03/15/21 13:20	1
Sand	35.4	1.0	1.0	1.0	%		03/15/21 13:20	1
Silt	39.8	1.0	1.0	1.0	%		03/15/21 13:20	1
Clay	8.0	1.0	1.0	1.0	%		03/15/21 13:20	1
75 mm	100.0	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
37.5 mm	100.0	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
19 mm	95.1	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
4.75 mm	83.2	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
3.35 mm	81.7	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
2.36 mm	80.6	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
1.18 mm	80.3	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.6 mm	77.9	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.3 mm	66.0	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.15 mm	52.7	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.075 mm	47.8	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.064 mm	45.0	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.05 mm	38.0	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.02 mm	23.0	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.005 mm	8.0	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.002 mm	7.5	1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.001 mm	8.0	1.0	1.0	1.0	% Passing		03/15/21 13:20	1

Client Sample ID: APG-NOBLE-ROAD-2-SO-(0-2)-031021	Lab Sample ID: 410-32109-13

Date Collected: 03/10/21 13:00 Matrix: Solid
Date Received: 03/11/21 17:15 Percent Solids: 88.5

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	<u></u>	03/16/21 15:30	1
8:2 Fluorotelomer sulfonic acid	<0.0018	0.0033	0.0018	0.0018	mg/Kg	☼	03/16/21 15:30	1
NEtFOSAA	<0.00044	0.0022	0.00044	0.00044	mg/Kg	☼	03/16/21 15:30	1
NMeFOSAA	<0.00044	0.0022	0.00044	0.00044	mg/Kg	⊅	03/16/21 15:30	1
Perfluorobutanesulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	₽	03/16/21 15:30	1

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Job ID: 410-32109-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-NOBLE-ROAD-2-SO-(0-2)-031021

Lab Sample ID: 410-32109-13 Date Collected: 03/10/21 13:00 **Matrix: Solid**

Date Received: 03/11/21 17:15 Percent Solids: 88.5

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorobutanoic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	<u></u>	03/16/21 15:30	1
Perfluorodecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₽	03/16/21 15:30	1
Perfluorododecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/16/21 15:30	1
Perfluoroheptanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	≎	03/16/21 15:30	1
Perfluorohexanesulfonic acid	0.0023		0.00066	0.00044	0.00044	mg/Kg	₽	03/16/21 15:30	1
Perfluorohexanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	≎	03/16/21 15:30	1
Perfluorononanoic acid	0.00053	J	0.00066	0.00044	0.00044	mg/Kg	≎	03/16/21 15:30	1
Perfluorooctanesulfonic acid	0.0099		0.00066	0.00044	0.00044	mg/Kg	≎	03/16/21 15:30	1
Perfluorooctanoic acid	0.00095	M	0.00066	0.00044	0.00044	mg/Kg	☼	03/16/21 15:30	1
Perfluoropentanoic acid	<0.00044	M	0.00066	0.00044	0.00044	mg/Kg	≎	03/16/21 15:30	1
Perfluorotetradecanoic acid	<0.00044	[0.00066	0.00044	0.00044	mg/Kg	₩	03/16/21 15:30	1
Perfluorotridecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/16/21 15:30	1
Perfluoroundecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/16/21 15:30	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepar	ed	Analyzed	Dil Fac
M2-6:2 FTS	114 ^c		50 - 150			03/15/21	20:40	03/16/21 15:30	1
M2-8:2 FTS	119		50 - 150			03/15/21	20:40	03/16/21 15:30	1
13C2 PFTeDA	116		50 - 150			03/15/21	20:40	03/16/21 15:30	1
13C3 PFBS	90		50 - 150			03/15/21 2	20:40	03/16/21 15:30	1
13C4 PFBA	97		50 - 150			03/15/21	20:40	03/16/21 15:30	1
13C4 PFHpA	103		50 - 150			03/15/21	20:40	03/16/21 15:30	1
13C5 PFPeA	101		50 - 150			03/15/21	20:40	03/16/21 15:30	1
13C8 PFOA	112		50 - 150			03/15/21 2	20:40	03/16/21 15:30	1
13C8 PFOS	110		50 - 150			03/15/21	20:40	03/16/21 15:30	1
d3-NMeFOSAA	58		50 - 150			03/15/21 2	20:40	03/16/21 15:30	1
d5-NEtFOSAA	75 ^c		50 - 150			03/15/21	20:40	03/16/21 15:30	1
13C2-PFDoDA	118		50 - 150			03/15/21	20:40	03/16/21 15:30	1
13C3 PFHxS	102		50 - 150			03/15/21 2	20:40	03/16/21 15:30	1
13C5 PFHxA	103		50 - 150			03/15/21 2	20:40	03/16/21 15:30	1
13C6 PFDA	114		50 - 150			03/15/21	20:40	03/16/21 15:30	1
13C7 PFUnA	120		50 - 150			03/15/21 2	20:40	03/16/21 15:30	1
13C9 PFNA	116		50 ₋ 150			03/15/21	0.40	03/16/21 15:30	1

General Chemistry							
Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
Percent Moisture	11.5	1.0		1.0 %		03/12/21 09:52	1
Percent Solids	88.5	1.0		1.0 %		03/12/21 09:52	1

Client Sample ID: APG-FB-05-031021 Lab Sample ID: 410-32109-14 Date Collected: 03/10/21 13:15 **Matrix: Water**

Date Received: 03/11/21 17:15

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15										
Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac				
6:2 Fluorotelomer sulfonic acid	<3.4	4.3	3.4	3.4 ng/L	03/17/21 17:18	1				
8:2 Fluorotelomer sulfonic acid	<1.7	2.6	1.7	1.7 ng/L	03/17/21 17:18	1				
NEtFOSAA	<0.86	2.6	0.86	0.86 ng/L	03/17/21 17:18	1				
NMeFOSAA	<1.0	1.7	1.0	1.0 ng/L	03/17/21 17:18	1				
Perfluorobutanesulfonic acid	<0.86	1.7	0.86	0.86 ng/L	03/17/21 17:18	1				
Perfluorobutanoic acid	<3.4	4.3	3.4	3.4 ng/L	03/17/21 17:18	1				
Perfluorodecanoic acid	<0.86	1.7	0.86	0.86 ng/L	03/17/21 17:18	1				

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Job ID: 410-32109-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-FB-05-031021

Lab Sample ID: 410-32109-14 Date Collected: 03/10/21 13:15

Matrix: Water Date Received: 03/11/21 17:15

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit I	D Analyzed	Dil Fac
Perfluorododecanoic acid	<0.86		1.7	0.86	0.86	ng/L	03/17/21 17:18	1
Perfluoroheptanoic acid	<0.86		1.7	0.86	0.86	ng/L	03/17/21 17:18	1
Perfluorohexanesulfonic acid	<0.86		1.7	0.86	0.86	ng/L	03/17/21 17:18	1
Perfluorohexanoic acid	<0.86		1.7	0.86	0.86	ng/L	03/17/21 17:18	1
Perfluorononanoic acid	<0.86	1	1.7	0.86	0.86	ng/L	03/17/21 17:18	1
Perfluorooctanesulfonic acid	<0.86	В	1.7	0.86	0.86	ng/L	03/17/21 17:18	1
Perfluorooctanoic acid	<0.86		1.7	0.86	0.86	ng/L	03/17/21 17:18	1
Perfluoropentanoic acid	<0.86	ľ	1.7	0.86	0.86	ng/L	03/17/21 17:18	1
Perfluorotetradecanoic acid	<0.86	· · [· · · · · · · · · ·	1.7	0.86	0.86	ng/L	03/17/21 17:18	1
Perfluorotridecanoic acid	<0.86		1.7	0.86	0.86	ng/L	03/17/21 17:18	1
Perfluoroundecanoic acid	<0.86		1.7	0.86	0.86	ng/L	03/17/21 17:18	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	120		50 - 150			03/14/21 17:1	03/17/21 17:18	1
M2-8:2 FTS	108		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C2 PFTeDA	75		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C3 PFBS	82		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C4 PFBA	94		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C4 PFHpA	100		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C5 PFPeA	94		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C8 PFOA	104		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C8 PFOS	91		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
d3-NMeFOSAA	89		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
d5-NEtFOSAA	95		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C2-PFDoDA	84		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C3 PFHxS	94		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C5 PFHxA	99		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C6 PFDA	98		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C7 PFUnA	92		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1
13C9 PFNA	95		50 - 150			03/14/21 17:1	1 03/17/21 17:18	1

Client Sample ID: APG-CASEY-YARD-1-SO-(0-2)-031021

Lab Sample ID: 410-32109-15 Date Collected: 03/10/21 13:30 **Matrix: Solid** Date Received: 03/11/21 17:15 Percent Solids: 82.0

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	<u></u>	03/13/21 19:17	1
8:2 Fluorotelomer sulfonic acid	<0.0018	0.0034	0.0018	0.0018	mg/Kg	₩	03/13/21 19:17	1
NEtFOSAA	<0.00045	0.0023	0.00045	0.00045	mg/Kg	☆	03/13/21 19:17	1
NMeFOSAA	<0.00045	0.0023	0.00045	0.00045	mg/Kg	☆	03/13/21 19:17	1
Perfluorobutanesulfonic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	≎	03/13/21 19:17	1
Perfluorobutanoic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	☆	03/13/21 19:17	1
Perfluorodecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	☆	03/13/21 19:17	1
Perfluorododecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	≎	03/13/21 19:17	1
Perfluoroheptanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	☆	03/13/21 19:17	1
Perfluorohexanesulfonic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	☼	03/13/21 19:17	1
Perfluorohexanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	≎	03/13/21 19:17	1
Perfluorononanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	☆	03/13/21 19:17	1
Perfluorooctanesulfonic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	☼	03/13/21 19:17	1
Perfluorooctanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg	☆	03/13/21 19:17	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32109-1 Project/Site: APG PFAS S1

Lab Sample ID: 410-32109-15 Client Sample ID: APG-CASEY-YARD-1-SO-(0-2)-031021

Date Collected: 03/10/21 13:30 **Matrix: Solid** Date Received: 03/11/21 17:15 Percent Solids: 82.0

Analyte	Result Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluoropentanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg 🕏	03/13/21 19:17	1
Perfluorotetradecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg ☆	03/13/21 19:17	1
Perfluorotridecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg ≎	03/13/21 19:17	1
Perfluoroundecanoic acid	<0.00045	0.00068	0.00045	0.00045	mg/Kg ≎	03/13/21 19:17	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	100	50 - 150			03/12/21 10:01	03/13/21 19:17	1
M2-8:2 FTS	96	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C2 PFTeDA	100	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C3 PFBS	86	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C4 PFBA	97	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C4 PFHpA	101	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C5 PFPeA	97	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C8 PFOA	103	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C8 PFOS	98	50 - 150			03/12/21 10:01	03/13/21 19:17	1
d3-NMeFOSAA	57	50 - 150			03/12/21 10:01	03/13/21 19:17	1
d5-NEtFOSAA	69	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C2-PFDoDA	103	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C3 PFHxS	98	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C5 PFHxA	103	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C6 PFDA	99	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C7 PFUnA	102	50 - 150			03/12/21 10:01	03/13/21 19:17	1
13C9 PFNA	97	50 - 150			03/12/21 10:01	03/13/21 19:17	1
General Chemistry							
Analyte	Result Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Total Organic Carbon	3010	2440	1630	1630	mg/Kg 🜣	03/18/21 16:02	6.68

Total Organic Carbon	3010	J-	2440	1030	1030	mg/rtg	74	03/10/21 10.02	0.00
Percent Moisture	18.0		1.0		1.0	%		03/12/21 09:52	1
Percent Solids	82.0		1.0		1.0	%		03/12/21 09:52	1
General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	7.6	J	0.01	0.01	0.01	S.U.		03/16/21 18:12	1

20.5

0.01

0.01

Temperature

Method: D422 - Grain Size Analyte	Result Qualific	er LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	28.4	1.0	1.0	1.0	%		03/25/21 15:24	1
Sand	32.7	1.0	1.0	1.0	%		03/25/21 15:24	1
Silt	24.9	1.0	1.0	1.0	%		03/25/21 15:24	1
Clay	14.0	1.0	1.0	1.0	%		03/25/21 15:24	1
75 mm	100.0	1.0	1.0	1.0	% Passing		03/25/21 15:24	1
37.5 mm	10.0	1.0	1.0	1.0	% Passing		03/25/21 15:24	1
19 mm	86.8	1.0	1.0	1.0	% Passing		03/25/21 15:24	1
4.75 mm	71.6	1.0	1.0	1.0	% Passing		03/25/21 15:24	1
3.35 mm	69.6	1.0	1.0	1.0	% Passing		03/25/21 15:24	1
2.36 mm	68.6	1.0	1.0	1.0	% Passing		03/25/21 15:24	1
1.18 mm	68.1	1.0	1.0	1.0	% Passing		03/25/21 15:24	1
0.6 mm	60.8	1.0	1.0	1.0	% Passing		03/25/21 15:24	1
0.3 mm	49.1	1.0	1.0	1.0	% Passing		03/25/21 15:24	1
0.15 mm	41.8	1.0	1.0	1.0	% Passing		03/25/21 15:24	1

03/16/21 18:12

0.01 Degrees C

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Client: ARCADIS U.S., Inc.

Job ID: 410-32109-1

Project/Site: APG PFAS S1

Method: D422 - Grain S	ethod: D422 - Grain Size (Continued)									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac	
0.075 mm	38.9		1.0	1.0	1.0	% Passing		03/25/21 15:24	1	
0.064 mm	37.0		1.0	1.0	1.0	% Passing		03/25/21 15:24	1	
0.05 mm	34.0		1.0	1.0	1.0	% Passing		03/25/21 15:24	1	
0.02 mm	24.0		1.0	1.0	1.0	% Passing		03/25/21 15:24	1	
0.005 mm	14.0		1.0	1.0	1.0	% Passing		03/25/21 15:24	1	
0.002 mm	9.0		1.0	1.0	1.0	% Passing		03/25/21 15:24	1	
0.001 mm	8.0		1.0	1.0	1.0	% Passing		03/25/21 15:24	1	

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Aberdeen Proving Ground - Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDG # 410-32605-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report #41218R

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-32605-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

			Sample		Aı	nalysis	
Sample ID	Lab ID	Matrix	Collection Date	Parent Sample	PFAS	тос	рН
APG-BLDG-300-1-SO-(0-2)-031521	410-32605-1	Soil	3/15/2021		Х	Х	Х
APG-BLDG-300-2-SO-(0-2)-031521	410-32605-2	Soil	3/15/2021		X		
APG-BLDG-300-1-GW-031521	410-32605-3	Water	3/15/2021		Х		
APG-BLDG-300-2-GW-031521	410-32605-4	Water	3/15/2021		Х		
APG-PI-12-1-SO-(0-2)-031521	410-32605-5	Soil	3/15/2021		Х	Х	Х
APG-PI-12-1-GW-031521	410-32605-6	Water	3/15/2021		X		
APG-PI-12-2-SO-(0-2)-031521	410-32605-7	Soil	3/15/2021		X		
APG-FB-04-031521	410-32605-8	Water	3/15/2021		X		
APG-PI-MINEFIELD-1-SO-(0-2)-031521	410-32605-9	Soil	3/15/2021		X	Х	X
APG-PI-MINEFIELD-2-SO-(0-2)-031521	410-32605-10	Soil	3/15/2021		X		
APG-PI-MINEFIELD-1-GW-031521	410-32605-11	Water	3/15/2021		Х		

Notes:

1. Stage 4 validation was performed on sample APG-BLDG-300-1-SO-(0-2)-031521.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Rep	orted	Perfor Acce	Not	
Items Reviewed	No	Yes	No	Yes	Required
Sample receipt condition		Х		Х	
Requested analyses and sample results		Х		Х	
Master tracking list		Х		Х	
4. Methods of analysis		Х		Х	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		Х	
11. Narrative summary of QA or sample problems provided		Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

1. The chain of custody states that 2 containers were submitted, whereas the laboratory received 3 containers for the following samples.

Lab ID	Sample ID
410-32605-4	APG-BLDG-300-2-GW-031521
410-32605-6	APG-PI-12-1-GW-031521

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
APG-BLDG-300-1-SO-(0-2)- 031521	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
APG-PI-12-1-SO-(0-2)- 031521	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
APG-PI-12-2-SO-(0-2)-	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 20%
031521	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 50% but > 20%

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification	
4500/	Non-detect	No Action	
> 150%	Detect	J-	
< 50% but > 20%	Non-detect	UJ	
	Detect	J+	
< 20%	Non-detect	UX	
	Detect	Χ	

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be ≤ 30%.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

An MS/MSD analysis was not performed on a sample within this SDG.

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

A field duplicate was not collected for a sample within this SDG.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

All identified compounds met method criteria.

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
APG-PI-12-1-GW-031521	6:2 Fluorotelomer sulfonic acid		1900	1900 D
	8:2 Fluorotelomer sulfonic acid		1600	1600 D
	Perfluoroheptanoic acid	650		650 D
	Perfluorohexanesulfonic acid		610	610 D
	Perfluorohexanoic acid		1200	1200 D
	Perfluorooctanesulfonic acid		3000	3000 D
	Perfluoropentanoic acid		1700	1700 D

Note: the lab did not report the original analysis; only the diluted result.

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification	
Diluted sample result within calibration range	D	

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Reported		Performance Acceptable		Not
	No	Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC/	MS/MS)			
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		Х		Х	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks	Х				X
C. Field blanks		X		Х	
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate(LCSD) %R		Х		Х	
LCS/LCSD Precision (RPD)		Х		Х	
Matrix Spike (MS) %R	Х				Х
Matrix Spike Duplicate(MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				Х
Field Duplicate (RPD)	Х				Х
Extracted Internal Standard %R		Х	Х		
Injection Internal Standard %R		Х		Х	
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation		1	ı	ı	1
Instrument tune and performance check		Х		Х	
Initial calibration %RSDs		Х		Х	
Continuing calibration %Ds		Х		Х	
Instrument sensitivity check		Х		Х	
Ion transitions used		Х		Х	
Compound identification and quantitation	1	1		1	1
A. Reconstructed ion chromatograms		Х		Х	
B. Quantitation Reports		Х		Х	
C. RT of sample compounds within the established RT windows		Х		Х	

PFAS: 537M/DoD QSM 5.3		orted		mance ptable	Not Required
		Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC/	MS/MS)			
D. Ion Ratio %R		Х		Х	
E. Transcription/calculations acceptable		Х		Х	
F. Reporting limits adjusted to reflect sample dilutions		Х		Х	

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

Concentration (C) Qualifiers

- U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
- J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).

Quantitation (Q) Qualifiers

E The compound was quantitated above the calibration range.

• Validation Qualifiers

- J The reported result was an estimated value with an unknown bias.
- J+ The result was an estimated quantity, but the result may be biased high.
- J- The result was an estimated quantity, but the result may be biased low.
- UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
- UB Analyte considered non-detect at the listed value due to associated blank contamination.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria		
APG-BLDG-300-1-SO-(0-2)-031521				
APG-PI-12-1-SO-(0-2)-031521	8 days from collection; 7 days from receipt	< 24 hours of receipt at the laboratory		
APG-PI-Minefield-1-SO-(0-2)-031521		and laboratory		

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

	Qualification
Criteria	Detected Analytes
Analysis completed past the holding time	J

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analytes	Standard Recovery
APG-BLDG-300-1-SO-(0-2)-031521			
APG-PI-12-1-SO-(0-2)-031521	CCV	TOC	69%
APG-PI-Minefield-1-SO-(0-2)-031521			1270

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Control Limit	Sample Result	Qualification
		Non-detect	UJ
	75% to 89%	Detect	J-
	O 5	Non-detect	X
T00	Gross Exceedance <75%	Detect	J-
TOC	4440/ 1- 4050/	Non-detect	No Action
	111% to 125%	Detect	J+
	Gross Exceedance >125%	Non-detect	No Action
	GIUSS EXCEEUALICE > 125%	Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

A MS analysis was not performed for TOC.

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

A laboratory duplicate analysis was not performed on sample location associated with this SDG.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within \pm 0.05 S.U. of the true value.

Sample locations associated with the LCS exhibiting recoveries outside of the control limits are presented in the following table.

Sample Locations	Compound	LCS %R
APG-BLDG-300-1-SO-(0-2)-031521 APG-PI-12-1-SO-(0-2)-031521 APG-PI-Minefield-1-SO-(0-2)-031521	тос	64%

The criteria used to evaluate the LCS recoveries are presented in the following table. In the case of an LCS deviation, the sample results are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
100%	Non-detect	No Action
> 120%	Detect	J+
9994	Non-detect	Х
< 80%	Detect	J-

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Rep	orted		Performance Acceptable		
	No	Yes	No	Yes	Required	
Miscellaneous Instrumentation						
Stage 2 Validation						
Holding times		X	X			
Reporting limits (units)		X		X		
Blanks						
A. Method blanks		X		Х		
B. Equipment blanks	Х				Х	
Laboratory Control Sample (LCS) %R		Х	Х			
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х	
LCS/LCSD Precision (RPD)	Х				Х	
Matrix Spike (MS) %R	Х				Х	
Matrix Spike Duplicate (MSD) %R	Х				Х	
MS/MSD Precision (RPD)	Х				Х	
Lab Duplicate (RPD)	Х				Х	
Field Duplicate (RPD)	Х				Х	
Dilution Factor		Х		Х		
Moisture Content		Х		Х		
Stage 3/4 Validation						
Initial calibration correlation coefficient (TOC)		Х		Х		
Continuing calibration %R		Х	Х			
Raw Data		Х		Х		
Transcription/calculations acceptable		X		Х		

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Andrew Korycinski

SIGNATURE:

DATE: May 4, 2021

a Kaz

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 10, 2021

Stage 3 / 4 PFAS Calibration Standards

 SDG #:
 410-32605-1
 Date:
 5/4/2021

 Lab:
 Eurofins Lancaster
 Page:
 1

Project: Aberdeen Proving Ground Validated by: AJK

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

Perfluorooctanesulfonic acid 3/17/2021 Calibration

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	ctanesanoni	. uc.u 3, 1	1 300 410	J2003 I						
Cal Conc					Calculated		Calc		Calculated	Reported
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D
0.185	112847	4530652	9.57	0.024907	1.2884558	1.129805	0.210978	0.185	14.042	14
0.463	237658	4291416	9.57	0.05538	1.1446765	1.129805	0.469095	0.463	1.316	1.4
1.85	1023084	4474362	9.57	0.228655	1.1828247	1.129805	1.936818	1.85	4.693	4.6
7.4	3457565	4321506	9.57	0.800083	1.0347024	1.129805	6.777099	7.4	-8.418	-8.5
18.5	8789708	4278558	9.57	2.054362	1.062716	1.129805	17.40146	18.5	-5.938	-6
46.3	22390022	4345279	9.57	5.152724	1.0650446	1.129805	43.6461	46.3	-5.732	-5.7
92.6	40632444	3715471	9.57	10.93601	1.1302123	1.129805	92.63341	92.6	0.036	0.1
					4 4000046					

Match Match Match Match Match Match Match

Avg RF = 1.1298046 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-32605-1Date:5/4/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:AJK

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-103929/9 3/17/2021 01:41

Page 985 of SDG 410-32605-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorooctanesulfonic acid	783741	3880536	9.57	0.2020	1.1290	1.712	1.91	-10.37	-10.5
Perfluoropentanoic acid	931437	4634587	10	0.2010	1.0900	1.844	2	-7.81	-7.8
Perfluoroundecanoic acid	958252	5675208	10	0.1688	0.9594	1.760	2	-12.00	-12

Match Match Match

CCV 410-104674/80 3/19/2021 08:35

Page 1109 of SDG 410-32605-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorooctanesulfonic acid	225429	3759767	9.57	0.0600	1.1290	0.508	0.463	9.77	9.8
Perfluoropentanoic acid	245899	4280286	10	0.0574	1.0900	0.527	0.5	5.41	5.4
Perfluoroundecanoic acid	264468	5091940	10	0.0519	0.9594	0.541	0.5	8.27	8.3

Match Match Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 SDG #:
 410-32605-1
 Date:
 5/4/2021

 Lab:
 Eurofins Lancaster
 Page:
 3

 Project:
 Aberdeen Proving Ground
 Validated by:
 AJK

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-104075/2-A

Page 1456 of SDG 410-32605-1

Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported	1
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorooctanesulfonic acid	2688260	4134836	9.57	0.650149	1.1290	22.04	23.700	93.01	93	Match
Perfluoropentanoic acid	2840471	4782251	10	0.593961	1.0900	21.80	25.600	85.14	85	Match
Perfluoroundecanoic acid	3341416	5730324	10	0.583111	0.9594	24.31	25.600	94.97	95	Match

Calculated Amount $ng/L = ((Peak area ratio/Avg RF) \times EIS concentration)/Sample volume)*1000$

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-32065-1
 Date:
 5/4/2021

 Lab:
 Eurofins Lancaster
 Page:
 4

 Project:
 Aberdeen Proving Ground
 Validated by:
 AJK

Method: EPA modified 537 per DoD QSM 5.3

Page 522 of SDG 410-32065-1

Field Sample ID: APG-BLDG-300-1-SO-(0-2)-031521 Lab ID: 410-32065-1 TS=84.1%, FV= 4ml Sample Weight=1.00 g

Extract: 2 mls concentrated to 1 ml

								Calculated		
						Calculated		Amount Dry	Reported	
						Amount	Calculated	Weight	Value	
Analyte	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mg/kg	mg/kg	mg/kg	
Perfluorooctanesulfonic acid	1424959	4543461	9.57	0.313629	1.1290	2.66	0.0053	0.00632	0.0063	Match
Perfluoropentanoic acid	151494	4539541	10	0.033372	1.0900	0.31	0.0006	0.00073	0.00073	Match
Perfluoroundecanoic acid	226593	6241868	10	0.036302	0.9594	0.38	0.0008	0.00090	0.00090	Match

Calculated Amount ng/ml = (Peak area ratio/Avg RF) x DF x EIS concentration Calculated mg/kg = $4 \times (Calc \ amt \ ng/ml \times 0.5)$ / sample weight g) / 1000 Dry Weight Amount = [Calculated mg/kg / (TS/100)]

Stage 3 / 4 PFAS EIS

SDG #:410-32065-1Date:5/4/2021Lab:Eurofins LancasterPage:5Project:Aberdeen Proving GroundValidated by:AJK

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-BLDG-300-1-SO-(0-2)-031521 Lab ID: 410-32065-1

EIS 13C8 PFOS
REPORTED EIS %R 106

 $\%R = \frac{100 * EIS Concentration}{EIS TV}$

EIS Concentration 10.2 ng/ml Page 522 of 410-32605-1
EIS TV 9.57
%R 106.6 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

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Lancaster Laboratories



nvironmental use

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COC #616537

Client Informati	on					Matrix					A	naly	sis F	Requested		For Lab U	se Only	
Client:	Acct. #:				П					Pr	eser	ation	and	Filtration C	odes	FSC:		
ARCADIS					Ľ											SCR#:		
roject Name/#:	PWSID #:				Tissue	P 8										Pres	ervation	Codes
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Dan Yack- tate where samples were collected: For Compliance:					Sediment	Potable NPDES		of Containers	(130)		5:34	J	-				Remark	<u> </u>
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Sample Identification	Col	lected	٩	d L	_	Te l	Jer	<u>a</u>	PFAS	Mo	2	Ho	a					
oumple identification	Date	Time	Grab	Composite	Soil	Water	Other:	Total #			-							
Aph-Bidi-300-1-50-(0-2)-03152	1 3/15/2	1 1045		X	50			4	X	X	X	X						
AP10-BLOG-300-2-50-(0-2)-03152		1100		X	50			2	X									
APG-BLDG-300-1-GU-031521		0930	X			GW		2		11			X					
APG-0100-300-2-6W-031521		1040	×			GW		2					X					147
APG- PI-12-1-50- (0-2)-031521		1300		X	50			4	X	X	X	X						
APG - P1-12-1-6W-0315-71		1340	×			12W		1.2				100	X	- 1				
APB-P1-12-2-50-(0-2)-031521		1400		X	50			142	X			10						8
APL P1-12-2 CIW D31521		1400	V			GW		.7					×	1 1		_00	_	
APG- F6-04-031521		1500	X			GWI		7					×					
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Environmental Analysis Request/Chain of Custody

eurofins 🔆	Lancaster Labora	tories	Acet #			Eurofii Group		ncaster Lab		ies En ample		nental	use o	nly	f	g 2		5 2	C	OC	#616	5571
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Type I (EPA L Equivalent/no		Type VI (F	Raw Data	Only)	Reline	quished	d by		E		III) i	Date		Time		Rećeived	EA	DAA	1		9-1/0-12	Time 1826
Type III (Redu	iced non-CLP)	NJ DKQP	TX	TRRP-13			If yes	EDD Res, format:	quire	d?	Yes	No				Relinqu UPS		•	omme dEx	rcial Carri		
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The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client.

7044 0919

Client: ARCADIS U.S., Inc. Job ID: 410-32605-1

Project/Site: APG PFAS SI

Client Sample ID: APG-BLDG-300-1-SO-(0-2)-031521 Lab Sample ID: 410-32605-1

Date Collected: 03/15/21 10:45 **Matrix: Solid** Date Received: 03/16/21 18:26 **Percent Solids: 84.1**

Analyte	Result	Qualifier	LOQ	LOD		Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	 	03/19/21 10:03	1
8:2 Fluorotelomer sulfonic acid	< 0.0019		0.0036	0.0019		mg/Kg	₩	03/19/21 10:03	1
NEtFOSAA	<0.00048		0.0024	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
NMeFOSAA	<0.00048	UJ	0.0024	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Perfluorobutanesulfonic acid	< 0.0019		0.0024	0.0019	0.0019	mg/Kg	☼	03/19/21 10:03	1
Perfluorobutanoic acid	< 0.0019		0.0024	0.0019	0.0019	mg/Kg	₩	03/19/21 10:03	1
Perfluorodecanoic acid	0.00051	J	0.00071	0.00048	0.00048	mg/Kg	₽	03/19/21 10:03	1
Perfluorododecanoic acid	<0.00048		0.00071	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Perfluoroheptanoic acid	<0.00048		0.00071	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Perfluorohexanesulfonic acid	0.00065	J	0.00071	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Perfluorohexanoic acid	<0.00048		0.00071	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Perfluorononanoic acid	<0.00048		0.00071	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Perfluorooctanesulfonic acid	0.0063		0.00071	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Perfluorooctanoic acid	<0.00048	M	0.00071	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Perfluoropentanoic acid	0.00073	M	0.00071	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Perfluorotetradecanoic acid	<0.00048		0.00071	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Perfluorotridecanoic acid	<0.00048		0.00071	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Perfluoroundecanoic acid	0.00090		0.00071	0.00048	0.00048	mg/Kg	₩	03/19/21 10:03	1
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepar	ed	Analyzed	Dil Fac
M2-6:2 FTS	106		50 - 150			03/17/21	11:39	03/19/21 10:03	1
M2-8:2 FTS	105		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C2 PFTeDA	91		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C3 PFBS	97		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C4 PFBA	94		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C4 PFHpA	110		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C5 PFPeA	92		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C8 PFOA	111		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C8 PFOS	106		50 - 150			03/17/21	11:39	03/19/21 10:03	1
d3-NMeFOSAA	39 *5	-	50 - 150			03/17/21	11:39	03/19/21 10:03	1
d5-NEtFOSAA	55		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C2-PFDoDA	102		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C3 PFHxS	113		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C5 PFHxA	104		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C6 PFDA	111		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C7 PFUnA	112		50 - 150			03/17/21	11:39	03/19/21 10:03	1
13C9 PFNA	106		50 ₋ 150			02/47/24	14.00	03/19/21 10:03	1

Method: EPA 537(M	flod) - PFAS for QSM 5.3.	, Table B-15 - RE
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-Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	☼	03/24/21 13:49	1
8:2 Fluorotelomer sulfonic acid	<0.0018	0.0033	0.0018	0.0018	mg/Kg	₩	03/24/21 13:49	1
NEtFOSAA	<0.00044	0.0022	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	1
NMeFOSAA	<0.00044	0.0022	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	1
Perfluorobutanesulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	₩	03/24/21 13:49	1
Perfluorobutanoic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	₩	03/24/21 13:49	1
Perfluorodecanoic acid	0.00081	0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	1
Perfluorododecanoic acid	<0.00044 M	0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	1
Perfluoroheptanoic acid	0.00061 J	0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	1
Perfluorohexanesulfonic acid	0.0013	0.00066	0.00044	0.00044	mg/Kg	₽	03/24/21 13:49	1_

Page 11 of 62

Client: ARCADIS U.S., Inc. Job ID: 410-32605-1

Project/Site: APG PFAS SI

Silt

Clay

75 mm

19 mm

37.5 mm

4.75 mm

3.35 mm

2.36 mm

Client Sample ID: APG-BLDG-300-1-SO-(0-2)-031521 Lab Sample ID: 410-32605-1

Date Collected: 03/15/21 10:45

Date Received: 03/16/21 18:26

Matrix: Solid

Percent Solids: 84.1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
Perfluorohexanoic acid	0.00069		0.00066	0.00044	0.00044	mg/Kg	-	03/24/21 13:49	-
Perfluorononanoic acid	0.00075		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	
Perfluorooctanesulfonic acid	0.013		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	
Perfluorooctanoic acid	0.00065	J M	0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	
Perfluoropentanoic acid	0.0012	M	0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	
Perfluorotetradecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	
Perfluorotridecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	
Perfluoroundecanoic acid	0.9014		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:49	
Isotope Dilution	%Recovery Q	alifier	Limits			Prepare	d	Analyzed	Dil Fa
M2-6:2 FTS	90		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
M2-8:2 FTS	74		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
13C2 PFTeDA	66		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
13C3 PFBS	77		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
13C4 PFBA	82		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
13C4 PFHpA	83		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
13C5 PFPeA	79		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
13C8 PFOA	82		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
13C8 PFOS	84		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
d3-NMeFOSAA	25 *5	- -	50 - 150			03/23/21 20	0:31	03/24/21 13:49	
d5-NEtFOSAA	32 *5	-	50 - 150			03/23/21 20	0:31	03/24/21 13:49	
13C2-PFDoDA	74		50 - 150			03/23/21 20	31	03/24/21 13:49	
13C3 PFHxS	83		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
13C5 PFHxA	80		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
13C6 PFDA	80		50 - 150			03/23/21 20	0:31	03/24/21 13.49	
13C7 PFUnA	81		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
13C9 PFNA	76		50 - 150			03/23/21 20	0:31	03/24/21 13:49	
General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
Total Organic Carbon	6370	J-	1690	1130	1130	mg/Kg	☼	03/18/21 17:31	4.
Percent Moisture	15.9		1.0		1.0	%		03/17/21 09:28	
Percent Solids	84.1		1.0		1.0	%		03/17/21 09:28	
General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
pH	7.6	J	0.01	0.01	0.01	S.U.		03/23/21 19:22	
Temperature	20.1	-	0.01	0.01	0.01	Degrees C		03/23/21 19:22	
Method: D422 - Grain Size									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
Gravel	8.1		1.0	1.0	1.0	%		03/23/21 01:00	
	26.2		1.0	1.0	1.0			03/23/21 01:00	

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03/23/21 01:00

03/23/21 01:00

03/23/21 01:00

03/23/21 01:00

03/23/21 01:00

03/23/21 01:00

03/23/21 01:00

03/23/21 01:00

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0 %

1.0 % Passing

% Passing

% Passing

% Passing

% Passing

1.0 % Passing

1.0 %

50.7

15.0

100.0

100.0

100.0

91.9

91.2

90.2

2

3

5

8

10

12

14

15

4/1/2021

Job ID: 410-32605-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS SI

Client Sample ID: APG-BLDG-300-1-SO-(0-2)-031521

Lab Sample ID: 410-32605-1 Date Collected: 03/15/21 10:45 **Matrix: Solid**

Date Received: 03/16/21 18:26 Percent Solids: 84.1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
1.18 mm	89.8		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.6 mm	88.7		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.3 mm	84.4		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.15 mm	74.9		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.075 mm	65.7		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.064 mm	62.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.05 mm	54.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.02 mm	33.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.005 mm	15.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.002 mm	12.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.001 mm	10.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1

Client Sample ID: APG-BLDG-300-2-SO-(0-2)-031521

Lab Sample ID: 410-32605-2 Date Collected: 03/15/21 11:00 **Matrix: Solid** Date Received: 03/16/21 18:26 Percent Solids: 85.9

	<u> </u>							CICCIII COIIC	
Method: EPA 537(Mod) - PFA	AS for QSM 5.3,	Table B-1	15						
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	<u></u>	03/19/21 10:14	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0035	0.0018	0.0018	mg/Kg	≎	03/19/21 10:14	1
NEtFOSAA	< 0.00046		0.0023	0.00046	0.00046	mg/Kg	≎	03/19/21 10:14	1
NMeFOSAA	<0.00046		0.0023	0.00046	0.00046	mg/Kg	₽	03/19/21 10:14	1
Perfluorobutanesulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	03/19/21 10:14	1
Perfluorobutanoic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	≎	03/19/21 10:14	1
Perfluorodecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₽	03/19/21 10:14	1
Perfluorododecanoic acid	< 0.00046		0.00069	0.00046	0.00046	mg/Kg	≎	03/19/21 10:14	1
Perfluoroheptanoic acid	< 0.00046		0.00069	0.00046	0.00046	mg/Kg	₽	03/19/21 10:14	1
Perfluorohexanesulfonic acid	0.0051		0.00069	0.00046	0.00046	mg/Kg	₽	03/19/21 10:14	1
Perfluorohexanoic acid	0.0013		0.00069	0.00046	0.00046	mg/Kg	☼	03/19/21 10:14	1
Perfluorononanoic acid	< 0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/19/21 10:14	1
Perfluorooctanesulfonic acid	0.017		0.00069	0.00046	0.00046	mg/Kg	₩	03/19/21 10:14	1
Perfluorooctanoic acid	0.0023	M	0.00069	0.00046	0.00046	mg/Kg	☼	03/19/21 10:14	1
Perfluoropentanoic acid	< 0.00046	M	0.00069	0.00046	0.00046	mg/Kg	☼	03/19/21 10:14	1
Perfluorotetradecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₽	03/19/21 10:14	1
Perfluorotridecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₽	03/19/21 10:14	1
Perfluoroundecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/19/21 10:14	•
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepa	ared	Analyzed	Dil Fac

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	115		50 - 150	03/17/21 11:39	03/19/21 10:14	1
M2-8:2 FTS	120		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C2 PFTeDA	93		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C3 PFBS	95		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C4 PFBA	108		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C4 PFHpA	116		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C5 PFPeA	102		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C8 PFOA	113		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C8 PFOS	106		50 - 150	03/17/21 11:39	03/19/21 10:14	1
d3-NMeFOSAA	91		50 - 150	03/17/21 11:39	03/19/21 10:14	1
d5-NEtFOSAA	106		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C2-PFDoDA	104		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C3 PFHxS	110		50 - 150	03/17/21 11:39	03/19/21 10:14	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32605-1 Project/Site: APG PFAS SI

Lab Sample ID: 410-32605-2 Client Sample ID: APG-BLDG-300-2-SO-(0-2)-031521

Date Collected: 03/15/21 11:00 **Matrix: Solid** Date Received: 03/16/21 18:26 Percent Solids: 85.9

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C5 PFHxA	112		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C6 PFDA	111		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C7 PFUnA	109		50 - 150	03/17/21 11:39	03/19/21 10:14	1
13C9 PFNA	111		50 - 150	03/17/21 11:39	03/19/21 10:14	1

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	14.1		1.0		1.0	%		03/17/21 09:28	1
Percent Solids	85.9		1.0		1.0	%		03/17/21 09:28	1

Lab Sample ID: 410-32605-3 Client Sample ID: APG-BLDG-300-1-GW-031521

Date Collected: 03/15/21 09:30 **Matrix: Water**

Date Received: 03/16/21 18:26

Method: FPA 537(Mod) - PFAS for QSM 5.3. Table B-15

Analyte	•	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	58		4.9	3.9	3.9	ng/L		03/19/21 01:13	1
8:2 Fluorotelomer sulfonic acid	<1.9		2.9	1.9	1.9	ng/L		03/19/21 01:13	1
NEtFOSAA	< 0.97		2.9	0.97	0.97	ng/L		03/19/21 01:13	1
NMeFOSAA	<1.2		1.9	1.2	1.2	ng/L		03/19/21 01:13	1
Perfluorobutanesulfonic acid	1.6	J	1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluorobutanoic acid	7.6		4.9	3.9	3.9	ng/L		03/19/21 01:13	1
Perfluorodecanoic acid	<0.97		1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluorododecanoic acid	< 0.97		1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluoroheptanoic acid	8.2		1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluorohexanesulfonic acid	27		1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluorohexanoic acid	19		1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluorononanoic acid	3.5		1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluorooctanesulfonic acid	170		1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluorooctanoic acid	9.7		1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluoropentanoic acid	26		1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluorotetradecanoic acid	<0.97		1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluorotridecanoic acid	< 0.97		1.9	0.97	0.97	ng/L		03/19/21 01:13	1
Perfluoroundecanoic acid	< 0.97		1.9	0.97	0.97	ng/L		03/19/21 01:13	1

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Isotope Dilution	%Recovery Qualifi	er Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	112	50 - 150	03/17/21 09:11	03/19/21 01:13	1
M2-8:2 FTS	111	50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C2 PFTeDA	78	50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C3 PFBS	92	50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C4 PFBA	101	50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C4 PFHpA	107	50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C5 PFPeA	97	50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C8 PFOA	106	50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C8 PFOS	99	50 - 150	03/17/21 09:11	03/19/21 01:13	1
d3-NMeFOSAA	99	50 - 150	03/17/21 09:11	03/19/21 01:13	1
d5-NEtFOSAA	106	50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C2-PFDoDA	95	50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C3 PFHxS	105	50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C5 PFHxA	101	50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C6 PFDA	101	50 - 150	03/17/21 09:11	03/19/21 01:13	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32605-1 Project/Site: APG PFAS SI

Client Sample ID: APG-BLDG-300-1-GW-031521

Lab Sample ID: 410-32605-3

Date Collected: 03/15/21 09:30 **Matrix: Water** Date Received: 03/16/21 18:26

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C7 PFUnA	99		50 - 150	03/17/21 09:11	03/19/21 01:13	1
13C9 PFNA	96		50 - 150	03/17/21 09:11	03/19/21 01:13	1

Client Sample ID: APG-BLDG-300-2-GW-031521 Lab Sample ID: 410-32605-4

Date Received: 03/16/21 18:26

Date Collected: 03/15/21 10:40 **Matrix: Water**

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 LOD Analyte Result Qualifier LOQ DL Unit Dil Fac Analyzed 6:2 Fluorotelomer sulfonic acid 11 5.9 4.8 4.8 ng/L 03/19/21 01:24 8:2 Fluorotelomer sulfonic acid 3.6 2.4 <2.4 2.4 ng/L 03/19/21 01:24 1 **NEtFOSAA** <1.2 3.6 1.2 1.2 ng/L 03/19/21 01:24 NMeFOSAA <1.4 2.4 1.4 1.4 ng/L 03/19/21 01:24 Perfluorobutanesulfonic acid 54 2.4 1.2 1.2 ng/L 03/19/21 01:24 Perfluorobutanoic acid 31 5.9 4.8 4.8 ng/L 03/19/21 01:24 Perfluorodecanoic acid <1.2 2.4 1.2 1.2 ng/L 03/19/21 01:24 Perfluorododecanoic acid <1.2 2.4 1.2 03/19/21 01:24 1.2 ng/L Perfluoroheptanoic acid 36 2.4 1.2 1.2 ng/L 03/19/21 01:24 1.2 350 2.4 1.2 ng/L 03/19/21 01:24 Perfluorohexanesulfonic acid 1.2 ng/L Perfluorohexanoic acid 110 2.4 1.2 03/19/21 01:24 Perfluorononanoic acid 5.5 2.4 1.2 1.2 ng/L 03/19/21 01:24 2.4 1.2 1.2 ng/L 03/19/21 01:24 Perfluorooctanesulfonic acid 220 1.2 Perfluorooctanoic acid 83 M 2.4 1.2 ng/L 03/19/21 01:24 2.4 1.2 1.2 ng/L 03/19/21 01:24 Perfluoropentanoic acid 69 Perfluorotetradecanoic acid 2.4 1.2 03/19/21 01:24 <1.2 1.2 ng/L Perfluorotridecanoic acid 2.4 <1.2 1.2 1.2 ng/L 03/19/21 01:24 Perfluoroundecanoic acid <1.2 2.4 1.2 1.2 ng/L 03/19/21 01:24

Isotope Dilution M2-6:2 FTS M2-8:2 FTS 13C2 PFTeDA 13C3 PFBS 13C4 PFBA 13C4 PFHpA 13C5 PFPeA 13C8 PFOA 13C8 PFOS d3-NMeFOSAA d5-NEtFOSAA 13C2-PFDoDA	11.2	2.7	1.2	1.2 11g/L	00/10/2101.24	
Isotope Dilution	%Recovery Qualifie	er Limits		Prepared	Analyzed	Dil Fac
M2-6:2 FTS	126	50 - 150		03/17/21 09:11	03/19/21 01:24	1
M2-8:2 FTS	118	50 ₋ 150		03/17/21 09:11	03/19/21 01:24	1
13C2 PFTeDA	92	50 - 150		03/17/21 09:11	03/19/21 01:24	1
13C3 PFBS	98	50 - 150		03/17/21 09:11	03/19/21 01:24	1
13C4 PFBA	102	50 ₋ 150		03/17/21 09:11	03/19/21 01:24	1
13C4 PFHpA	105	50 ₋ 150		03/17/21 09:11	03/19/21 01:24	1
13C5 PFPeA	102	50 - 150		03/17/21 09:11	03/19/21 01:24	1
13C8 PFOA	108	50 - 150		03/17/21 09:11	03/19/21 01:24	1
13C8 PFOS	100	50 ₋ 150		03/17/21 09:11	03/19/21 01:24	1
d3-NMeFOSAA	104	50 - 150		03/17/21 09:11	03/19/21 01:24	1
d5-NEtFOSAA	117	50 ₋ 150		03/17/21 09:11	03/19/21 01:24	1
13C2-PFDoDA	102	50 ₋ 150		03/17/21 09:11	03/19/21 01:24	1
13C3 PFHxS	102	50 - 150		03/17/21 09:11	03/19/21 01:24	1
13C5 PFHxA	102	50 ₋ 150		03/17/21 09:11	03/19/21 01:24	1
13C6 PFDA	109	50 ₋ 150		03/17/21 09:11	03/19/21 01:24	1
13C7 PFUnA	109	50 - 150		03/17/21 09:11	03/19/21 01:24	1
13C9 PFNA	101	50 ₋ 150		03/17/21 09:11	03/19/21 01:24	1
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Job ID: 410-32605-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS SI

Client Sample ID: APG-PI-12-1-SO-(0-2)-031521

Lab Sample ID: 410-32605-5 Date Collected: 03/15/21 13:00 **Matrix: Solid** Date Received: 03/16/21 18:26 Percent Solids: 86.6

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	_ D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg	☆	03/19/21 10:25	1
8:2 Fluorotelomer sulfonic acid	<0.0017		0.0031	0.0017	0.0017	mg/Kg	₩	03/19/21 10:25	1
NEtFOSAA	<0.00042		0.0021	0.00042	0.00042	mg/Kg	≎	03/19/21 10:25	1
NMeFOSAA	<0.00042	UJ	0.0021	0.00042	0.00042	mg/Kg	₩	03/19/21 10:25	1
Perfluorobutanesulfonic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg	≎	03/19/21 10:25	1
Perfluorobutanoic acid	< 0.0017		0.0021	0.0017	0.0017	mg/Kg	≎	03/19/21 10:25	1
Perfluorodecanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	₩	03/19/21 10:25	1
Perfluorododecanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	≎	03/19/21 10:25	1
Perfluoroheptanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	≎	03/19/21 10:25	1
Perfluorohexanesulfonic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	₩	03/19/21 10:25	1
Perfluorohexanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	≎	03/19/21 10:25	1
Perfluorononanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	≎	03/19/21 10:25	1
Perfluorooctanesulfonic acid	0.0030		0.00063	0.00042	0.00042	mg/Kg	⇔	03/19/21 10:25	1
Perfluorooctanoic acid	< 0.00042	M	0.00063	0.00042	0.00042	mg/Kg	≎	03/19/21 10:25	1
Perfluoropentanoic acid	0.00066	M	0.00063	0.00042	0.00042	mg/Kg	≎	03/19/21 10:25	1
Perfluorotetradecanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	⇔	03/19/21 10:25	1
Perfluorotridecanoic acid	< 0.00042		0.00063	0.00042	0.00042	mg/Kg	≎	03/19/21 10:25	1
Perfluoroundecanoic acid	<0.00042		0.00063	0.00042	0.00042	mg/Kg	☼	03/19/21 10:25	1
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepar	ed	Analyzed	Dil Fac
M2-6:2 FTS	107		50 - 150			03/17/21	11:39	03/19/21 10:25	1
M2-8:2 FTS	110		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C2 PFTeDA	87		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C3 PFBS	91		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C4 PFBA	99		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C4 PFHpA	108		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C5 PFPeA	94		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C8 PFOA	106		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C8 PFOS	99		50 - 150			03/17/21	11:39	03/19/21 10:25	1
d3-NMeFOSAA	41 *5	-	50 - 150			03/17/21	11:39	03/19/21 10:25	1
d5-NEtFOSAA	54		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C2-PFDoDA	103		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C3 PFHxS	104		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C5 PFHxA	103		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C6 PFDA	106		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C7 PFUnA	103		50 - 150			03/17/21	11:39	03/19/21 10:25	1
13C9 PFNA	105		50 - 150			02/17/21	11.20	03/19/21 10:25	1

Method: EPA 537(M	lod) - PFAS for QSM 5.3,	Table B-15 - RE
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Analyte	Result Qual	alifier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017	0.0021	0.0017	0.0017	mg/Kg	\$	03/24/21 14:00	1
8:2 Fluorotelomer sulfonic acid	<0.0017	0.0032	0.0017	0.0017	mg/Kg	₽	03/24/21 14:00	1
NEtFOSAA	<0.00042	0.0021	0.00042	0.00042	mg/Kg	₽	03/24/21 14:00	1
NMeFOSAA	<0.00042	0.0021	0.00042	0.00042	mg/Kg	₽	03/24/21 14:00	1
Perfluorobutanesulfonic acid	<0.0017	0.9021	0.0017	0.0017	mg/Kg	₽	03/24/21 14:00	1
Perfluorobutanoic acid	<0.0017 M	0.0021	0.0017	0.0017	mg/Kg	₽	03/24/21 14:00	1
Perfluorodecanoic acid	<0.00042	0.00064	0.00042	0.00042	mg/Kg	₽	03/24/21 14:00	1
Perfluorododecanoic acid	<0.00042	0.00064	0.00042	0.00042	mg/Kg	Ď.	03/24/21 14:00	1
Perfluoroheptanoic acid	<0.00042	0.00064	0.00042	0.00042	mg/Kg	₽	03/24/21 14:00	1
Perfluorohexanesulfonic acid	<0.00042	0.00064	0.00042	0.00042	mg/Kg	₽	03/24/21 14:00	+

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Client: ARCADIS U.S., Inc. Job ID: 410-32605-1

Project/Site: APG PFAS SI

2.36 mm

Client Sample ID: APG-PI-12-1-SO-(0-2)-031521 Lab Sample ID: 410-32605-5

Date Collected: 03/15/21 13:00

Matrix: Solid

Date Received: 03/16/21 18:26

Matrix: Solid

Percent Solids: 86.6

Analyte	S for QSM 5.3, Result	Qualifier	LOQ	LOD	DI	Unit	D	Analyzed	Dil F
Perfluorohexanoic acid	<0.00042	Guuinioi	0.00064	0.00042	0.00042		- -	03/24/21 14:00	
Perfluorononanoic acid	<0.00042		0.00064	0.00042	0.00042		~ ☆	03/24/21 14:00	
Perfluorooctanesulfonic acid	0.0020		0.00064	0.00042	0.00042		∵. #	03/24/21 14:00	
Perfluorooctanoic acid	<0.00042	M	0.00064	0.00042	0.00042		~ ☆	03/24/21 14:00	
Perfluoropentanoic acid	0.00042		0.00064	0.00042	0.00042		≎	03/24/21 14:00	
erfluorotetradecanoic acid	<0.00042	J W	0.00064	0.00042	0.00042		~ . \$	03/24/21 14:00	
Perfluorotettadecarioic acid	<0.00042		0.00064	0.00042	0.00042		₩	03/24/21 14:00	
erfluoroundecanoic acid	< 0.00042		0.00064	0.00042	0.00042		₩	03/24/21 14:00	
				0.00042	0.00042	mg/rxg	340	03/24/21 14.00	
sotope Dilution	%Recovery Qu	alifier	Limits			Prepare		Analyzed	Dil F
12-6:2 FTS	111		50 - 150			03/23/21 2		03/24/21 14:00	
12-8:2 FTS	85		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
3C2 PFTeDA	78		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
3C3 PFBS	96		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
3C4 PFBA	81		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
3C4 PFHpA	90		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
BC5 PFPeA	82		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
BC8 PFOA	95		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
BC8 PFOS	102		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
3-NMeFOSAA	23 *5-		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
5-NEtFOSAA	31 *5-		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
BC2-PFDoDA	88		50 ₋ 150			03/23/21 2	0.31	03/24/21 14:00	
3C3 PFHxS	107		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
3C5 PFHxA	85		50 ₋ 150			03/23/21 2	0:31	03/24/21 14:00	
BC6 PFDA	91		50 - 150			03/23/21 2	0:31	03/24/21 14:00	
3C7 PFUnA	89		50 - 150					03/24/21 14:00	1
3C9 PFNA	88		50 - 150					03/24/21 14:00	
Canaval Chamiatmy									
General Chemistry	Posult	Qualifier	LOQ	LOD	DI.	Unit	D	Analyzod	Dil F
nalyte			1750	1170			- "	Analyzed 03/18/21 17:43	5
otal Organic Carbon	2670	J-		1170	1170		1, t		5
ercent Moisture	13.4		1.0		1.0			03/17/21 09:28	
ercent Solids	86.6		1.0		1.0	%		03/17/21 09:28	
eneral Chemistry - Soluble									
nalyte		Qualifier	LOQ	LOD		Unit	_ D	Analyzed	Dil
Н	7.0	J	0.01	0.01	0.01	S.U.		03/23/21 19:22	
emperature	20.5		0.01	0.01	0.01	Degrees C		03/23/21 19:22	
lethod: D422 - Grain Size									
nalyte		Qualifier	LOQ	LOD		Unit	_ D	Analyzed	Dil
ravel	12.6		1.0	1.0	1.0	%		03/23/21 01:00	
and	45.8		1.0	1.0	1.0	%		03/23/21 01:00	
lt	29.7		1.0	1.0	1.0	%		03/23/21 01:00	
lay	12.0		1.0	1.0	1.0	%		03/23/21 01:00	
5 mm	100.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	
7.5 mm	100.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	
9 mm	95.8		1.0	1.0	1.0	% Passing		03/23/21 01:00	
.75 mm	87.5		1.0	1.0	1.0	% Passing		03/23/21 01:00	
3.35 mm	87.3		1.0	1.0	1.0	% Passing		03/23/21 01:00	

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03/23/21 01:00

1.0 % Passing

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1.0

1.0

87.2

2

3

5

7

9

11

13

14

16

4/1/2021

Job ID: 410-32605-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS SI

Client Sample ID: APG-PI-12-1-SO-(0-2)-031521

Lab Sample ID: 410-32605-5 Date Collected: 03/15/21 13:00 **Matrix: Solid** Date Received: 03/16/21 18:26 Percent Solids: 86.6

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
1.18 mm	87.1		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.6 mm	81.7		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.3 mm	58.7		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.15 mm	45.4		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.075 mm	41.7		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.064 mm	40.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.05 mm	36.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.02 mm	23.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.005 mm	12.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.002 mm	5.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.001 mm	3.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1

Client Sample ID: APG-PI-12-1-GW-031521

Lab Sample ID: 410-32605-6 Date Collected: 03/15/21 13:40 Date Received: 03/16/21 18:26

Analyte	Result (Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
NEtFOSAA	<1.2		3.6	1.2	1.2	ng/L		03/25/21 08:03	1
NMeFOSAA	<1.4		2.4	1.4	1.4	ng/L		03/25/21 08:03	1
Perfluorobutanesulfonic acid	47		2.4	1.2	1.2	ng/L		03/25/21 08:03	1
Perfluorobutanoic acid	370		6.0	4.8	4.8	ng/L		03/25/21 08:03	1
Perfluorodecanoic acid	48		2.4	1.2	1.2	ng/L		03/25/21 08:03	1
Perfluorododecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/25/21 08:03	1
Perfluorononanoic acid	120		2.4	1.2	1.2	ng/L		03/25/21 08:03	1
Perfluorooctanoic acid	330		2.4	1.2	1.2	ng/L		03/25/21 08:03	1
Perfluorotetradecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/25/21 08:03	1
Perfluorotridecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/25/21 08:03	1
Perfluoroundecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/25/21 08:03	1

Periluoroundecanoic acid	<1	.2	2.4	1.2	1.2 ng]/L	03/25/21 08:03	1
Isotope Dilution	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	87		50 - 150			03/24/21 07:53	03/25/21 08:03	1
M2-8:2 FTS	78		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C2 PFTeDA	59		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C3 PFBS	75		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C4 PFBA	71		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C4 PFHpA	75		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C5 PFPeA	65		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C8 PFOA	72		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C8 PFOS	51		50 - 150			03/24/21 07:53	03/25/21 08:03	1
d3-NMeFOSAA	82		50 - 150			03/24/21 07:53	03/25/21 08:03	1
d5-NEtFOSAA	86		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C2-PFDoDA	70		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C3 PFHxS	72		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C5 PFHxA	69		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C6 PFDA	68		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C7 PFUnA	78		50 - 150			03/24/21 07:53	03/25/21 08:03	1
13C9 PFNA	54		50 - 150			03/24/21 07:53	03/25/21 08:03	1

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Matrix: Water

Client: ARCADIS U.S., Inc. Job ID: 410-32605-1

Client Sample ID: APG-PI-12-1-GW-031521

Project/Site: APG PFAS SI

13C3 PFHxS

13C5 PFHxA

Lab Sample ID: 410-32605-6

Date Collected: 03/15/21 13:40 **Matrix: Water** Date Received: 03/16/21 18:26

Method: EPA 537(Mod) - PFA	•								
Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit [) Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	1900	D		60	48	48	ng/L	03/25/21 08:15	10
8:2 Fluorotelomer sulfonic acid	1600	D		36	24	24	ng/L	03/25/21 08:15	10
Perfluoroheptanoic acid	650	D		24	12	12	ng/L	03/25/21 08:15	10
Perfluorohexanesulfonic acid	610	D		24	12	12	ng/L	03/25/21 08:15	10
Perfluorohexanoic acid	1200	D		24	12	12	ng/L	03/25/21 08:15	10
Perfluorooctanesulfonic acid	3000	D		24	12	12	ng/L	03/25/21 08:15	10
Perfluoropentanoic acid	1700	D		24	12	12	ng/L	03/25/21 08:15	10
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	128		50 - 150				03/24/21 07:53	03/25/21 08:15	10
M2-8:2 FTS	99		50 - 150				03/24/21 07:53	3 03/25/21 08:15	10
13C4 PFHpA	91		50 - 150				03/24/21 07:53	3 03/25/21 08:15	10
13C5 PFPeA	83		50 - 150				03/24/21 07:53	3 03/25/21 08:15	10
13C8 PFOS	85		50 - 150				03/24/21 07:53	3 03/25/21 08:15	10

Client Sample ID: APG-PI-12-2-SO-(0-2)-031521

87

86

Date Collected: 03/15/21 14:00 Matrix: Solid Date Received: 03/16/21 18:26 Percent Solids: 89.3

50 - 150

50 - 150

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0016		0.0020	0.0016	0.0016	mg/Kg	*	03/19/21 10:36	1
8:2 Fluorotelomer sulfonic acid	<0.0016		0.0031	0.0016	0.0016	mg/Kg	⇔	03/19/21 10:36	1
NEtFOSAA	< 0.00041	UJ	0.0020	0.00041	0.00041	mg/Kg	⇔	03/19/21 10:36	1
NMeFOSAA	<0.00041	UJ	0.0020	0.00041	0.00041	mg/Kg	₩	03/19/21 10:36	1
Perfluorobutanesulfonic acid	<0.0016		0.0020	0.0016	0.0016	mg/Kg	₩	03/19/21 10:36	1
Perfluorobutanoic acid	<0.0016		0.0020	0.0016	0.0016	mg/Kg	☆	03/19/21 10:36	1
Perfluorodecanoic acid	0.0038		0.00061	0.00041	0.00041	mg/Kg	₩	03/19/21 10:36	1
Perfluorododecanoic acid	<0.00041		0.00061	0.00041	0.00041	mg/Kg	₩	03/19/21 10:36	1
Perfluoroheptanoic acid	< 0.00041		0.00061	0.00041	0.00041	mg/Kg	☆	03/19/21 10:36	1
Perfluorohexanesulfonic acid	<0.00041		0.00061	0.00041	0.00041	mg/Kg	₩	03/19/21 10:36	1
Perfluorohexanoic acid	< 0.00041		0.00061	0.00041	0.00041	mg/Kg	☆	03/19/21 10:36	1
Perfluorononanoic acid	0.0011		0.00061	0.00041	0.00041	mg/Kg	☆	03/19/21 10:36	1
Perfluorooctanesulfonic acid	0.0077		0.00061	0.00041	0.00041	mg/Kg	₩	03/19/21 10:36	1
Perfluorooctanoic acid	< 0.00041		0.00061	0.00041	0.00041	mg/Kg	☆	03/19/21 10:36	1
Perfluoropentanoic acid	< 0.00041	M	0.00061	0.00041	0.00041	mg/Kg	☆	03/19/21 10:36	1
Perfluorotetradecanoic acid	<0.00041		0.00061	0.00041	0.00041	mg/Kg	₩	03/19/21 10:36	1
Perfluorotridecanoic acid	< 0.00041		0.00061	0.00041	0.00041	mg/Kg	☆	03/19/21 10:36	1
Perfluoroundecanoic acid	0.00072		0.00061	0.00041	0.00041	mg/Kg	₩	03/19/21 10:36	1
Isotope Dilution	%Recovery Qu	ıalifier	Limits			Prep	ared	Analyzed	Dil Fac

isotope Dilution	%Recovery	Qualitier	Limits	Prepared	Anaiyzea	DII Fac
M2-6:2 FTS	99		50 - 150	03/17/21 11:39	03/19/21 10:36	1
M2-8:2 FTS	100		50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C2 PFTeDA	84		50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C3 PFBS	86		50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C4 PFBA	92		50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C4 PFHpA	104		50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C5 PFPeA	87		50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C8 PFOA	101		50 - 150	03/17/21 11:39	03/19/21 10:36	1

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03/24/21 07:53 03/25/21 08:15

03/24/21 07:53 03/25/21 08:15

Lab Sample ID: 410-32605-7

Client: ARCADIS U.S., Inc. Job ID: 410-32605-1 Project/Site: APG PFAS SI

Client Sample ID: APG-PI-12-2-SO-(0-2)-031521

Lab Sample ID: 410-32605-7 Date Collected: 03/15/21 14:00 **Matrix: Solid** Date Received: 03/16/21 18:26 Percent Solids: 89.3

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C8 PFOS	94		50 - 150	03/17/21 11:39	03/19/21 10:36	1
d3-NMeFOSAA	27	*5-	50 - 150	03/17/21 11:39	03/19/21 10:36	1
d5-NEtFOSAA	36	*5-	50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C2-PFDoDA	93		50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C3 PFHxS	102		50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C5 PFHxA	96		50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C6 PFDA	98		50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C7 PFUnA	94		50 - 150	03/17/21 11:39	03/19/21 10:36	1
13C9 PFNA	96		50 - 150	03/17/21 11:39	03/19/21 10:36	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg	-	03/24/21 14:11	1
8:2 Fluorotelomer sulfonic acid	0.0030	J	0.0031	0.0017	0.0017	mg/Kg	☆	03/24/21 14:11	1
NEtFOSAA	< 0.00041		0.0021	0.00041	0.00041	mg/Kg	☆	03/24/21 14:11	1
NMeFOSAA	<0.00041		0.0021	0.00041	0.00041	mg/Kg	≎	03/24/21 14:11	1
Perfluorobutanesulfonic acid	< 0.0017		0.0021	0.0017	0.0017	mg/Kg	≎	03/24/21 14:11	1
Perfluorobutanoic acid	< 0.0017	M	0.0021	0.0017	0.0017	mg/Kg	≎	03/24/21 14:11	1
Perfluorodecanoic acid	0.0037		0.00062	0.00041	0.00041	mg/Kg	≎	03/24/21 14:11	1
Perfluorododecanoic acid	0.00076		0.00062	0.00041	0.00041	mg/Kg	≎	03/24/21 14:11	1
Perfluoroheptanoic acid	<0.00041		0.00062	0.00041	0.00041	mg/Kg	☼	03/24/21 14:11	1
Perfluorohexanesulfonic acid	0.00048	J	0.00062	0.00041	0.00041	mg/Kg	≎	03/24/21 14:11	1
Perfluorohexanoic acid	<0.00041	M	0.00062	0.00041	0.00041	mg/Kg	☼	03/24/21 14:11	1
Perfluorononanoic acid	0.0812		0.00062	0.00041	0.00041	mg/Kg	☼	03/24/21 14:11	1
Perfluorooctanesulfonic acid	0.0077		0.00062	0.00041	0.00041	mg/Kg	≎	03/24/21 14:11	1
Perfluorooctanoic acid	< 0.00041	M	0.00062	0.00041	0.00041	mg/Kg	☼	03/24/21 14:11	1
Perfluoropentanoic acid	0.00066	M	0.00062	0.00041	0.00041	mg/Kg	≎	03/24/21 14:11	1
Perfluorotetradecanoic acid	<0.00041		0.00062	0.00041	0.00041	mg/Kg	₩	03/24/21 14:11	1
Perfluorotridecanoic acid	< 0.00041		0.00062	0.00041	0.00041	mg/Kg	≎	03/24/21 14:11	1
Perfluoroundecanoic acid	0.00073		0.00062	0.00041	0.00041	mg/Kg	≎	03/24/21 14:11	1

Isotope Dilution	%Recovery	Qualifier Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	83	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
M2-8:2 FTS	62	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C2 PFTeDA	60	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C3 PFBS	71	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C4 PFBA	66	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C4 PFHpA	73	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C5 PFPeA	65	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C8 PFOA	74	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C8 PFOS	77	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
d3-NMeFOSAA	16 *	*5- 50 <i>-</i> 150	03/23/21 28:	31 03/24/21 14:11	1
d5-NEtFOSAA	20 '	*5- 50 ₋ 150	03/23/21 20:	31 03/24/21 14:11	1
13C2-PFDoDA	67	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C3 PFHxS	82	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C5 PFHxA	68	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C6 PFDA	69	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C7 PFUnA	67	50 - 150	03/23/21 20:	31 03/24/21 14:11	1
13C9 PFNA	70	50 - 150	03/23/21 20:	31 03/24/21 14:11	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32605-1 Project/Site: APG PFAS SI

Client Sample ID: APG-PI-12-2-SO-(0-2)-031521

Lab Sample ID: 410-32605-7 Date Collected: 03/15/21 14:00 **Matrix: Solid** Date Received: 03/16/21 18:26 Percent Solids: 89.3

General Chemistry								
Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	10.7	1.0		1.0	%		03/17/21 09:28	1
Percent Solids	89.3	1.0		1.0	%		03/17/21 09:28	1

Lab Sample ID: 410-32605-8 Client Sample ID: APG-FB-04-031521 **Matrix: Water**

Date Collected: 03/15/21 15:00 Date Received: 03/16/21 18:26

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5	4.4	3.5	3.5	ng/L		03/19/21 02:19	1
8:2 Fluorotelomer sulfonic acid	<1.8	2.6	1.8	1.8	ng/L		03/19/21 02:19	1
NEtFOSAA	<0.88	2.6	0.88	0.88	ng/L		03/19/21 02:19	1
NMeFOSAA	<1.1	1.8	1.1	1.1	ng/L		03/19/21 02:19	1
Perfluorobutanesulfonic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1
Perfluorobutanoic acid	<3.5	4.4	3.5	3.5	ng/L		03/19/21 02:19	1
Perfluorodecanoic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1
Perfluorododecanoic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1
Perfluoroheptanoic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1
Perfluorohexanesulfonic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1
Perfluorohexanoic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1
Perfluorononanoic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1
Perfluorooctanesulfonic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1
Perfluorooctanoic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1
Perfluoropentanoic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1
Perfluorotetradecanoic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1
Perfluorotridecanoic acid	<0.88	1.8	0.88	0.88	ng/L		03/19/21 02:19	1

							J.		
Perfluoroundecanoic acid	<0.8	38	1.8	8	0.88	0.88	ng/L	03/19/21 02:19	1
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	121		50 - 150				03/17/21 09:11	03/19/21 02:19	1
M2-8:2 FTS	131		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C2 PFTeDA	91		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C3 PFBS	102		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C4 PFBA	107		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C4 PFHpA	118		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C5 PFPeA	102		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C8 PFOA	115		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C8 PFOS	105		50 - 150				03/17/21 09:11	03/19/21 02:19	1
d3-NMeFOSAA	103		50 - 150				03/17/21 09:11	03/19/21 02:19	1
d5-NEtFOSAA	119		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C2-PFDoDA	100		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C3 PFHxS	113		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C5 PFHxA	109		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C6 PFDA	110		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C7 PFUnA	107		50 - 150				03/17/21 09:11	03/19/21 02:19	1
13C9 PFNA	106		50 - 150				03/17/21 09:11	03/19/21 02:19	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32605-1

Project/Site: APG PFAS SI

Temperature

Client Sample ID: APG-PI-Minefield-1-SO-(0-2)-031521 Lab Sample ID: 410-32605-9

Date Collected: 03/15/21 15:05

Matrix: Solid

Parcent Solids: 89 1

ate Received: 03/16/21 18:26							Percent Solid	13. 03.
Method: EPA 537(Mod) - PFA Analyte	•	Table B-1 Qualifier	l5 LOQ	LOD	DL	Unit D	Analyzed	Dil Fa
6:2 Fluorotelomer sulfonic acid	0.0021		0.0021	0.0016	0.0016	mg/Kg	03/19/21 10:47	
3:2 Fluorotelomer sulfonic acid	0.018		0.0031	0.0016		mg/Kg ☆	03/19/21 10:47	
NEtFOSAA	< 0.00041		0.0021	0.00041	0.00041	mg/Kg ☆	03/19/21 10:47	
NMeFOSAA	<0.00041		0.0021	0.00041	0.00041		03/19/21 10:47	
Perfluorobutanesulfonic acid	<0.0016		0.0021	0.0016		mg/Kg ☆	03/19/21 10:47	
Perfluorobutanoic acid	<0.0016		0.0021	0.0016		mg/Kg ☆	03/19/21 10:47	
Perfluorodecanoic acid	0.0059		0.00062	0.00041	0.00041		03/19/21 10:47	
Perfluorododecanoic acid	0.0063		0.00062	0.00041	0.00041		03/19/21 10:47	
Perfluoroheptanoic acid	0.00050	J	0.00062	0.00041	0.00041		03/19/21 10:47	
Perfluorohexanesulfonic acid	<0.00041		0.00062	0.00041	0.00041		03/19/21 10:47	
Perfluorohexanoic acid	0.00091		0.00062	0.00041	0.00041		03/19/21 10:47	
Perfluorononanoic acid	0.00077		0.00062	0.00041	0.00041	0 0	03/19/21 10:47	
Perfluorooctanesulfonic acid	0.00093		0.00062	0.00041	0.00041			
Perfluorooctanoic acid	0.0011		0.00062	0.00041	0.00041		03/19/21 10:47	
Perfluoropentanoic acid	0.00059	J M	0.00062	0.00041	0.00041			
Perfluorotetradecanoic acid	0.0025		0.00062	0.00041	0.00041			
Perfluorotridecanoic acid	0.0014		0.00062	0.00041	0.00041		03/19/21 10:47	
Perfluoroundecanoic acid	0.0048		0.00062	0.00041	0.00041			
sotope Dilution	%Recovery Qu	ıalifier	Limits			Prepared	Analyzed	Dil Fa
12-6:2 FTS	113	-	50 - 150				03/19/21 10:47	
M2-8:2 FTS	112		50 - 150				03/19/21 10:47	
13C2 PFTeDA	87		50 ₋ 150				03/19/21 10:47	
13C3 PFBS	92		50 - 150				03/19/21 10:47	
13C4 PFBA	98		50 - 150				03/19/21 10:47	
13C4 PFHpA	106		50 ₋ 150				03/19/21 10:47	
13C5 PFPeA	90		50 - 150				03/19/21 10:47	
13C8 PFOA	108		50 - 150				03/19/21 10:47	
13C8 PFOS	103		50 - 150				03/19/21 10:47	
d3-NMeFOSAA	74		50 - 150				03/19/21 10:47	
d5-NEtFOSAA	88		50 - 150				03/19/21 10:47	
13C2-PFDoDA	95		50 - 150				03/19/21 10:47	
13C3 PFHxS	106		50 - 150				03/19/21 10:47	
13C5 PFHxA	105		50 - 150				03/19/21 10:47	
13C6 PFDA	108		50 - 150				03/19/21 10:47	
13C7 PFUnA	100		50 - 150				03/19/21 10:47	
13C9 PFNA	102		50 - 150 50 - 150				03/19/21 10:47	
			00 = 700			00/1//2/ ///00	00/10/2/10/1/	
General Chemistry	_							
Analyte		Qualifier	LOQ	LOD		Unit D		Dil Fa
Total Organic Carbon	4000	J-	2590	1730		mg/Kg ⇔		7.6
Percent Moisture	10.9		1.0		1.0		03/17/21 09:28	
Percent Solids	89.1		1.0		1.0	%	03/17/21 09:28	
General Chemistry - Soluble								
Analyte		Qualifier	LOQ	LOD		Unit D	Analyzed	Dil Fa
рН	7.2	J	0.01	0.01	0.01	S.U.	03/23/21 19:22	
T	04.4		0.01	0.04	0.01	Degrees C	02/22/24 40:22	

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03/23/21 19:22

0.01 Degrees C

0.01

21.1

0.01

3

5

8

11

13

14

15

4/1/2021

Client: ARCADIS U.S., Inc. Job ID: 410-32605-1 Project/Site: APG PFAS SI

Client Sample ID: APG-PI-Minefield-1-SO-(0-2)-031521

Lab Sample ID: 410-32605-9 Date Collected: 03/15/21 15:05 **Matrix: Solid** Percent Solids: 89.1 Date Received: 03/16/21 18:26

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	44.5		1.0	1.0	1.0	%	_	03/23/21 01:00	1
Sand	36.7		1.0	1.0	1.0	%		03/23/21 01:00	1
Silt	16.8		1.0	1.0	1.0	%		03/23/21 01:00	1
Clay	2.0		1.0	1.0	1.0	%		03/23/21 01:00	1
75 mm	100.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
19 mm	92.5		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
4.75 mm	55.5		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
3.35 mm	53.6		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
2.36 mm	52.4		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
1.18 mm	51.3		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.6 mm	42.4		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.3 mm	34.7		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.15 mm	26.5		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.075 mm	18.8		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.064 mm	17.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.05 mm	13.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.02 mm	5.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.005 mm	2.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.002 mm	2.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.001 mm	2.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1

Client Sample ID: APG-PI-Minefield-2-SO-(0-2)-031521 Lab Sample ID: 410-32605-10

Date Collected: 03/15/21 15:15 **Matrix: Solid** Date Received: 03/16/21 18:26 Percent Solids: 92.7

Analyte	Result C	Qualifier LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017	0.0021	0.0017	0.0017	mg/Kg	03/19/21 10:59	1
8:2 Fluorotelomer sulfonic acid	<0.0017	0.0031	0.0017	0.0017	mg/Kg ⇔	03/19/21 10:59	1
NEtFOSAA	<0.00042	0.0021	0.00042	0.00042	mg/Kg ⇔	03/19/21 10:59	1
NMeFOSAA	<0.00042	0.0021	0.00042	0.00042	mg/Kg ☆	03/19/21 10:59	1
Perfluorobutanesulfonic acid	<0.0017	0.0021	0.0017	0.0017	mg/Kg ☆	03/19/21 10:59	1
Perfluorobutanoic acid	<0.0017	0.0021	0.0017	0.0017	mg/Kg ☆	03/19/21 10:59	1
Perfluorodecanoic acid	<0.00042	0.00063	0.00042	0.00042	mg/Kg ⇔	03/19/21 10:59	1
Perfluorododecanoic acid	0.0014	0.00063	0.00042	0.00042	mg/Kg ⇔	03/19/21 10:59	1
Perfluoroheptanoic acid	<0.00042	0.00063	0.00042	0.00042	mg/Kg ☆	03/19/21 10:59	1
Perfluorohexanesulfonic acid	<0.00042	0.00063	0.00042	0.00042	mg/Kg ☆	03/19/21 10:59	1
Perfluorohexanoic acid	<0.00042	0.00063	0.00042	0.00042	mg/Kg ☆	03/19/21 10:59	1
Perfluorononanoic acid	<0.00042	0.00063	0.00042	0.00042	mg/Kg ☆	03/19/21 10:59	1
Perfluorooctanesulfonic acid	0.0020	0.00063	0.00042	0.00042	mg/Kg ☆	03/19/21 10:59	1
Perfluorooctanoic acid	<0.00042	0.00063	0.00042	0.00042	mg/Kg ☆	03/19/21 10:59	1
Perfluoropentanoic acid	<0.00042	0.00063	0.00042	0.00042	mg/Kg ⇔	03/19/21 10:59	1
Perfluorotetradecanoic acid	0.00088	0.00063	0.00042	0.00042	mg/Kg ☆	03/19/21 10:59	1
Perfluorotridecanoic acid	0.00058 J	0.00063	0.00042	0.00042	mg/Kg ☆	03/19/21 10:59	1
Perfluoroundecanoic acid	0.00088	0.00063	0.00042	0.00042	mg/Kg ⇔	03/19/21 10:59	1
Isotope Dilution	%Recovery Qua	alifier Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	108	50 - 150			03/17/21 11:39	03/19/21 10:59	1
M2-8:2 FTS	101	50 - 150			03/17/21 11:39	03/19/21 10:59	1
13C2 PFTeDA	86	50 ₋ 150			03/17/21 11:39	03/19/21 10:59	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32605-1 Project/Site: APG PFAS SI

Client Sample ID: APG-PI-Minefield-2-SO-(0-2)-031521

Lab Sample ID: 410-32605-10 Date Collected: 03/15/21 15:15 **Matrix: Solid** Date Received: 03/16/21 18:26 Percent Solids: 92.7

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 PFBS	90	50 - 150	03/17/21 11:39	03/19/21 10:59	1
13C4 PFBA	92	50 - 150	03/17/21 11:39	03/19/21 10:59	1
13C4 PFHpA	103	50 - 150	03/17/21 11:39	03/19/21 10:59	1
13C5 PFPeA	88	50 - 150	03/17/21 11:39	03/19/21 10:59	1
13C8 PFOA	103	50 - 150	03/17/21 11:39	03/19/21 10:59	1
13C8 PFOS	98	50 - 150	03/17/21 11:39	03/19/21 10:59	1
d3-NMeFOSAA	63	50 - 150	03/17/21 11:39	03/19/21 10:59	1
d5-NEtFOSAA	83	50 - 150	03/17/21 11:39	03/19/21 10:59	1
13C2-PFDoDA	97	50 - 150	03/17/21 11:39	03/19/21 10:59	1
13C3 PFHxS	104	50 - 150	03/17/21 11:39	03/19/21 10:59	1
13C5 PFHxA	99	50 - 150	03/17/21 11:39	03/19/21 10:59	1
13C6 PFDA	98	50 - 150	03/17/21 11:39	03/19/21 10:59	1
13C7 PFUnA	98	50 - 150	03/17/21 11:39	03/19/21 10:59	1
13C9 PFNA	101	50 ₋ 150	03/17/21 11:39	03/19/21 10:59	1

General Chemistry

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
Percent Moisture	7.3	1.0		1.0 %	0	3/17/21 09:28	1
Percent Solids	92.7	1.0		1.0 %	0	3/17/21 09:28	1

Client Sample ID: APG-PI-Minefield-1-GW-031521

Lab Sample ID: 410-32605-11 Date Collected: 03/15/21 15:15 **Matrix: Water** Date Received: 03/16/21 18:26

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	29		5.9	4.7	4.7	ng/L		03/19/21 02:30	1
8:2 Fluorotelomer sulfonic acid	6.4		3.5	2.4	2.4	ng/L		03/19/21 02:30	1
NEtFOSAA	<1.2		3.5	1.2	1.2	ng/L		03/19/21 02:30	1
NMeFOSAA	<1.4		2.4	1.4	1.4	ng/L		03/19/21 02:30	1
Perfluorobutanesulfonic acid	7.6		2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluorobutanoic acid	64		5.9	4.7	4.7	ng/L		03/19/21 02:30	1
Perfluorodecanoic acid	17		2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluorododecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluoroheptanoic acid	140		2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluorohexanesulfonic acid	53		2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluorohexanoic acid	140		2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluorononanoic acid	82		2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluorooctanesulfonic acid	260		2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluorooctanoic acid	160	M	2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluoropentanoic acid	180		2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluorotetradecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluorotridecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/19/21 02:30	1
Perfluoroundecanoic acid	2.1	J	2.4	1.2	1.2	ng/L		03/19/21 02:30	1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	116	50 - 150	03/17/21 09:11	03/19/21 02:30	1
M2-8:2 FTS	108	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C2 PFTeDA	83	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C3 PFBS	84	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C4 PFBA	90	50 - 150	03/17/21 09:11	03/19/21 02:30	1

Eurofins Lancaster Laboratories Env, LLC

Client: ARCADIS U.S., Inc. Job ID: 410-32605-1 Project/Site: APG PFAS SI

Client Sample ID: APG-PI-Minefield-1-GW-031521

Lab Sample ID: 410-32605-11

Matrix: Water

Date Collected: 03/15/21 15:15 Date Received: 03/16/21 18:26

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFHpA	100	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C5 PFPeA	84	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C8 PFOA	94	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C8 PFOS	88	50 - 150	03/17/21 09:11	03/19/21 02:30	1
d3-NMeFOSAA	92	50 - 150	03/17/21 09:11	03/19/21 02:30	1
d5-NEtFOSAA	113	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C2-PFDoDA	87	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C3 PFHxS	96	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C5 PFHxA	93	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C6 PFDA	100	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C7 PFUnA	95	50 - 150	03/17/21 09:11	03/19/21 02:30	1
13C9 PFNA	88	50 ₋ 150	03/17/21 09:11	03/19/21 02:30	1



Aberdeen Proving Ground - Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDG # 410-32720-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report #41219R1

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-32720-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

			Sample		Analysis		
Sample ID	Lab ID	Matrix	Collection Date	Parent Sample	PFAS	тос	рН
APG-AA5-1-GW-031621	410-32720-1	Water	3/16/2021		Х		
APG-AA5-1-SE-031621	410-32720-2	Sediment	3/16/2021		Х		
APG-DUP-05-031621	410-32720-3	Soil	3/16/2021	APG-AA5-1-SE- 031621	X		
APG-FUZE-1-GW-031621	410-32720-4	Water	3/16/2021		Х		
APG-FUZE-1-SW-031621	410-32720-5	Water	3/16/2021		Х		
APG-FUZE-1-SE-031621	410-32720-6	Sediment	3/16/2021		Х		
APG-DUP-06-031621	410-32720-7	Water	3/16/2021	APG-FUZE-1-SW- 031621	X		
APG-BAF-S6-1-SO-(0-2)-031621	410-32720-8	Soil	3/16/2021		Х	Х	Х
APG-BAF-S6-1-GW-031621	410-32720-9	Water	3/16/2021		Х		
APG-EF15-1-GW-031621	410-32720-10	Water	3/16/2021		Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-AA5-1-GW-031621.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was performed on samples APG-AA5-1-SE-031621 and APG-FUZE-1-SW-031621.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Reported		Performance Acceptable		Not
Items Reviewed	No	Yes	No	Yes	Required
Sample receipt condition		Х		Х	
Requested analyses and sample results		Х		Х	
Master tracking list		Х		Х	
4. Methods of analysis		Х		Х	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
9. Sample preparation/extraction/analysis dates		Х		X	
10. Fully executed Chain-of-Custody (COC) form		Х		X	
11. Narrative summary of QA or sample problems provided		Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
APG-AA5-1-GW-031621 DL	M2-6:2 FTS	6:2 Fluorotelomer sulfonic acid	>150%	NA
APG-FUZE-1-GW-031621 DL	M2-6:2 FTS	6:2 Fluorotelomer sulfonic acid	>150%	>150%
APG-FUZE-1-SW-031621	13C2 PFTeDA	Perfluorotetradecanoic acid	< 50% but > 20%	< 50% but > 20% (MS/MSD)
APG-DUP-06-031621	13C2 PFTeDA	Perfluorotetradecanoic acid	< 50% but > 20%	< 50% but > 20%
	M2-6:2 FTS	6:2- Fluorotelomersulfonate	< 50% but > 20%	< 50% but > 20%
	M2-8:2 FTS	8:2- Fluorotelomersulfonate	< 50% but > 20%	< 50% but > 20%
APG-BAF-S6-1-SO-(0-2)- 031621	13C2 PFTeDA	Perfluorotetradecanoic acid	< 50% but > 20%	< 50% but > 20%
	13C4 PFBA	Perfluorobutanoic acid	< 50% but > 20%	< 50% but > 20%
	13C5 PFPeA	Perfluoropentanoic acid	< 50% but > 20%	< 50% but > 20%
	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%

Sample ID	EIS	Associated Compounds	%R	RE %R
	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
	13C5 PFHxA	Perfluorohexanoic acid	< 50% but > 20%	< 50% but > 20%

Note:

AC Acceptable NA Not Analyzed

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
4500/	Non-detect	No Action
> 150%	Detect	
500/ 1	Non-detect	UJ
< 50% but > 20%	Detect	J+
000/	Non-detect	UX
< 20%	Detect	Х

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be ≤ 30%.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

MS/MSD analysis was performed on samples APG-AA5-1-SE-031621 and APG-FUZE-1-SW-031621.

Sample APG-FUZE-1-SW-031621 exhibited several compounds where the parent sample concentration was greater than four times the MS/MSD spiking solution concentration, and therefore not evaluated. All other MS/MSD recoveries were within the control limits.

The MS/MSD recoveries outside of the control limits in sample APG-AA5-1-SE-031621 are presented in the following table.

Sample Locations	Compound	MS Recovery	MSD Recovery
	8:2 Fluorotelomer sulfonic acid	SR>4X	SR>4X
APG-AA5-1-SE-031621	Perfluorooctanesulfonic acid	>UL	>UL
	6:2 Fluorotelomer sulfonic acid	AC	<ll but="">10%</ll>

Note:

AC Acceptable

LL Lower control limit
UL Upper control limit

SR>4X Sample result greater than 4 times added spike

The criteria used to evaluate the MS/MSD recoveries are presented in the following table. In the case of an MS/MSD deviation, the sample results are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
	Non-detect	No Action
> the upper control limit (UL)	Detect	J+
	Non-detect	UJ
< the lower control limit (LL) but > 10%	Detect	J-
	Non-detect	Х
< 10%	Detect	J-
SR>4X: Parent sample concentration > four times the MS/MSD	Detect	
spiking solution concentration.	Non-detect	No Action

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

Results for field duplicate samples are summarized in the following table.

Sample ID / Duplicate ID	Compounds	Sample Result	Duplicate Result	RPD
	6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	0.053	0.091	AC
	8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	0.15	0.16	6.4 %
	Perfluorobutanoic acid (PFBA)	0.0028	0.0054	AC
	Perfluorodecanoic acid (PFDA)	0.0094	0.01	6.1 %
	Perfluorododecanoic acid (PFDoA)	0.038	0.039	AC
	Perfluoroheptanoic acid (PFHpA)	0.012	0.011	8.6 %
	Perfluorohexane sulfonic acid (PFHxS)	0.0022	0.0037	AC
APG-AA5-1-SE-031621/ APG-DUP-05-031621	Perfluorohexanoic acid (PFHxA)	0.016	0.024	40.0 %
AI 0-001 -03-031021	Perfluorononanoic acid (PFNA)	0.0014	0.0027	AC
	Perfluorooctane sulfonic acid (PFOS)	0.031	0.067	73.4 %
	Perfluorooctanoic acid (PFOA)	0.0036	0.0075	NC
	Perfluoropentanoic acid (PFPeA)	0.021	0.031	38.4 %
	Perfluorotetradecanoic acid (PFTeA)	0.022	0.023	4.4 %
	Perfluorotridecanoic acid (PFTrDA)	0.0049	0.008	48.0 %
	Perfluoroundecanoic acid (PFUdA)	0.0046	0.0066	35.7 %
	6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	930	850	8.9 %
	8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	270	330	20.0 %
	Perfluorobutane sulfonic acid (PFBS)	6.3	19 U	AC
	Perfluorobutanoic acid (PFBA)	250	260	3.9 %
	Perfluorodecanoic acid (PFDA)	310	350	12.1 %
	Perfluorododecanoic acid (PFDoA)	16	15 J	AC
	Perfluoroheptanoic acid (PFHpA)	860	870	1.1 %
APG-FUZE-1-SW-031621/	Perfluorohexane sulfonic acid (PFHxS)	530	530	0.0 %
APG-DUP-06-031621	Perfluorohexanoic acid (PFHxA)	1300	1200	8.0 %
	Perfluorononanoic acid (PFNA)	520	540	3.7 %
	Perfluorooctane sulfonic acid (PFOS)	400	400	0.0 %
	Perfluorooctanoic acid (PFOA)	880	930	5.5 %
	Perfluoropentanoic acid (PFPeA)	1100	1100	0.0 %
	Perfluorotetradecanoic acid (PFTeA)	1.3 J	19 U	AC
	Perfluorotridecanoic acid (PFTrDA)	1.8	19 U	AC
	Perfluoroundecanoic acid (PFUdA)	88	98	10.7 %

Notes:

AC Acceptable NC Not compliant

The compounds perfluorooctane sulfonic acid, and perfluorooctanoic acid associated with sample locations APG-AA5-1-SE-031621 and APG-DUP-05-031621 exhibited a field duplicate RPD greater than the control limit. The associated sample results from these sample locations for the listed analytes were qualified as estimated.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

All identified compounds met method criteria.

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
	6:2 Fluorotelomer sulfonic acid		5200	5200 D
	Perfluorobutanesulfonic acid		5000	5000 D
ADO AAS A OW 004004 DI	Perfluorohexanesulfonic acid		42000 E	42000 EDJ
APG-AA5-1-GW-031621 DL	Perfluorohexanoic acid		16000	16000 D
	Perfluorooctanesulfonic acid		64000 E	64000 EDJ
	Perfluoropentanoic acid		11000	11000 D
APG-AA5-1-SE-031621	8:2 Fluorotelomer sulfonic acid		0.15	0.15 D
APG-DUP-05-031621	8:2 Fluorotelomer sulfonic acid		0.16	0.16 D
	6:2 Fluorotelomer sulfonic acid		8500	8500 D
	Perfluoroheptanoic acid		8000	8000 D
	Perfluorohexanesulfonic acid		4400	4400 D
APG-FUZE-1-GW-031621 DL	Perfluorohexanoic acid		14000	14000 D
	Perfluorooctanesulfonic acid		4300	4300 D
	Perfluorooctanoic acid		7800	7800 D
	Perfluoropentanoic acid		8300	8300 D
	6:2 Fluorotelomer sulfonic acid		930	930 D
	Perfluoroheptanoic acid		860	860 D
APG-FUZE-1-SW-031621	Perfluorohexanesulfonic acid		530	530 D
	Perfluorohexanoic acid		1300	1300 D
	Perfluorononanoic acid		520	520 D

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
	Perfluorooctanesulfonic acid		400	400 D
	Perfluorooctanoic acid		880	880 D
	Perfluoropentanoic acid		1100	1100 D
APG-EF15-1-GW-031621	Perfluorooctanesulfonic acid		1300	1300 D

Note: the lab didn't report the original analysis; only the diluted result.

Sample locations APG -AA5-1-GW-031621 and APG-FUZE-1-GW-031621 are reported from a 10-fold and 100-fold dilution. An undiluted analysis was not performed due to the concentration of target compounds. Therefore, the detection limits are elevated.

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification
Diluted sample result within calibration range	D
Diluted sample result less than the calibration range	DJ
Diluted sample result greater than the calibration range	EDJ
Original sample result greater than the calibration range	EJ

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

As noted in Section 5.1, N-EtFOSAA and N-MeFOSAA results were qualified "X" for sample location APG-BAF-S6-1-SO-(0-2)-031621. This was due to EIS recoveries less than 20%. After review with the project team and USACE chemist, the results were rejected, and the final qualifier has been revised from "X" to "R" on December 15, 2021.

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Rep	oorted		mance ptable	Not
	No	Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC/	MS/MS)			
Stage 2 Validation					
Holding times		Х		Х	
Reporting limits (units)		Х		Х	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks	Х				X
C. Field blanks	Х				X
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate(LCSD) %R		Х		Х	
LCS/LCSD Precision (RPD)		Х		Х	
Matrix Spike (MS) %R		Х	Х		
Matrix Spike Duplicate(MSD) %R		Х	Х		
MS/MSD Precision (RPD)		Х		Х	
Field Duplicate (RPD)		Х	Х		
Extracted Internal Standard %R		Х	Х		
Injection Internal Standard %R		Х		Х	
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation			·		
Instrument tune and performance check		Х		Х	
Initial calibration %RSDs		Х		Х	
Continuing calibration %Ds		Х		Х	
Instrument sensitivity check		Х		Х	
Ion transitions used		Х		Х	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		Х		Х	
B. Quantitation Reports		Х		Х	
C. RT of sample compounds within the established RT windows		Х		Х	

PFAS: 537M/DoD QSM 5.3		Reported		mance ptable	Not Required
		Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
D. Ion Ratio %R		Х		Х	
E. Transcription/calculations acceptable		Х		Х	
F. Reporting limits adjusted to reflect sample dilutions		Х		Х	

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

Concentration (C) Qualifiers

- U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
- J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).

Quantitation (Q) Qualifiers

E The compound was quantitated above the calibration range.

• Validation Qualifiers

- J The reported result was an estimated value with an unknown bias.
- J+ The result was an estimated quantity, but the result may be biased high.
- J- The result was an estimated quantity, but the result may be biased low.
- UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
- UB Analyte considered non-detect at the listed value due to associated blank contamination.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria
APG-BAF-S6-1-SO-(0-2)-031621	7 days from collection; 6 days from receipt	< 24 hours of receipt at the laboratory

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

	Qualification
Criteria	Detected Analytes
Analysis completed past the holding time	J

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analytes	Standard Recovery
APG-BAF-S6-1-SO-(0-2)-031621	CCV	TOC	69%

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Control Limit	Sample Result	Qualification
	750/ 1 000/	Non-detect	UJ
	75% to 89%	Detect	J-
	0 5 1 750/	Non-detect	X
T00	Gross Exceedance <75%	Detect	J-
TOC	4440/ 4 4050/	Non-detect	No Action
	111% to 125%	Detect	J+
	Cross Evenedones (1950)	Non-detect	No Action
	Gross Exceedance >125%	Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

Sample locations associated with the MS exhibiting recoveries outside of the control limits are presented in the following table.

Sample Locations	Compound	MS Recovery
APG-BAF-S6-1-SO-(0-2)-031621	TOC	50%

The criteria used to evaluate the MS recoveries are presented in the following table. In the case of an MS deviation, the sample results are qualified as documented in the table below.

Analytes	Control Limit	Sample Result	Qualification
	200/ +- 740/	Non-detect	UJ
TOC	30% to 74%	Detect	J-
	2007	Non-detect	X
100	<30%	Detect	J-
	4050/	Non-detect	No Action
	> 125%	Detect	J+

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

The laboratory duplicate analysis performed for TOC exhibited RPD within the specified control limits.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within \pm 0.05 S.U. of the true value.

Sample locations associated with the LCS exhibiting recoveries outside of the control limits are presented in the following table.

Sample Locations	Compound	LCS %R
APG-BAF-S6-1-SO-(0-2)-031621	TOC	68%

The criteria used to evaluate the LCS recoveries are presented in the following table. In the case of an LCS deviation, the sample results are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
10004	Non-detect	No Action
> 120%	Detect	J+
0004	Non-detect	X
< 80%	Detect	J-

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Repo	orted		Performance Acceptable		
	No	Yes	No	Yes	Required	
Miscellaneous Instrumentation						
Stage 2 Validation						
Holding times		X	X			
Reporting limits (units)		X		X		
Blanks						
A. Method blanks		X		X		
B. Equipment blanks	Х				Х	
Laboratory Control Sample (LCS) %R		Х	Х			
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х	
LCS/LCSD Precision (RPD)	Х				Х	
Matrix Spike (MS) %R		Х	Х			
Matrix Spike Duplicate (MSD) %R	Х				Х	
MS/MSD Precision (RPD)	Х				Х	
Lab Duplicate (RPD)		X		X		
Field Duplicate (RPD)	Х				Х	
Dilution Factor		X		Х		
Moisture Content		Х		Х		
Stage 3/4 Validation						
Initial calibration correlation coefficient (TOC)		X		Х		
Continuing calibration %R		X	Х			
Raw Data		X		Х		
Transcription/calculations acceptable		Х		Х		

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Andrew Korycinski

SIGNATURE:

DATE: May 5, 2021

a Kays

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 10, 2021

Stage 3 / 4 PFAS Calibration Standards

SDG #:410-32720-1Date:5/5/2021Lab:Eurofins LancasterPage:1Project:Aberdeen Proving GroundValidated by:AJK

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

Perfluoroheptanoic acid 3/17/2021 Calibration

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Cal Conc					Calculated		Calc		Calculated	Reported
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D
0.2	145909	5669610	10	0.025735	1.286764	1.1706	0.219845	0.2	9.922	9.9
0.5	347651	5830141	10	0.05963	1.1925989	1.1706	0.509392	0.5	1.878	1.9
2	1439885	5586600	10	0.257739	1.2886953	1.1706	2.201749	2	10.087	10.1
8	5069911	5633282	10	0.899992	1.1249905	1.1706	7.68823	8	-3.897	-3.9
20	12200655	5325160	10	2.291134	1.145567	1.1706	19.57213	20	-2.139	-2.1
50	28356865	5202098	10	5.451044	1.0902088	1.1706	46.56582	50	-6.868	-6.9
100	47689610	4476006	10	10.6545	1.0654501	1.1706	91.01661	100	-8.983	-9.0

Match Match Match Match Match

Match Match

Avg RF = 1.1706107 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

 SDG #:
 410-32720-1
 Date:
 5/5/2021

 Lab:
 Eurofins Lancaster
 Page:
 1

Project: Aberdeen Proving Ground Validated by: AJK

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-103929/9 3/17/2021 01:41

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	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluoroheptanoic acid	1138680	5302738	10	0.2147	1.1710	1.834	2	-8.31	-8.3
Perfluorononanoic acid	821719	4533612	10	0.1813	0.9430	1.922	2	-3.90	-3.9
Perfluorooctanoic acid	1050583	5961164	10	0.1762	0.9768	1.804	2	-9.79	-9.8

Match Match Match

CCVIS 410-107908/1 3/27/2021 09:26

Page 1317 of SDG 410-32720-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluoroheptanoic acid	335131	5906008	10	0.0567	1.1340	0.500	0.5	0.08	0
Perfluorononanoic acid	239446	4727817	10	0.0506	0.9723	0.521	0.5	4.18	4.2
Perfluorooctanoic acid	359053	5932397	10	0.0605	1.0130	0.597	0.5	19.49	19.5

Match Match Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

SDG #: 410-32720-1 Date: 5/5/2021
Lab: Eurofins Lancaster Page: 3
Project: Aberdeen Proving Ground Validated by: AJK

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-105032/2-A Page 1587 of SDG 410-32720-1

Sample volume = 250 ml Final volume = 1ml

						Calculated Amount	True Value	Calculated Percent	Reported Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluoroheptanoic acid	4360015	5466824	10	0.797541	1.1710	27.24	25.600	106.42	106	Matc
Perfluorononanoic acid	3227508	4677965	10	0.689938	0.9430	29.27	25.600	114.32	114	Matc
Perfluorooctanoic acid	4141599	5976832	10	0.692942	0.9768	28.38	25.600	110.84	111	Matc

Calculated Amount $ng/L = ((Peak area ratio/Avg RF) \times EIS concentration)/Sample volume)*1000$

Stage 3 / 4 PFAS MS/MSD

SDG #:410-32720-1Date:5/5/2021Lab:Eurofins LancasterPage:4Project:Aberdeen Proving GroundValidated by:AJK

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID APG-FUZE-1-SW-031621 Page 1660 SDG 410-32720-1

ANALYTE Perfluorobutanesulfonic acid

REPORTED MS %R 106
REPORTED MSD %R 102
REPORTED RPD 1

%R = 100 * (MS Conc - Sample Conc)RPD = 100 * | MS %R - MSD %RAverage of MS MSD %R

Sample Concentration 6.3 MS Concentration 27 MS %R 105.61 MATCH MSD Concentration 26.8 MSD %R 101.49 MATCH MS TV 19.6 RPD 0.74 MATCH MSD TV 20.2

Differences in %R may be due to rounding of the true value

Stage 3 / 4 PFAS Sample Concentration

SDG #: 410-32720-1 Date: 5/5/2021 Lab: Eurofins Lancaster Page: Project: Aberdeen Proving Ground Validated by:

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-AA5-1-GW-031621 Lab ID: 410-32720-1

Page 537 of SDG 410-32720-1

Dilution = 10

						Calculated	Final		Final	Reported
						Amount	Volume	Sample	Calculated	Value
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mls	Volume mls	ng/L	ng/L
Perfluoroheptanoic acid	30794937	350321	1	87.90491	1.1340	775.18	1	219.9	3525.1	3500
Perfluorononanoic acid	3891205	280935	1	13.85091	0.9723	142.46	1	219.9	647.8	650
Perfluorooctanoic acid	51289555	553401	1	92.68063	1.0130	914.91	1	219.9	4160.6	4200

Calculated amount ng/L = (Peak area ratio/Avg RF) x DF x EIS conc <math>ng/LFinal Calculated amount ng/L = ((calculated ng/ml x Final Volume mls) / (sample volume mls/1000) Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

SDG #: 410-32720-1 Date: 5/5/2021
Lab: Eurofins Lancaster Page: 6
Project: Aberdeen Proving Ground Validated by: AJK

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-AA5-1-GW-031621 Lab ID: 410-32720-1

EIS 13C8 PFOA

REPORTED EIS %R 90

 $\%R = \frac{100 * EIS Concentration}{EIS TV}$

EIS Concentration 0.8995 ng/ml Page 539 of 410-32720-1

EIS TV 1.0

%R 90.0 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental Analysis Request/Chain of

For Eurofins Lancaster Laboratories Environ

COC #616538

eurofins

Lancaster Laboratories Acct. #

Sample # _ Group #

410-32720 Chain of Custody

Environmental Client Information **Analysis Requested** Matrix For Lab Use Only Client: Preservation and Filtration Codes FSC: Q ARCADIS SCR#: Ground Surface PWSID #: **Preservation Codes** APG PFAS S H=HCI T=Thiosulfate N=HNO₃ B=NaOH Containers 30001996. 3BXSTO S=H2SO4 P=H₂PO₄ Sediment F=Field Filtered O=Other NPDES Remarks For Compliance: MD No 🗆 Yes 5 Total # (Collected Grab Sample Identification Soil Date Time 2 X APG-AAS-1-GW-031621 3/16/21 092 C SE 0900 MS/MSID 406-AA5-1-5E-031621 MJ/MJD APG-040-05-031621 1200 APG-FUZE-1-6W-031621 1050 2 GW APG-FUZE-1-5W-031621 MS/MID 1040 SW ms /msn 2 APG-FUZE-1-SE-031621 1030 X APG- DUP-06-031621 1200 GW 1120 X X X APG-BAE-56-1-50-(0-2)-031621 1150 2 X APG-BAF-56-1-GW-03162 GW APG- EF15-1-6W-031621 Turnaround Time (TAT) Requested (please circle) Relinquished by 3/17/21 Rush 10700 Date 3/1/2/ Time Received by (Rush TAT is subject to laboratory approval and surcharge.) Requested TAT in business days: Received by Matthew. Blowe DARREADIS, Com E-mail address: Keth, Showed DARCADIS, Com Relinquished by Time Data Package Options (circle if required) Type I (EPA Level 3 Relinquished by Date Γime Type VI (Raw Data Only) Equivalent/non-CLP) EDD Required? Yes No Helinquished by Commercial Carrier: Type III (Reduced non-CLP) NJ DKQP TX TRRP-13 If yes, format: FedEx Site-Specific QC (MS/MSD/Dup)? (Yes) NYSDEC Category A or B MA MCP CT RCP Temperature upon receipt (If yes, indicate QC sample and submit triplicate sample volume.)

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • FOR HELP COMPLETING FORM CHECK OUT https://www.eurofinsus.com/coc The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client. 7044 0919

4/1/2021

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Qualifiers

LC	MS
A	1:6: -

Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
*5+	Isotope dilution analyte is outside acceptance limits, high biased.
^c	CCV Recovery is outside acceptance limits.
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
D	The reported value is from a dilution.
E	Result exceeded calibration range.
FH	MS and/or MSD recovery above control limits.
FL	MS and/or MSD recovery below control limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
M	Manual integrated compound.
Conoral C	h a waistur .

General Chemistry

Qualifier	Qualifier Description
F5	Duplicate RPD exceeds limit, and one or both sample results are less than 5 times RL, and the absolute difference between results is <
	the upper reporting limits for both.
FL	MS and/or MSD recovery below control limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Giossaiy	
Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)

	p
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)

MCL	EPA recommended Maximum Contaminant Level
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit

MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated

ND	Not Detected at the reporting limit (or MDL or FDL if show	ın۱

		•	_
NEG	Negative / Absent		
POS	Positive / Present		
PQL	Practical Quantitation	Limit	

PRES	Presumptive
QC	Quality Control

nistry)
em

Reporting Limit or Requested Limit (Radiochemistry) RL

RPD Relative Percent Difference, a measure of the relative difference between two points

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Eurofins Lancaster Laboratories Env, LLC

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-AA5-1-GW-031621

Lab Sample ID: 410-32720-1 Date Collected: 03/16/21 09:20 **Matrix: Water**

Date Received: 03/17/21 16:00

Analyte	Result	Qualifier	LOQ	L	OD	DL	Unit D	Analyzed	Dil Fac
8:2 Fluorotelomer sulfonic acid	67	D	34		23	23	ng/L	03/27/21 10:10	10
NEtFOSAA	<11		34		11	11	ng/L	03/27/21 10:10	10
NMeFOSAA	<14		23		14	14	ng/L	03/27/21 10:10	10
Perfluorobutanoic acid	3000	D	57		45	45	ng/L	03/27/21 10:10	10
Perfluorodecanoic acid	93	D	23		11	11	ng/L	03/27/21 10:10	10
Perfluorododecanoic acid	<11		23		11	11	ng/L	03/27/21 10:10	10
Perfluoroheptanoic acid	3500	D	23		11	11	ng/L	03/27/21 10:10	10
Perfluorononanoic acid	650	D	23		11	11	ng/L	03/27/21 10:10	10
Perfluorooctanoic acid	4200	D	23		11	11	ng/L	03/27/21 10:10	10
Perfluorotetradecanoic acid	<11		23		11	11	ng/L	03/27/21 10:10	10
Perfluorotridecanoic acid	<11		23		11	11	ng/L	03/27/21 10:10	10
Perfluoroundecanoic acid	<11	M	23		11	11	ng/L	03/27/21 10:10	10
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	143		50 - 150				03/25/21 16:55	03/27/21 10:10	10
M2-8:2 FTS	110		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C2 PFTeDA	80		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C3 PFBS	78		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C4 PFBA	89		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C4 PFHpA	60		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C5 PFPeA	79		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C8 PFOA	90		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C8 PFOS	56		50 - 150				03/25/21 16:55	03/27/21 10:10	10
d3-NMeFOSAA	107		50 - 150				03/25/21 16:55	03/27/21 10:10	10
d5-NEtFOSAA	121		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C2-PFDoDA	102		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C3 PFHxS	57		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C5 PFHxA	74		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C6 PFDA	100		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C7 PFUnA	104		50 - 150				03/25/21 16:55	03/27/21 10:10	10
13C9 PFNA	57		50 - 150				03/25/21 16:55	03/27/21 10:10	10

Method: EPA 537(Mod) - PFA Analyte	•	Qualifier		QQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	5200	D J-		570	450	450	ng/L	03/27/21 10:21	100
Perfluorobutanesulfonic acid	5000	D	2	230	110	110	ng/L	03/27/21 10:21	100
Perfluorohexanesulfonic acid	42000	ED J	2	230	110	110	ng/L	03/27/21 10:21	100
Perfluorohexanoic acid	16000	D	2	230	110	110	ng/L	03/27/21 10:21	100
Perfluorooctanesulfonic acid	64000	ED J	2	230	110	110	ng/L	03/27/21 10:21	100
Perfluoropentanoic acid	11000	D	2	230	110	110	ng/L	03/27/21 10:21	100
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	203 *5	<u>i</u> +	50 - 150				03/25/21 16:55	03/27/21 10:21	100

M2-6:2 FTS	203 *5+	50 - 150	03/25/21 16:55 03/27/21 10:21 100
13C3 PFBS	94	50 - 150	03/25/21 16:55 03/27/21 10:21 100
13C5 PFPeA	103	50 - 150	03/25/21 16:55 03/27/21 10:21 100
13C8 PFOS	113	50 - 150	03/25/21 16:55 03/27/21 10:21 100
13C3 PFHxS	101	50 - 150	03/25/21 16:55 03/27/21 10:21 100
13C5 PFHxA	104	50 - 150	03/25/21 16:55 03/27/21 10:21 100

Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client: ARCADIS U.S., Inc.

Percent Moisture

Percent Solids

Client Sample ID: APG-AA5-1-SE-031621

Lab Sample ID: 410-32720-2 Date Collected: 03/16/21 09:00 **Matrix: Solid**

Date Received: 03/17/21 16:00 Percent Solids: 76.6

Method: EPA 537(Mod) - PFA Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	0.053	F ⊾ J-	0.0025	0.0020	0.0020	mg/Kg	<u></u>	03/24/21 14:22	
NEtFOSAA	<0.00049		0.0025	0.00049	0.00049	mg/Kg	☼	03/24/21 14:22	1
NMeFOSAA	< 0.00049		0.0025	0.00049	0.00049	mg/Kg	₩	03/24/21 14:22	1
Perfluorobutanesulfonic acid	<0.0020		0.0025	0.0020	0.0020	mg/Kg	₩	03/24/21 14:22	1
Perfluorobutanoic acid	0.0028		0.0025	0.0020	0.0020	mg/Kg	☼	03/24/21 14:22	1
Perfluorodecanoic acid	0.0094		0.00074	0.00049	0.00049		≎	03/24/21 14:22	1
Perfluorododecanoic acid	0.038		0.00074	0.00049	0.00049	mg/Kg	₩	03/24/21 14:22	1
Perfluoroheptanoic acid	0.012		0.00074	0.00049	0.00049	mg/Kg	☼	03/24/21 14:22	1
Perfluorohexanesulfonic acid	0.0022		0.00074	0.00049	0.00049	mg/Kg	☼	03/24/21 14:22	1
Perfluorohexanoic acid	0.016		0.00074	0.00049	0.00049	mg/Kg	₩	03/24/21 14:22	1
Perfluorononanoic acid	0.0014		0.00074	0.00049	0.00049	mg/Kg	☼	03/24/21 14:22	1
Perfluorooctanesulfonic acid	0.031	PN J+	0.00074	0.00049	0.00049	mg/Kg	☼	03/24/21 14:22	1
Perfluorooctanoic acid	0.0036	J	0.00074	0.00049	0.00049	mg/Kg	₩	03/24/21 14:22	1
Perfluoropentanoic acid	0.021		0.00074	0.00049	0.00049	mg/Kg	☼	03/24/21 14:22	1
Perfluorotetradecanoic acid	0.022		0.00074	0.00049	0.00049		₩	03/24/21 14:22	1
Perfluorotridecanoic acid	0.0049		0.00074	0.00049	0.00049	mg/Kg	₩	03/24/21 14:22	· · · · · · · ·
Perfluoroundecanoic acid	0.0046		0.00074	0.00049	0.00049	mg/Kg	☼	03/24/21 14:22	•
Isotope Dilution	%Recovery Qu	ıalifier	Limits			Prepa	ared	Analyzed	Dil Fa
M2-6:2 FTS	109		50 - 150			03/23/21	20:31	03/24/21 14:22	
M2-8:2 FTS	83		50 - 150			03/23/21	1 20:31	03/24/21 14:22	
13C2 PFTeDA	51		50 - 150			03/23/21	20:31	03/24/21 14:22	
13C3 PFBS	72		50 - 150			03/23/21	20:31	03/24/21 14:22	
13C4 PFBA	83		50 - 150			03/23/21	20:31	03/24/21 14:22	
13C4 PFHpA	87		50 - 150			03/23/21	20:31	03/24/21 14:22	
13C5 PFPeA	80		50 - 150			03/23/21	20:31	03/24/21 14:22	
13C8 PFOA	81		50 - 150			03/23/21	20:31	03/24/21 14:22	
13C8 PFOS	74		50 - 150			03/23/21	20:31	03/24/21 14:22	
d3-NMeFOSAA	69		50 - 150			03/23/21	20:31	03/24/21 14:22	
d5-NEtFOSAA	73		50 - 150			03/23/21	20:31	03/24/21 14:22	
13C2-PFDoDA	54		50 - 150			03/23/21	20:31	03/24/21 14:22	
13C3 PFHxS	81		50 - 150			03/23/21	20:31	03/24/21 14:22	
13C5 PFHxA	81		50 - 150			03/23/21	1 20:31	03/24/21 14:22	
13C6 PFDA	66		50 - 150			03/23/21	1 20:31	03/24/21 14:22	
13C7 PFUnA	62		50 - 150			03/23/21	20:31	03/24/21 14:22	
13C9 PFNA	73		50 - 150			03/23/21	20:31	03/24/21 14:22	
Mothod: EDA 527(Mod) DEA	S for OSM E 2	Table P 4	15 - DI						
Method: EPA 537(Mod) - PFA Analyte	•	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
8:2 Fluorotelomer sulfonic acid	0.15		0.037	0.020		mg/Kg	— <u>-</u>	03/24/21 21:23	10
Isotope Dilution	%Recovery Qu	ıalifier	Limits			Prepa	ared	Analyzed	Dil Fa
M2-8:2 FTS	91		50 - 150			03/23/21	20:31	03/24/21 21:23	10
Ganaral Chamistry									
General Chemistry Analyte	Result	Qualifier	LOQ	LOD	DI	Unit	D	Analyzed	Dil Fac
· ·····, ···								 y = 0 u	u

Eurofins Lancaster Laboratories Env, LLC

03/18/21 08:33

03/18/21 08:33

1.0 %

1.0 %

1.0

1.0

23.4

76.6

4/1/2021

Client: ARCADIS U.S., Inc.

Analyte

Percent Moisture

Percent Solids

Client Sample ID: APG-DUP-05-031621

Lab Sample ID: 410-32720-3 Date Collected: 03/16/21 12:00 **Matrix: Solid**

Date Received: 03/17/21 16:00 Percent Solids: 71.9

Analyte	Result (Qualifier	LOQ	LOD		Unit	_ D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	0.091		0.0027	0.0022	0.0022	mg/Kg	₩	03/24/21 14:56	1
NEtFOSAA	<0.00055		0.0027 0	.00055	0.00055		₩	03/24/21 14:56	1
NMeFOSAA	<0.00055	(0.0027 0	.00055	0.00055		₩	03/24/21 14:56	1
Perfluorobutanesulfonic acid	<0.0022	(0.0027	0.0022	0.0022		₩	03/24/21 14:56	1
Perfluorobutanoic acid	0.0054	(0.0027	0.0022	0.0022		≎	03/24/21 14:56	1
Perfluorodecanoic acid	0.010	0.	00082 0	.00055	0.00055		₩	03/24/21 14:56	1
Perfluorododecanoic acid	0.039	0.	00082 0	.00055	0.00055	mg/Kg	₩	03/24/21 14:56	1
Perfluoroheptanoic acid	0.011	0.	00082 0	.00055	0.00055	mg/Kg	≎	03/24/21 14:56	1
Perfluorohexanesulfonic acid	0.0037	0.	00082 0	.00055	0.00055	mg/Kg	≎	03/24/21 14:56	1
Perfluorohexanoic acid	0.024	0.	00082 0	.00055	0.00055	mg/Kg	₽	03/24/21 14:56	1
Perfluorononanoic acid	0.0027	0	00082 0	.00055	0.00055	mg/Kg	≎	03/24/21 14:56	1
Perfluorooctanesulfonic acid	0.067	J 0.	00082 0	.00055	0.00055	mg/Kg	≎	03/24/21 14:56	1
Perfluorooctanoic acid	0.0075	J 0	00082 0	.00055	0.00055	mg/Kg	⇔	03/24/21 14:56	1
Perfluoropentanoic acid	0.031	0	00082 0	.00055	0.00055	mg/Kg	≎	03/24/21 14:56	1
Perfluorotetradecanoic acid	0.023	0	00082 0	.00055	0.00055	mg/Kg	≎	03/24/21 14:56	1
Perfluorotridecanoic acid	0.0080	0	00082 0	.00055	0.00055	mg/Kg	₩	03/24/21 14:56	1
Perfluoroundecanoic acid	0.0066	0	00082 0	.00055	0.00055	mg/Kg	₩	03/24/21 14:56	1
Isotope Dilution	%Recovery Qua	alifier Limits	;			Prepai	ed	Analyzed	Dil Fa
M2-6:2 FTS	95	50 - 18	50					03/24/21 14:56	
M2-8:2 FTS	78	50 - 18	50			03/23/21	20:31	03/24/21 14:56	
13C2 PFTeDA	59	50 - 18	50			03/23/21	20:31	03/24/21 14:56	1
13C3 PFBS	71	50 - 18	50			03/23/21	20:31	03/24/21 14:56	
13C4 PFBA	81	50 - 18	50			03/23/21	20:31	03/24/21 14:56	
13C4 PFHpA	84	50 - 15	50			03/23/21	20:31	03/24/21 14:56	
13C5 PFPeA	80	50 - 18	50			03/23/21	20:31	03/24/21 14:56	
13C8 PFOA	75	50 - 18	50			03/23/21	20:31	03/24/21 14:56	
13C8 PFOS	72	50 - 18	50			03/23/21	20:31	03/24/21 14:56	
d3-NMeFOSAA	71	50 - 18	50			03/23/21	20:31	03/24/21 14:56	
d5-NEtFOSAA	81	50 - 18	50			03/23/21	20:31	03/24/21 14:56	
13C2-PFDoDA	60	50 - 18	50			03/23/21	20:31	03/24/21 14:56	
13C3 PFHxS	79	50 - 18	50			03/23/21	20:31	03/24/21 14:56	
13C5 PFHxA	77	50 - 15	50			03/23/21	20:31	03/24/21 14:56	
13C6 PFDA	69	50 - 15	50			03/23/21	20:31	03/24/21 14:56	
	76	50 - 15	50			03/23/21	20:31	03/24/21 14:56	
13C7 PFUnA						03/23/21	20:31	03/24/21 14:56	
	73	50 - 18	50						
13C9 PFNA	73								
13C9 PFNA Method: EPA 537(Mod) - PFA	73 .S for QSM 5.3, T	able B-15 - DL							
13C9 PFNA <mark>Method: EPA 537(Mod) - PFA</mark> Analyte	73 S for QSM 5.3, T Result (able B-15 - DL	LOQ	LOD		Unit	<u>D</u>	Analyzed	Dil Fac
13C9 PFNA Method: EPA 537(Mod) - PFA	73 .S for QSM 5.3, T	able B-15 - DL		LOD 0.022		Unit mg/Kg		Analyzed 03/24/21 21:45	
13C9 PFNA <mark>Method: EPA 537(Mod) - PFA</mark> Analyte	73 S for QSM 5.3, T Result (Table B-15 - DL Qualifier	LOQ 0.041				— <u></u>		Dil Fac

Analyzed

03/18/21 08:33

03/18/21 08:33

Dil Fac

4/1/2021

LOQ

1.0

1.0

LOD

DL Unit

1.0 %

1.0 %

Result Qualifier

28.1

71.9

Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client: ARCADIS U.S., Inc.

Client Sample ID: APG-FUZE-1-GW-031621

Lab Sample ID: 410-32720-4

Date Collected: 03/16/21 10:50 **Matrix: Water** Date Received: 03/17/21 16:00

Analyte	Result	Qualifier	LOQ)	LOD	DL	Unit D	Analyzed	Dil Fac
8:2 Fluorotelomer sulfonic acid	690	D	38	3	25	25	ng/L	03/23/21 18:57	10
NEtFOSAA	<13		38	3	13	13	ng/L	03/23/21 18:57	10
NMeFOSAA	<15		25	j	15	15	ng/L	03/23/21 18:57	10
Perfluorobutanesulfonic acid	91	D	25	,	13	13	ng/L	03/23/21 18:57	10
Perfluorobutanoic acid	2300	D	63	}	50	50	ng/L	03/23/21 18:57	10
Perfluorodecanoic acid	260	D	25	;	13	13	ng/L	03/23/21 18:57	10
Perfluorododecanoic acid	<13		25	,	13	13	ng/L	03/23/21 18:57	10
Perfluorononanoic acid	2300	D	25	;	13	13	ng/L	03/23/21 18:57	10
Perfluorotetradecanoic acid	<13		25	;	13	13	ng/L	03/23/21 18:57	10
Perfluorotridecanoic acid	<13		25	,	13	13	ng/L	03/23/21 18:57	10
Perfluoroundecanoic acid	16	J D	25	5	13	13	ng/L	03/23/21 18:57	10
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	216 *5	+	50 - 150				03/19/21 09:11	03/23/21 18:57	10
M2-8:2 FTS	104		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C2 PFTeDA	86		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C3 PFBS	87		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C4 PFBA	89		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C4 PFHpA	80		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C5 PFPeA	81		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C8 PFOA	72		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C8 PFOS	92		50 - 150				03/19/21 09:11	03/23/21 18:57	10
d3-NMeFOSAA	87		50 - 150				03/19/21 09:11	03/23/21 18:57	10
d5-NEtFOSAA	106		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C2-PFDoDA	100		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C3 PFHxS	80		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C5 PFHxA	74		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C6 PFDA	97		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C7 PFUnA	103		50 - 150				03/19/21 09:11	03/23/21 18:57	10
13C9 PFNA	86		50 - 150				03/19/21 09:11	03/23/21 18:57	10

Method: EPA 537(Mod) - PFAS fo	or QSM 5.3,	Table B-15	- DL						
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	8500	D J-	630	500	500	ng/L		03/23/21 19:08	100
Perfluoroheptanoic acid	8000	D	250	130	130	ng/L		03/23/21 19:08	100
Perfluorohexanesulfonic acid	4400	D	250	130	130	ng/L		03/23/21 19:08	100
Perfluorohexanoic acid	14000	D	250	130	130	ng/L		03/23/21 19:08	100
Perfluorooctanesulfonic acid	4300	D	250	130	130	ng/L		03/23/21 19:08	100
Perfluorooctanoic acid	7800	D	250	130	130	ng/L		03/23/21 19:08	100
Perfluoropentanoic acid	8300	D	250	130	130	ng/L		03/23/21 19:08	100

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	353	*5+	50 - 150	03/19/21 09:11	03/23/21 19:08	100
13C4 PFHpA	93		50 - 150	03/19/21 09:11	03/23/21 19:08	100
13C5 PFPeA	89		50 - 150	03/19/21 09:11	03/23/21 19:08	100
13C8 PFOA	98		50 - 150	03/19/21 09:11	03/23/21 19:08	100
13C5 PFHxA	89		50 - 150	03/19/21 09:11	03/23/21 19:08	100

Method: EPA 537(Mod) - PFAS fo	or QSM 5.3, Ta	able B-15 - RE					
Analyte	Result C	Qualifier LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	7700 E	D 60	48	48 ng/L		03/27/21 10:33	10

Eurofins Lancaster Laboratories Env, LLC

4/1/2021

Client: ARCADIS U.S., Inc. Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-FUZE-1-GW-031621

Lab Sample ID: 410-32720-4

Date Collected: 03/16/21 10:50 **Matrix: Water** Date Received: 03/17/21 16:00

Analyte	Result	Qualifier	l	_OQ	LOD	DL	Unit D	Analyzed	Dil Fac
8:2 Fluorotelomer sulfonic acid	580	D		36	24	24	ng/L	03/27/21 10:33	10
NEtFOSAA	<12			36	12	12	ng/L	03/27/21 10:33	10
NMeFOSAA	<14			24	14	14	ng/L	03/27/21 10:33	10
Perfluorobutanesulfonic acid	88	D		24	12	12	ng/L	03/27/21 10:33	10
Perfluorobutanoic acid	2200	D		60	48	48	ng/L	03/27/21 10:33	10
Perfluorodecanoic acid	280	D		24	12	12	ng/L	03/27/21 10:33	10
Perfluorododecanoic acid	<12			24	12	12	ng/L	03/27/21 10:33	10
Perfluoroheptanoic acid	6600	E D		24	12	12	ng/L	03/27/21 10:33	10
Perfluorohexanesulfonic acid	4300	D		24	12	12	ng/L	03/27/21 10:33	10
Perfluorohexanoic acid	12000	E D		24	12	12	ng/L	03/27/21 10:33	10
Perfluorononanoic acid	2200	D		24	12	12	ng/L	03/27/21 10:33	10
Perfluorooctanesulfonic acid	4200	D		24	12	12	ng/L	03/27/21 10:33	10
Perfluorooctanoic acid	7400	ED \		24	12	12	ng/L	03/27/21 10:33	10
Perfluoropentanoic acid	7500	E D		24	12	12	ng/L	03/27/21 10:33	10
Perfluorotetradecanoic acid	<12			24	12	12	ng/L	03/27/21 10:33	10
Perfluorotridecanoic acid	<12			24	12	12	ng/L	03/27/21 10:33	10
Perfluoroundecanoic acid	23	J D		24	12	12	ng/L	03/27/21 10:33	10
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	209 *5	<u>i</u> +	50 - 150				03/25/21 16:55	03/27/21 10:33	10
M2-8:2 FTS	108		50 - 150				03/25/21 16:55	03/27/21 10:33	10
13C2 PFTeDA	77		50 - 150			<u></u>	03/25/21 16:55	03/27/21 10:33	10
13C3 PFBS	81		50 - 150				03/25/21 16:55	03/27/21 10:33	10
13C4 PFBA	86		50 - 150				03/25/21 16:55	03/27/21 10:33	10
13C4 PFHpA	81		50 - 150				03/25/21 16:55	03/27/21 10:33	10
13C5 PFPeA	77		50 - 150				03/25/21 16:55	03/27/21 10:33	10
13C8 PFOA	72		50 - 150				03/25/21 16:55	03/27/21 10:33	10
13C8 PFOS	88		50 - 150				03/25/21 16:55	03/27/21 10:33	10
d3-NMeFOSAA	96		50 - 150				03/25/21 16:55	03/27/21 10:33	10
d5-NEtFOSAA	101		50 - 150				03/25/21 16:55	03/27/21 10:33	10
13C2-PFDoDA	88		50 - 150				03/25/21 16:55	03/27/21 10:33	10
13C3 PFHxS	79		50 - 150				03/25/21 16:55	03/27/21 10:33	10
13C5 PFHxA	73		50 - 150				03/25/21 16:55	03/27/21 10:33	10
13C6 PFDA	92		50 - 150				03/25/21 16:55	03/27/21 10:33	10
13C7 PFUnA	90		50 - 150				03/25/21 16:55	03/27/21 10:33	10

Client Sample ID: APG-FUZE-1-SW-031621

Date Collected: 03/16/21 10:40 **Matrix: Water**

Date Received: 03/17/21 16:00

Analyte	Result (Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
8:2 Fluorotelomer sulfonic acid	270		2.6	1.8	1.8	ng/L		03/22/21 14:54	1
NEtFOSAA	<0.88 1	M.	2.6	0.88	0.88	ng/L		03/22/21 14:54	1
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L		03/22/21 14:54	1
Perfluorobutanesulfonic acid	6.3		1.8	0.88	0.88	ng/L		03/22/21 14:54	1
Perfluorobutanoic acid	250		4.4	3.5	3.5	ng/L		03/22/21 14:54	1
Perfluorodecanoic acid	310		1.8	0.88	0.88	ng/L		03/22/21 14:54	1
Perfluorododecanoic acid	16		1.8	0.88	0.88	ng/L		03/22/21 14:54	1
Perfluorotetradecanoic acid	1.3	J +	1.8	0.88	0.88	ng/L		03/22/21 14:54	1

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Lab Sample ID: 410-32720-5

Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-FUZE-1-SW-031621

Lab Sample ID: 410-32720-5 Date Collected: 03/16/21 10:40 **Matrix: Water**

Date Received: 03/17/21 16:00

Client: ARCADIS U.S., Inc.

Analyte	Res	ult Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorotridecanoic acid		.8	1.8	0.88	0.88	ng/L	03/22/21 14:54	1
Perfluoroundecanoic acid		88	1.8	0.88	0.88	ng/L	03/22/21 14:54	1
Isotope Dilution	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	55		50 - 150			03/19/21 09:11	03/22/21 14:54	1
M2-8:2 FTS	85		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C2 PFTeDA	49	*5-	50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C3 PFBS	92		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C4 PFBA	71		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C4 PFHpA	77		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C5 PFPeA	64		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C8 PFOA	56		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C8 PFOS	81		50 - 150			03/19/21 09:11	03/22/21 14:54	1
d3-NMeFOSAA	94		50 - 150			03/19/21 09:11	03/22/21 14:54	1
d5-NEtFOSAA	104		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C2-PFDoDA	65		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C3 PFHxS	79		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C5 PFHxA	69		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C6 PFDA	78		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C7 PFUnA	83		50 - 150			03/19/21 09:11	03/22/21 14:54	1
13C9 PFNA	78		50 - 150			03/19/21 09:11	03/22/21 14:54	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	930	D	44	35	35	ng/L		03/23/21 19:19	10
Perfluoroheptanoic acid	860	D	18	8.8	8.8	ng/L		03/23/21 19:19	10
Perfluorohexanesulfonic acid	530	D	18	8.8	8.8	ng/L		03/23/21 19:19	10
Perfluorohexanoic acid	1300	D	18	8.8	8.8	ng/L		03/23/21 19:19	10
Perfluorononanoic acid	520	D	18	8.8	8.8	ng/L		03/23/21 19:19	10
Perfluorooctanesulfonic acid	400	D	18	8.8	8.8	ng/L		03/23/21 19:19	10
Perfluorooctanoic acid	880	D	18	8.8	8.8	ng/L		03/23/21 19:19	10
Perfluoropentanoic acid	1100	D	18	8.8	8.8	ng/L		03/23/21 19:19	10

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	103		50 - 150	03/19/21 09:11	03/23/21 19:19	10
13C4 PFHpA	98		50 - 150	03/19/21 09:11	03/23/21 19:19	10
13C5 PFPeA	97		50 - 150	03/19/21 09:11	03/23/21 19:19	10
13C8 PFOA	98		50 - 150	03/19/21 09:11	03/23/21 19:19	10
13C8 PFOS	91		50 - 150	03/19/21 09:11	03/23/21 19:19	10
13C3 PFHxS	97		50 - 150	03/19/21 09:11	03/23/21 19:19	10
13C5 PFHxA	95		50 - 150	03/19/21 09:11	03/23/21 19:19	10
13C9 PFNA	93		50 - 150	03/19/21 09:11	03/23/21 19:19	10

Client Sample ID: APG-FUZE-1-SE-031621

Date Collected: 03/16/21 10:30 Date Received: 03/17/21 16:00

Lab Sample ID: 410-32720-6 **Matrix: Solid**

Percent Solids: 32.3

Method: EPA 537(Mod) - PFAS 1	for QSM 5.3, Table B-1	5					
Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	0.0089	0.0060	0.0048	0.0048 mg/Kg	₩	03/24/21 15:07	1
8:2 Fluorotelomer sulfonic acid	0.012	0.0090	0.0048	0.0048 mg/Kg	₩	03/24/21 15:07	1
NEtFOSAA	<0.0012	0.0060	0.0012	0.0012 mg/Kg	₩	03/24/21 15:07	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-FUZE-1-SE-031621 Lab Sample ID: 410-32720-6

Date Collected: 03/16/21 10:30 Matrix: Solid
Date Received: 03/17/21 16:00 Percent Solids: 32.3

Analyte	Result Q	ualifier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
NMeFOSAA	<0.0012	0.0060	0.0012	0.0012	mg/Kg	<u></u>	03/24/21 15:07	1
Perfluorobutanesulfonic acid	<0.0048	0.0060	0.0048	0.0048	mg/Kg	₩	03/24/21 15:07	1
Perfluorobutanoic acid	<0.0048	0.0060	0.0048	0.0048	mg/Kg	☆	03/24/21 15:07	1
Perfluorodecanoic acid	0.044	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Perfluorododecanoic acid	0.022	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Perfluoroheptanoic acid	0.0089	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Perfluorohexanesulfonic acid	0.0080	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Perfluorohexanoic acid	0.0092	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Perfluorononanoic acid	0.030	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Perfluorooctanesulfonic acid	0.061	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Perfluorooctanoic acid	0.019	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Perfluoropentanoic acid	0.0096	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Perfluorotetradecanoic acid	0.0035	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Perfluorotridecanoic acid	0.0048	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Perfluoroundecanoic acid	0.043	0.0018	0.0012	0.0012	mg/Kg	₩	03/24/21 15:07	1
Isotope Dilution	%Recovery Qual	ifier Limits			Prepa	red	Analyzed	Dil Fac

r erituorounidecanoic acid	0.043	0.0010	0.0012	0.0012 mg/rtg	00/24/21 10:01	
Isotope Dilution	%Recovery Qualifier	Limits		Prepared	Analyzed	Dil Fac
M2-6:2 FTS	90	50 - 150		03/23/21 20:31	03/24/21 15:07	1
M2-8:2 FTS	73	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C2 PFTeDA	60	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C3 PFBS	70	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C4 PFBA	80	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C4 PFHpA	81	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C5 PFPeA	78	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C8 PFOA	76	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C8 PFOS	76	50 - 150		03/23/21 20:31	03/24/21 15:07	1
d3-NMeFOSAA	79	50 - 150		03/23/21 20:31	03/24/21 15:07	1
d5-NEtFOSAA	81	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C2-PFDoDA	69	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C3 PFHxS	79	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C5 PFHxA	77	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C6 PFDA	71	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C7 PFUnA	72	50 - 150		03/23/21 20:31	03/24/21 15:07	1
13C9 PFNA	72	50 - 150		03/23/21 20:31	03/24/21 15:07	1

General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	67.7		1.0		1.0	%		03/18/21 08:33	1
Percent Solids	32.3		1.0		1.0	%		03/18/21 08:33	1

Client Sample ID: APG-DUP-06-031621

Date Collected: 03/16/21 12:00

Lab Sample ID: 410-32720-7

Matrix: Water

Date Received: 03/17/21 16:00

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	850	D	47	37	37	ng/L		03/23/21 19:30	10
8:2 Fluorotelomer sulfonic acid	330	D	28	19	19	ng/L		03/23/21 19:30	10
NEtFOSAA	<9.4		28	9.4	9.4	ng/L		03/23/21 19:30	10
NMeFOSAA	<11		19	11	11	ng/L		03/23/21 19:30	10
Perfluorobutanesulfonic acid	<9.4	M	19	9.4	9.4	ng/L		03/23/21 19:30	10

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-DUP-06-031621

Lab Sample ID: 410-32720-7 Date Collected: 03/16/21 12:00 **Matrix: Water**

Date Received: 03/17/21 16:00

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorobutanoic acid	260	D		47	37	37	ng/L	_ (03/23/21 19:30	10
Perfluorodecanoic acid	350	D		19	9.4	9.4	ng/L	(03/23/21 19:30	10
Perfluorododecanoic acid	15	J D		19	9.4	9.4	ng/L	(03/23/21 19:30	10
Perfluoroheptanoic acid	870	D		19	9.4	9.4	ng/L	(03/23/21 19:30	10
Perfluorohexanesulfonic acid	530	D		19	9.4	9.4	ng/L	(03/23/21 19:30	10
Perfluorohexanoic acid	1200	D		19	9.4	9.4	ng/L	(03/23/21 19:30	10
Perfluorononanoic acid	540	D		19	9.4	9.4	ng/L	(03/23/21 19:30	10
Perfluorooctanesulfonic acid	400	D		19	9.4	9.4	ng/L	(03/23/21 19:30	10
Perfluorooctanoic acid	930	D		19	9.4	9.4	ng/L	(03/23/21 19:30	10
Perfluoropentanoic acid	1100	D		19	9.4	9.4	ng/L	(03/23/21 19:30	10
Perfluorotetradecanoic acid	<9.4	UJ		19	9.4	9.4	ng/L	(03/23/21 19:30	10
Perfluorotridecanoic acid	<9.4			19	9.4	9.4	ng/L	(03/23/21 19:30	10
Perfluoroundecanoic acid	98	D		19	9.4	9.4	ng/L	C	03/23/21 19:30	10
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared		Analyzed	Dil Fac
M2-6:2 FTS	111		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
M2-8:2 FTS	86		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C2 PFTeDA	36 *5	-	50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C3 PFBS	90		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C4 PFBA	100		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C4 PFHpA	101		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C5 PFPeA	104		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C8 PFOA	95		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C8 PFOS	93		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
d3-NMeFOSAA	80		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
d5-NEtFOSAA	82		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C2-PFDoDA	55		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C3 PFHxS	99		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C5 PFHxA	97		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C6 PFDA	90		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C7 PFUnA	78		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10
13C9 PFNA	96		50 - 150				03/19/21 09:1	11 (03/23/21 19:30	10

Method: EPA 537(Mod) - PFAS fo				1.00	DI.	11:4	_	A a b a .d	Dil 5
Analyte	Result	Qualifier	LOQ	LOD		Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	830	D	44	35	35	ng/L		03/27/21 10:55	10
8:2 Fluorotelomer sulfonic acid	280	D	26	18	18	ng/L		03/27/21 10:55	10
NEtFOSAA	<8.8		26	8.8	8.8	ng/L		03/27/21 10:55	10
NMeFOSAA	<11		18	11	11	ng/L		03/27/21 10:55	10
Perfluorobutanesulfonic acid	<8.8		18	8.8	8.8	ng/L		03/27/21 10:55	10
Perfluorobutanoic acid	240	D	44	35	35	ng/L		03/27/21 10:55	10
Perfluorodecanoic acid	350	D	18	8.8	8.8	ng/L		03/27/21 10:55	10
Perfluorododecanoic acid	16	J D	18	8.8	8.8	ng/L		03/27/21 10:55	10
Perfluoroheptanoic acid	830	D	18	8.8	8.8	ng/L		03/27/21 10:55	10
Perfluorohexanesulfonic acid	490	D	18	8.8	8.8	ng/L		03/27/21 10:55	10
Perfluorohexanoic acid	1300	D	18	8.8	8.8	ng/L		03/27/21 10:55	10
Perfluorononanoic acid	540	D	18	8.8	8.8	ng/L		03/27/21 10:55	10
Perfluorooctanesulfonic acid	390	D	18	8.8	8.8	ng/L		03/27/21 10:55	10
Perfluorooctanoic acid	900	D	18	8.8	8.8	ng/L		03/27/21 10:55	10
Perfluoropentanoic acid	1100	D	18	8.8	8.8	ng/L		03/27/21 10:55	10

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Client: ARCADIS U.S., Inc. Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-DUP-06-031621 Lab Sample ID: 410-32720-7

Date Collected: 03/16/21 12:00 **Matrix: Water**

Date Received: 03/17/21 16:00

Analyte	Result Qualific	er LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorotetradecanoic acid	<8.8	18	8.8	8.8	ng/L	03/27/21 10:55	10
Perfluorotridecanoic acid	<8.8	18	8.8	8.8	ng/L	03/27/21 10:55	10
Perfluoroundecanoic acid	96 D	18	8.8	8.8	ng/L	03/27/21 10:55	10
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	99	50 - 150			03/25/21 16:55	03/27/21 10:55	10
M2-8:2 FTS	94	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C2 PFTeDA	<i>33 *5-</i>	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C3 PFBS	79	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C4 PFBA	92	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C4 PFHpA	95	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C5 PFPeA	86	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C8 PFOA	89	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C8 PFOS	91	50 - 150			03/25/21 16:55	03/27/21 10:55	10
d3-NMeFOSAA	91	50 - 150			03/25/21 16:55	03/27/21 10:55	10
d5-NEtFOSAA	98	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C2-PFDoDA	57	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C3 PFHxS	92	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C5 PFHxA	85	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C6 PFDA	89	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C7 PFUnA	81	50 - 150			03/25/21 16:55	03/27/21 10:55	10
13C9 PFNA	89	50 ₋ 150			03/25/21 16:55	03/27/21 10:55	10

Client Sample ID: APG-BAF-S6-1-SO-(0-2)-031621 Lab Sample ID: 410-32720-8 Date Collected: 03/16/21 11:20 **Matrix: Solid**

Date Received: 03/17/21 16:00 Percent Solids: 82.4

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018 UJ	0.0023	0.0018	0.0018	mg/Kg	☆	03/26/21 12:48	1
8:2 Fluorotelomer sulfonic acid	<0.0018 UJ	0.0035	0.0018	0.0018	mg/Kg	≎	03/26/21 12:48	1
NEtFOSAA	<0.00046	0.0023	0.00046	0.00046	mg/Kg	₩	03/26/21 12:48	R 1
NMeFOSAA	<0.00046	0.0023	0.00046	0.00046	mg/Kg	*	03/26/21 12:48	R 1
Perfluorobutanesulfonic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	≎	03/26/21 12:48	1
Perfluorobutanoic acid	<0.0018 <mark>UJ</mark>	0.0023	0.0018	0.0018	mg/Kg	≎	03/26/21 12:48	1
Perfluorodecanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	≎	03/26/21 12:48	1
Perfluorododecanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	☼	03/26/21 12:48	1
Perfluoroheptanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	≎	03/26/21 12:48	1
Perfluorohexanesulfonic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	≎	03/26/21 12:48	1
Perfluorohexanoic acid	<0.00046 UJ	0.00069	0.00046	0.00046	mg/Kg	≎	03/26/21 12:48	1
Perfluorononanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	☆	03/26/21 12:48	1
Perfluorooctanesulfonic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	≎	03/26/21 12:48	1
Perfluorooctanoic acid	<0.00046 M	0.00069	0.00046	0.00046	mg/Kg	☆	03/26/21 12:48	1
Perfluoropentanoic acid	<0.00046 UJ	0.00069	0.00046	0.00046	mg/Kg	☆	03/26/21 12:48	1
Perfluorotetradecanoic acid	<0.00046 UJ	0.00069	0.00046	0.00046	mg/Kg	≎	03/26/21 12:48	1
Perfluorotridecanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	☆	03/26/21 12:48	1
Perfluoroundecanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	₩	03/26/21 12:48	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepare	ed	Analyzed	Dil Fac
M2-6:2 FTS	45 *5-	50 - 150			03/25/21 1	5:04	03/26/21 12:48	1
M2-8:2 FTS	41 *5-	50 - 150			03/25/21 1	5:04	03/26/21 12:48	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-BAF-S6-1-SO-(0-2)-031621 Lab Sample ID: 410-32720-8

Date Collected: 03/16/21 11:20 **Matrix: Solid** Date Received: 03/17/21 16:00 Percent Solids: 82.4

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFTeDA	47	*5-	50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C3 PFBS	68		50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C4 PFBA	47	*5-	50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C4 PFHpA	53		50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C5 PFPeA	48	*5-	50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C8 PFOA	52		50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C8 PFOS	74		50 - 150	03/25/21 15:04	03/26/21 12:48	1
d3-NMeFOSAA	11	*5-	50 - 150	03/25/21 15:04	03/26/21 12:48	1
d5-NEtFOSAA	18	*5-	50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C2-PFDoDA	51		50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C3 PFHxS	77		50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C5 PFHxA	49	*5-	50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C6 PFDA	51		50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C7 PFUnA	54		50 - 150	03/25/21 15:04	03/26/21 12:48	1
13C9 PFNA	50		50 ₋ 150	03/25/21 15:04	03/26/21 12:48	1

Analyte	Result Q	ualifier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluoretelomer sulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	*	03/24/21 15:18	1
8:2 Fluorotelomer sulfonic acid	< 0.0019	0.0036	0.0019	0.0019	mg/Kg	₽	03/24/21 15:18	1
NEtFOSAA	<0.00049	0.0024	0.00049	0.00049	mg/Kg	₽	03/24/21 15:18	1
NMeFOSAA	<0.00049	0.0024	0.00049	0.00049	mg/Kg	₽	03/24/21 15:18	1
Perfluorobutanesulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	₩	03/24/21 15:18	1
Perfluorobutanoic acid	< 0.0019	0.0024	0.0019	0.0019	mg/Kg	₽	03/24/21 15:18	1
Perfluorodecanoic acid	<0.00049	0.00073	0.00049	0.00049	mg/Kg	₩	03/24/21 15:18	1
Perfluorododecanoic acid	<0.00049	0.00073	0.00049	0.00049	mg/Kg	₽	03/24/21 15:18	1
Perfluoroheptanoic acid	0.00049	0.00073	0.00049	0.00049	mg/Kg	₽	03/24/21 15:18	1
Perfluorohexanesulfonic acid	<0.00049	0.00073	0.00049	0.00049	mg/Kg	₽	03/24/21 15:18	1
Perfluorohexanoic acid	<0.00049	0.00073	0.00049	0.00049	mg/Kg	₽	03/24/21 15:18	1
Perfluorononanoic acid	<0.00049	0.00073	0.00049	0.00049	mg/Kg	₩	03/24/21 15:18	1
Perfluorooctanesulfonic acid	<0.00049	0.00073	0.00049	0.00049	mg/Kg	₽	03/24/21 15:18	1
Perfluorooctanoic acid	<0.00049	0.00073	0.00049	0.00049	mg/Kg	₽	03/24/21 15:18	1
Perfluoropentanoic acid	<0.00049 M	0.00073	0.00049	0.00049	mg/Kg	₩	03/24/21 15:18	1
Perfluorotetradecanoic acid	<0.00049	0.00073	0.00049	0.00049	mg/Kg	₽	03/24/21 15:18	1
Perfluorotridecanoic acid	<0.00049	0.00073	0.00049	0.00049	mg/Kg	₩	03/24/21 15:18	1
Perfluoroundecanoic acid	<0.00049	0.00073	0.90049	0.00049	mg/Kg	☼	03/24/21 15:18	1
Isotope Dilution	%Recovery Qual	lifier Limits			Pre	pared	Analyzed	Dil Fac

ı	Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	DII Fac
	M2-6:2 FTS	47	*5-	50 - 150	03/23/21 20:31	03/24/21 15:18	1
	M2-8:2 FTS	38	*5-	50 - 150	03/23/21 20:31 (03/24/21 15:18	1
ı	13C2 PFTeDA	47	*5-	50 - 150	03/23/21 20:31 (03/24/21 15:18	1
I	13C3 PFBS	72		50 - 150	03/23/21 20:31 (03/24/21 15:18	1
	13C4 PFBA	43	*5-	50 - 150	03/23/24 20:31 (03/24/21 15:18	1
	13C4 PFHpA	48	*5-	50 - 150	03/23/21 20:31 (03/24/21 15:18	1
ı	13C5 PFPeA	43	*5-	50 - 150	03/23/21 20:31	93/24/21 15:18	1
	13C8 PFOA	48	*5-	50 - 150	03/23/21 20:31 (03/24/21 15:18	1
	13C8 PFOS	78		50 - 150	03/23/21 20:31 (03/24/21 15:18	1
١	d3-NMeFOSAA	8	*5-	50 - 150	03/23/21 20:31 (03/24/21 15:18	1
	d5-NEtFOSAA	12	*5-	50 - 150	03/23/21 20:31 (03/24/21 15:18	1
	13C2-PFDoDA	50		50 - 150	03/23/21 20:31 (03/24/21 15:18	X
1							

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Client: ARCADIS U.S., Inc.

Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Date Collected: 03/16/21 11:20

Matrix: Solid

Date Received: 03/17/21 16:00 Percent Solids: 82.4

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 PFHxS	84	50 - 150	03/23/21 20:31	03/24/21 15:18	1
13C5 PFHxA	44 *5-	50 - 15 0	03/23/21 20:31	03/24/21 15:18	1
13C6 PFDA	48 *5-	50 - 150	03/23/21 20:31	03/24/21 15:18	1
13C7 PFUnA	52	50 - 150	03/23/21 20:31	03/24/21 15:18	1
13C9 PFNA	44 *5-	50 ₋ 150	03/23/21 20:31	03/24/21 15:18	1

General Chemistry Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	1870	FL J-	1750	1170	1170	mg/Kg	-	03/20/21 15:24	4.81
Percent Moisture	17.6		1.0		1.0	%		03/18/21 08:33	1
Percent Solids	82.4		1.0		1.0	%		03/18/21 08:33	1

General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	5.6	J	0.01	0.01	0.01	S.U.	_	03/23/21 19:22	1
Temperature	20.4		0.01	0.01	0.01	Degrees C		03/23/21 19:22	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%	_	03/23/21 01:00	1
Sand	13.3		1.0	1.0	1.0	%		03/23/21 01:00	1
Silt	67.2		1.0	1.0	1.0	%		03/23/21 01:00	1
Clay	19.5		1.0	1.0	1.0	%		03/23/21 01:00	1
75 mm	100.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
19 mm	100		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
4.75 mm	100		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
3.35 mm	99.9		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
2.36 mm	99.9		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
1.18 mm	99.9		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.6 mm	99.2		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.3 mm	94.2		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.15 mm	90.1		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.075 mm	86.7		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.064 mm	83.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.05 mm	76.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.02 mm	40.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.005 mm	19.5		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.002 mm	14.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.001 mm	12.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1

Client Sample ID: APG-BAF-S6-1-GW-031621 Lab Sample ID: 410-32720-9

Date Collected: 03/16/21 11:50 Matrix: Water Date Received: 03/17/21 16:00

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	29		5.7	4.6	4.6	ng/L		03/22/21 15:49	1
8:2 Fluorotelomer sulfonic acid	2.4	J	3.4	2.3	2.3	ng/L		03/22/21 15:49	1
NEtFOSAA	<1.1		3.4	1.1	1.1	ng/L		03/22/21 15:49	1
NMeFOSAA	<1.4		2.3	1.4	1.4	ng/L		03/22/21 15:49	1

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Client Sample ID: APG-BAF-S6-1-GW-031621

Date Collected: 03/16/21 11:50 Date Received: 03/17/21 16:00

Client: ARCADIS U.S., Inc.

Lab Sample ID: 410-32720-9

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorobutanesulfonic acid	1.6	J	2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluorobutanoic acid	12		5.7	4.6	4.6	ng/L		03/22/21 15:49	1
Perfluorodecanoic acid	2.0	JM	2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluorododecanoic acid	<1.1		2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluoroheptanoic acid	13		2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluorohexanesulfonic acid	9.7		2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluorohexanoic acid	23		2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluorononanoic acid	4.3		2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluorooctanesulfonic acid	34		2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluorooctanoic acid	22	M	2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluoropentanoic acid	18		2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluorotetradecanoic acid	<1.1		2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluorotridecanoic acid	<1.1		2.3	1.1	1.1	ng/L		03/22/21 15:49	1
Perfluoroundecanoic acid	<1.1		2.3	1.1	1.1	ng/L		03/22/21 15:49	1

				J		
Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	149		50 - 150	03/19/21 09:11	03/22/21 15:49	1
M2-8:2 FTS	121		50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C2 PFTeDA	86		50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C3 PFBS	92	;	50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C4 PFBA	98		50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C4 PFHpA	108		50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C5 PFPeA	98		50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C8 PFOA	112		50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C8 PFOS	101		50 - 150	03/19/21 09:11	03/22/21 15:49	1
d3-NMeFOSAA	111	^c	50 - 150	03/19/21 09:11	03/22/21 15:49	1
d5-NEtFOSAA	128	^c	50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C2-PFDoDA	102		50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C3 PFHxS	105	;	50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C5 PFHxA	101		50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C6 PFDA	109		50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C7 PFUnA	112	,	50 - 150	03/19/21 09:11	03/22/21 15:49	1
13C9 PFNA	105		50 - 150	03/19/21 09:11	03/22/21 15:49	1

Client Sample ID: APG-EF15-1-GW-031621

Date Collected: 03/16/21 12:40 Date Received: 03/17/21 16:00 Lab Sample ID: 410-32720-10

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	19		6.9	5.5	5.5	ng/L		03/22/21 16:00	1
8:2 Fluorotelomer sulfonic acid	<2.8		4.1	2.8	2.8	ng/L		03/22/21 16:00	1
NEtFOSAA	<1.4		4.1	1.4	1.4	ng/L		03/22/21 16:00	1
NMeFOSAA	<1.7		2.8	1.7	1.7	ng/L		03/22/21 16:00	1
Perfluorobutanesulfonic acid	440		2.8	1.4	1.4	ng/L		03/22/21 16:00	1
Perfluorobutanoic acid	39		6.9	5.5	5.5	ng/L		03/22/21 16:00	1
Perfluorodecanoic acid	8.9		2.8	1.4	1.4	ng/L		03/22/21 16:00	1
Perfluorododecanoic acid	<1.4		2.8	1.4	1.4	ng/L		03/22/21 16:00	1
Perfluoroheptanoic acid	76		2.8	1.4	1.4	ng/L		03/22/21 16:00	1
Perfluorohexanesulfonic acid	220		2.8	1.4	1.4	ng/L		03/22/21 16:00	1
Perfluorohexanoic acid	78		2.8	1.4	1.4	ng/L		03/22/21 16:00	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-32720-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-EF15-1-GW-031621

Lab Sample ID: 410-32720-10 Date Collected: 03/16/21 12:40 **Matrix: Water**

Date Received: 03/17/21 16:00

Method: EPA 537(Mod) - PF	AS for QSM 5.3,	Table B-	15 (Contin	nued)				
Analyte	Result	Qualifier	LO	Q	LOD	DL	Unit	D Analyzed	Dil Fac
Perfluorononanoic acid	48		2	2.8	1.4	1.4	ng/L	03/22/21 16:00	1
Perfluorooctanoic acid	170		2	2.8	1.4	1.4	ng/L	03/22/21 16:00	1
Perfluoropentanoic acid	43	M	2	2.8	1.4	1.4	ng/L	03/22/21 16:00	1
Perfluorotetradecanoic acid	<1.4		2	2.8	1.4	1.4	ng/L	03/22/21 16:00	1
Perfluorotridecanoic acid	<1.4		2	2.8	1.4	1.4	ng/L	03/22/21 16:00	1
Perfluoroundecanoic acid	1.5	J M	2	2.8	1.4	1.4	ng/L	03/22/21 16:00	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac

r ernuoroundecanoic acid	1.5 5 10		2.0	1.7	1.4 11g/L	03/22/21 10.00	
Isotope Dilution	%Recovery	Qualifier	Limits		Prepared	Analyzed	Dil Fa
M2-6:2 FTS	140		50 - 150		03/19/21 09:11	03/22/21 16:00	-
M2-8:2 FTS	109		50 - 150		03/19/21 09:11	03/22/21 16:00	
13C2 PFTeDA	62		50 - 150		03/19/21 09:11	03/22/21 16:00	
13C3 PFBS	81		50 - 150		03/19/21 09:11	03/22/21 16:00	
13C4 PFBA	81		50 - 150		03/19/21 09:11	03/22/21 16:00	
13C4 PFHpA	97		50 - 150		03/19/21 09:11	03/22/21 16:00	
13C5 PFPeA	90		50 - 150		03/19/21 09:11	03/22/21 16:00	
13C8 PFOA	103		50 - 150		03/19/21 09:11	03/22/21 16:00	
13C8 PFOS	80		50 - 150		03/19/21 09:11	03/22/21 16:00	
d3-NMeFOSAA	102	^c	50 - 150		03/19/21 09:11	03/22/21 16:00	
d5-NEtFOSAA	113	^c	50 - 150		03/19/21 09:11	03/22/21 16:00	
13C2-PFDoDA	87		50 - 150		03/19/21 09:11	03/22/21 16:00	
13C3 PFHxS	96		50 - 150		03/19/21 09:11	03/22/21 16:00	
13C5 PFHxA	92		50 - 150		03/19/21 09:11	03/22/21 16:00	
13C6 PFDA	103		50 - 150		03/19/21 09:11	03/22/21 16:00	•
13C7 PFUnA	96		50 - 150		03/19/21 09:11	03/22/21 16:00	
13C9 PFNA	82		50 - 150		03/19/21 09:11	03/22/21 16:00	

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - DL												
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac				
Perfluorooctanesulfonic acid	1300	D	28	14	14	ng/L	03/23/21 19:41	10				
Isotope Dilution 13C8 PFOS	%Recovery 92	ualifier	Limits 50 - 150			Prepared 03/19/21 09:11	Analyzed 03/23/21 19:41	Dil Fac				



Aberdeen Proving Ground – Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDG # 410-32347-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report #41265R

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-32347-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

0.1.15	Lab ID Marris		Sample	5 (0)	Analysis		
Sample ID	Lab ID	Matrix	Collection Date	Parent Sample	PFAS	тос	рН
APG-FB-03-031221	410-32347-1	Water	3/12/2021		Х		
APG-BLDG-2308-1-GW-031221	410-32347-2	Water	3/12/2021		Х		
APG-BLDG-2200-2-SO-(0-2)-031221	410-32347-3	Soil	3/12/2021		Х		
APG-BLDG-2200-1-SO-(0-2)-031221	410-32347-4	Soil	3/12/2021		Х	Х	Х
APG-HELI-FIRE-1-SO-(0-2)-031221	410-32347-5	Soil	3/12/2021		Х	Х	Х
APG-HELI-FIRE-1-GW-031221	410-32347-6	Water	3/12/2021		Х		
APG-FB-07-031221	410-32347-7	Water	3/12/2021		Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-BLDG-2308-1-GW-031221.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was not performed on sample location associated with this SDG.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Rep	orted		mance ptable	Not
Items Reviewed		Yes	No	Yes	Required
Sample receipt condition		Х		Х	
2. Requested analyses and sample results		Х		X	
Master tracking list		Х		X	
4. Methods of analysis		Х		Х	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		Х	
11. Narrative summary of QA or sample problems provided		Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

1. The chain of custody states that 2 containers were submitted, whereas the laboratory received 3 containers for the following sample.

Lab ID	Sample ID
410-32347-6	APG-HELI-FIRE-1-GW-031221

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
APG-HELI-FIRE-1-SO-(0-2)-	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
031221	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 50% but > 20%
APG-HELI-FIRE-1-GW- 031221	M2 – 6:2 FTS	6:2 Fluorotelomer sulfonic acid	> 150%	> 150%

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
. 4500/	Non-detect	No Action
> 150%	Detect	J-
500/ 1 / 000/	Non-detect	UJ
< 50% but > 20%	Detect	J+
	Non-detect	UX
< 20%	Detect	Х

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be $\leq 30\%$.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

The MS/MSD analysis was not performed on sample location associated with this SDG.

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

A field duplicate was not collected for a sample location associated with this SDG.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

All identified compounds met method criteria.

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
APG-BLDG-2308-1-GW-	6:2 Fluorotelomer sulfonic acid		220	220 D
031221	Perfluorohexanesulfonic acid		990	990 D

Note: the lab didn't report the original analysis; only the diluted result.

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification
Diluted sample result within the calibration range	D

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Rep	Reported		rmance ptable	Not Required		
	No	Yes	No	Yes	-Required		
LIQUID CHROMATOGRAPHY/MASS SPECTROME	LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)						
Stage 2 Validation							
Holding times		Х		Х			
Reporting limits (units)		Х		Х			
Blanks							
A. Method blanks		Х		Х			
B. Equipment blanks	Х				X		
C. Field blanks		Х		Х			
Laboratory Control Sample (LCS) %R		Х		Х			
Laboratory Control Sample Duplicate (LCSD) %R		Х		Х			
LCS/LCSD Precision (RPD)		Х		Х			
Matrix Spike (MS) %R	Х				Х		
Matrix Spike Duplicate (MSD) %R	Х				Х		
MS/MSD Precision (RPD)	Х				X		
Field Duplicate (RPD)	Х				Х		
Extracted Internal Standard %R		Х	Х				
Injection Internal Standard %R		Х		Х			
Dilution Factor		Х		Х			
Moisture Content		Х		Х			
Stage 3/4 Validation							
Instrument tune and performance check		Х		Х			
Initial calibration %RSDs		Х		Х			
Continuing calibration %Ds		Х		Х			
Instrument sensitivity check		Х		Х			
Ion transitions used		Х		Х			
Compound identification and quantitation							
A. Reconstructed ion chromatograms		X		Х			
B. Quantitation Reports		Х		Х			
C. RT of sample compounds within the established RT windows		Х		Х			

PFAS: 537M/DoD QSM 5.3		Reported		mance ptable	Not Required	
		Yes	No	Yes	Required	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)						
D. Ion Ratio %R		X		Х		
E. Transcription/calculations acceptable		Х		Х		
F. Reporting limits adjusted to reflect sample dilutions		Х		Х		

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Analyte considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria
APG-BLDG-2200-1-SO-(0-2)-031221	4 days from collection; 4 days	< 24 hours of receipt at
APG-HELI-FIRE-1-SO-(0-2)-031221	from receipt	the laboratory

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

	Qualification
Criteria	Detected Analytes
Analysis completed past the holding time	J

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analytes	Standard Recovery
APG-BLDG-2200-1-SO-(0-2)-031221 APG-HELI-FIRE-1-SO-(0-2)-031221	CCV	TOC	73%

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Control Limit	Sample Result	Qualification
	O F 1.75%	Non-detect	UX
	Gross Exceedance < 75%	Detect	J-
T00	75% to 89%	Non-detect	UJ
TOC	75% 10 69%	Detect	J-
	4440/ 1- 4050/	Non-detect	No Action
	111% to 125%	Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

A MS analysis was not performed for TOC.

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

A laboratory duplicate analysis was not performed on sample location associated with this SDG.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within ± 0.05 S.U. of the true value.

All LCS recoveries were within control limits, with the exception of the analytes associated with sample locations, as presented in the following table.

Sample ID	Analyte	LCS Recovery	
APG-BLDG-2200-1-SO-(0-2)-031221	Total Organia Carbon	64%	
APG-HELI-FIRE-1-SO-(0-2)-031221	Total Organic Carbon	04%	

The criteria used to evaluate LCS recoveries are presented in the following table. In the case of an LCS deviation, the sample results are qualified.

Control limit	Sample Result	Qualification
0/ D	Non-detect	UJ
% Recovery < lower limit of 80%	Detect	J-
0/ 5	Non-detect	No Action
% Recovery > upper limit of 120%	Detect	J+

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Rep	orted		mance otable	Not
	No	Yes	No	Yes	Required
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	Х		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks	Х				Х
Laboratory Control Sample (LCS) %R		Х	Х		
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х
LCS/LCSD Precision (RPD)	Х				Х
Matrix Spike (MS) %R	Х				Х
Matrix Spike Duplicate (MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				Х
Lab Duplicate (RPD)	Х				Х
Field Duplicate (RPD)	Х				Х
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation	-				
Initial calibration correlation coefficient (TOC)		X		Х	
Continuing calibration %R		X	Х		
Raw Data		Х		Х	
Transcription/calculations acceptable		Х		Х	

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE: R n Sm

DATE: May 7, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 14, 2021

Stage 3 / 4 PFAS Calibration Standards

SDG #:410-32347-1Date:5/7/2021Lab:Eurofins LancasterPage:1Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

PFOA 3/17/2021 Calibration

Page 634 - 647 of SDG 410-32347-1

Match Match Match Match Match Match Match

1104 3/	LIT ZUZI CUIID	ration				Tuge 05-	047 01 300	710 32377	_	
Cal Conc					Calculated		Calc		Calculated	Reported
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D
0.2	141234	6771971	10	0.020856	1.0427836	0.9768	0.21351	0.2	6.755	6.8
0.5	339917	6639170	10	0.051199	1.0239744	0.9768	0.524147	0.5	4.829	4.8
2	1428396	6518513	10	0.219129	1.0956456	0.9768	2.243337	2	12.167	12.2
8	4606305	6241486	10	0.738014	0.9225177	0.9768	7.555427	8	-5.557	-5.6
20	11353940	6107162	10	1.859119	0.9295594	0.9768	19.03275	20	-4.836	-4.8
50	26265377	5722106	10	4.590159	0.9180318	0.9768	46.9918	50	-6.016	-6
100	43121158	4763137	10	9.053101	0.9053101	0.9768	92.68121	100	-7.319	-7.3

Avg RF = 0.9768318 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-32347-1Date:5/7/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-103929/9 3/17/2021 01:41

Page 924 - 929 of SDG 410-32347-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	874409	4859351	10	0.1799	0.9055	1.987	2	-0.64	-0.6
Perfluoropentanoic acid	931437	4634587	10	0.2010	1.0900	1.844	2	-7.81	-7.8
Perfluorobutanesulfonic acid	772307	3826669	9.36	0.2018	1.1250	1.679	2	-5.13	-5
Perfluorohexanoic acid	897494	5038802	10	0.1781	0.8906	2.000	2	0.00	0
Perfluoroheptanoic acid	1138680	5302738	10	0.2147	1.1710	1.834	2	-8.31	-8.3
Perfluorohexanesulfonic acid	721897	3684758	9.46	0.1959	1.0560	1.755	2	-7.14	-7.2
Perfluorooctanesulfonic acid	783741	3880536	9.57	0.2020	1.1290	1.712	2	-10.37	-10.5

Match Match Match Match Match Match

CCV 410-104674/26 3/17/2021 13:03

Page 956 - 961 of SDG 410-32347-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	1026168	4959129	10	0.2069	0.9055	2.285	2.0	14.26	14.3
Perfluoropentanoic acid	1120771	4551362	10	0.2462	1.0900	2.259	2.0	12.96	12.9
Perfluorobutanesulfonic acid	968137	4236967	9.36	0.2285	1.1250	1.901	1.8	7.41	7.4
Perfluorohexanoic acid	1057799	5262676	10	0.2010	0.8906	2.257	2.0	12.85	12.9
Perfluoroheptanoic acid	1332276	5385910	10	0.2474	1.1710	2.112	2.0	5.62	5.7
Perfluorohexanesulfonic acid	831776	3812500	9.46	0.2182	1.0560	1.954	1.8	7.39	7.2
Perfluorooctanesulfonic acid	1001900	4163874	9.57	0.2406	1.1291	2.039	1.9	10.24	10.1

Match Match Match Match Match Match Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 $\begin{array}{c|ccccc} \text{SDG \#:} & 410\text{-}32347\text{-}1 & \text{Date:} & 5/7/2021 \\ \text{Lab:} & \hline{\text{Eurofins Lancaster}} & \text{Page:} & 3 \\ \hline \text{Project:} & \text{Aberdeen Proving Ground} & \text{Validated by:} & \text{SPR} \\ \end{array}$

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-103137/2-A

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Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported	
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	2933803	5604159	10	0.523505	0.9055	23.13	25.6	90.33	90	Match
Perfluoropentanoic acid	2981683	5179035	10	0.575722	1.0900	21.13	25.6	82.53	82	Match
Perfluorobutanesulfonic acid	2677919	3947482	9.36	0.678387	1.1250	22.58	22.7	99.46	100	Match
Perfluorohexanoic acid	3178997	6138530	10	0.517876	0.8906	23.26	25.6	90.86	91	Match
Perfluoroheptanoic acid	4172643	5977857	10	0.698017	1.1710	23.84	25.6	93.14	93	Match
Perfluorohexanesulfonic acid	2344444	3971928	9.46	0.590253	1.0560	21.15	23.3	90.78	91	Match
Perfluorooctanesulfonic acid	2767806	4363614	9.57	0.634292	1.1290	21.51	23.7	90.74	91	Match

Calculated Amount ng/L = ((Peak area ratio/Avg RF) x EIS concentration)/Sample volume)*1000

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-32347-1
 Date:
 5/7/2021

 Lab:
 Eurofins Lancaster
 Page:
 4

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-BLDG-2308-1-GW-031221 Lab ID: 410-32347-2 Page 528 - 532 of SDG 410-32347-1

						Calculated	Final		Final	Reported	1
						Amount	Volume	Sample	Calculated	Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	12401977	4797460	10	2.585113	0.9055	28.55	1	235.4	121.3	120	Mat
Perfluoropentanoic acid	42841422	4109267	10	10.42556	1.0900	95.65	1	235.4	406.3	410	Mat
Perfluorobutanesulfonic acid	4453799	3651886	9.36	1.219589	1.1250	10.15	1	235.4	43.1	43	Mat
Perfluorohexanoic acid	39372402	4981202	10	7.904197	0.8906	88.75	1	235.4	377.0	380	Mat
Perfluoroheptanoic acid	25938975	4427253	10	5.858932	1.1710	50.03	1	235.4	212.5	210	Mat
Perfluorohexanesulfonic acid	8738570	337650	9.46	25.88056	1.0560	231.85	1	235.4	984.9	990	Mat
Perfluorooctanesulfonic acid	22282883	3863000	9.57	5.768284	1.1290	48.90	1	235.4	207.7	210	Mat

Calculated amount $ng/ml = (Peak area ratio/Avg RF) \times DF \times EIS conc ng/ml$ Final Calculated amount $ng/L = ((calculated ng/ml \times Final Volume mls) / sample volume mls) *1000$ Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

SDG #:410-32347-1Date:5/7/2021Lab:Eurofins LancasterPage:5Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-BLDG-2308-1-GW-031221 Lab ID: 410-32347-2

EIS 13C8 PFOS
REPORTED EIS %R 90

 $%R = \frac{100 * EIS Concentration}{EIS TV}$

EIS Concentration 8.63 ng/ml Page 531 of 410-32347-1

EIS TV 9.57

%R 90.2 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental Analysi

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Lancaster Laboratories Acct. # 410-

410-32347 Chain of Custody

Environmental use only

COC #616536

Client Information	n					Matrix					- 4	naly	sis l	Requeste	.d		For Lab Use Only		
Client:	Acct. #:							1 '		Pi				d Filtration		S	FSC:		
ARLADIS				,								21-4					SCR#:		
Project Name/#: APL PFAS SI Project Manager:	PWSID #:				Tissue	Ground											H=HCI		Thiosulfate
Sampler:		996.3BXS	50		nent			Total # of Containers	1	(44)	r (43	(34)	(173)			-	N=HNO ₃ S=H ₂ SO ₄ F=Field F		The second secon
State where samples were collected: For Compliance: Yes	No □	1		Site	Sediment	Potable		of Con	5 (170	7)	in Si	F	FAS (Tiona	
Sample Identification	Co	ollected e Time	Grab	Composite	Soil 🗵	Water	Other:	Total #	PEAS	Moi	Gra	H d	d				200	1	
APL-F8-03-1221 APG-F6-03-031221	3/12/2	0810	×			GW	77	2		1			X						
Apa-BLOG-2308-1-GW-031221		1000	×			GW		2					×						
APG-BIDG-2200-2-50-(0-2)-031221		0930		×	50	1		2	X			1=1					1		
APG-BLDG-2200-1-50-(0-2)-031221		1040		X	50	-1	7	4	×	X	×	X		1-11					
APG-HELT-FIRE-1-50-(0-2)-031221	4	1330	1L =	X	50	r –	1-7	4	X	×	X	X		FE					
ADG-HELI-FIRE-1-6W-031221		1400	×			GW	Engl	2	1-1				X	-17		-	THE LET		
APG-FB-07-031221	1	1340	×			GW		2					×						
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Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • FOR HELP COMPLETING FORM CHECK OUT https://www.eurofinsus.com/coc

The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client.

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-32347-1

Project/Site: APG PFAS S1

Manual integrated compound

Qualifiers

LCMS

N/I

LCIVIS	
Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
*5+	Isotope dilution analyte is outside acceptance limits, high biased.
В	Blank contamination: The analyte was detected above one-half the reporting limit in an associated blank.
D	The reported value is from a dilution.
I	Value is EMPC (estimated maximum possible concentration).
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Abbreviation These commonly used abbreviations may or may not be present in this report. Listed under the "D" column to designate that the result is reported on a dry weight basis Result is from the primary column on a dual-column method. Result is from the confirmation column on a dual-column method. CFL Contains Free Liquid CFU Colony Forming Unit CNF Contains No Free Liquid DER Duplicate Error Ratio (normalized absolute difference) Dil Fac Dilution Factor DL Detection Limit (DoD/DOE) DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample DLC Decision Level Concentration (Radiochemistry)
Listed under the "D" column to designate that the result is reported on a dry weight basis Percent Recovery Result is from the primary column on a dual-column method. Result is from the confirmation column on a dual-column method. CFL Contains Free Liquid CFU Colony Forming Unit CNF Contains No Free Liquid DER Duplicate Error Ratio (normalized absolute difference) Dil Fac Dilution Factor DL Detection Limit (DoD/DOE) DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample DLC Decision Level Concentration (Radiochemistry)
%RPercent Recovery1CResult is from the primary column on a dual-column method.2CResult is from the confirmation column on a dual-column method.CFLContains Free LiquidCFUColony Forming UnitCNFContains No Free LiquidDERDuplicate Error Ratio (normalized absolute difference)Dil FacDilution FactorDLDetection Limit (DoD/DOE)DL, RA, RE, INIndicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sampleDLCDecision Level Concentration (Radiochemistry)
Result is from the primary column on a dual-column method. CR Result is from the confirmation column on a dual-column method. CR Contains Free Liquid CRU Colony Forming Unit CNF Contains No Free Liquid DER Duplicate Error Ratio (normalized absolute difference) Dil Fac Dilution Factor DL Detection Limit (DoD/DOE) DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample DLC Decision Level Concentration (Radiochemistry)
2C Result is from the confirmation column on a dual-column method. CFL Contains Free Liquid CFU Colony Forming Unit CNF Contains No Free Liquid DER Duplicate Error Ratio (normalized absolute difference) Dil Fac Dilution Factor DL Detection Limit (DoD/DOE) DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample DLC Decision Level Concentration (Radiochemistry)
CFL Contains Free Liquid CFU Colony Forming Unit CNF Contains No Free Liquid DER Duplicate Error Ratio (normalized absolute difference) Dil Fac Dilution Factor DL Detection Limit (DoD/DOE) DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample DLC Decision Level Concentration (Radiochemistry)
CFU Colony Forming Unit CNF Contains No Free Liquid DER Duplicate Error Ratio (normalized absolute difference) Dil Fac Dilution Factor DL Detection Limit (DoD/DOE) DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample DLC Decision Level Concentration (Radiochemistry)
CNF Contains No Free Liquid DER Duplicate Error Ratio (normalized absolute difference) Dil Fac Dilution Factor DL Detection Limit (DoD/DOE) DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample DLC Decision Level Concentration (Radiochemistry)
DER Duplicate Error Ratio (normalized absolute difference) Dil Fac Dilution Factor DL Detection Limit (DoD/DOE) DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample DLC Decision Level Concentration (Radiochemistry)
Dil Fac Dilution Factor DL Detection Limit (DoD/DOE) DL, RA, RE, IN DLC Decision Level Concentration (Radiochemistry)
DL Detection Limit (DoD/DOE) DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample DLC Decision Level Concentration (Radiochemistry)
DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample DLC Decision Level Concentration (Radiochemistry)
DLC Decision Level Concentration (Radiochemistry)
EDI E Porto I D A di Sa Livia (Pirota)
EDL Estimated Detection Limit (Dioxin)
LOD Limit of Detection (DoD/DOE)
LOQ Limit of Quantitation (DoD/DOE)
MCL EPA recommended "Maximum Contaminant Level"
MDA Minimum Detectable Activity (Radiochemistry)

Minimum Detectable Concentration (Radiochemistry) MDC MDL Method Detection Limit MLMinimum Level (Dioxin) Most Probable Number MPN Method Quantitation Limit MQL

NC Not Calculated

ND Not Detected at the reporting limit (or MDL or EDL if shown)

NEG Negative / Absent POS Positive / Present PQL **Practical Quantitation Limit**

PRES Presumptive QC **Quality Control**

RER Relative Error Ratio (Radiochemistry)

Reporting Limit or Requested Limit (Radiochemistry) RL

RPD Relative Percent Difference, a measure of the relative difference between two points

Toxicity Equivalent Factor (Dioxin) TEF TEQ Toxicity Equivalent Quotient (Dioxin)

TNTC Too Numerous To Count

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Client: ARCADIS U.S., Inc. Job ID: 410-32347-1 Project/Site: APG PFAS S1

Client Sample ID: APG-FB-03-031221

Lab Sample ID: 410-32347-1 **Matrix: Water**

Date Collected: 03/12/21 08:10 Date Received: 03/12/21 17:30

Analyte	Result	Qualifier	LO	Q	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5		4	.4	3.5	3.5	ng/L	03/17/21 12:52	1
8:2 Fluorotelomer sulfonic acid	<1.8		2	.6	1.8	1.8	ng/L	03/17/21 12:52	1
NEtFOSAA	<0.88		2	.6	0.88	0.88	ng/L	03/17/21 12:52	1
NMeFOSAA	<1.1		1	.8	1.1	1.1	ng/L	03/17/21 12:52	1
Perfluorobutanesulfonic acid	<0.88		1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluorobutanoic acid	<3.5		4	.4	3.5	3.5	ng/L	03/17/21 12:52	1
Perfluorodecanoic acid	<0.88		1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluorododecanoic acid	<0.88		1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluoroheptanoic acid	<0.88		1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluorohexanesulfonic acid	<0.88		1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluorohexanoic acid	<0.88		1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluorononanoic acid	<0.88		1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluorooctanesulfonic acid	<0.88		1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluorooctanoic acid	<0.88	M	1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluoropentanoic acid	<0.88	١	1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluorotetradecanoic acid	<0.88		1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluorotridecanoic acid	<0.88		1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Perfluoroundecanoic acid	<0.88		1	.8	0.88	0.88	ng/L	03/17/21 12:52	1
Isotope Dilution	%Recovery Qu	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	130		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
M2-8:2 FTS	115		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C2 PFTeDA	92		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C3 PFBS	86		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C4 PFBA	108		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C4 PFHpA	115		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C5 PFPeA	108		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C8 PFOA	114		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C8 PFOS	97		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
d3-NMeFOSAA	92		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
d5-NEtFOSAA	104		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C2-PFDoDA	102		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C3 PFHxS	102		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C5 PFHxA	113		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C6 PFDA	106		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1
13C7 PFUnA	110		50 - 150				03/15/21 08:3	4 03/17/21 12:52	1

Client Sample ID: APG-BLDG-2308-1-GW-031221 Lab Sample ID: 410-32347-2

Date Collected: 03/12/21 10:00 **Matrix: Water**

Date Received: 03/12/21 17:30

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
8:2 Fluorotelomer sulfonic acid	<2.1	3.2	2.1	2.1 ng/L	03/17/21 13:14	1
NEtFOSAA	<1.1	3.2	1.1	1.1 ng/L	03/17/21 13:14	1
NMeFOSAA	<1.3	2.1	1.3	1.3 ng/L	03/17/21 13:14	1
Perfluorobutanesulfonic acid	43	2.1	1.1	1.1 ng/L	03/17/21 13:14	1
Perfluorobutanoic acid	120	5.3	4.2	4.2 ng/L	03/17/21 13:14	1
Perfluorodecanoic acid	1.3 J	2.1	1.1	1.1 ng/L	03/17/21 13:14	1
Perfluorododecanoic acid	<1.1	2.1	1.1	1.1 ng/L	03/17/21 13:14	1

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Job ID: 410-32347-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-BLDG-2308-1-GW-031221

Date Collected: 03/12/21 10:00

Date Received: 03/12/21 17:30

Lab Sample	ID: 410-32347-2
------------	-----------------

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluoroheptanoic acid	210		2.1	1.1	1.1	ng/L		03/17/21 13:14	1
Perfluorohexanoic acid	380		2.1	1.1	1.1	ng/L		03/17/21 13:14	1
Perfluorononanoic acid	24		2.1	1.1	1.1	ng/L		03/17/21 13:14	1
Perfluorooctanesulfonic acid	210	M	2.1	1.1	1.1	ng/L		03/17/21 13:14	1
Perfluorooctanoic acid	190	M	2.1	1.1	1.1	ng/L		03/17/21 13:14	1
Perfluoropentanoic acid	410		2.1	1.1	1.1	ng/L		03/17/21 13:14	1
Perfluorotetradecanoic acid	<1.1		2.1	1.1	1.1	ng/L		03/17/21 13:14	1
Perfluorotridecanoic acid	<1.1		2.1	1.1	1.1	ng/L		03/17/21 13:14	1
Perfluoroundecanoic acid	<1.1		2.1	1.1	1.1	ng/L		03/17/21 13:14	1

			· ·	
Isotope Dilution	%Recovery Qualifier	Limits	Prepared Anai	lyzed Dil Fac
M2-6:2 FTS	104	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
M2-8:2 FTS	101	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C2 PFTeDA	68	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C3 PFBS	84	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C4 PFBA	91	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C4 PFHpA	82	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C5 PFPeA	84	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C8 PFOA	97	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C8 PFOS	90	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
d3-NMeFOSAA	81	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
d5-NEtFOSAA	88	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C2-PFDoDA	91	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C3 PFHxS	76	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C5 PFHxA	91	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C6 PFDA	98	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C7 PFUnA	101	50 - 150	03/15/21 08:34 03/17/2	1 13:14 1
13C9 PFNA	99	50 ₋ 150	03/15/21 08:34 03/17/2	1 13:14 1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	220	D	53	42	42	ng/L	03/19/21 03:04	10
Perfluorohexanesulfonic acid	990	D	21	11	11	ng/L	03/19/21 03:04	10
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	121		50 - 150			03/15/21 08:34	03/19/21 03:04	10
13C3 PFHxS	87		50 - 150			03/15/21 08:34	03/19/21 03:04	10

Lab Sample ID: 410-32347-3 Client Sample ID: APG-BLDG-2200-2-SO-(0-2)-031221 Date Collected: 03/12/21 09:30

Matrix: Solid Date Received: 03/12/21 17:30 Percent Solids: 85.7

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	03/17/21 20:03	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0035	0.0018	0.0018	mg/Kg	₩	03/17/21 20:03	1
NEtFOSAA	<0.00046		0.0023	0.00046	0.00046	mg/Kg	☼	03/17/21 20:03	1
NMeFOSAA	<0.00046		0.0023	0.00046	0.00046	mg/Kg	⊅	03/17/21 20:03	1
Perfluorobutanesulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₩	03/17/21 20:03	1
Perfluorobutanoic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₩	03/17/21 20:03	1
Perfluorodecanoic acid	0.0081		0.00069	0.00046	0.00046	mg/Kg	⊅	03/17/21 20:03	1
Perfluorododecanoic acid	0.0015		0.00069	0.00046	0.00046	mg/Kg	₽	03/17/21 20:03	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32347-1 Project/Site: APG PFAS S1

Client Sample ID: APG-BLDG-2200-2-SO-(0-2)-031221

Lab Sample ID: 410-32347-3 Date Collected: 03/12/21 09:30 **Matrix: Solid**

Date Received: 03/12/21 17:30 Percent Solids: 85.7

Analyte	Result Qualif	ier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluoroheptanoic acid	0.00075	0.00069	0.00046	0.00046	mg/Kg	<u></u>	03/17/21 20:03	1
Perfluorohexanesulfonic acid	<0.00046 M	0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:03	1
Perfluorohexanoic acid	0.00068 J M	0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:03	1
Perfluorononanoic acid	0.0020	0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:03	1
Perfluorooctanesulfonic acid	0.0033	0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:03	1
Perfluorooctanoic acid	0.00094 M	0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:03	1
Perfluoropentanoic acid	0.0010 M	0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:03	1
Perfluorotetradecanoic acid	0.00049 J	0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:03	1
Perfluorotridecanoic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:03	1
Perfluoroundecanoic acid	0.0028	0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:03	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepa	ared	Analyzed	Dil Fac
M2-6:2 FTS	121	50 - 150			03/15/21	1 13:55	03/17/21 20:03	1
M2-8:2 FTS	103	50 - 150			03/15/21	1 13:55	03/17/21 20:03	1
13C2 PFTeDA	105	50 ₋ 150			03/15/21	1 13:55	03/17/21 20:03	1
13C3 PFBS	95	50 - 150			03/15/21	13:55	03/17/21 20:03	1
13C4 PFBA	109	50 - 150			03/15/21	1 13:55	03/17/21 20:03	1
13C4 PFHpA	117	50 - 150			03/15/21	1 13:55	03/17/21 20:03	1
13C5 PFPeA	109	50 - 150			03/15/21	13:55	03/17/21 20:03	1
13C8 PFOA	114	50 - 150			03/15/21	1 13:55	03/17/21 20:03	1
13C8 PFOS	104	50 - 150			03/15/21	1 13:55	03/17/21 20:03	1
d3-NMeFOSAA	60	50 - 150			03/15/21	13:55	03/17/21 20:03	1
d5-NEtFOSAA	77	50 - 150			03/15/21	1 13:55	03/17/21 20:03	1
13C2-PFDoDA	110	50 ₋ 150			03/15/21	1 13:55	03/17/21 20:03	1
13C3 PFHxS	111	50 - 150			03/15/21	13:55	03/17/21 20:03	1
13C5 PFHxA	114	50 - 150			03/15/21	1 13:55	03/17/21 20:03	1
13C6 PFDA	111	50 - 150			03/15/21	1 13:55	03/17/21 20:03	1
13C7 PFUnA	113	50 - 150			03/15/21	13:55	03/17/21 20:03	1
13C9 PFNA	109	50 - 150			03/15/21	1 13:55	03/17/21 20:03	1
General Chemistry								
Analyte	Result Qualif	ier LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	14.3	1.0		1.0	%		03/13/21 08:14	1

General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	14.3		1.0		1.0	%		03/13/21 08:14	1
Percent Solids	85.7		1.0		1.0	%		03/13/21 08:14	1

Client Sample ID: APG-BLDG-2200-1-SO-(0-2)-031221 Lab Sample ID: 410-32347-4 Date Collected: 03/12/21 10:40 **Matrix: Solid** Date Received: 03/12/21 17:30 Percent Solids: 85.4

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	₽	03/17/21 20:14	1
8:2 Fluorotelomer sulfonic acid	<0.0018 M	0.0034	0.0018	0.0018	mg/Kg	☼	03/17/21 20:14	1
NEtFOSAA	<0.00046	0.0023	0.00046	0.00046	mg/Kg	≎	03/17/21 20:14	1
NMeFOSAA	<0.00046	0.0023	0.00046	0.00046	mg/Kg	₽	03/17/21 20:14	1
Perfluorobutanesulfonic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	☼	03/17/21 20:14	1
Perfluorobutanoic acid	<0.0018	0.0023	0.0018	0.0018	mg/Kg	≎	03/17/21 20:14	1
Perfluorodecanoic acid	0.0035	0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:14	1
Perfluorododecanoic acid	0.0020	0.00069	0.00046	0.00046	mg/Kg	≎	03/17/21 20:14	1
Perfluoroheptanoic acid	0.00091	0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:14	1
Perfluorohexanesulfonic acid	<0.00046	0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:14	1

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Client: ARCADIS U.S., Inc.

Project/Site: APG PFAS S1

Job ID: 410-32347-1

Client Sample ID: APG-BLDG-2200-1-SO-(0-2)-031221 Lab Sample ID: 410-32347-4

Date Collected: 03/12/21 10:40

Matrix: Solid

Date Received: 03/12/21 17:30

Percent Solids: 85.4

Analyte	Result	Qualifier	LOQ	LOD	DI	Unit	D	Analyzed	Dil Fa
Perfluorohexanoic acid	0.00080	<u> </u>	0.00069	0.00046	0.00046		— -	03/17/21 20:14	
Perfluorononanoic acid	0.0012		0.00069	0.00046	0.00046		₽	03/17/21 20:14	
Perfluorooctanesulfonic acid	0.0012		0.00069	0.00046	0.00046			03/17/21 20:14	
Perfluorooctanoic acid	0.00078		0.00069	0.00046	0.00046		☆	03/17/21 20:14	
Perfluoropentanoic acid	0.0015	М	0.00069	0.00046	0.00046		;;;	03/17/21 20:14	
Perfluorotetradecanoic acid	0.00053		0.00069	0.00046	0.00046			03/17/21 20:14	
Perfluorotridecanoic acid	0.00059		0.00069	0.00046	0.00046		;;;	03/17/21 20:14	
Perfluoroundecanoic acid	0.0043		0.00069	0.00046	0.00046			03/17/21 20:14	
									D:/ E
sotope Dilution M2-6:2 FTS	%Recovery 124	uaiitier	Limits 50 - 150			Prepa		Analyzed 03/17/21 20:14	Dil F
M2-8:2 FTS	103		50 - 150 50 - 150					03/17/21 20:14	
	103 107								
13C2 PFTeDA			50 - 150					03/17/21 20:14	
3C3 PFBS	100 109		50 - 150 50 - 150					03/17/21 20:14	
3C4 PFBA			50 - 150 50 - 150					03/17/21 20:14	
13C4 PFHpA	112		50 - 150 50 - 150					03/17/21 20:14	
13C5 PFPeA	108 115		50 - 150 50 - 150					03/17/21 20:14	
13C8 PFOA	115		50 - 150					03/17/21 20:14	
3C8 PFOS	114		50 - 150					03/17/21 20:14	
I3-NMeFOSAA	98		50 - 150					03/17/21 20:14	
I5-NEtFOSAA	102		50 - 150					03/17/21 20:14	
I3C2-PFDoDA	108		50 - 150					03/17/21 20:14	
13C3 PFHxS	113		50 - 150					03/17/21 20:14	
13C5 PFHxA	114		50 - 150					03/17/21 20:14	
I3C6 PFDA	110		50 - 150					03/17/21 20:14	
13C7 PFUnA	107		50 - 150					03/17/21 20:14	
13C9 PFNA	117		50 - 150			03/15/21	13:55	03/17/21 20:14	
General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DI	Unit	D	Analyzed	Dil Fa
Total Organic Carbon	5690	J-	3000	2000		mg/Kg	— <u>=</u>		8.5
Percent Moisture	14.6	0 -	1.0	2000	1.0		~	03/13/21 08:14	0.
Percent Solids	85.4		1.0		1.0			03/13/21 08:14	
reicent Sonas	03.4		1.0		1.0	70		03/13/21 00.14	
General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
oH	6.8	J	0.01	0.01	0.01	S.U.		03/16/21 18:12	
Temperature	20.5		0.01	0.01	0.01	Degrees C		03/16/21 18:12	
-									
Wethod: D422 - Grain Size									
Analyte	Result	Qualifier	LOQ	LOD		Unit	_ D	Analyzed	Dil F
Gravel	28.8		1.0	1.0	1.0			03/15/21 13:20	
Sand	33.3		1.0	1.0	1.0			03/15/21 13:20	
Silt	33.0		1.0	1.0	1.0			03/15/21 13:20	
Clay	5.0		1.0	1.0	1.0	%		03/15/21 13:20	
'5 mm	100.0		1.0	1.0		% Passing		03/15/21 13:20	
7.5 mm	100.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	
9 mm	95.1		1.0	1.0	1.0	% Passing		03/15/21 13:20	
I.75 mm	71.3		1.0	1.0	1.0	% Passing		03/15/21 13:20	
3.35 mm	70.3		1.0	1.0	1.0	% Passing		03/15/21 13:20	
2.36 mm	69.8		1.0	1.0		% Passing		03/15/21 13:20	

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Job ID: 410-32347-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-BLDG-2200-1-SO-(0-2)-031221

Lab Sample ID: 410-32347-4 Date Collected: 03/12/21 10:40 **Matrix: Solid** Date Received: 03/12/21 17:30 Percent Solids: 85.4

Method: D422 - Grain S	ize (Continued)								
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
1.18 mm	69.2		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.6 mm	59.1		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.3 mm	50.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.15 mm	43.1		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.075 mm	38.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.064 mm	38.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.05 mm	30.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.02 mm	16.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.005 mm	5.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.002 mm	5.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.001 mm	5.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1

Client Sample ID: APG-HELI-FIRE-1-SO-(0-2)-031221

Lab Sample ID: 410-32347-5 Date Collected: 03/12/21 13:30 **Matrix: Solid** Date Received: 03/12/21 17:30 Percent Solids: 89.9

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg	<u></u>	03/24/21 13:05	1
8:2 Fluorotelomer sulfonic acid	<0.0017		0.0032	0.0017	0.0017	mg/Kg	☼	03/24/21 13:05	1
NEtFOSAA	<0.00042	UJ	0.0021	0.00042	0.00042	mg/Kg	☼	03/24/21 13:05	1
NMeFOSAA	<0.00042	UJ	0.0021	0.00042	0.00042	mg/Kg	₩	03/24/21 13:05	1
Perfluorobutanesulfonic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg	₩	03/24/21 13:05	1
Perfluorobutanoic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg	☼	03/24/21 13:05	1
Perfluorodecanoic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	₩	03/24/21 13:05	1
Perfluorododecanoic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	₩	03/24/21 13:05	1
Perfluoroheptanoic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 13:05	1
Perfluorohexanesulfonic acid	<0.00042	_	0.00064	0.00042	0.00042	mg/Kg	₩	03/24/21 13:05	1
Perfluorohexanoic acid	<0.00042	M	0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 13:05	1
Perfluorononanoic acid	<0.00042	'	0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 13:05	1
Perfluorooctanesulfonic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 13:05	1
Perfluorooctanoic acid	<0.00042	M	0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 13:05	1
Perfluoropentanoic acid	<0.00042	`	0.00064	0.00042	0.00042	mg/Kg	₩	03/24/21 13:05	1
Perfluorotetradecanoic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	₩	03/24/21 13:05	1
Perfluorotridecanoic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 13:05	1
Perfluoroundecanoic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	₩	03/24/21 13:05	1
Isotone Dilution	%Recovery O	ualifior	l imits			Prena	red	Analyzed	Dil Fac

%Recovery Qualifie	r Limits	Prepared	Analyzed	Dil Fac
97	50 - 150	03/23/21 20:31	03/24/21 13:05	1
72	50 - 150	03/23/21 20:31	03/24/21 13:05	1
67	50 - 150	03/23/21 20:31	03/24/21 13:05	1
81	50 - 150	03/23/21 20:31	03/24/21 13:05	1
62	50 - 150	03/23/21 20:31	03/24/21 13:05	1
80	50 - 150	03/23/21 20:31	03/24/21 13:05	1
64	50 - 150	03/23/21 20:31	03/24/21 13:05	1
85	50 - 150	03/23/21 20:31	03/24/21 13:05	1
85	50 - 150	03/23/21 20:31	03/24/21 13:05	1
24 *5-	50 - 150	03/23/21 20:31	03/24/21 13:05	1
30 *5-	50 - 150	03/23/21 20:31	03/24/21 13:05	1
78	50 - 150	03/23/21 20:31	03/24/21 13:05	1
91	50 - 150	03/23/21 20:31	03/24/21 13:05	1
	97 72 67 81 62 80 64 85 85 24 *5- 30 *5- 78	97 50 - 150 72 50 - 150 67 50 - 150 81 50 - 150 62 50 - 150 80 50 - 150 64 50 - 150 85 50 - 150 85 50 - 150 24 *5- 50 - 150 30 *5- 50 - 150 78 50 - 150	97 50 - 150 03/23/21 20:31 72 50 - 150 03/23/21 20:31 67 50 - 150 03/23/21 20:31 81 50 - 150 03/23/21 20:31 62 50 - 150 03/23/21 20:31 80 50 - 150 03/23/21 20:31 64 50 - 150 03/23/21 20:31 85 50 - 150 03/23/21 20:31 85 50 - 150 03/23/21 20:31 24 *5 - 50 - 150 03/23/21 20:31 30 *5 - 50 - 150 03/23/21 20:31 78 50 - 150 03/23/21 20:31	97 50 - 150 03/23/21 20:31 03/24/21 13:05 72 50 - 150 03/23/21 20:31 03/24/21 13:05 67 50 - 150 03/23/21 20:31 03/24/21 13:05 81 50 - 150 03/23/21 20:31 03/24/21 13:05 62 50 - 150 03/23/21 20:31 03/24/21 13:05 80 50 - 150 03/23/21 20:31 03/24/21 13:05 64 50 - 150 03/23/21 20:31 03/24/21 13:05 85 50 - 150 03/23/21 20:31 03/24/21 13:05 85 50 - 150 03/23/21 20:31 03/24/21 13:05 85 50 - 150 03/23/21 20:31 03/24/21 13:05 30 *5 - 50 - 150 03/23/21 20:31 03/24/21 13:05 30 *5 - 50 - 150 03/23/21 20:31 03/24/21 13:05 78 50 - 150 03/23/21 20:31 03/23/21 20:31 03/24/21 13:05

Client: ARCADIS U.S., Inc. Job ID: 410-32347-1 Project/Site: APG PFAS S1

Client Sample ID: APG-HELI-FIRE-1-SO-(0-2)-031221

Lab Sample ID: 410-32347-5 Date Collected: 03/12/21 13:30 **Matrix: Solid**

Date Received: 03/12/21 17:30 Percent Solids: 89.9

Method: EPA 537(Mod) - PFAS	for QSM 5.3	3, Table B-	15 (Continued)			
Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C5 PFHxA	70		50 - 150	03/23/21 20:31	03/24/21 13:05	1
13C6 PFDA	80		50 - 150	03/23/21 20:31	03/24/21 13:05	1
13C7 PFUnA	80		50 - 150	03/23/21 20:31	03/24/21 13:05	1
13C9 PFNA	77		50 - 150	03/23/21 20:31	03/24/21 13:05	1

Method: EPA 537(Mod) - PFAS fo	r QSM 5.3, Table B-1	5 - RE						
Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0016	0.0021	0.0016	0.0016	mg/Kg	*	03/17/21 20:25	1
8:2 Fluorotelomer sulfonic acid	<0.0016	0.0031	0.0016	0.0016	mg/Kg	☼	03/17/21 20:25	1
NEtFOSAA	<0.00041	0.0021	0.00041	0.00041	mg/Kg	☼	03/17/21 20:25	1
NMeFOSAA	<0.00041	0.0021	0.00041	0.00041	mg/Kg	⊅	03/17/21 20:25	1
Perfluorobutanesulfonic acid	<0.0016	0.0021	0.0016	0.0016	mg/Kg	☼	03/17/21 20:25	1
Perfluorobutanoic acid	<0.0016	0.0021	0.0016	0.0016	mg/Kg	☼	03/17/21 20:25	1
Perfluorodecanoic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	⊅	03/17/21 20:25	1
Perfluorododecanoic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	☼	03/17/21 20:25	1
Perfluoroheptanoic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	☼	03/17/21 20:25	1
Perfluorohexanesulfonic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	⊅	03/17/21 20:25	1
Perfluorohexanoic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	☼	03/17/21 20:25	1
Perfluorononanoic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	☼	03/17/21 20:25	1
Perfluorooctanesulfonic acid	<0.00041 M	0.00062	0.00041	0.00041	mg/Kg	⊅	03/17/21 20:25	1
Perfluorooctanoic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	☼	03/17/21 20:25	1
Perfluoropentanoic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	☼	03/17/21 20:25	1
Perfluorotetradecanoic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	☼	03/17/21 20:25	1
Perfluorotridecanoic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	☼	03/17/21 20:25	1
Perfluoroundecanoic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	☼	03/17/21 20:25	1

Ferniuorounidecanoic acid	~0.0004 I	0.00002 0.00041	0.00041 Hig/Ng 🔀	03/11/21 20.23	
Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	108	50 - 150	03/15/21 13:55	03/17/21 20:25	1
M2-8:2 FTS	96	50 - 150	03/15/21 13:55	03/17/21 20:25	1
13C2 PFTeDA	92	50 - 150	03/15/21 13:55	03/17/21 20:25	1
13C3 PFBS	92	50 - 150	03/15/21 13:55	03/17/21 20:25	1
13C4 PFBA	99	<i>50 - 150</i>	03/15/21 13:55	03/17/21 20:25	1
13C4 PFHpA	108	50 ₋ 150	03/15/21 13:55	03/17/21 20:25	1
13C5 PFPeA	96	50 - 150	03/15/21 13:55	03/17/21 20:25	1
13C8 PFOA	104	50 - 150	03/15/21 13:55	03/17/21 20:25	1
13C8 PFOS	104	50 - 150	03/15/21 13:55	03/17/21 20:25	1
d3-NMeFOSAA	23 *5-	50 - 150	03/15/21 13:55	03/17/21 20:25	1
d5-NEtFOSAA	32 *5-	50 - 150	03/15/21 13:55	03/17/21 20:25	1
13C2-PFDoDA	98	50 - 150	03/15/21 13:55	03/17/21 20:25	1
13C3 PFHxS	108	50 - 150	03/15/21 13:55	03/17/21 20:25	1
13C5 PFHxA	105	50 - 150	03/15/21 13:55	03/17/21 20:25	1
13C6 PFDA	102	50 - 150	03/15/21 13:55	03/17/21 20:25	1
13C7 PFUnA	99	50 - 150	03/15/21 13:55	03/17/21 20:25	1
13C9 PFNA	105	50 - 150	03/15/21 13:55	03/17/21 20:25	1

General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	1640	J-	1020	681	681	mg/Kg	☆	03/18/21 16:27	3.06
Percent Moisture	10.1		1.0		1.0	%		03/13/21 08:14	1
Percent Solids	89.9		1.0		1.0	%		03/13/21 08:14	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32347-1 Project/Site: APG PFAS S1

Client Sample ID: APG-HELI-FIRE-1-SO-(0-2)-031221

Lab Sample ID: 410-32347-5 Date Collected: 03/12/21 13:30 **Matrix: Solid** Date Received: 03/12/21 17:30 Percent Solids: 89.9

General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	6.4	J	0.01	0.01	0.01	S.U.	_	03/16/21 18:12	1
Temperature	20.8		0.01	0.01	0.01	Degrees C		03/16/21 18:12	1

Method: D422 - Grain Size Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	1.2		1.0	1.0	1.0	%		03/15/21 13:20	1
Sand	71.6		1.0	1.0	1.0	%		03/15/21 13:20	1
Silt	21.3		1.0	1.0	1.0	%		03/15/21 13:20	1
Clay	6.0		1.0	1.0	1.0	%		03/15/21 13:20	1
75 mm	100.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
19 mm	100		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
4.75 mm	99.8		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
3.35 mm	98.3		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
2.36 mm	98.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
1.18 mm	97.9		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.6 mm	92.9		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.3 mm	57.2		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.15 mm	30.6		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.075 mm	27.3		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.064 mm	26.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.05 mm	23.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.02 mm	13.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.005 mm	6.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.002 mm	4.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.001 mm	5.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1

Client Sample ID: APG-HELI-FIRE-1-GW-031221

Lab Sample ID: 410-32347-6 Date Collected: 03/12/21 14:00 **Matrix: Water** Date Received: 03/12/21 17:30

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	3.8	<u></u> → J-	4.7	3.8	3.8	ng/L		03/17/21 13:25	1
8:2 Fluorotelomer sulfonic acid	<1.9		2.8	1.9	1.9	ng/L		03/17/21 13:25	1
NEtFOSAA	< 0.94		2.8	0.94	0.94	ng/L		03/17/21 13:25	1
NMeFOSAA	<1.1		1.9	1.1	1.1	ng/L		03/17/21 13:25	1
Perfluorobutanesulfonic acid	4.8		1.9	0.94	0.94	ng/L		03/17/21 13:25	1
Perfluorobutanoic acid	5.3		4.7	3.8	3.8	ng/L		03/17/21 13:25	1
Perfluorodecanoic acid	<0.94		1.9	0.94	0.94	ng/L		03/17/21 13:25	1
Perfluorododecanoic acid	< 0.94		1.9	0.94	0.94	ng/L		03/17/21 13:25	1
Perfluoroheptanoic acid	2.1		1.9	0.94	0.94	ng/L		03/17/21 13:25	1
Perfluorohexanesulfonic acid	84		1.9	0.94	0.94	ng/L		03/17/21 13:25	1
Perfluorohexanoic acid	10		1.9	0.94	0.94	ng/L		03/17/21 13:25	1
Perfluorononanoic acid	1.3	J	1.9	0.94	0.94	ng/L		03/17/21 13:25	1
Perfluorooctanesulfonic acid	200		1.9	0.94	0.94	ng/L		03/17/21 13:25	1
Perfluorooctanoic acid	8.1		1.9	0.94	0.94	ng/L		03/17/21 13:25	1
Perfluoropentanoic acid	3.6		1.9	0.94	0.94	ng/L		03/17/21 13:25	1
Perfluorotetradecanoic acid	<0.94		1.9	0.94	0.94	ng/L		03/17/21 13:25	1
Perfluorotridecanoic acid	< 0.94		1.9	0.94	0.94	ng/L		03/17/21 13:25	1

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Client: ARCADIS U.S., Inc. Job ID: 410-32347-1 Project/Site: APG PFAS S1

Client Sample ID: APG-HELI-FIRE-1-GW-031221

Lab Sample ID: 410-32347-6 Date Collected: 03/12/21 14:00 **Matrix: Water**

Date Received: 03/12/21 17:30

Analyte	Result Qualif	ier LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluoroundecanoic acid	<0.94 M	1.9	0.94	0.94	ng/L	03/17/21 13:25	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	154 *5+	50 - 150			03/15/21 08:34	03/17/21 13:25	1
M2-8:2 FTS	125	50 ₋ 150			03/15/21 08:34	03/17/21 13:25	1
13C2 PFTeDA	93	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C3 PFBS	93	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C4 PFBA	98	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C4 PFHpA	105	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C5 PFPeA	101	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C8 PFOA	118	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C8 PFOS	102	50 - 150			03/15/21 08:34	03/17/21 13:25	1
d3-NMeFOSAA	91	50 - 150			03/15/21 08:34	03/17/21 13:25	1
d5-NEtFOSAA	107	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C2-PFDoDA	103	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C3 PFHxS	104	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C5 PFHxA	108	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C6 PFDA	110	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C7 PFUnA	113	50 - 150			03/15/21 08:34	03/17/21 13:25	1
13C9 PFNA	109	50 - 150			03/15/21 08:34	03/17/21 13:25	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluoretelomer sulfonic acid	6.7		4.8	3.8	3.8	ng/L	03/22/21 11:57	1
8:2 Fluorotelomer sulfonic acid	<1.9		2.9	1.9	1.9	ng/L	03/22/21 11:57	1
NEtFOSAA	<0.95		2.9	0.95	0.95	ng/L	03/22/21 11:57	1
NMeFOSAA	<1.1		1.9	1.1	1.1	ng/L	03/22/21 11:57	1
Perfluorobutanesulfonic acid	5.2		1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluorobutanoic acid	5.7		4.8	3.8	3.8	ng/L	03/22/21 11:57	1
Perfluorodecanoic acid	<0.95		1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluorododecanoic acid	<0.95		1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluoroheptanoic acid	21	M	1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluorohexanesulfonic acid	97		1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluorohexanoic acid	11		1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluorononanoic acid	2.0		1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluorooctanesulfonic acid	220		1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluorooctanoic acid	9.5	M	1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluoropentanoic acid	3.5	M	1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluorotetradecanoic acid	<0.95	В	1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluorotridecanoic acid	< 0.95	В	1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Perfluoroundecanoic acid	<0.95		1.9	0.95	0.95	ng/L	03/22/21 11:57	1
Isotope Dilution	%Recovery Qu	ualifier Limits				Prepared	Analyzed	Dil Fac

M2-6:2 FTS	164 *5+	50 - 150	03/20/21 10:25 03/22/21 11:57 1
M2-8:2 FTS	140	50 - 150	03/20/21 10:25 03/22/21 11:57 1
13C2 PFTeDA	99	50 - 150	03/20/21 10:25 03/22/21 11:57 1
13C3 PFBS	109	50 - 150	03/20/21 10:25 03/22/21 11:57 1
13C4 PFBA	97	50 - 150	03/20/21 10:25 03/22/21 11:57 1
13C4 PFHpA	112	50 - 150	03/20/21 10:25 03/22/21 17:57 1
13C5 PFPeA	102	50 - 150	03/20/21 10:25 03/22/21 11:57 1
13C8 PFOA	119	50 - 150	03/20/21 10:25 03/22/21 11:57

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Client: ARCADIS U.S., Inc. Job ID: 410-32347-1 Project/Site: APG PFAS S1

Client Sample ID: APG-HELI-FIRE-1-GW-031221

Lab Sample ID: 410-32347-6 Date Collected: 03/12/21 14:00 **Matrix: Water**

Date Received: 03/12/21 17:30

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - RE (Continued)

Isotope Dilution	%Recovery Quali	fier Limits	Prepared	Analyzed	Dil Fac
13C8 PFOS	118	50 - 150	03/20/21 10:25	03/22/21 11:57	1
d3-NMeFOSAA	126	50 ₋ 150	03/20/21 10:25	03/22/21 11:57	1
d5-NEtFOSAA	146	50 ₋ 150	03/20/21 10:25	03/22/21 11:57	1
13C2-PFDoDA	99	5 0 150	03/20/21 10:25	03/22/21 11:57	1
13C3 PFHxS	119	50 - 150	03/20/21 10:25	03/22/21 11:57	1
13C5 PFHxA	107	<i>50 - 150</i>	03/20/21 10:25	03/22/21 11:57	1
13C6 PFDA	121	50 ₋ 150	03/20/21 10:2 5	03/22/21 11:57	1
13C7 PFUnA	110	50 - 150	03/20/21 10:25	03/22/21 11:57	1
13C9 PFNA	114	50 ₋ 150	03/20/21 10:25	03/22/21 11:57	1

Client Sample ID: APG-FB-07-031221 Lab Sample ID: 410-32347-7 **Matrix: Water**

Date Collected: 03/12/21 13:40 Date Received: 03/12/21 17:30

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5		4.4	3.5	3.5	ng/L		03/17/21 13:37	1
8:2 Fluorotelomer sulfonic acid	<1.8		2.6	1.8	1.8	ng/L		03/17/21 13:37	1
NEtFOSAA	<0.88		2.6	0.88	0.88	ng/L		03/17/21 13:37	1
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L		03/17/21 13:37	1
Perfluorobutanesulfonic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluorobutanoic acid	<3.5		4.4	3.5	3.5	ng/L		03/17/21 13:37	1
Perfluorodecanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluorododecanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluoroheptanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluorohexanesulfonic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluorohexanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluorononanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluorooctanesulfonic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluorooctanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluoropentanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluorotetradecanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluorotridecanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1
Perfluoroundecanoic acid	<0.88		1.8	0.88	0.88	ng/L		03/17/21 13:37	1

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Isotope Dilution	%Recovery (Qualifier Limits		Prepared	Analyzed	Dil Fac	
M2-6:2 FTS	146	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
M2-8:2 FTS	116	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
13C2 PFTeDA	96	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
13C3 PFBS	100	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
13C4 PFBA	112	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
13C4 PFHpA	119	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
13C5 PFPeA	110	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
13C8 PFOA	122	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
13C8 PFOS	113	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
d3-NMeFOSAA	99	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
d5-NEtFOSAA	115	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
13C2-PFDoDA	109	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
13C3 PFHxS	116	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
13C5 PFHxA	113	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
13C6 PFDA	111	50 - 150		03/15/21 08:34	03/17/21 13:37	1	
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Eurofins Lancaster Laboratories Env, LLC

Client: ARCADIS U.S., Inc.

Job ID: 410-32347-1

Project/Site: APG PFAS S1

Client Sample ID: APG-FB-07-031221

Date Collected: 03/12/21 13:40

Lab Sample ID: 410-32347-7

Matrix: Water

Date Collected: 03/12/21 13:40 Matrix: Water Date Received: 03/12/21 17:30

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C7 PFUnA	110	50 - 150	03/15/21 08:34	03/17/21 13:37	1
13C9 PFNA	115	50 - 150	03/15/21 08:34	03/17/21 13:37	1

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Aberdeen Proving Ground – Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDG # 410-32349-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report # 41266R1

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-32349-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

Ourselle ID	Lability	Madrica	Sample Collection	Demont Committee	Aı		
Sample ID	Lab ID	Matrix	Date	Parent Sample	PFAS	тос	рН
APG-BONEYARD-1-SO-(0-2)-031121	410-32349-1	Soil	3/11/2021		Х	Х	Х
APG-BONEYARD-1-GW-031121	410-32349-2	Water	3/11/2021		X		
APG-BONEYARD-6-SO-(0-2)-031121	410-32349-3	Soil	3/11/2021		Х		
APG-BONEYARD-6-GW-031121	410-32349-4	Water	3/11/2021		Х		
APG-BONEYARD-7-SO-(0-2)-031121	410-32349-5	Soil	3/11/2021		Х		
APG-BONEYARD-7-GW-031121	410-32349-6	Water	3/11/2021		Х		
APG-OLD-FTA-1-SO-(0-2)-031121	410-32349-7	Soil	3/11/2021		Х	Х	Х
APG-OLD-FTA-1-GW-031121	410-32349-8	Water	3/11/2021		Х		
APG-OLD-FTA-2-SO-(0-2)-031121	410-32349-9	Soil	3/11/2021		Х		
APG-OLD-FTA-2-GW-031121	410-32349-10	Water	3/11/2021		Х		
APG-FTA-M08-031121	410-32349-11	Water	3/11/2021		Х		
APG-DUP-04-031121	410-32349-12	Water	3/11/2021	APG-FTA-M08-031121	Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-FTA-M08-031121.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was performed on sample APG-FTA-M08-031121.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Rep	orted	Performance Acceptable		Not
Items Reviewed		Yes	No	Yes	Required
Sample receipt condition		Х		Х	
2. Requested analyses and sample results		Х		Х	
Master tracking list		Х		Х	
4. Methods of analysis		Х		Х	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
9. Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		Х	
11. Narrative summary of QA or sample problems provided		Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

1. The chain of custody states that 2 containers were submitted, whereas the laboratory received 3 containers per sample for the following samples.

Lab ID	Sample ID
410-32349-2	APG-BONEYARD-1-GW-031121
410-32349-4	APG-BONEYARD-6-GW-031121
410-32349-8	APG-OLD-FTA-1-GW-031121
410-32349-10	APG-OLD-FTA-2-GW-031121

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

The compounds perfluorotetradecanoic acid and perfluorotridecanoic acid were detected in the laboratory preparation blank batch 105366. However, the associated sample result was non-detect and qualification was not required. Therefore, the laboratory qualifier (B) was removed.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
APG-BONEYARD-1-SO-(0-	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
2)-031121	d5-NEtFOSAA	NEtFOSAA	< 20%	<u>≤</u> 20%
	M2-6:2 FTS	6:2 Fluorotelomer sulfonic acid	< 50% but > 20%	< 50% but > 20%
APG-BONEYARD-6-SO-(0-2)-031121	M2-8:2 FTS	8:2 Fluorotelomer sulfonic acid	< 50% but > 20%	< 50% but > 20%
	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
APG-BONEYARD-7-SO-(0-	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
2)-031121	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
APG-OLD-FTA-1-SO-(0-2)-	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
031121	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
APG-OLD-FTA-2-SO-(0-2)-	d3-NMeFOSAA	NMeFOSAA	< 20%	< 20%
031121	d5-NEtFOSAA	NEtFOSAA	< 20%	< 20%
APG-OLD-FTA-2-GW- 031121 DL	13C8 PFOS	Perfluorooctanesulfonic acid	> 150%	AC

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
4500/	Non-detect	No Action
> 150%	Detect	J-
500/ 1 / 000/	Non-detect	UJ
< 50% but > 20%	Detect	J+
000/	Non-detect	UX
< 20%	Detect	Х

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be ≤ 30%.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

Sample associated with the MS/MSD exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	Compounds	MS Recovery	MSD Recovery	
	6:2 Fluorotelomer sulfonic acid	SR>4X	SR>4X	
	8:2 Fluorotelomer sulfonic acid	D	D	
	Perfluorobutanesulfonic acid	SR>4X	SR>4X	
	Perfluorobutanoic acid	SR>4X	SR>4X	
APG-FTA-M08-031121	Perfluoroheptanoic acid	SR>4X	SR>4X	
	Perfluorohexanesulfonic acid	SR>4X	SR>4X	
	Perfluorohexanoic acid	SR>4X	SR>4X	
	Perfluorononanoic acid	SR>4X	SR>4X	
	Perfluorooctanesulfonic acid	SR>4X	SR>4X	

Sample ID	Compounds	ounds MS Recovery	
	Perfluorooctanoic acid	SR>4X	SR>4X
	Perfluoropentanoic acid	SR>4X	SR>4X

Notes:

D MS/MSD diluted below calibration range

SR>4X Sample result is greater than 4 times the added spike

The criteria used to evaluate the MS/MSD recoveries are presented in the following table. In the case of an MS/MSD deviation, the sample results are qualified as documented in the table below.

Control Limit	Sample Result	Qualification	
4 18 3 4 11)	Non-detect	No Action	
> the upper control limit (UL)	Detect	J+	
	Non-detect	UJ	
< the lower control limit (LL) but > 10%	Detect	J-	
	Non-detect	UX	
< 10%	Detect	J-	
SR>4X: Parent sample concentration > four times the MS/MSD spiking solution concentration.	Detect	No Action	
	Non-detect		
D: MS/MSD added spike diluted below calibration range	Detect	No Action	

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

The LCS recovery for compound perfluorobutanesulfonic acid and RPD between LCS/LCSD for perfluoroundecanoic acid were greater than the control limit in laboratory preparation batch 109306. However, these compounds were not reported from batch 109306. Hence, qualification was not required.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

Results for field duplicate samples are summarized in the following table.

Sample ID/Duplicate ID	Compound	Sample Result	Duplicate Result	RPD
	6:2 Fluorotelomer sulfonic acid	670	660	1.5 %
	8:2 Fluorotelomer sulfonic acid	44	37	AC
	Perfluorobutanesulfonic acid	160	150	6.5 %
	Perfluorobutanoic acid	190	180	AC
	Perfluoroheptanoic acid	270	260	3.7 %
APG-FTA-M08-031121 / APG-DUP-04-031121	Perfluorohexanesulfonic acid	2900	3100	6.6 %
7.11 0 20.1 0 1 001 12.1	Perfluorohexanoic acid	1100	1100	0.0 %
	Perfluorononanoic acid	1700	1600	6.1 %
	Perfluoropentanoic acid	560	560	0.0 %
	Perfluorooctanesulfonic acid	9000	8500	5.7 %
	Perfluorooctanoic acid	6500	6600	1.5 %

Note:

AC Acceptable

The calculated RPD and results between the parent sample and field duplicate were acceptable.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

Samples associated with ion ratios outside of the control limits of 50 to 150% recovery are presented in the following table.

Sample ID	Compound	Ion Ratio %R
APG-OLD-FTA-1-SO-(0-2)-031121	Perfluoroundecanoic acid	25 %
APG-OLD-FTA-1-GW-031121	Perfluoroundecanoic acid	10 %

In the case of an ion ratio deviation, the sample results are qualified as documented in the table below.

Control limit	Sample Result	Qualification
< 50% or > 150% Recovery	Detect	J

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
APG-BLDG-2308-1-GW- 031221	8:2 Fluorotelomer sulfonic acid		120	120 D
	Perfluorobutanesulfonic acid		130	130 D

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
	Perfluorobutanoic acid		72	72 D
	Perfluorodecanoic acid		64	64 D
	Perfluoroheptanoic acid		62	62 D
	Perfluorohexanesulfonic acid		1200	1200 D
APG-BLDG-2308-1-GW-	Perfluorohexanoic acid		250	250 D
031221 (continued)	Perfluorononanoic acid		220	220 D
	Perfluorooctanoic acid		720	720 D
	Perfluoropentanoic acid		130	130 D
	Perfluoroundecanoic acid		19 J	19 DJ
	Perfluorooctanesulfonic acid		7000	7000 D
	8:2 Fluorotelomer sulfonic acid		25 J	25 DJ
	6:2 Fluorotelomer sulfonic acid		2000	2000 D
	Perfluorobutanesulfonic acid		680	680 D
	Perfluorobutanoic acid		580	580 D
	Perfluorodecanoic acid		30	30 D
APG-OLD-FTA-2-GW-	Perfluoroheptanoic acid		860	860 D
031121	Perfluorohexanesulfonic acid		11000	11000 D
	Perfluorohexanoic acid		4300	4300 D
	Perfluorononanoic acid		6600	6600 D
	Perfluorooctanoic acid		27000	27000 D
	Perfluoropentanoic acid		1700	1700 D
	Perfluorooctanesulfonic acid		22000	22000 D
	8:2 Fluorotelomer sulfonic acid		44	44 D
	6:2 Fluorotelomer sulfonic acid		670	670 D
	Perfluorobutanesulfonic acid		160	160 D
	Perfluorobutanoic acid		190	190 D
APG-FTA-M08-031121	Perfluoroheptanoic acid		270	270 D
	Perfluorohexanesulfonic acid		2900	2900 D
	Perfluorohexanoic acid		1100	1100 D
	Perfluorononanoic acid		1700	1700 D
	Perfluorooctanoic acid		6500	6500 D

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
	Perfluoropentanoic acid		560	560 D
	Perfluorooctanesulfonic acid		9000	9000 D
	8:2 Fluorotelomer sulfonic acid		37	37 D
	6:2 Fluorotelomer sulfonic acid		660	660 D
	Perfluorobutanesulfonic acid		150	150 D
APG-DUP-04-031121	Perfluorobutanoic acid		180	180 D
	Perfluoroheptanoic acid		260	260 D
	Perfluorohexanesulfonic acid		3100	3100 D
	Perfluorohexanoic acid		1100	1100 D
	Perfluorononanoic acid		1600	1600 D
	Perfluorooctanoic acid		6600	6600 D
	Perfluoropentanoic acid		560	560 D
	Perfluorooctanesulfonic acid		8500	8500 D

Note: the lab didn't report the original analysis; only the diluted result.

The samples APG-OLD-FTA-1-GW-031121, APG-OLD-FTA-2-GW-031121, APG-FTA-M08-031121 and APG-DUP-04-031121 were analyzed at 10-fold and 100-fold dilution due to interference from sample matrix. An undiluted analysis was not performed. Therefore, the detection limits are elevated.

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification
Diluted sample result within the calibration range	D
Diluted sample results less than the calibration range	DJ

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

As noted in Section 5.1, N-EtFOSAA and N-MeFOSAA results were qualified "X" for sample locations APG-BONEYARD-1-SO-(0-2)-031121, APG-BONEYARD-7-SO-(0-2)-031121, APG-BONEYARD-6-SO-(0-2)-031121, APG-OLD-FTA-1-SO-(0-2), and APG-OLD-FTA-2-SO-(0-2)-031121. This was due to EIS recoveries less than 20%. After review with the project team and USACE chemist, the results were rejected, and the final qualifier has been revised from "X" to "R" on December 15, 2021.

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Rep	oorted		rmance eptable	Not Required
	No	Yes	No	Yes	. Keyulleu
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC/	MS/MS)			'
Stage 2 Validation					
Holding times		Х		Х	
Reporting limits (units)		Х		Х	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks	Х				Х
C. Field blanks / Source blanks	Х				Х
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate(LCSD) %R		Х		Х	
LCS/LCSD Precision (RPD)		Х		Х	
Matrix Spike (MS) %R		Х		Х	
Matrix Spike Duplicate(MSD) %R		Х		Х	
MS/MSD Precision (RPD)		Х		Х	
Field Duplicate (RPD)		Х		Х	
Extracted Internal Standard %R		Х	Х		
Injection Internal Standard %R		Х		Х	
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation		1			
Instrument tune and performance check		Х		Х	
Initial calibration %RSDs		Х		Х	
Continuing calibration %Ds		Х		Х	
Instrument sensitivity check		Х		Х	
Ion transitions used		Х		Х	
Compound identification and quantitation	1	1		1	1
A. Reconstructed ion chromatograms		X		Х	
B. Quantitation Reports		Х		Х	
C. RT of sample compounds within the established RT windows		Х		Х	

PFAS: 537M/DoD QSM 5.3		oorted	Performance Acceptable		Not Required
		Yes	No	Yes	rtoquirou
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
D. Ion Ratio %R		X	Х		
E. Transcription/calculations acceptable		Х		Х	
F. Reporting limits adjusted to reflect sample dilutions		Х		Х	

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

Concentration (C) Qualifiers

- U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
- J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).

Quantitation (Q) Qualifiers

E The compound was quantitated above the calibration range.

• Validation Qualifiers

- J The reported result was an estimated value with an unknown bias.
- J+ The result was an estimated quantity, but the result may be biased high.
- J- The result was an estimated quantity, but the result may be biased low.
- UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
- UB Analyte considered non-detect at the listed value due to associated blank contamination.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria
APG-BONEYARD-1-SO-(0-2)-031121	5 days from collection; 4 days	< 24 hours of receipt at
APG-OLD-FTA-1-SO-(0-2)-031121	from receipt	the laboratory

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

	Qualification
Criteria	Detected Analytes
Analysis completed past the holding time	J

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analytes	Standard Recovery
APG-BONEYARD-1-SO-(0-2)-031121	ccv	Total Organic Carbon	73%
APG-OLD-FTA-1-SO-(0-2)-031121	CCV	Total Organic Carbon	69%

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Control Limit	Sample Result	Qualification
TOC	0 5 1 75%	Non-detect	UX
	Gross Exceedance < 75%	Detect	J-
	75% to 89%	Non-detect	UJ
		Detect	J-
	111% to 125%	Non-detect	No Action
		Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

A MS analysis was not performed for TOC.

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

A laboratory duplicate analysis was not performed on sample location associated with this SDG.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within \pm 0.05 S.U. of the true value.

All LCS recoveries were within control limits, with the exception of the analytes associated with sample locations, as presented in the following table.

Sample ID	Analyte	LCS Recovery
APG-BONEYARD-1-SO-(0-2)-031121	Total Organic Carbon	64%
APG-OLD-FTA-1-SO-(0-2)-031121	Total Organic Carbon	68%

The criteria used to evaluate LCS recoveries are presented in the following table. In the case of an LCS deviation, the sample results are qualified.

Control limit	Sample Result	Qualification
0/ December James limit of 900/	Non-detect	UJ
% Recovery < lower limit of 80%	Detect	J-
0/ D	Non-detect	No Action
% Recovery > upper limit of 120%	Detect	J+

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Rep	orted	Perfor Acce	Not	
	No	Yes	No	Yes	Required
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	Х				X
Laboratory Control Sample (LCS) %R		X	X		
Laboratory Control Sample Duplicate (LCSD) %R	X				X
LCS/LCSD Precision (RPD)	Х				X
Matrix Spike (MS) %R	Х				X
Matrix Spike Duplicate (MSD) %R	Х				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)	Х				X
Field Duplicate (RPD)	Х				Х
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		Х	
Continuing calibration %R		Х	Х		
Raw Data		Х		Х	
Transcription/calculations acceptable		Х		Х	

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE:

DATE: May 7, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 14, 2021

Stage 3 / 4 PFAS Calibration Standards

SDG #:410-32349-1Date:5/7/2021Lab:Eurofins LancasterPage:1Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

PFOA 3/17/2021 Calibration

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Match Match Match Match Match Match Match

1104 3/	1 dgc 347 300 01350 410 32343 1													
Cal Conc					Calculated		Calc		Calculated	Reported				
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D				
0.2	141234	6771971	10	0.020856	1.0427836	0.9768	0.21351	0.2	6.755	6.8				
0.5	339917	6639170	10	0.051199	1.0239744	0.9768	0.524147	0.5	4.829	4.8				
2	1428396	6518513	10	0.219129	1.0956456	0.9768	2.243337	2	12.167	12.2				
8	4606305	6241486	10	0.738014	0.9225177	0.9768	7.555427	8	-5.557	-5.6				
20	11353940	6107162	10	1.859119	0.9295594	0.9768	19.03275	20	-4.836	-4.8				
50	26265377	5722106	10	4.590159	0.9180318	0.9768	46.9918	50	-6.016	-6				
100	43121158	4763137	10	9.053101	0.9053101	0.9768	92.68121	100	-7.319	-7.3				
	· ·	· ·	·	·	· ·		· ·	·	·	· ·				

Avg RF = 0.9768318 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-32349-1Date:5/7/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-103929/9 3/17/2021 01:41

Page 1381 - 1386 of SDG 410-32349-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	874409	4859351	10	0.1799	0.9055	1.987	2	-0.64	-0.6
Perfluoropentanoic acid	931437	4634587	10	0.2010	1.0900	1.844	2	-7.81	-7.8
Perfluorobutanesulfonic acid	772307	3826669	9.36	0.2018	1.1250	1.679	2	-5.13	-5
Perfluorohexanoic acid	897494	5038802	10	0.1781	0.8906	2.000	2	0.00	0
Perfluoroheptanoic acid	1138680	5302738	10	0.2147	1.1710	1.834	2	-8.31	-8.3
Perfluorohexanesulfonic acid	721897	3684758	9.46	0.1959	1.0560	1.755	2	-7.14	-7.2
Perfluorooctanesulfonic acid	783741	3880536	9.57	0.2020	1.1290	1.712	2	-10.37	-10.5

Match Match Match Match Match Match

Match

CCV 410-104674/53 3/19/2021 03:37

Page 1505 - 1510 of SDG 410-32349-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	1009628	4955298	10	0.2037	0.9055	2.250	2.0	12.51	12.5
Perfluoropentanoic acid	1073805	4357270	10	0.2464	1.0900	2.261	2.0	13.05	13
Perfluorobutanesulfonic acid	880987	3932902	9.36	0.2240	1.1250	1.864	1.8	5.29	5.3
Perfluorohexanoic acid	1021509	5165110	10	0.1978	0.8906	2.221	2.0	11.03	11
Perfluoroheptanoic acid	1390524	5311875	10	0.2618	1.1710	2.235	2.0	11.77	11.8
Perfluorohexanesulfonic acid	794749	3611340	9.46	0.2201	1.0560	1.971	1.8	8.32	8.1
Perfluorooctanesulfonic acid	915554	3838793	9.57	0.2385	1.1291	2.021	1.9	9.27	9.2

Match Match Match Match Match Match Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 $\begin{array}{c|cccc} \text{SDG \#} & 410\text{-}32349\text{-}1 & \text{Date:} & 5/7/2021 \\ \text{Lab:} & & \text{Eurofins Lancaster} & \text{Page:} & 3 \\ \hline \text{Project:} & \text{Aberdeen Proving Ground} & \text{Validated by:} & \text{SPR} \\ \end{array}$

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-103137/2-A Page 2059 - 2064 of SDG 410-32349-1

Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported	
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	2933803	5604159	10	0.523505	0.9055	23.13	25.6	90.33	90	Match
Perfluoropentanoic acid	2981683	5179035	10	0.575722	1.0900	21.13	25.6	82.53	82	Match
Perfluorobutanesulfonic acid	2677919	3947482	9.36	0.678387	1.1250	22.58	22.7	99.46	100	Match
Perfluorohexanoic acid	3178997	6138530	10	0.517876	0.8906	23.26	25.6	90.86	91	Match
Perfluoroheptanoic acid	4172643	5977857	10	0.698017	1.1710	23.84	25.6	93.14	93	Match
Perfluorohexanesulfonic acid	2344444	3971928	9.46	0.590253	1.0560	21.15	23.3	90.78	91	Match
Perfluorooctanesulfonic acid	2767806	4363614	9.57	0.634292	1.1290	21.51	23.7	90.74	91	Match

Calculated Amount ng/L = ((Peak area ratio/Avg RF) x EIS concentration)/Sample volume)*1000

Stage 3 / 4 PFAS MS/MSD

SDG #:410-32349-1Date:5/7/2021Lab:Eurofins LancasterPage:4Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID APG-FTA-M08-031121 Page 608 - 609 SDG 410-32349-1

ANALYTE Perfluorotetradecanoic acid

REPORTED MS %R 88
REPORTED MSD %R 97
REPORTED RPD 3

%R = 100 * (MS Conc - Sample Conc) RPD = 100 * | MS %R - MSD %R MS TVAverage of MS MSD %R

Sample Concentration 0 19.8 MS Concentration MS %R 88.00 MATCH MSD Concentration 20.4 96.68 MATCH MSD %R MS TV 22.5 2.99 MATCH RPD MSD TV 21.1

Differences in %R may be due to rounding of the true value

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-32349-1
 Date:
 5/7/2021

 Lab:
 Eurofins Lancaster
 Page:
 5

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-FTA-M08-031121 Lab ID: 410-32349-11 Page 901 - 905 of SDG 410-32349-1

						Calculated	Final		Final	Reported	1
						Amount	Volume	Sample	Calculated	Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	2854020	549347	10	5.195296	0.9055	57.37	1	305.3	187.9	190	Ma
Perfluoropentanoic acid	8623350	459069	10	18.78443	1.0900	172.33	1	305.3	564.5	560	Ma
Perfluorobutanesulfonic acid	2283337	398068	9.36	5.736048	1.1250	47.72	1	305.3	156.3	160	Ma
Perfluorohexanoic acid	16738461	555645	10	30.12438	0.8906	338.25	1	305.3	1107.9	1100	Ma
Perfluoroheptanoic acid	4985957	524770	10	9.501223	1.1710	81.14	1	305.3	265.8	270	Ma
Perfluorohexanesulfonic acid	40631793	408277	9.46	99.52016	1.0560	891.53	1	305.3	2920.2	2900	Ma
Perfluorootanoic acid	14242712	73078	10	194.8974	0.9768	1995.26	1	305.3	6535.4	6500	Ma
Perfluorooctanesulfonic acid	16516195	51106	9.57	323.1753	1.1290	2739.40	1	305.3	8972.8	9000	Ma

Calculated amount ng/ml = (Peak area ratio/Avg RF) x DF x EIS conc ng/ml
Final Calculated amount ng/L = ((calculated ng/ml x Final Volume mls) / sample volume mls) *1000
Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

SDG #:410-32349-1Date:5/7/2021Lab:Eurofins LancasterPage:6Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-FTA-M08-031121 Lab ID: 410-32349-11

EIS 13C4 PFBA

REPORTED EIS %R 104

%R = 100 * EIS ConcentrationEIS TV

EIS Concentration 10.4 ng/ml Page 903 of 410-32349-1

EIS TV 10.00

%R 104 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental Analysis

Lancaster Laboratories

eurofins



410-32349 Chain of Custody

Custody

nmental use only



COC #616534

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Aph-Boneyard-1-50-(0-2)-031121	3 111 21	0830	-	Х	50	31.		4	X	X	X	X	- 11		P. B.		elie en	- (-412-)
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Environmental Analysis Request/Chain of Custody

eurofins	Lancaster Laboratories						ncaster Lab					use o	nly	PJ	Z .	5 5	ALI T	COC	#616	5572
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Client:		Acct. #:					\square	Date	-	2	Pr	eser	ation a	nd Fi	Itratio	n Cod	es	FSC:		
Project Name/#:	per 1-2 1-3 1-3 1-3 1-3	DIAGOD #				P			31-	6114	2 11/2	100	CAS.	24			41	SCR#:		
Project Name/#:		PWSID#				Tissue	Ground Surface		Jake	- 0		Interes							servation	
Project Manager:		P.O. #:	- 1	, 4		느	Surf		417	1		1-1	11-1-	1				H=HCI N=HNO ₃		Thiosulfate NaOH
	n 68	Table 5				Ш			S	(5)								S=H ₂ SO		-NaOn -H₃PO₄
Sampler:		Quote #:	Law -	1 10/60		Ĕ			اعًا	(133	+ =		1: 1					_	iltered O	
				100		Sediment	ble		Containers	-		-						e i e e e e e e	Remark	(S
State where samples were				-	0	ed	Potable NPDES		ပြီ	FAS		-15 111		7			1011			
	Yes	No 🗆			Sit	l ^S	a z		ō	4		-140-01	-		-17			When the		
Samp	le Identification	Coll	ected	٩	du	닏	Į.	er:	#	14-	-,-	-				10	-	of the section		A THE STREET
Gump		Date	Time	Grab	Composite	Soil	Water	Other:	Total	711					0.00					A Second
APG-ETA-	151150-80M	3/11/21	1345	X			GW		Ce	X			GHT.		4	11	0.03	m	5/m	1
APG-DUP-O		3/11/21	1200	×	12.0		GW	9-3	2	X		1	\neg	\top	W (2.1)	1	Light II	- 10		The Name of the
THE DUP O	4-03(12)	JIIIEI	1.500		21.2		Clas	5.2		1		Lil Va		.0	1		20	ed les negl		- 1-3
5													-		-		5,71	11		7 - 7 - 17
	X	i Greve		\vdash	14.7		13.7	F		177	-			+		\vdash				
17	Manual of the second	p.== 2m_	-1700		-		cho ti		Terror	-	_		9.4 (6)	P1 P1		1400	7 - Y			
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5.05.50	Letrine Main - No Ar Love					-	13.00											L- 23"		
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	ndard	Rush		f	Jack	-	In				3/12	121	0700			but			3/12/2	15:45
(Rush TAT is subje	ect to laboratory approval and sur	rcharge)			uished		M				Date	1	Time		ceived by				Date	Time
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Requested TAT in b	usiness days: po	•		Reling	quished	by					Date	-1	Time	Re	ceived by	'			Date	Time
- mail address:	5,00			Beling	uished	l hv	-				Date		Time	Re	ceived by	,		_	Date	Time
	Package Options (cire	cle if required)	Te	-	44.07.00	,			\		Dute	7.4	11110	"	00,100 0			1		
Type I (EPA Le	evel 3			Relino	quished	l by	age II			~	Date		Time	Re	ceived by	10			Date	Time
Equivalent/non	\/r	e VI (Raw Data	Only)	0.8								~		- (E	1	2		3-12-2	1730
Type III (Reduc	ced non-CLP) N.I.	DKQP TX	TRRP-13				EDD Re	quire	d? .	Yes	No		2	R	elinquis	shed b		nercial Carr	er:	Herman Hall
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NYSDEC Cate	gory A or B MA	MCP CT	RCP			-	ecific QC	•			_			-1	T	emper	ature u	pon receipt	14	°C

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4/1/2021 (Rev. 1)

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-32349-1 Project/Site: APG PFAS S1

Qualifiers

LC	MS
Qua	lifie

Qualifier	Qualifier Description
*+	LCS and/or LCSD is outside acceptance limits, high biased.
*1	LCS/LCSD RPD exceeds control limits.
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
*5+	Isotope dilution analyte is outside acceptance limits, high biased.
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
В	Blank contamination: The analyte was detected above one-half the reporting limit in an associated blank.
D	The reported value is from a dilution.
E	Result exceeded calibration range.
FL	MS and/or MSD recovery below control limits.
1	Value is EMPC (estimated maximum possible concentration).
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
M	Manual integrated compound.

Glossarv

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)

LOD Limit of Detection (DoD/DOE) LOQ Limit of Quantitation (DoD/DOE) MCL EPA recommended "Maximum Contaminant Level" Minimum Detectable Activity (Radiochemistry) MDA

MDC Minimum Detectable Concentration (Radiochemistry) Method Detection Limit MDL ML Minimum Level (Dioxin) MPN Most Probable Number MQL Method Quantitation Limit

NC Not Calculated

Not Detected at the reporting limit (or MDL or EDL if shown) ND

NEG Negative / Absent POS Positive / Present PQL **Practical Quantitation Limit**

PRES Presumptive QC **Quality Control**

RER Relative Error Ratio (Radiochemistry)

RLReporting Limit or Requested Limit (Radiochemistry)

RPD Relative Percent Difference, a measure of the relative difference between two points

TEF Toxicity Equivalent Factor (Dioxin) TEQ Toxicity Equivalent Quotient (Dioxin)

TNTC Too Numerous To Count

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-1-SO-(0-2)-031121

Lab Sample ID: 410-32349-1 Date Collected: 03/11/21 08:30 **Matrix: Solid**

Date Received: 03/12/21 17:30 Percent Solids: 83.9

Method: EPA 537(Mod) - PF Analyte	•	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	<u></u>	03/24/21 13:16	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0033	0.0018	0.0018	mg/Kg	₽	03/24/21 13:16	1
NEtFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg	*	03/24/21 13:16	R 1
NMcFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg	许	03/24/21 13:16	R 1
Perfluorobutanesulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	₽	03/24/21 13:16	1
Perfluorobutanoic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	☆	03/24/21 13:16	1
Perfluorodecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:16	1
Perfluorododecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 13:16	1
Perfluoroheptanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☆	03/24/21 13:16	1
Perfluorohexanesulfonic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:16	1
Perfluorohexanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:16	1
Perfluorononanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:16	1
Perfluorooctanesulfonic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:16	1
Perfluorooctanoic acid	0.00048	J M	0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 13:16	1
Perfluoropentanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:16	1
Perfluorotetradecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:16	1
Perfluorotridecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 13:16	1
Perfluoroundecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 13:16	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepa	ared	Analyzed	Dil Fac
M2-6:2 FTS	73		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
M2-8:2 FTS	59		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C2 PFTeDA	61		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C3 PFBS	81		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C4 PFBA	58		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C4 PFHpA	64		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C5 PFPeA	57		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C8 PFOA	66		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C8 PFOS	86		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
d3-NMeFOSAA	8 *5	-	50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
d5-NEtFOSAA	12 *5	-	50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C2-PFDoDA	67		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C3 PFHxS	91		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C5 PFHxA	60		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C6 PFDA	64		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C7 PFUnA	72		50 - 150			03/23/21	1 20:31	03/24/21 13:16	1
13C9 PFNA	61							03/24/21 13:16	

Method: EPA 537(Mo	d) - PFAS for QSM 5.3	8, Table B-15 - RE
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Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019		0.0023	0.0019	0.0019	mg/Kg	*	03/17/21 20:36	1
8:2 Fluorotelomer sulfonic acid	<0.0019		0.0035	0.0019	0.0019	mg/Kg	₽	03/17/21 20:36	1
NEtFOSAA	< 0.00046	_	0.0023	0.00046	0.00046	mg/Kg	₽	03/17/21 20:36	1
NMeFOSAA	<0.00046		0.0023	0.00046	0.00046	mg/Kg	₩	03/17/21 20:36	1
Perfluorobutanesulfonic acid	<0.0019		0.0023	0.0019	0.0019	mg/Kg	₽	03/17/21 20:36	1
Perfluorobutanoic acid	< 0.0019		0.0023	0.0019	0.0019	mg/Kg	₩	03/17/21 20:36	1
Perfluorodecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₽	03/17/21 20:36	1
Perfluorododecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:36	1
Perfluoroheptanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/17/21 20:36	1
Perfluorohexanesulfonic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	≎	03/17/21 20:36	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-32349-1 Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-1-SO-(0-2)-031121

Lab Sample ID: 410-32349-1 Date Collected: 03/11/21 08:30 **Matrix: Solid** Date Received: 03/12/21 17:30 Percent Solids: 83.9

Method: EPA 537(Mod) - PFAS Analyte		Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
Perfluorohexanoic acid	<0.00046		0.00069	0.00046	0.00046		-	03/17/21 20:36	
Perfluorononanoic acid	<0.00046		0.00069	0.00046	0.00046		☆	03/17/21 20:36	
Perfluorooctanesulfonic acid	<0.00046		0.00069	0.00046	0.00046		 ∵	03/17/21 20:36	
Perfluorooctanoic acid	<0.00046	М	0.00069	0.00046	0.00046		₩	03/17/21 20:36	
Perfluoropentanoic acid	<0.00046		0.00069	0.00046	0.00046		☆	03/17/21 20:36	
Perfluorotetradecanoic acid	<0.00046		0.00069	0.00046	0.00046				
Perfluorotridecanoic acid	<0.00046		0.00069	0.00046	0.00046		₩	03/17/21 20:36	
Perfluoroundecanoic acid	<0.00046		0.00069	0.00046	0.00046		₩		
				0.000.0	0.000.0	0 0			D:// E
sotope Dilution	%Recovery Q	uaiitier -	Limits			Prepared		Analyzed	Dil F
M2-6:2 FTS	97		50 ₋ 150					03/17/21 20:36	
M2-8:2 FTS	89		50 - 150					03/17/21 20:36	
13C2 PFTeDA	94		50 - 150					03/17/21 20:36	
13C3 PFBS	98		50 - 150					03/17/21 20:36	
13C4 PFBA	97		50 - 150					03/17/21 20:36	
13C4 PFHpA	106		50 - 150					03/17/21 20:36	
13C5 PFPeA	94		50 - 150					03/17/21 20:36	
13C8 PFOA	104		50 - 150					03/17/21 20:36	
13C8 PFOS	108		50 - 150					03/17/21 20:36	
13-NMeFOSAA	14 *5		50 - 150					03/17/21 20:36	
15-NEtFOSAA	20 *5	-	50 - 150					03/17/21 20:36	
13C2-PFDoDA	97		50 - 150				V	03/17/21 20:36	
13C3 PFHxS	112		50 - 150					03/17/21 20:36	
13C5 PFHxA	100		50 - 150					03/17/21 20:36	
13C6 PFDA	103		50 - 150			03/15/21 13	3:55	03/17/21 20:36	
13C7 PFUnA	104		50 - 150			03/15/21 13	3:55	03/17/21 20:36	
13C9 PFNA	101		50 - 150			03/15/21 13	3:55	03/17/21 20:36	
General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil F
otal Organic Carbon	3290	J-	2170	1450	1450	mg/Kg	☼	03/18/21 16:40	6.
Percent Moisture	16.1		1.0		1.0	%		03/15/21 05:25	
Percent Solids	83.9		1.0		1.0	%		03/15/21 05:25	
General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil F
oH	6.3	J	0.01	0.01	0.01	S.U.	_	03/16/21 18:12	
Temperature	20.3		0.01	0.01	0.01	Degrees C		03/16/21 18:12	
Method: D422 - Grain Size									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil F
Gravel	7.0		1.0	1.0	1.0		-	03/15/21 13:20	
Sand	22.3		1.0	1.0	1.0			03/15/21 13:20	
Silt	56.7		1.0	1.0	1.0			03/15/21 13:20	
Clay	14.0		1.0	1.0	1.0			03/15/21 13:20	
75 mm	100.0		1.0	1.0		% Passing		03/15/21 13:20	
07.5	100.0		1.0	1.0	1.0			03/15/21 13:20	

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03/15/21 13:20

03/15/21 13:20

03/15/21 13:20

03/15/21 13:20

03/15/21 13:20

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1.0 % Passing

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

100.0

100

93.0

91.1

89.6

37.5 mm

4.75 mm

3.35 mm

2.36 mm

19 mm

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-1-SO-(0-2)-031121

Lab Sample ID: 410-32349-1 Date Collected: 03/11/21 08:30 **Matrix: Solid** Date Received: 03/12/21 17:30

Percent Solids: 83.9

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
1.18 mm	89.2		1.0	1.0	1.0	% Passing	_	03/15/21 13:20	1
0.6 mm	85.9		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.3 mm	77.1		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.15 mm	72.4		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.075 mm	70.7		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.064 mm	64.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.05 mm	63.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.02 mm	41.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.005 mm	14.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.002 mm	10.5		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.001 mm	12.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1

Client Sample ID: APG-Boneyard-1-GW-031121

Lab Sample ID: 410-32349-2 Date Collected: 03/11/21 09:10 **Matrix: Water**

Date Received: 03/12/21 17:30

Analyte	Result	Qualifier	L	_OQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	6.8		_	4.9	3.9	3.9	ng/L	03/17/21 13:48	1
8:2 Fluorotelomer sulfonic acid	<2.0			2.9	2.0	2.0	ng/L	03/17/21 13:48	1
NEtFOSAA	<0.98			2.9	0.98	0.98	ng/L	03/17/21 13:48	1
NMeFOSAA	<1.2			2.0	1.2	1.2	ng/L	03/17/21 13:48	1
Perfluorobutanesulfonic acid	1.9	J M		2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluorobutanoic acid	39			4.9	3.9	3.9	ng/L	03/17/21 13:48	1
Perfluorodecanoic acid	<0.98			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluorododecanoic acid	<0.98			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluoroheptanoic acid	47			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluorohexanesulfonic acid	27			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluorohexanoic acid	72			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluorononanoic acid	10			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluorooctanesulfonic acid	23			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluorooctanoic acid	19			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluoropentanoic acid	110			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluorotetradecanoic acid	<0.98			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluorotridecanoic acid	<0.98			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Perfluoroundecanoic acid	<0.98			2.0	0.98	0.98	ng/L	03/17/21 13:48	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analvzed	Dil Fac

Isotope Dilution	%Recovery 0	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	142		50 - 150	03/15/21 08:34	03/17/21 13:48	1
M2-8:2 FTS	126		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C2 PFTeDA	93		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C3 PFBS	102		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C4 PFBA	110		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C4 PFHpA	119		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C5 PFPeA	104		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C8 PFOA	123		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C8 PFOS	107		50 - 150	03/15/21 08:34	03/17/21 13:48	1
d3-NMeFOSAA	96		50 - 150	03/15/21 08:34	03/17/21 13:48	1
d5-NEtFOSAA	107		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C2-PFDoDA	109		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C3 PFHxS	112		50 - 150	03/15/21 08:34	03/17/21 13:48	1

Eurofins Lancaster Laboratories Env, LLC

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-1-GW-031121

Lab Sample ID: 410-32349-2

Date Collected: 03/11/21 09:10 **Matrix: Water** Date Received: 03/12/21 17:30

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C5 PFHxA	113		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C6 PFDA	112		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C7 PFUnA	119		50 - 150	03/15/21 08:34	03/17/21 13:48	1
13C9 PFNA	115		50 - 150	03/15/21 08:34	03/17/21 13:48	1

Client Sample ID: APG-Boneyard-6-SO-(0-2)-031121 Lab Sample ID: 410-32349-3

Date Collected: 03/11/21 10:45 **Matrix: Solid** Date Received: 03/12/21 17:30 **Percent Solids: 81.9**

Method: EPA 537(Mod) - PFA	S for QSM 5.3,	Table B-15	,						
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0020	UJ	0.0024	0.0020	0.0020	mg/Kg	☼	03/30/21 16:09	1
8:2 Fluorotelomer sulfonic acid	<0.0020	UJ	0.0037	0.0020	0.0020	mg/Kg	☼	03/30/21 16:09	1
NEtFOSAA	<0.00049		0.0024	0.00049	0.00049	mg/Kg	*	03/30/21 16:09	R 1
NMeFOSAA	<0.00049		0.0024	0.00049	0.00049	mg/Kg	*	03/30/21 16:09	R 1
Perfluorobutanesulfonic acid	< 0.0020		0.0024	0.0020	0.0020	mg/Kg	☼	03/30/21 16:09	1
Perfluorobutanoic acid	<0.0020		0.0024	0.0020	0.0020	mg/Kg	☼	03/30/21 16:09	1
Perfluorodecanoic acid	<0.00049		0.00073	0.00049	0.00049	mg/Kg	☼	03/30/21 16:09	1
Perfluorododecanoic acid	< 0.00049		0.00073	0.00049	0.00049	mg/Kg	☼	03/30/21 16:09	1
Perfluoroheptanoic acid	< 0.00049		0.00073	0.00049	0.00049	mg/Kg	☼	03/30/21 16:09	1
Perfluorohexanesulfonic acid	<0.00049	N/I	0.00073	0.00049	0.00049	mg/Kg	☼	03/30/21 16:09	1
Perfluorohexanoic acid	< 0.00049	N	0.00073	0.00049	0.00049	mg/Kg	☼	03/30/21 16:09	1
Perfluorononanoic acid	< 0.00049	•	0.00073	0.00049	0.00049	mg/Kg	☼	03/30/21 16:09	1
Perfluorooctanesulfonic acid	<0.00049	Ι <mark>γ</mark> Ι	0.00073	0.00049	0.00049	mg/Kg	⊅	03/30/21 16:09	1
Perfluorooctanoic acid	0.00056	J M	0.00073	0.00049	0.00049	mg/Kg	☼	03/30/21 16:09	1
Perfluoropentanoic acid	< 0.00049		0.00073	0.00049	0.00049	mg/Kg	☼	03/30/21 16:09	1
Perfluorotetradecanoic acid	<0.00049		0.00073	0.00049	0.00049	mg/Kg	⊅	03/30/21 16:09	1
Perfluorotridecanoic acid	< 0.00049		0.00073	0.00049	0.00049	mg/Kg	☼	03/30/21 16:09	1
Perfluoroundecanoic acid	< 0.00049		0.00073	0.00049	0.00049	ma/Ka	Ť	03/30/21 16:09	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	48	*5-	50 - 150	03/29/21 08:26	03/30/21 16:09	1
M2-8:2 FTS	46	*5-	50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C2 PFTeDA	53		50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C3 PFBS	71		50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C4 PFBA	50		50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C4 PFHpA	55		50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C5 PFPeA	52		50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C8 PFOA	58		50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C8 PFOS	78		50 - 150	03/29/21 08:26	03/30/21 16:09	1
d3-NMeFOSAA	5	*5-	50 - 150	03/29/21 08:26	03/30/21 16:09	1
d5-NEtFOSAA	7	*5-	50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C2-PFDoDA	57		50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C3 PFHxS	78		50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C5 PFHxA	51		50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C6 PFDA	55		50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C7 PFUnA	58		50 - 150	03/29/21 08:26	03/30/21 16:09	1
13C9 PFNA	54		50 - 150	03/29/21 08:26	03/30/21 16:09	1

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Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-6-SO-(0-2)-031121

Date Collected: 03/11/21 10:45

Date Received: 03/12/21 17:30

Lab Sample ID: 410-32349-3 **Matrix: Solid** Percent Solids: 81.9

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019		0.0023	0.0019	0.0019	mg/Kg	₽	03/31/21 18:36	1
8:2 Fluorotelomer sulfonic acid	<0.0019		0.0035	0.0019	0.0019	mg/Kg	₩	03/31/21 18:36	1
NEtFOSAA	<0.00047		0.0023	0.00047	0.00047	mg/Kg	₩	03/31/21 18:36	1
NMeFOSAA	<0.00047		0.0023	0.00047	0.00047	mg/Kg	☼	03/31/21 18:36	1
Perfluorobutanesulfonic acid	<0.0019	*+	0.0023	0.0019	0.0019	mg/Kg	₩	03/31/21 18:36	1
Perfluorobutanoic acid	<0.0019	M	0.0023	0.0019	0.0019	mg/Kg	☼	03/31/21 18:36	1
Perfluorodecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/31/21 18:36	1
Perfluorododecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/31/21 18:36	1
Perfluoroheptanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	≎	03/31/21 18:36	1
Perfluorohexanesulfonic acid	<0.00047	М	0.00070	0.00047	0.00047	mg/Kg	☼	03/31/21 18:36	1
Perfluorohexanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	₩	03/31/21 18:36	1
Perfluorononanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/31/21 18:36	1
Perfluorooctanesulfonic acid	<0.00047	М	0.00070	0.00047	0.00047	mg/Kg	☼	03/31/21 18:36	1
Perfluorooctanoic acid	<0.00047	M	0.00070	0.00047	0.00047	mg/Kg	₩	03/31/21 18:36	1
Perfluoropentanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	₩	03/31/21 18:36	1
Perfluorotetradecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	₩	03/31/21 18:36	1
Perfluorotridecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	₩	03/31/21 18:36	1
Perfluoroundecanoic acid	<0.00047	*1	0.00070	0.00047	0.00047	mg/Kg	☼	03/31/21 18:36	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepa	red	Analyzed	Dil Fac
M2-6:2 FTS	39 *5-	-	50 - 150			03/31/21	10:07	03/31/21 18:36	1
M2-8:2 FTS	37 *5-	-	50 - 150			03/31/21	10:07	03/31/21 18:36	1
13C2 PFTeDA	46 *5-	-	50 - 150			03/31/21	10:07	03/31/21 18:36	1
13C3 PFBS	69		50 - 150			03/31/21	10:07	03/31/21 18:36	1
13C4 PFBA	53		50 - 150			03/31/21	10:07	03/31/21 18:36	1
13C4 PFHpA	55		50 - 150			03/31/21	10:07	03/31/21 18:36	1
13C5 PFPeA	52		50 - 150			03/31/21	10:07	03/31/21 18:36	1
13C8 PFOA	56		50 - 150			03/31/21	10:07	03/31/21 18:36	1
13C8 PFOS	77		50 - 150			03/31/21	10:07	03/31/21 18:36	1
d3-NMeFOSAA	4 *5-		50 - 150			03/31/21	10:07	03/31/21 18:36	1
d5-NEtFOSAA	6 *5-	-	50 - 150			03/31/21	10:07	03/31/21 18:36	1
13C2-PFDoDA	52		50 ₋ 150			03/31/21	10:07	03/31/21 18:36	1

13C3 PFHxS

13C5 PFHxA

13C6 PFDA

13C7 PFUnA

13C9 PFNA

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
Percent Moisture	18.1	1.0		1.0 %	03/13/21 08:14	1
Percent Solids	81.9	1.0		1.0 %	03/13/21 08:14	1

50 - 150

50 - 150

50 - 150

50 - 150

50 - 150

Client Sample ID: APG-Boneyard-6-GW-031121

76

52

53

54

54

Lab Sample ID: 410-32349-4 Date Collected: 03/11/21 11:20 **Matrix: Water** Date Received: 03/12/21 17:30

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15											
	Analyte	Result	Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac			
	6:2 Fluorotelomer sulfonic acid	15		5.0	4.0	4.0 ng/L	03/17/21 13:59	1			
	8:2 Fluorotelomer sulfonic acid	<2.0		3.0	2.0	2.0 ng/L	03/17/21 13:59	1			

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03/31/21 10:07 03/31/21 18:36

03/31/21 10:07 03/31/21 18:36 03/31/21 10:07 03/31/21 18:36

03/31/21 10:07 03/31/21 18:36

03/31/21 10:07 03/31/21 18:36

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Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

13C6 PFDA

13C7 PFUnA

13C9 PFNA

Client Sample ID: APG-Boneyard-6-GW-031121

Lab Sample ID: 410-32349-4 Date Collected: 03/11/21 11:20

Matrix: Water Date Received: 03/12/21 17:30

Analyte	Result	Qualifier	LOC	2	LOD	DL	Unit I	O Analyzed	Dil Fac
NEtFOSAA	<0.99		3.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
NMeFOSAA	<1.2		2.0	0	1.2	1.2	ng/L	03/17/21 13:59	1
Perfluorobutanesulfonic acid	1.6	J M	2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluorobutanoic acid	<4.0		5.0	0	4.0	4.0	ng/L	03/17/21 13:59	1
Perfluorodecanoic acid	<0.99		2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluorododecanoic acid	<0.99		2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluoroheptanoic acid	1.5	J	2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluorohexanesulfonic acid	26		2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluorohexanoic acid	7.5		2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluorononanoic acid	1.5	J	2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluorooctanesulfonic acid	17		2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluorooctanoic acid	13	M	2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluoropentanoic acid	1.8	J M	2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluorotetradecanoic acid	<0.99		2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluorotridecanoic acid	<0.99		2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Perfluoroundecanoic acid	<0.99		2.0	0	0.99	0.99	ng/L	03/17/21 13:59	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	132		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
M2-8:2 FTS	109		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
13C2 PFTeDA	74		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
13C3 PFBS	88		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
13C4 PFBA	99		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
13C4 PFHpA	108		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
13C5 PFPeA	97		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
13C8 PFOA	108		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
13C8 PFOS	95		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
d3-NMeFOSAA	80		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
d5-NEtFOSAA	96		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
13C2-PFDoDA	87		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
13C3 PFHxS	99		50 - 150				03/15/21 08:3	4 03/17/21 13:59	1
13C5 PFHxA	108		50 ₋ 150				02/45/24 00:2	4 03/17/21 13:59	1

Client Sample ID: APG-Boneyard-7-SO-(0-2)-031121 Lab Sample ID: 410-32349-5

100

107

108

Date Collected: 03/11/21 09:30 **Matrix: Solid** Date Received: 03/12/21 17:30 Percent Solids: 84.4

50 - 150

50 - 150

50 - 150

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil F
6:2 Fluorotelomer sulfonic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg		03/30/21 16:20	
8:2 Fluorotelomer sulfonic acid	<0.0019	0.0035	0.0019	0.0019	mg/Kg	☼	03/30/21 16:20	
NEtFOSAA	<0.00047	0.0023	0.00047	0.00047	mg/Kg	‡	03/30/21 16:20	R
NMeFOSAA	<0.00047	0.0023	0.00047	0.00047		*	03/30/21 16:20	R
Perfluorobutanesulfonic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	☼	03/30/21 16:20	
Perfluorobutanoic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	☼	03/30/21 16:20	
Perfluorodecanoic acid	<0.00047	0.00070	0.00047	0.00047	mg/Kg	☼	03/30/21 16:20	
Perfluorododecanoic acid	< 0.00047	0.00070	0.00047	0.00047	mg/Kg	☼	03/30/21 16:20	
Perfluoroheptanoic acid	<0.00047	0.00070	0.00047	0.00047	mg/Kg	₩	03/30/21 16:20	

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03/15/21 08:34 03/17/21 13:59

03/15/21 08:34 03/17/21 13:59

03/15/21 08:34 03/17/21 13:59

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Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-7-SO-(0-2)-031121

Lab Sample ID: 410-32349-5 Date Collected: 03/11/21 09:30

Matrix: Solid Date Received: 03/12/21 17:30 Percent Solids: 84.4

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☆	03/30/21 16:20	1
Perfluorohexanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/30/21 16:20	1
Perfluorononanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/30/21 16:20	1
Perfluorooctanesulfonic acid	<0.00047	M	0.00070	0.00047	0.00047	mg/Kg	₩	03/30/21 16:20	1
Perfluorooctanoic acid	<0.00047	N	0.00070	0.00047	0.00047	mg/Kg	☼	03/30/21 16:20	1
Perfluoropentanoic acid	< 0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/30/21 16:20	1
Perfluorotetradecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	₽	03/30/21 16:20	1
Perfluorotridecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/30/21 16:20	1
Perfluoroundecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/30/21 16:20	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepa	red	Analyzed	Dil Fac
M2-6:2 FTS	66		50 - 150			03/29/21	08:26	03/30/21 16:20	1
M2-8:2 FTS	59		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C2 PFTeDA	66		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C3 PFBS	76		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C4 PFBA	53		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C4 PFHpA	64		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C5 PFPeA	56		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C8 PFOA	69		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C8 PFOS	89		50 - 150			03/29/21	08:26	03/30/21 16:20	1
d3-NMeFOSAA	7 *5	-	50 - 150			03/29/21	08:26	03/30/21 16:20	1
d5-NEtFOSAA	8 *5	-	50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C2-PFDoDA	68		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C3 PFHxS	93		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C5 PFHxA	58		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C6 PFDA	72		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C7 PFUnA	71		50 - 150			03/29/21	08:26	03/30/21 16:20	1
13C9 PFNA	68		50 ₋ 150			03/29/21	08:26	03/30/21 16:20	1

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019	0.0023	0.0019	0.0019	mg/Kg	<u></u>	03/31/21 18:47	1
8:2 Fluorotelomer sulfonic acid	<0.0019	0.0035	0.0019	0.0019	mg/Kg	₩	03/31/21 18:47	1
NEtFOSAA	<0.00046	0.0023	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
NMeFOSAA	<0.00046	0.0023	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluorobutanesulfonic acid	<0.0019 *+	0.0023	0.0019	0.0019	mg/Kg	₩	03/31/21 18:47	1
Perfluorobutanoic acid	<0.0019 M	0.0023	0.0019	0.0019	mg/Kg	₩	03/31/21 18:47	1
Perfluorodecanoic acid	<0.00046	0.00070	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluorododecanoic acid	<0.00046	0.00070	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluoroheptanoic acid	<0.00046	0.00079	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluorohexanesulfonic acid	<0.00046	0.00070	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluorohexanoic acid	<0.00046	0.00070	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluorononanoic acid	<0.00046	0.00070	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluorooctanesulfonic acid	<0.00046	0.00070	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluorooctanoic acid	<0.00046 M	0.00070	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluoropentanoic acid	<0.00046	0.00070	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluorotetradecanoic acid	<0.00046	0.00070	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluorotridecanoic acid	<0.00046	0.00070	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1
Perfluoroundecanoic acid	<0.00046 *1	0.00070	0.00046	0.00046	mg/Kg	₩	03/31/21 18:47	1

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Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-7-SO-(0-2)-031121

Lab Sample ID: 410-32349-5 Date Collected: 03/11/21 09:30 Matrix: Solid

Date Received: 03/12/21 17:30 Percent Solids: 84.4

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	52		50 - 150	03/31/21 10:07	03/31/21 18:47	1
M2-8:2 FTS	43	*5-	50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C2 PFTeDA	56		50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C3 PFBS	71		50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C4 PFBA	62		50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C4 PFHpA	68		50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C5 PFPeA	62		50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C8 PFOA	67		50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C8 PFOS	78		50 - 150	03/31/21 10:07	03/31/21 18:47	1
d3-NMeFOSAA	5	*5-	50 - 150	03/31/21 10:07	03/31/21 18:47	1
d5-NEtFOSAA	6	*5-	50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C2-PFDoDA	60		50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C3 PFHxS	84		50 - 150	93/31/21 10:07	03/31/21 18:47	1
13C5 PFHxA	62		50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C6 PFDA	66		50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C7 PFUnA	65		50 - 150	03/31/21 10:07	03/31/21 18:47	1
13C9 PFNA	63		50 - 150	03/31/21 10:07	03/31/21 18:47	1

General Chemistry

M2-6:2 FTS

M2-8:2 FTS

13C2 PFTeDA

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	15.6		1.0		1.0	%		03/13/21 08:14	1
Percent Solids	84.4		1.0		1.0	%		03/13/21 08:14	1

Client Sample ID: APG-Boneyard-7-GW-031121

Lab Sample ID: 410-32349-6 Date Collected: 03/11/21 10:10 **Matrix: Water** Date Received: 03/12/21 17:30

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 Result Qualifier LOQ LOD **DL** Unit Dil Fac Analyzed 6:2 Fluorotelomer sulfonic acid <4.0 5.1 4.0 4.0 ng/L 03/17/21 14:10 8:2 Fluorotelomer sulfonic acid <2.0 3.0 2.0 2.0 ng/L 03/17/21 14:10 **NEtFOSAA** <1.0 3.0 1.0 1.0 ng/L 03/17/21 14:10 **NMeFOSAA** <1.2 2.0 1.2 1.2 ng/L 03/17/21 14:10 Perfluorobutanesulfonic acid 2.0 <1.0 1.0 1.0 ng/L 03/17/21 14:10 Perfluorobutanoic acid <4.0 5.1 4.0 4.0 ng/L 03/17/21 14:10 Perfluorodecanoic acid 2.0 <1.0 1.0 1.0 ng/L 03/17/21 14:10 Perfluorododecanoic acid <1.0 2.0 1.0 1.0 ng/L 03/17/21 14:10 Perfluoroheptanoic acid <1.0 M 2.0 1.0 1.0 ng/L 03/17/21 14:10 Perfluorohexanesulfonic acid 25 2.0 1.0 1.0 ng/L 03/17/21 14:10 Perfluorohexanoic acid 2.0 1.0 1.0 ng/L 03/17/21 14:10 3.6 2.0 Perfluorononanoic acid <1.0 1.0 1.0 ng/L 03/17/21 14:10 Perfluorooctanesulfonic acid 1.7 2.0 1.0 1.0 ng/L 03/17/21 14:10 Perfluorooctanoic acid 6.9 2.0 1.0 ng/L 03/17/21 14:10 Perfluoropentanoic acid <1.0 2.0 1.0 1.0 ng/L 03/17/21 14:10 Perfluorotetradecanoic acid 2.0 1.0 1.0 ng/L 03/17/21 14:10 <1.0 Perfluorotridecanoic acid <1.0 2.0 1.0 1.0 ng/L 03/17/21 14:10 Perfluoroundecanoic acid <10 20 1.0 1.0 ng/L 03/17/21 14:10 Isotope Dilution %Recovery Qualifier Limits Prepared Analyzed Dil Fac

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03/15/21 08:34 03/17/21 14:10

03/15/21 08:34 03/17/21 14:10

03/15/21 08:34 03/17/21 14:10

50 - 150

50 - 150

50 - 150

135

125

94

Job ID: 410-32349-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

Client Sample ID: APG-Boneyard-7-GW-031121

Lab Sample ID: 410-32349-6

Date Collected: 03/11/21 10:10 **Matrix: Water** Date Received: 03/12/21 17:30

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 PFBS	94	50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C4 PFBA	111	50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C4 PFHpA	114	50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C5 PFPeA	107	50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C8 PFOA	118	50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C8 PFOS	100	50 - 150	03/15/21 08:34	03/17/21 14:10	1
d3-NMeFOSAA	92	50 - 150	03/15/21 08:34	03/17/21 14:10	1
d5-NEtFOSAA	108	50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C2-PFDoDA	109	50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C3 PFHxS	104	50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C5 PFHxA	113	50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C6 PFDA	110	50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C7 PFUnA	110	50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C9 PFNA	109	50 - 150	03/15/21 08:34	03/17/21 14:10	1

Client Sample ID: APG-OLD-FTA-1-SO-(0-2)-031121 Lab Sample ID: 410-32349-7

Date Collected: 03/11/21 12:30 **Matrix: Solid** Date Received: 03/12/21 17:30 **Percent Solids: 81.8**

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	☼	03/17/21 20:47	1
8:2 Fluorotelomer sulfonic acid	<0.0019	0.0036	0.0019	0.0019	mg/Kg	☼	03/17/21 20:47	1
NEtFOSAA	<0.00048	0.0024	0.00048	0.00048	mg/Kg	\(\delta\)	03/17/21 20:47	R 1
NMeFOSAA	<0.00048	0.0024	0.00048	0.00048	mg/Kg	*	03/17/21 20:47	R 1
Perfluorobutanesulfonic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	☼	03/17/21 20:47	1
Perfluorobutanoic acid	<0.0019	0.0024	0.0019	0.0019	mg/Kg	₩	03/17/21 20:47	1
Perfluorodecanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg	☼	03/17/21 20:47	1
Perfluorododecanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg	₩	03/17/21 20:47	1
Perfluoroheptanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg	₩	03/17/21 20:47	1
Perfluorohexanesulfonic acid	0.00086	0.00072	0.00048	0.00048	mg/Kg	₩	03/17/21 20:47	1
Perfluorohexanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg	₩	03/17/21 20:47	1
Perfluorononanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg	₩	03/17/21 20:47	1
Perfluorooctanesulfonic acid	0.0052	0.00072	0.00048	0.00048	mg/Kg	₩	03/17/21 20:47	1
Perfluorooctanoic acid	0.00095	0.00072	0.00048	0.00048	mg/Kg	☼	03/17/21 20:47	1
Perfluoropentanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg	☼	03/17/21 20:47	1
Perfluorotetradecanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg	₩	03/17/21 20:47	1
Perfluorotridecanoic acid	<0.00048	0.00072	0.00048	0.00048	mg/Kg	☼	03/17/21 20:47	1
Perfluoroundecanoic acid	0.0051 /	0.00072	0.00048	0.00048	mg/Kg	☼	03/17/21 20:47	1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared Analyzed	l Dil Fac
M2-6:2 FTS	54	50 - 150	03/15/21 13:55 03/17/21 20	:47 1
M2-8:2 FTS	55	50 - 150	03/15/21 13:55 03/17/21 20	:47 1
13C2 PFTeDA	72	50 - 150	03/15/21 13:55 03/17/21 20	:47 1
13C3 PFBS	91	50 - 150	03/15/21 13:55 03/17/21 20	:47 1
13C4 PFBA	74	50 - 150	03/15/21 13:55 03/17/21 20	:47 1
13C4 PFHpA	79	50 - 150	03/15/21 13:55 03/17/21 20	:47 1
13C5 PFPeA	71	50 - 150	03/15/21 13:55 03/17/21 20	:47 1
13C8 PFOA	80	50 - 150	03/15/21 13:55 03/17/21 20	:47 1
13C8 PFOS	100	50 - 150	03/15/21 13:55 03/17/21 20	:47 1
d3-NMeFOSAA	8 *5-	50 - 150	03/15/21 13:55 03/17/21 20	:47 1

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Job ID: 410-32349-1

Client Sample ID: APG-OLD-FTA-1-SO-(0-2)-031121

Lab Sample ID: 410-32349-7 Date Collected: 03/11/21 12:30 **Matrix: Solid**

Percent Solids: 81.8

Date Received: 03/12/21 17:30

Method: EPA 537(Mod) - P	FAS for QSM 5.3, Table	B-15 (Continued)			
Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
d5-NEtFOSAA	10 *5-	50 - 150	03/15/21 13:55	03/17/21 20:47	1
13C2-PFDoDA	77	50 - 150	03/15/21 13:55	03/17/21 20:47	1
13C3 PFHxS	104	50 - 150	03/15/21 13:55	03/17/21 20:47	1
13C5 PFHxA	75	50 - 150	03/15/21 13:55	03/17/21 20:47	1
13C6 PFDA	78	50 - 150	03/15/21 13:55	03/17/21 20:47	1
13C7 PFUnA	80	50 - 150	03/15/21 13:55	03/17/21 20:47	1
13C9 PFNA	76	50 - 150	03/15/21 13:55	03/17/21 20:47	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	<u></u>	03/24/21 13:27	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0034	0.0018	0.0018	mg/Kg	₩	03/24/21 13:27	1
NEtFOSAA	<0.00045		0.0023	0.00045	0.00045	mg/Kg	☼	03/24/21 13:27	1
NMeFOSAA	<0.00045		0.0023	0.00045	0.00045	mg/Kg	₽	03/24/21 13:27	1
Perfluorobutanesulfonic asid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₩	03/24/21 13:27	1
Perfluorobutanoic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	03/24/21 13:27	1
Perfluorodecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₽	03/24/21 13:27	1
Perfluorododecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/24/21 13:27	1
Perfluoroheptanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 13:27	1
Perfluorohexanesulfonic acid	0.00094		0.00068	0.00045	0.00045	mg/Kg	₽	03/24/21 13:27	1
Perfluorohexanoic acid	<0.00045	M	0.00068	0.00045	0.00045	mg/Kg	₩	03/24/21 13:27	1
Perfluorononanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/24/21 13:27	1
Perfluorooctanesulfonic acid	0.0049		0.00068	0.00045	0.00045	mg/Kg	₽	03/24/21 13:27	1
Perfluorooctanoic acid	0.0010	M	0.00068	0.00045	0.00045	mg/Kg	₩	03/24/21 13:27	1
Perfluoropentanoic acid	<0.00045	М	0.00068	0.00045	0.00045	mg/Kg	₩	03/24/21 13:27	1
Perfluorotetradecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/24/21 13:27	1
Perfluorotridecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	03/24/21 13:27	1
Perfluoroundecanoic acid	0.0050	1	0.00068	0.00045	0.00045	mg/Kg	₽	03/24/21 13:27	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepa	ared	Analyzed	Dil Fac

		and the state of t					
Isotope Dilution	%Recovery	Qualifier	Limits		Prepared	Analyzed	Dil Fac
M2-6:2 FTS	39	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
M2-8:2 FTS	31	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C2 PFTeDA	39	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C3 PFBS	61		50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C4 PFBA	42	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C4 PFHpA	46	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C5 PFPeA	41	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C8 PFOA	49	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C8 PFOS	65		50 - 150		03/23/21 20:31	03/24/21 13:27	1
d3-NMeFOSAA	5	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
d5-NEtFOSAA	7	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C2-PFDoDA	45	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C3 PFHxS	69		50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C5 PFHxA	42	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C6 PFDA	44	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C7 PFUnA	43	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	1
13C9 PFNA	44	*5-	50 - 150		03/23/21 20:31	03/24/21 13:27	A

General Chemistry Dil Fac Analyte Result Qualifier LOQ LOD DL Unit Analyzed **Total Organic Carbon** 928 619 mg/Kg 1170 619

Eurofins Lancaster Laboratories Env, LLC

Client: ARCADIS U.S., Inc. Job ID: 410-32349-1 Project/Site: APG PFAS S1

Client Sample ID: APG-OLD-FTA-1-SO-(0-2)-031121

Lab Sample ID: 410-32349-7 Date Collected: 03/11/21 12:30 **Matrix: Solid**

Date Received: 03/12/21 17:30 **Percent Solids: 81.8**

General Chemistry (Continued)										
	Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
	Percent Moisture	18.2		1.0		1.0	%		03/13/21 08:14	1
	Percent Solids	81.8		1.0		1.0	%		03/13/21 08:14	1

General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	6.8	J	0.01	0.01	0.01	S.U.		03/16/21 18:12	1
Temperature	20.7		0.01	0.01	0.01	Degrees C		03/16/21 18:12	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%		03/15/21 13:20	1
Sand	4.5		1.0	1.0	1.0	%		03/15/21 13:20	1
Silt	68.4		1.0	1.0	1.0	%		03/15/21 13:20	1
Clay	27.0		1.0	1.0	1.0	%		03/15/21 13:20	1
75 mm	100.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
19 mm	100		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
4.75 mm	99.9		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
3.35 mm	99.9		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
2.36 mm	99.8		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
1.18 mm	99.8		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.6 mm	99.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.3 mm	97.4		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.15 mm	96.3		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.075 mm	95.4		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.064 mm	93.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.05 mm	86.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.02 mm	58.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.005 mm	27.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.002 mm	19.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
0.001 mm	17.0		1.0	1.0	1.0	% Passing		03/15/21 13:20	1

Client Sample ID: APG-OLD-FTA-1-GW-031121

Lab Sample ID: 410-32349-8 Date Collected: 03/11/21 13:10 **Matrix: Water** Date Received: 03/12/21 17:30

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<44		55	44	44	ng/L		03/19/21 03:15	10
8:2 Fluorotelomer sulfonic acid	120	D	33	22	22	ng/L		03/19/21 03:15	10
NEtFOSAA	<11		33	11	11	ng/L		03/19/21 03:15	10
NMeFOSAA	<13		22	13	13	ng/L		03/19/21 03:15	10
Perfluorobutanesulfonic acid	130	D	22	11	11	ng/L		03/19/21 03:15	10
Perfluorobutanoic acid	72	D	55	44	44	ng/L		03/19/21 03:15	10
Perfluorodecanoic acid	64	D	22	11	11	ng/L		03/19/21 03:15	10
Perfluorododecanoic acid	<11		22	11	11	ng/L		03/19/21 03:15	10
Perfluoroheptanoic acid	62	D	22	11	11	ng/L		03/19/21 03:15	10
Perfluorohexanesulfonic acid	1200	D	22	11	11	ng/L		03/19/21 03:15	10
Perfluorohexanoic acid	250	D	22	11	11	ng/L		03/19/21 03:15	10
Perfluorononanoic acid	220	D	22	11	11	ng/L		03/19/21 03:15	10

Eurofins Lancaster Laboratories Env, LLC

Job ID: 410-32349-1

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

13C9 PFNA

Client Sample ID: APG-OLD-FTA-1-GW-031121

Lab Sample ID: 410-32349-8 Date Collected: 03/11/21 13:10

Matrix: Water Date Received: 03/12/21 17:30

Analyte	Res	ult Qualifie	r I	_OQ	LOD	DL	Unit	D Analyzed	Dil Fac
Perfluorooctanoic acid	7	20 D M		22	11	11	ng/L	03/19/21 03:15	10
Perfluoropentanoic acid	1:	30 D		22	11	11	ng/L	03/19/21 03:15	10
Perfluorotetradecanoic acid	<	11		22	11	11	ng/L	03/19/21 03:15	10
Perfluorotridecanoic acid	<	11		22	11	11	ng/L	03/19/21 03:15	10
Perfluoroundecanoic acid		19 J IDM	JDM	22	11	11	ng/L	03/19/21 03:15	10
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	119		50 - 150	_			03/15/21 08:3	03/19/21 03:15	10
M2-8:2 FTS	113		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C2 PFTeDA	81		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C3 PFBS	89		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C4 PFBA	109		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C4 PFHpA	117		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C5 PFPeA	101		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C8 PFOA	110		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C8 PFOS	88		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
d3-NMeFOSAA	95		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
d5-NEtFOSAA	105		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C2-PFDoDA	104		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C3 PFHxS	104		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C5 PFHxA	111		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C6 PFDA	106		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10
13C7 PFUnA	105		50 - 150				03/15/21 08:3	4 03/19/21 03:15	10

Method: EPA 537(Mod) - PFAS	6 for QSM 5.3,	Table B-	15 - DL					
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorooctanesulfonic acid	7000	D	220	110	110	ng/L	03/19/21 03:48	100
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
13C8 PFOS	98		50 - 150			03/15/21 08:34	03/19/21 03:48	100

50 - 150

Client Sample ID: APG-OLD-FTA-2-SO-(0-2)-031121 Lab Sample ID: 410-32349-9

84

Date Collected: 03/11/21 13:25 **Matrix: Solid** Date Received: 03/12/21 17:30 **Percent Solids: 87.4**

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil	Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	*	03/30/21 16:31		1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0033	0.0018	0.0018	mg/Kg	₩	03/30/21 16:31		1
NEIFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg	∺	03/30/21 16:31	R	1
NMeFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg	*	03/30/21 16:31	R	1
Perfluorobutanesulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	☼	03/30/21 16:31		1
Perfluorobutanoic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	☼	03/30/21 16:31		1
Perfluorodecanoic acid	<0.00044	M	0.00067	0.00044	0.00044	mg/Kg	₩	03/30/21 16:31		1
Perfluorododecanoic acid	<0.00044	•	0.00067	0.00044	0.00044	mg/Kg	☼	03/30/21 16:31		1
Perfluoroheptanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/30/21 16:31		1
Perfluorohexanesulfonic acid	0.00050	JM	0.00067	0.00044	0.00044	mg/Kg	₩	03/30/21 16:31		1
Perfluorohexanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	☼	03/30/21 16:31		1
Perfluorononanoic acid	<0.00044	Ν <mark>ή</mark>	0.00067	0.00044	0.00044	mg/Kg	☼	03/30/21 16:31		1
Perfluorooctanesulfonic acid	0.019		0.00067	0.00044	0.00044	mg/Kg	₩	03/30/21 16:31		1
Perfluorooctanoic acid	< 0.00044	M	0.00067	0.00044	0.00044	mg/Kg	⇔	03/30/21 16:31		1

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03/15/21 08:34 03/19/21 03:15

10

Client: ARCADIS U.S., Inc. Job ID: 410-32349-1 Project/Site: APG PFAS S1

Client Sample ID: APG-OLD-FTA-2-SO-(0-2)-031121

M2-6:2 FTS

M2-8:2 FTS

13C3 PFBS

13C4 PFBA

13C2 PFTeDA

Lab Sample ID: 410-32349-9 Date Collected: 03/11/21 13:25 **Matrix: Solid**

Date Received: 03/12/21 17:30 Percent Solids: 87.4

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluoropentanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/30/21 16:31	1
Perfluorotetradecanoic acid	<0.00044		0.00067	0.00044	0.00044	mg/Kg	₩	03/30/21 16:31	1
Perfluorotridecanoic acid	0.00063	J	0.00067	0.00044	0.00044	mg/Kg	₩	03/30/21 16:31	1
Perfluoroundecanoic acid	0.0010		0.00067	0.00044	0.00044	mg/Kg	₩	03/30/21 16:31	1
Isotope Dilution	%Recovery Qu	alifier	Limits			Prepared	1	Analyzed	Dil Fac
M2-6:2 FTS	82		50 - 150			03/29/21 08	26	03/30/21 16:31	1
M2-8:2 FTS	75		50 - 150			03/29/21 08.	26	03/30/21 16:31	1
13C2 PFTeDA	73		50 - 150			03/29/21 08.	26	03/30/21 16:31	1
13C3 PFBS	76		50 - 150			03/29/21 08.	26	03/30/21 16:31	1
13C4 PFBA	51		50 - 150			03/29/21 08.	26	03/30/21 16:31	1
13C4 PFHpA	67		50 - 150			03/29/21 08.	26	03/30/21 16:31	1
13C5 PFPeA	54		50 - 150			03/29/21 08.	26	03/30/21 16:31	1
13C8 PFOA	74		50 - 150			03/29/21 08.	26	03/30/21 16:31	1
13C8 PFOS	88		50 - 150			03/29/21 08.	26	03/30/21 16:31	1
d3-NMeFOSAA	14 *5-		50 - 150			03/29/21 08	26	03/30/21 16:31	1
d5-NEtFOSAA	17 *5-		50 - 150			03/29/21 08.	26	03/30/21 16:31	1
13C2-PFDoDA	72		50 - 150			03/29/21 08.	26	03/30/21 16:31	1
13C3 PFHxS	91		50 - 150			03/29/21 08	26	03/30/21 16:31	1
13C5 PFHxA	58		50 - 150			03/29/21 08.	26	03/30/21 16:31	1
13C6 PFDA	81		50 - 150			03/29/21 08	26	03/30/21 16:31	1
13C7 PFUnA	82		50 - 150			03/29/21 08	26	03/30/21 16:31	1
13C9 PFNA	75		50 - 150			03/29/21 08.	26	03/30/21 16:31	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	<u></u>	03/31/21 18:58	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0034	0.0018	0.0018	mg/Kg	☆	03/31/21 18:58	1
NEtFOSAA	< 0.00046		0.0023	0.00046	0.00046	mg/Kg	☆	03/31/21 18:58	1
NMeFOSAA	<0.00046		0.0023	0.00046	0.00046	mg/Kg	₩	03/31/21 18:58	1
Perfluorobutanesulfonic acid	<0.0018	*+	0.0023	0.0018	0.0018	mg/Kg	☆	03/31/21 18:58	1
Perfluorobutanoic acid	<0.0018	M	0.0023	0.0018	0.0018	mg/Kg	☆	03/31/21 18:58	1
Perfluorodecanoic acid	<0:00046	М	0.00069	0.00046	0.00046	mg/Kg	₩	03/31/21 18:58	1
Perfluorododecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/31/21 18:58	1
Perfluoroheptanoic acid	< 0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/31/21 18:58	1
Perfluorohexanesulfonic acid	0.00063	J	0.00069	0.00046	0.00046	mg/Kg	☼	03/31/21 18:58	1
Perfluorohexanoic acid	< 0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/31/21 18:58	1
Perfluorononanoic acid	< 0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/31/21 18:58	1
Perfluorooctanesulfonic acid	0.020		0.00069	0.00046	0.00046	mg/Kg	☼	03/31/21 18:58	1
Perfluorooctanoic acid	< 0.00046	M	0.00069	0.00046	0.00046	mg/Kg	₩	03/31/21 18:58	1
Perfluoropentanoic acid	< 0.00046		0.00069	0.00046	0.00046	mg/Kg	₩	03/31/21 18:58	1
Perfluorotetradecanoic acid	<0.00046		0.00069	0.00046	0.00946	mg/Kg	₩	03/31/21 18:58	1
Perfluorotridecanoic acid	0.00057	J	0.00069	0.00046	0.00046	mg/Kg	₩	03/31/21 18:58	1
Perfluoroundecanoic acid	0.0012	*1	0.00069	0.00046	0.00046	mg/Kg	₽	03/31/21 18:58	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepai	red	Analyzed	Dil Fac

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03/31/21 10:07 03/31/21 18:58

03/31/21 10:07 03/31/21 18:58 03/31/21 10:07 03/31/21 18:58

03/31/21 10:07 03/31/21 18:58

03/31/21 10:07 03/31/21 18:58

50 - 150

50 - 150

50 - 150

50 - 150

50 - 150

76

62

73

77

83

Client: ARCADIS U.S., Inc. Job ID: 410-32349-1 Project/Site: APG PFAS S1

Client Sample ID: APG-OLD-FTA-2-SO-(0-2)-031121

Lab Sample ID: 410-32349-9

Date Collected: 03/11/21 13:25 Date Received: 03/12/21 17:30

Matrix: Solid Percent Solids: 87.4

Method: EPA 537(Mod) - PFAS	for QSM 5.	3, Table B	3-15 - RE (C	continued)
Isotope Dilution	%Recovery	Qualifier	Limits	
13C4 PFHpA	84		50 - 150	

Isotope Dilution	%Recovery G	Qualifier Limits	Prepared	Analyzed	Dil Fac
13C4 PFHpA	84	50 - 150	03/31/21 10:07	03/31/21 18:58	1
13C5 PFPeA	84	50 - 150	03/31/21 10:07	03/31/21 18:58	1
13C8 PFOA	87	50 - 150	03/31/21 10:07	03/31/21 18:58	1
13C8 PFOS	86	50 - 150	03/31/21 10:07	03/31/21 18:58	1
d3-NMeFOSAA	14 *.	50 ₋ 150	03/31/21 10:07	03/31/21 18:58	1
d5-NEtFOSAA	18 *:	*5- 50 - 150	03/31/21 10:07	03/31/21 18:58	1
13C2-PFDoDA	77	50 - 150	03/31/21 10:07	03/31/21 18:58	1
13C3 PFHxS	87	50 - 150	03/31/21 10:07	03/31/21 18:58	1
13C5 PFHxA	80	50 - 150	93/31/21 10:07	03/31/21 18:58	1
13C6 PFDA	78	50 - 150	03/31/21 10:07	03/31/21 18:58	1
13C7 PFUnA	80	50 - 150	03/31/21 10:07	03/31/21 18:58	1
13C9 PFNA	81	50 - 150	03/31/21 10:07	03/31/21 18:58	1

General Chemistry

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
Percent Moisture	12.6	1.0		1.0 %		03/13/21 08:21	1
Percent Solids	87.4	1.0		1.0 %		03/13/21 08:21	1

Client Sample ID: APG-OLD-FTA-2-GW-031121

Lab Sample ID: 410-32349-10 Date Collected: 03/11/21 14:10 **Matrix: Water**

Date Received: 03/12/21 17:30

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit	D Analyzed	Dil Fac
8:2 Fluorotelomer sulfonic acid	25	J D		31	21	21	ng/L	03/22/21 11:35	10
NEtFOSAA	<10			31	10	10	ng/L	03/22/21 11:35	10
NMeFOSAA	<12			21	12	12	ng/L	03/22/21 11:35	10
Perfluorobutanesulfonic acid	680	D		21	10	10	ng/L	03/22/21 11:35	10
Perfluorobutanoic acid	580	D		52	41	41	ng/L	03/22/21 11:35	10
Perfluorodecanoic acid	30	D		21	10	10	ng/L	03/22/21 11:35	10
Perfluorododecanoic acid	<10			21	10	10	ng/L	03/22/21 11:35	10
Perfluoroheptanoic acid	860	D		21	10	10	ng/L	03/22/21 11:35	10
Perfluoropentanoic acid	1700	D		21	10	10	ng/L	03/22/21 11:35	10
Perfluorotetradecanoic acid	<10	В		21	10	10	ng/L	03/22/21 11:35	10
Perfluorotridecanoic acid	<10	В		21	10	10	ng/L	03/22/21 11:35	10
Perfluoroundecanoic acid	<10	-		21	10	10	ng/L	03/22/21 11:35	10
Isotope Dilution	%Recovery Qu	ualifier	Limits				Prepared	Analyzed	Dil Fac

ізоюре Біншыні	∕∞Recovery	Quaimer	LIIIIII	riepareu	Allalyzeu	DII Fac
M2-6:2 FTS	65		50 - 150	03/20/21 10:25	03/22/21 11:35	10
M2-8:2 FTS	143		50 - 150	03/20/21 10:25	03/22/21 11:35	10
13C2 PFTeDA	95		50 - 150	03/20/21 10:25	03/22/21 11:35	10
13C3 PFBS	98		50 - 150	03/20/21 10:25	03/22/21 11:35	10
13C4 PFBA	97		50 - 150	03/20/21 10:25	03/22/21 11:35	10
13C4 PFHpA	87		50 - 150	03/20/21 10:25	03/22/21 11:35	10
13C5 PFPeA	90		50 - 150	03/20/21 10:25	03/22/21 11:35	10
13C8 PFOA	62		50 - 150	03/20/21 10:25	03/22/21 11:35	10
13C8 PFOS	114		50 - 150	03/20/21 10:25	03/22/21 11:35	10
d3-NMeFOSAA	121		50 - 150	03/20/21 10:25	03/22/21 11:35	10
d5-NEtFOSAA	145		50 - 150	03/20/21 10:25	03/22/21 11:35	10
13C2-PFDoDA	117		50 - 150	03/20/21 10:25	03/22/21 11:35	10
13C3 PFHxS	92		50 - 150	03/20/21 10:25	03/22/21 11:35	10

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Job ID: 410-32349-1 Client: ARCADIS U.S., Inc.

Project/Site: APG PFAS S1

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

%Recovery Qualifier

Client Sample ID: APG-OLD-FTA-2-GW-031121 Lab Sample ID: 410-32349-10

Date Collected: 03/11/21 14:10 **Matrix: Water** Date Received: 03/12/21 17:30

	, , , , , , , , , , , , , , , , , , , ,						, . .,	
13C5 PFHxA	91		50 - 150			03/20/21 10:25	03/22/21 11:35	10
13C6 PFDA	124		50 - 150			03/20/21 10:25	03/22/21 11:35	10
13C7 PFUnA	113		50 - 150			03/20/21 10:25	03/22/21 11:35	10
13C9 PFNA	70		50 - 150			03/20/21 10:25	03/22/21 11:35	10
Method: EPA 537(Mod) - PFA	S for QSM 5.3, 1	Table B-	15 - DL					
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	2000	D	520	410	410	ng/L	03/22/21 11:46	100
Perfluorohexanesulfonic acid	11000	D	210	100	100	ng/L	03/22/21 11:46	100
Perfluorohexanoic acid	4300	D	210	100	100	ng/L	03/22/21 11:46	100
Perfluorononanoic acid	6600	D	210	100	100	ng/L	03/22/21 11:46	100
Perfluorooctanesulfonic acid	22000	🗹 DJ-	210	100	100	ng/L	03/22/21 11:46	100
Perfluorooctanoic acid	27000	D	210	100	100	ng/L	03/22/21 11:46	100
Isotope Dilution	%Recovery Qua	alifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	124		50 - 150			03/20/21 10:25	03/22/21 11:46	100
13C8 PFOA	108		50 - 150			03/20/21 10:25	03/22/21 11:46	100
13C8 PFOS	153 *5+		50 - 150			03/20/21 10:25	03/22/21 11:46	100
13C3 PFHxS	117		50 - 150			03/20/21 10:25	03/22/21 11:46	100
13C5 PFHxA	102		50 - 150			03/20/21 10:25	03/22/21 11:46	100
13C9 PFNA	111		50 - 150			03/20/21 10:25	03/22/21 11:46	100

Analyte	Result	Qualifier	L	.oq	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	1800	D		57	45	45	ng/L		03/19/21 03:59	10
8:2 Fluorotelomer sulfonic acid	38	D		34	23	23	ng/L		03/19/21 03:59	10
NEtFOSAA	<11			34	11	11	ng/L		03/19/21 03:59	10
NMeFOSAA	<14			23	14	14	ng/L		03/19/21 03:59	10
Perfluorobutanesulfonic acid	670	D		23	11	11	ng/L		03/19/21 03:59	10
Perfluorobutanoic acid	590	D		57	45	45	ng/L		03/19/21 03:59	10
Perfluorodecanoic acid	28	D		23	11	11	ng/L		03/19/21 03:59	10
Perfluorododecanoic acid	<11			23	11	11	ng/L		03/19/21 03:59	10
Perfluoroheptanoic acid	910	Q		23	11	11	ng/L		03/19/21 03:59	10
Perfluorohexanesulfonic acid	11000	E D		23	11	11	ng/L		03/19/21 03:59	10
Perfluorohexanoic acid	4200	D		23	11	11	ng/L		03/19/21 03:59	10
Perfluorononanoic acid	5800	ED		23	11	11	ng/L		03/19/21 03:59	10
Perfluorooctanesulfonic acid	19000	ED		23	11	11	ng/L		03/19/21 03:59	10
Perfluorooctanoic acid	26000	ED		23	11	11	ng/L		03/19/21 03:59	10
Perfluoropentanoic acid	1700	D		23	11	11	ng/L		03/19/21 03:59	10
Perfluorotetradecanoic acid	<11			23	11	11	ng/L		03/19/21 03:59	10
Perfluorotridecanoic acid	<11			23	11	11	ng/L		03/19/21 03:59	10
Perfluoroundecanoic acid	<11			23	11	14	ng/L		03/19/21 03:59	10
Isotope Dilution	%Recovery Qu	ualifier	Limits				Rrepai	red	Analyzed	Dil Fac

Isotope Dilution	%Recovery	Qualifier	Limits	Rrepared	Analyzed	DII Fac
M2-6:2 FTS	51		50 - 150	03/15/21 08:34	03/19/21 03:59	10
M2-8:2 FTS	58		50 - 150	03/15/21 08:34	03/19/21 03:59	10
13C2 PFTeDA	34	*5-	50 - 150	03/15/21 08:34	03/19/21 03:59	10
13C3 PFBS	54		50 - 150	03/15/21 08:34	03/19/21 03:59	10
13C4 PFBA	59		50 - 150	03/15/21 08:34	03/19/21 03:59	10
13C4 PFHpA	56		50 - 150	03/15/21 08:34	03/19/21 03:59	10
13C5 PFPeA	55		50 - 150	03/15/21 08:34	03/19/21 03:59	10

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6

Dil Fac

Prepared

Analyzed

Job ID: 410-32349-1

03/15/21 08:34 03/19/21 03:59

Client: ARCADIS U.S., Inc. Project/Site: APG PFAS S1

13C5 PFHxA

Client Sample ID: APG-OLD-FTA-2-GW-031121

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Lab Sample ID: 410-32349-10

Date Collected: 03/11/21 14:10 **Matrix: Water** Date Received: 03/12/21 17:30

Method: EPA 537(Mod	d) - PFAS for QSM 5	.3, Table E	3-15 - RE (Continued))		
Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C8 PFOA	45	*5-	50 - 150	03/15/21 08:34	03/19/21 03:59	10
13C8 PFOS	66		50 - 150	03/15/21 08:34	03/19/21 03:59	10
d3-NMeFOSAA	61		50 - 150	03/15/21 08:34	03/19/21 03:59	10
d5-NEtFOSAA	72		50 - 150	03/15/21 08:34	03/19/21 03:59	10
13C2-PFDoDA	51		50 150	03/15/21 08:34	03/19/21 03:59	10
13C3 PFHxS	57		50 - 150	03/15/21 08:34	03/19/21 03:59	10

13C6 PFDA 03/15/21 08:34 03/19/21 03:59 64 50 - 150 10 13C7 PFUnA 50 - 150 03/15/21 08:34 03/19/21 03:59 62 10 13C9 PFNA 50 - 150 03/15/21 08:34 03/19/21 03:59 10 46 *5-Lab Sample ID: 410-32349-11

50 - 150

Client Sample ID: APG-FTA-M08-031121

Date Collected: 03/11/21 13:45 **Matrix: Water** Date Received: 03/12/21 17:30

Analyte	Result	Qualifier	L	_OQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	670	D	_	41	33	33	ng/L	03/19/21 04:21	10
8:2 Fluorotelomer sulfonic acid	44	FL-D)	25	16	16	ng/L	03/19/21 04:21	10
NEtFOSAA	<8.2			25	8.2	8.2	ng/L	03/19/21 04:21	10
NMeFOSAA	<9.8			16	9.8	9.8	ng/L	03/19/21 04:21	10
Perfluorobutanesulfonic acid	160	D		16	8.2	8.2	ng/L	03/19/21 04:21	10
Perfluorobutanoic acid	190	D		41	33	33	ng/L	03/19/21 04:21	10
Perfluorodecanoic acid	<8.2	M		16	8.2	8.2	ng/L	03/19/21 04:21	10
Perfluorododecanoic acid	<8.2			16	8.2	8.2	ng/L	03/19/21 04:21	10
Perfluoroheptanoic acid	270	D		16	8.2	8.2	ng/L	03/19/21 04:21	10
Perfluorohexanesulfonic acid	2900	D		16	8.2	8.2	ng/L	03/19/21 04:21	10
Perfluorohexanoic acid	1100	D		16	8.2	8.2	ng/L	03/19/21 04:21	10
Perfluorononanoic acid	1700	D		16	8.2	8.2	ng/L	03/19/21 04:21	10
Perfluoropentanoic acid	560	D		16	8.2	8.2	ng/L	03/19/21 04:21	10
Perfluorotetradecanoic acid	<8.2			16	8.2	8.2	ng/L	03/19/21 04:21	10
Perfluorotridecanoic acid	<8.2			16	8.2	8.2	ng/L	03/19/21 04:21	10
Perfluoroundecanoic acid	<8.2			16	8.2	8.2	ng/L	03/19/21 04:21	10
Isotone Dilution	%Pocovory O	ualifior	l imite				Propared	Analyzod	Dil Eac

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	88		50 - 150	03/15/21 08:34	03/19/21 04:21	10
M2-8:2 FTS	112		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C2 PFTeDA	71		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C3 PFBS	91		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C4 PFBA	104		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C4 PFHpA	97		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C5 PFPeA	94		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C8 PFOA	84		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C8 PFOS	94		50 - 150	03/15/21 08:34	03/19/21 04:21	10
d3-NMeFOSAA	105		50 - 150	03/15/21 08:34	03/19/21 04:21	10
d5-NEtFOSAA	108		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C2-PFDoDA	100		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C3 PFHxS	105		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C5 PFHxA	102		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C6 PFDA	108		50 - 150	03/15/21 08:34	03/19/21 04:21	10
13C7 PFUnA	115		50 - 150	03/15/21 08:34	03/19/21 04:21	10

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Client: ARCADIS U.S., Inc. Job ID: 410-32349-1 Project/Site: APG PFAS S1

Client Sample ID: APG-FTA-M08-031121

Lab Sample ID: 410-32349-11 Date Collected: 03/11/21 13:45 **Matrix: Water**

Date Received: 03/12/21 17:30

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

%Recovery Qualifier Limits Prepared Analyzed Dil Fac 13C9 PFNA 03/15/21 08:34 03/19/21 04:21

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - DL

Analyte	Result Quali	fier LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorooctanesulfonic acid	9000 D	160	82	82	ng/L	03/19/21 04:32	100
Perfluorooctanoic acid	6500 D M	160	82	82	ng/L	03/19/21 04:32	100
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
13C2 PFTeDA	77	50 - 150			03/15/21 08:34	03/19/21 04:32	100
13C8 PFOA	120	50 - 150			03/15/21 08:34	03/19/21 04:32	100
13C8 PFOS	119	50 - 150			03/15/21 08:34	03/19/21 04:32	100
13C2-PFDoDA	95	50 - 150			03/15/21 08:34	03/19/21 04:32	100

Client Sample ID: APG-DUP-04-031121 Lab Sample ID: 410-32349-12

Date Collected: 03/11/21 12:00 **Matrix: Water**

Date Received: 03/12/21 17:30

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	660	D	45	36	36	ng/L		03/19/21 05:05	10
8:2 Fluorotelomer sulfonic acid	37	D	27	18	18	ng/L		03/19/21 05:05	10
NEtFOSAA	<8.9		27	8.9	8.9	ng/L		03/19/21 05:05	10
NMeFOSAA	<11		18	11	11	ng/L		03/19/21 05:05	10
Perfluorobutanesulfonic acid	150	D	18	8.9	8.9	ng/L		03/19/21 05:05	10
Perfluorobutanoic acid	180	D	45	36	36	ng/L		03/19/21 05:05	10
Perfluorodecanoic acid	<8.9		18	8.9	8.9	ng/L		03/19/21 05:05	10
Perfluorododecanoic acid	<8.9		18	8.9	8.9	ng/L		03/19/21 05:05	10
Perfluoroheptanoic acid	260	D	18	8.9	8.9	ng/L		03/19/21 05:05	10
Perfluorohexanesulfonic acid	3100	D	18	8.9	8.9	ng/L		03/19/21 05:05	10
Perfluorohexanoic acid	1100	D	18	8.9	8.9	ng/L		03/19/21 05:05	10
Perfluorononanoic acid	1600	D	18	8.9	8.9	ng/L		03/19/21 05:05	10
Perfluoropentanoic acid	560	D	18	8.9	8.9	ng/L		03/19/21 05:05	10
Perfluorotetradecanoic acid	<8.9		18	8.9	8.9	ng/L		03/19/21 05:05	10
Perfluorotridecanoic acid	<8.9		18	8.9	8.9	ng/L		03/19/21 05:05	10
Perfluoroundecanoic acid	<8.9		18	8.9	8.9	ng/L		03/19/21 05:05	10

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	81		50 - 150	03/15/21 08:34	03/19/21 05:05	10
M2-8:2 FTS	122		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C2 PFTeDA	78		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C3 PFBS	83		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C4 PFBA	108		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C4 PFHpA	99		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C5 PFPeA	94		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C8 PFOA	85		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C8 PFOS	85		50 - 150	03/15/21 08:34	03/19/21 05:05	10
d3-NMeFOSAA	92		50 - 150	03/15/21 08:34	03/19/21 05:05	10
d5-NEtFOSAA	119		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C2-PFDoDA	98		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C3 PFHxS	90		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C5 PFHxA	102		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C6 PFDA	105		50 - 150	03/15/21 08:34	03/19/21 05:05	10

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Client: ARCADIS U.S., Inc. Job ID: 410-32349-1 Project/Site: APG PFAS S1

Client Sample ID: APG-DUP-04-031121

Lab Sample ID: 410-32349-12 Date Collected: 03/11/21 12:00

Matrix: Water

Date Received: 03/12/21 17:30

Method: EPA 537(Mod) - PFAS	for QSM 5.	3, Table B-1	15 (Continued)			
Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C7 PFUnA	100		50 - 150	03/15/21 08:34	03/19/21 05:05	10
13C9 PFNA	81		50 - 150	03/15/21 08:34	03/19/21 05:05	10

Analyte	Resu	lt Qualifier	LO	Q	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorooctanesulfonic acid	850	0 D	18	80	89	89	ng/L	03/19/21 05:16	100
Perfluorooctanoic acid	660	0 D	18	80	89	89	ng/L	03/19/21 05:16	100
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
13C8 PFOA	114		50 - 150				03/15/21 08:34	03/19/21 05:16	100
13C8 PFOS	107		50 - 150				03/15/21 08:34	03/19/21 05:16	100



Aberdeen Proving Ground – Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDG # 410-32859-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report # 41295R

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-32859-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

Oswals ID	Lability	Madrica	Sample Collection	Barrard Committee	Aı	nalysis	
Sample ID	Lab ID	Matrix	Date	Parent Sample	PFAS	тос	рН
APG-DUP-07-031721	410-32859-1	Water	3/17/2021	APG-NOBLE-ROAD-1- GW-031721	Х		
APG-NOBLE-ROAD-1-GW-031721	410-32859-2	Water	3/17/2021		Х		
APG-WEIDE-1-SO-(0-2)-031721	410-32859-3	Soil	3/17/2021		Х	Х	X
APG-WEIDE-1-GW-031721	410-32859-4	Water	3/17/2021		Х		
APG-BLDG-E4081-1-GW-031721	410-32859-5	Water	3/17/2021		Х		
APG-BLDG-E5180-1-SO-(0-2)-031721	410-32859-6	Soil	3/17/2021		Х	Х	X
APG-BLDG-E5180-1-GW-031721	410-32859-7	Water	3/17/2021		Х		
APG-BLDG-E5180-2-GW-031721	410-32859-8	Water	3/17/2021		Х		
APG-FB-06-031721	410-32859-9	Water	3/17/2021		Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-NOBLE-ROAD-1-GW-031721.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was performed on sample APG-NOBLE-ROAD-1-GW-031721.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

		Rep	orted	Performance Acceptable		Not
	Items Reviewed	No	Yes	No	Yes	Required
1.	Sample receipt condition		Х		Х	
2.	Requested analyses and sample results		Х		Х	
3.	Master tracking list		Х		Х	
4.	Methods of analysis		Х		Х	
5.	Reporting limits		Х		Х	
6.	Sample collection date		Х		Х	
7.	Laboratory sample received date		Х		Х	
8.	Sample preservation verification (as applicable)		Х		Х	
9.	Sample preparation/extraction/analysis dates		Х		Х	
10.	Fully executed Chain-of-Custody (COC) form		Х		Х	
11.	Narrative summary of QA or sample problems provided		Х		Х	
12.	Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation	
Soil USEPA modified		28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C	
537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C	

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
APG-NOBLE-ROAD-1-GW-031721	13C2 PFTeDA	Perfluorotetradecanoic acid	< 50% but > 20%	< 50% but > 20% (MS/MSD)
APG-WEIDE-1-SO-(0-2)-	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
031721	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 50% but > 20%
	13C2 PFTeDA	Perfluorotetradecanoic acid	< 50% but > 20%	NA
APG-WEIDE-1-GW-031721	13C4 PFBA	Perfluorobutanoic acid	< 50% but > 20%	NA
	13C5 PFPeA	Perfluoropentanoic acid	< 50% but > 20%	NA

Note:

NA Not analyzed

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
4500/	Non-detect	No Action
> 150%	Detect	J-
< 50% but > 20%	Non-detect	UJ

Control Limit	Sample Result	Qualification	
	Detect	J+	
.000/	Non-detect	UX	
< 20%	Detect	X	

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be $\leq 30\%$.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

Sample associated with the MS/MSD exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	Compounds	MS Recovery	MSD Recovery	
APG-NOBLE-ROAD-1-GW-	Perfluorohexanesulfonic acid	05.4	SR>4X	
	Perfluorooctanesulfonic acid	SR>4X		
	Perfluorooctanoic acid			

Note:

SR>4X Sample result is greater than 4 times the added spike

The criteria used to evaluate the MS/MSD recoveries are presented in the following table. In the case of an MS/MSD deviation, the sample results are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
	Non-detect	No Action
> the upper control limit (UL)	Detect	J+
	Non-detect	UJ
< the lower control limit (LL) but > 10%	Detect	J-
< 10%	Non-detect	UX

Control Limit	Sample Result	Qualification	
	Detect	J-	
SR>4X: Parent sample concentration > four times the MS/MSD spiking solution concentration.	Detect	No Action	

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

Results for field duplicate samples are summarized in the following table.

Sample ID/Duplicate ID	Duplicate ID Compounds		Duplicate Result	RPD
	Perfluorobutanesulfonic acid	30	29	3.4 %
	Perfluorobutanoic acid	36	35	2.8 %
	Perfluoroheptanoic acid	22	22	0.0 %
	Perfluorohexanesulfonic acid	580	540	7.1 %
APG-NOBLE-ROAD-1-GW-031721 / APG-DUP-07-031721	Perfluorohexanoic acid	55	54	1.8 %
/	Perfluorononanoic acid	14	15	6.9 %
	Perfluoropentanoic acid	36	37	2.7 %
	Perfluorooctanesulfonic acid	740	700	5.5 %
	Perfluorooctanoic acid	170	170	0.0 %

The calculated RPD between the parent sample and field duplicate were acceptable.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

All identified compounds met method criteria.

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
ADC DUD 07 004704	Perfluorohexanesulfonic acid		540	540 D
APG-DUP-07-031721	Perfluorooctanesulfonic acid		700	700 D
APG-NOBLE-ROAD-1-GW-	Perfluorohexanesulfonic acid		580	580 D
031721	Perfluorooctanesulfonic acid		740	740 D
	6:2 Fluorotelomer sulfonic acid		790	790 D
	Perfluorobutanesulfonic acid		830	830 D
	Perfluorobutanoic acid		700	700 D
	Perfluoroheptanoic acid		970	970 D
APG-BLDG-E5180-1-GW-	Perfluorohexanoic acid		2900	2900 D
031721	Perfluorononanoic acid		49	49 D
	Perfluorooctanesulfonic acid		530	530 D
	Perfluorooctanoic acid		2700	2700 D
	Perfluoropentanoic acid		2300	2300 D
	Perfluorohexanesulfonic acid		4300	4300 D
	6:2 Fluorotelomer sulfonic acid		380	380 D
	Perfluorobutanesulfonic acid		220	220 D
	Perfluorobutanoic acid		820	820 D
	Perfluoroheptanoic acid		3000	3000 D
APG-BLDG-E5180-2-GW-	Perfluorohexanoic acid		3300	3300 D
031721	Perfluorononanoic acid		1100	1100 D
	Perfluorooctanesulfonic acid		9300	9300 D
	Perfluorooctanoic acid		6500	6500 D
	Perfluoropentanoic acid		3200	3200 D
	Perfluorohexanesulfonic acid		10000	10000 D

Note: the lab didn't report the original analysis; only the diluted result.

The samples APG-BLDG-E5180-1-GW-031721 and APG-BLDG-E5180-2-GW-031721 were analyzed at 10-fold and 100-fold dilution due to interference from sample matrix. An undiluted analysis was not performed. Therefore, the detection limits are elevated.

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification
Diluted sample result within the calibration range	D

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Rep	oorted		rmance eptable	Not Required
	No	Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC	MS/MS)			
Stage 2 Validation					
Holding times		Х		Х	
Reporting limits (units)		Х		Х	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks	Х				Х
C. Field blanks		Х		Х	
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate (LCSD) %R		Х		Х	
LCS/LCSD Precision (RPD)		Х		Х	
Matrix Spike (MS) %R		Х		Х	
Matrix Spike Duplicate (MSD) %R		Х		Х	
MS/MSD Precision (RPD)		Х		Х	
Field Duplicate (RPD)		Х		Х	
Extracted Internal Standard %R		Х	Х		
Injection Internal Standard %R		Х		Х	
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation		ı			
Instrument tune and performance check		Х		Х	
Initial calibration %RSDs		Х		Х	
Continuing calibration %Ds		Х		Х	
Instrument sensitivity check		Х		Х	
Ion transitions used		Х		Х	
Compound identification and quantitation	<u> </u>	ı		1	1
A. Reconstructed ion chromatograms		Х		Х	
B. Quantitation Reports		X		Х	
C. RT of sample compounds within the established RT windows		Х		Х	

PFAS: 537M/DoD QSM 5.3		Reported		mance ptable	Not Required
		Yes	No	Yes	rtoquilou
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
D. Ion Ratio %R		Х		Х	
E. Transcription/calculations acceptable		Х		Х	
F. Reporting limits adjusted to reflect sample dilutions		х		Х	

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Analyte considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria	
APG-WEIDE-1-SO-(0-2)-031721	6 days from collection; 5 days	< 24 hours of receipt at	
APG-BLDG-E5180-1-SO-(0-2)-031721	from receipt	the laboratory	

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

	Qualification
Criteria	Detected Analytes
Analysis completed past the holding time	J

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analyte	Standard Recovery	
APG-WEIDE-1-SO-(0-2)-031721	001/	Total Organia Carban	000/	
APG-BLDG-E5180-1-SO-(0-2)-031721	CCV	Total Organic Carbon	69%	

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Control Limit	Sample Result	Qualification
	O F 1.75%	Non-detect	UX
	Gross Exceedance < 75%	Detect	J-
	75% to 89%	Non-detect	UJ
TOC	75% 10 69%	Detect	J-
	4440/ 1 4050/	Non-detect	No Action
	111% to 125%	Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

A MS analysis was not performed for TOC.

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

A laboratory duplicate analysis was not performed on sample location associated with this SDG.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within ± 0.05 S.U. of the true value.

All LCS recoveries were within control limits, with the exception of the analytes associated with sample locations, as presented in the following table.

Sample ID	Analyte	LCS Recovery	
APG-WEIDE-1-SO-(0-2)-031721	Total Organia Carbon	600/	
APG-BLDG-E5180-1-SO-(0-2)-031721	Total Organic Carbon	68%	

The criteria used to evaluate LCS recoveries are presented in the following table. In the case of an LCS deviation, the sample results are qualified.

Control limit	Sample Result	Qualification
0/ D	Non-detect	UJ
% Recovery < lower limit of 80%	Detect	J-
0/ D	Non-detect	No Action
% Recovery > upper limit of 120%	Detect	J+

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Rep	orted	Perfor Acce	Not	
	No	Yes	No	Yes	Required
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks	Х				Х
Laboratory Control Sample (LCS) %R		Х	Х		
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х
LCS/LCSD Precision (RPD)	Х				Х
Matrix Spike (MS) %R	Х				Х
Matrix Spike Duplicate (MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				Х
Lab Duplicate (RPD)	Х				Х
Field Duplicate (RPD)	Х				Х
Dilution Factor		X		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		Х	
Continuing calibration %R		Х	Х		
Raw Data		Х		Х	
Transcription/calculations acceptable		Х		Х	

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE:

DATE: May 14, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 24, 2021

Stage 3 / 4 PFAS Calibration Standards

 SDG #:
 410-32859-1
 Date:
 5/14/2021

 Lab:
 Eurofins Lancaster
 Page:
 1

Project: Aberdeen Proving Ground Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

Perfluorohexanoic acid 3/23/2021 Calibration

Page 692 - 705 of SDG 410-32859-1

Match Match Match Match Match Match Match

	caurore acra	0, 20, 202		. age 032	, 00 0. 02 0	0 _ 0 _ 0 0 0	_			
Cal Conc					Calculated		Calc		Calculated	Reported
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D
0.2	115624	6026889	10	0.019185	0.9592345	0.8912	0.215268	0.2	7.634	7.6
0.5	259283	5341810	10	0.048538	0.9707683	0.8912	0.544641	0.5	8.928	8.9
2	1053537	5346282	10	0.19706	0.9852988	0.8912	2.211173	2	10.559	10.6
8	3635346	5465297	10	0.665169	0.8314612	0.8912	7.463745	8	-6.703	-6.7
20	10343596	6051931	10	1.70914	0.8545699	0.8912	19.17796	20	-4.110	-4.1
50	24124585	5884392	10	4.099758	0.8199517	0.8912	46.00267	50	-7.995	-8.0
100	40646397	4974602	10	8.170784	0.8170784	0.8912	91.68294	100	-8.317	-8.3
	•				•				•	

Avg RF = 0.8911947 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-32859-1Date:5/14/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-105926/9 3/23/2021 10:08

Page 840 - 845 of SDG 410-32859-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	913589	5148581	10	0.1774	0.9165	1.936	2	-3.19	-3.2
Perfluoropentanoic acid	980836	4464334	10	0.2197	1.1370	1.932	2	-3.38	-3.4
Perfluorobutanesulfonic acid	841695	3966701	9.36	0.2122	1.1058	1.796	2	1.47	1.5
Perfluorohexanoic acid	966270	5539738	10	0.1744	0.8912	1.957	2	-2.14	-2.1
Perfluoroheptanoic acid	1251604	5694521	10	0.2198	1.1340	1.938	2	-3.09	-3.1
Perfluorohexanesulfonic acid	779632	4070289	9.46	0.1915	1.0470	1.731	2	-8.43	-8.5
Perfluorooctanesulfonic acid	832886	4243385	9.57	0.1963	1.1450	1.641	2	-14.11	-14.2

Match Match Match Match Match Match Match

CCV 410-106599/19 3/24/2021 15:40

Page 890 - 895 of SDG 410-32859-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	3628514	5202022	10	0.6975	0.9165	7.611	8.0	-4.87	-4.9
Perfluoropentanoic acid	3734763	4351629	10	0.8582	1.1370	7.548	8.0	-5.65	-5.6
Perfluorobutanesulfonic acid	3252444	4121321	9.36	0.7892	1.1058	6.680	7.1	-5.65	-5.7
Perfluorohexanoic acid	3507130	5397840	10	0.6497	0.8912	7.290	8.0	-8.87	-8.9
Perfluoroheptanoic acid	5122953	5539034	10	0.9249	1.1340	8.156	8.0	1.95	1.9
Perfluorohexanesulfonic acid	2866760	3743321	9.46	0.7658	1.0470	6.920	7.3	-5.21	-5.2
Perfluorooctanesulfonic acid	3135905	3742734	9.57	0.8379	1.1450	7.003	7.4	-5.37	-5.4

Match Match Match Match Match Match Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 $\begin{array}{c|cccc} \text{SDG \#} & 410\text{-}32859\text{-}1 & \text{Date:} & 5/14/2021 \\ \text{Lab:} & \hline{\text{Eurofins Lancaster}} & \text{Page:} & 3 \\ \hline \text{Project:} & \text{Aberdeen Proving Ground} & \text{Validated by:} & \text{SPR} \\ \end{array}$

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-106300/2-A Page 1210 - 1215 of SDG 410-32859-1

Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported	1
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	2425902	4056186	10	0.598075	0.9165	26.10	25.6	101.96	102	Match
Perfluoropentanoic acid	2327723	3555968	10	0.654596	1.1370	23.03	25.6	89.96	90	Match
Perfluorobutanesulfonic acid	2339909	3264697	9.36	0.716731	1.1058	24.27	22.7	106.90	107	Match
Perfluorohexanoic acid	2313229	4358936	10	0.530687	0.8912	23.82	25.6	93.04	93	Match
Perfluoroheptanoic acid	3211342	4677113	10	0.686608	1.1340	24.22	25.6	94.61	95	Match
Perfluorohexanesulfonic acid	1969553	3288783	9.46	0.59887	1.0470	21.64	23.3	92.89	93	Match
Perfluorooctanesulfonic acid	2156725	3390341	9.57	0.636138	1.1450	21.27	23.7	89.74	90	Match

Calculated Amount ng/L = ((Peak area ratio/Avg RF) x EIS concentration)/Sample volume)*1000

Stage 3 / 4 PFAS MS/MSD

SDG #:410-32859-1Date:5/14/2021Lab:Eurofins LancasterPage:4Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID APG-NOBLE-ROAD-1-GW-031721 Page 453 - 454 SDG 410-32859-1

 ${\color{red}\mathsf{ANALYTE}}\ \underline{{\color{blue}\mathsf{Perfluorohexanoic}}\ \mathsf{acid}}$

REPORTED MS %R 107
REPORTED MSD %R 93
REPORTED RPD 4

%R = 100 * (MS Conc - Sample Conc) RPD = 100 * | MS %R - MSD %R MS TVAverage of MS MSD %R

Sample Concentration 55 MS Concentration 84.8 MS %R 106.05 MATCH 81.6 92.36 MATCH MSD Concentration MSD %R MS TV 3.85 MATCH 28.1 RPD MSD TV 28.8

Differences in %R may be due to rounding of the true value

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-32859-1
 Date:
 5/14/2021

 Lab:
 Eurofins Lancaster
 Page:
 5

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-NOBLE-ROAD-1-GW-031721 Lab ID: 410-32859-2 Page 525 - 529 of SDG 410-32859-1

						Calculated Final Amount Volume			Final Calculated	Reported Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	2457370	3244951	10	0.75729	0.9165	8.26	1	228.6	36.1	36	Matc
Perfluoropentanoic acid	3426314	3642902	10	0.940545	1.1370	8.27	1	228.6	36.2	36	Mato
Perfluorobutanesulfonic acid	2676402	3271662	9.36	0.818056	1.1058	6.92	1	228.6	30.3	30	Mato
Perfluorohexanoic acid	4550838	4080916	10	1.115151	0.8912	12.51	1	228.6	54.7	55	Mato
Perfluoroheptanoic acid	2395815	4136705	10	0.57916	1.1340	5.11	1	228.6	22.3	22	Matc
Perfluorohexanesulfonic acid	4455298	305080	9.46	14.6037	1.0470	131.95	1	228.6	577.2	580	Matc
Perfluorooctanesulfonic acid	6442493	318955	9.57	20.19875	1.1450	168.82	1	228.6	738.5	740	Matc

Calculated amount ng/ml = (Peak area ratio/Avg RF) x DF x EIS conc ng/ml
Final Calculated amount ng/L = ((calculated ng/ml x Final Volume mls) / sample volume mls) *1000
Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

SDG #:410-32859-1Date:5/14/2021Lab:Eurofins LancasterPage:6Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-NOBLE-ROAD-1-GW-031721 Lab ID: 410-32859-2

EIS 13C5 PFHxA
REPORTED EIS %R 73

%R = 100 * EIS ConcentrationEIS TV

EIS Concentration 7.31 ng/ml Page 527 of 410-32859-1

EIS TV 10.00

%R 73.1 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental Analysis Request/Chain of

CC #616539

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: eurofins	

This.

Lancaster Laboratories
Environmental

cct. # _____ Group # _____ Sample # _

For Eurofins Lancaster Laboratories Environ

Client Information						Matrix					A	naly	sis l	Requested		For Lab Use Only		
Client:	Acct. #:						Preservation and				n and	Filtration Cod	es	FSC:				
ARCADIS					 -											SCR#:		
Project Name/#:	PWSID #:			nt Tissue	Ground		Containers							-	Pres	ervation C	odes	
APG PFAS SI	P.O. #:				urf.			(0)	(++)	4 (43)	34)	- 1			H=HCI		hiosulfate	
					ပ လ										N=HNO ₃		laOH	
Mith Shephod Sampler:	30001996.38x50 Quote #:					(3					1			S=H ₂ SO ₄ F=Field Fil	l ₃ PO₄ Other			
Dale Lynch					Sediment	<u>a</u> (3)		iai	(130))	5: 3		(1)				Remarks	
State where samples were collected: For Compliance:				0	ğ	Potable NPDES		Ö		_		JQT.	15					
MI) Yes 🗆	No 🗆			site		g R		# of	PFAS	7+45 no.3+0	منحود	Ha	PFA			9		
	Collected			0d	X	ē							4					
Sample Identification	Date	Time	Grab	Composite	Soil	Water	Other:	Total		`		٦						
APG-DUP-07-031721	3/12/21	izoo	X			Cali		2					X					
APG-NOBLE-ROAD-1-(2W-031721 MS/MID		1030	X			GW		6					X	6.1		MS	1 mst	
APG-WEIDE-1-50-(0-2)-031771		1100		X	50			4	X	×	×	×						
APG-WEIDE-1-GW-031721		1130	×			GW		2					X			-,		
APG- BLDG- E4081-1-6W-031721		1210	X			GW		2					X					
APG-13106- E5180-1-50-(0-2)-031721		1230		X	50			4	X	×	X	X					1-0	
APG-BLOG- ES180-1-6W-031721		1315	X			GW		2					X					
APG-BLDG-ESIRO-Z-GW-031721		1400	×			GW		2					X					
APG- FB-06-031721		1250	Х			GW		2					X					
			Della	quished						Date		~					D-4-	T
Turnaround Time (TAT) Requested		le)		on		.11	1			Date	day	Time	10	Received by	Kn	IDA.	Date 2	11'5C
Standard Rush (Rush TAT is subject to laboratory approval and surcharge.)			quishec		H	h-	-	_	3 18 Date				Received by	100	9	Date //	Time	
(husti TAT is subject to laboratory approval and surcharge.)				31	jan	Kay				Date 3 18	1/2/-	Time	10					
Requested TAT in business days:			Reline	quished	by	, 1			_	Date		Time	7.0	Received by	-		Date	Time
Matthew Blow & ARLADIS. Com					+													
E-mail address: Keith. She pland J ARCADIS. Com				quished	l by	_				Date		Time		Received by			Date	Time
Data Package Options (circle if required)			Relin	quished	l hv /	/			-	Date	-	Time		Received by			Date	Time
Type I (EPA Level 3 Type VI (Raw Data Only) Equivalent/non-CLP)				/									(1/2	7		3-1821	(5:00)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13						EDD Re				No			. 0	Relinquished b	y Comme FedEx _	ercial Carrie	r: V	
NYSDEC Category A or B MA MCP CT RCP					Site-Specific QC (MS/MSD/Dup)? (Vs. No (If yes, indicate QC sample and submit triplicate sample volume.)													

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The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client.

4/7/2021 (Rev 1)

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Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-32859-1

Project/Site: Aberdeen Proving Ground PFAS S1

Qualifiers

1	\sim	N/A	C
ш	U	IV	J

Qualifier Description
Isotope dilution analyte is outside acceptance limits, low biased.
MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
The reported value is from a dilution.
Result exceeded calibration range.
Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
Manual integrated compound.

Glossary	
Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)

MDC Minimum Detectable Concentration (Radiochemistry) MDL Method Detection Limit

Minimum Level (Dioxin) ML MPN Most Probable Number MQL Method Quantitation Limit NC

Not Calculated

ND Not Detected at the reporting limit (or MDL or EDL if shown)

NEG Negative / Absent POS Positive / Present PQL **Practical Quantitation Limit**

PRES Presumptive QC **Quality Control**

RER Relative Error Ratio (Radiochemistry)

RL Reporting Limit or Requested Limit (Radiochemistry)

Relative Percent Difference, a measure of the relative difference between two points **RPD**

TEF Toxicity Equivalent Factor (Dioxin) Toxicity Equivalent Quotient (Dioxin) TEQ

TNTC Too Numerous To Count

Eurofins Lancaster Laboratories Env, LLC

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4/7/2021 (Rev. 1)

Job ID: 410-32859-1

Client: ARCADIS U.S., Inc. Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-DUP-07-031721

Date Collected: 03/17/21 12:00 Date Received: 03/18/21 15:00 Lab Sample ID: 410-32859-1

Matrix: Water

Method: EPA 537(Mod) - PFAS f Analyte	•	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<4.4	M	5.5	4.4	4.4	ng/L		03/28/21 12:46	1
8:2 Fluorotelomer sulfonic acid	<2.2	M	3.3	2.2	2.2	ng/L		03/28/21 12:46	1
NEtFOSAA	<1.1	•	3.3	1.1	1.1	ng/L		03/28/21 12:46	1
NMeFOSAA	<1.3		2.2	1.3	1.3	ng/L		03/28/21 12:46	1
Perfluorobutanesulfonic acid	29		2.2	1.1	1.1	ng/L		03/28/21 12:46	1
Perfluorobutanoic acid	35		5.5	4.4	4.4	ng/L		03/28/21 12:46	1
Perfluorodecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/28/21 12:46	1
Perfluorododecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/28/21 12:46	1
Perfluoroheptanoic acid	22		2.2	1.1	1.1	ng/L		03/28/21 12:46	1
Perfluorohexanoic acid	54		2.2	1.1	1.1	ng/L		03/28/21 12:46	1
Perfluorononanoic acid	15		2.2	1.1	1.1	ng/L		03/28/21 12:46	1
Perfluorooctanoic acid	170	M	2.2	1.1	1.1	ng/L		03/28/21 12:46	1
Perfluoropentanoic acid	37		2.2	1.1	1.1	ng/L		03/28/21 12:46	1
Perfluorotetradecanoic acid	<1.1	M	2.2	1.1	1.1	ng/L		03/28/21 12:46	1
Perfluorotridecanoic acid	<1.1	•	2.2	1.1	1.1	ng/L		03/28/21 12:46	1
Perfluoroundecanoic acid	<1.1	Ν <mark>1</mark>	2.2	1.1	1.1	ng/L		03/28/21 12:46	1
						_	_		

Perfluoroundecanoic acid	<1	I.1 M	2.2	1.1	1.1	ng/L	03/28/21 12:46	1
Isotope Dilution	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	123		50 - 150			03/26/21 16:45	03/28/21 12:46	1
M2-8:2 FTS	94		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C2 PFTeDA	72		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C3 PFBS	84		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C4 PFBA	71		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C4 PFHpA	89		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C5 PFPeA	94		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C8 PFOA	92		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C8 PFOS	82		50 - 150			03/26/21 16:45	03/28/21 12:46	1
d3-NMeFOSAA	100		50 - 150			03/26/21 16:45	03/28/21 12:46	1
d5-NEtFOSAA	107		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C2-PFDoDA	87		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C3 PFHxS	87		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C5 PFHxA	86		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C6 PFDA	90		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C7 PFUnA	95		50 - 150			03/26/21 16:45	03/28/21 12:46	1
13C9 PFNA	81		50 - 150			03/26/21 16:45	03/28/21 12:46	1

Method: EPA 537(Mod) - PFA	S for QSM 5.3,	Table B-	15 - DL					
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	540	D		11	11	ng/L	03/28/21 12:57	10
Perfluorooctanesulfonic acid	700	D	22	11	11	ng/L	03/28/21 12:57	10
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
13C8 PFOS	92		50 - 150			03/26/21 16:45	03/28/21 12:57	10
13C3 PFHxS	98		50 - 150			03/26/21 16:45	03/28/21 12:57	10

Client Sample ID: APG-NOBLE-ROAD-1-GW-031721 Lab Sample ID: 410-32859-2

Date Collected: 03/17/21 10:30 Date Received: 03/18/21 15:00

Method: EPA 537(Mod) - PFAS fo	or QSM 5.3,	Table B-15							
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<4.4		5.5	4.4	4.4	ng/L		03/24/21 17:08	1

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Matrix: Water

Client Sample ID: APG-NOBLE-ROAD-1-GW-031721

Date Collected: 03/17/21 10:30

Lab Sample ID: 410-32859-2 Matrix: Water

Date Received: 03/18/21 15:00

Client: ARCADIS U.S., Inc.

Analyte	Result (Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
8:2 Fluorotelomer sulfonic acid	<2.2		3.3	2.2	2.2	ng/L		03/24/21 17:08	1
NEtFOSAA	<1.1		3.3	1.1	1.1	ng/L		03/24/21 17:08	1
NMeFOSAA	<1.3		2.2	1.3	1.3	ng/L		03/24/21 17:08	1
Perfluorobutanesulfonic acid	30		2.2	1.1	1.1	ng/L		03/24/21 17:08	1
Perfluorobutanoic acid	36		5.5	4.4	4.4	ng/L		03/24/21 17:08	1
Perfluorodecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/24/21 17:08	1
Perfluorododecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/24/21 17:08	1
Perfluoroheptanoic acid	22		2.2	1.1	1.1	ng/L		03/24/21 17:08	1
Perfluorohexanoic acid	55		2.2	1.1	1.1	ng/L		03/24/21 17:08	1
Perfluorononanoic acid	14		2.2	1.1	1.1	ng/L		03/24/21 17:08	1
Perfluorooctanoic acid	170	M	2.2	1.1	1.1	ng/L		03/24/21 17:08	1
Perfluoropentanoic acid	36	M	2.2	1.1	1.1	ng/L		03/24/21 17:08	1
Perfluorotetradecanoic acid	<1.1	UJ	2.2	1.1	1.1	ng/L		03/24/21 17:08	1
Perfluorotridecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/24/21 17:08	1
Perfluoroundecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/24/21 17:08	1

i ciliadi dallacoaliolo aola	*1.1		2.2	 1.1 119/2	00/24/21 17:00	•
Isotope Dilution	%Recovery Q	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	104		50 - 150	03/23/21 17:10	03/24/21 17:08	1
M2-8:2 FTS	81		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C2 PFTeDA	40 *8	5-	50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C3 PFBS	71		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C4 PFBA	61		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C4 PFHpA	71		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C5 PFPeA	77		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C8 PFOA	77		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C8 PFOS	66		50 - 150	03/23/21 17:10	03/24/21 17:08	1
d3-NMeFOSAA	74		50 - 150	03/23/21 17:10	03/24/21 17:08	1
d5-NEtFOSAA	73		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C2-PFDoDA	57		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C3 PFHxS	70		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C5 PFHxA	73		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C6 PFDA	74		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C7 PFUnA	70		50 - 150	03/23/21 17:10	03/24/21 17:08	1
13C9 PFNA	64		50 - 150	03/23/21 17:10	03/24/21 17:08	1

Method: EPA 537(Mod) - PFA	AS for QSM 5.3,	Table B-	15 - DL					
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	580	D		11	11	ng/L	03/25/21 18:39	10
Perfluorooctanesulfonic acid	740	D	22	11	11	ng/L	03/25/21 18:39	10
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac
13C8 PFOS	73		50 - 150			03/23/21 17:10	03/25/21 18:39	10
13C3 PFHxS	75		50 - 150			03/23/21 17:10	03/25/21 18:39	10

Client Sample ID: APG-WEIDE-1-SO-(0-2)-031721 Lab Sample ID: 410-32859-3

Date Collected: 03/17/21 11:00 Matrix: Solid
Date Received: 03/18/21 15:00 Percent Solids: 84.6

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15								
Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac	
6:2 Fluorotelomer sulfonic acid	<0.0018	0.0022	0.0018	0.0018 mg/Kg	<u></u>	03/26/21 12:59	1	
8:2 Fluorotelomer sulfonic acid	<0.0018	0.0033	0.0018	0.0018 mg/Kg	₩	03/26/21 12:59	1	

Eurofins Lancaster Laboratories Env, LLC

Job ID: 410-32859-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-WEIDE-1-SO-(0-2)-031721

Date Collected: 03/17/21 11:00

Date Received: 03/18/21 15:00

Client: ARCADIS U.S., Inc.

Lab Sample ID: 410-32859-3

Matrix: Solid

Percent Solids: 84.6

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
NEtFOSAA	<0.00044	UJ	0.0022	0.00044	0.00044	mg/Kg 🕏	03/26/21 12:59	1
NMeFOSAA	<0.00044	UJ	0.0022	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluorobutanesulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg ≎	03/26/21 12:59	1
Perfluorobutanoic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg ≎	03/26/21 12:59	1
Perfluorodecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluorododecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluoroheptanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluorohexanesulfonic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluorohexanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluorononanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluorooctanesulfonic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluorooctanoic acid	<0.00044	M	0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluoropentanoic acid	<0.00044	ı	0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluorotetradecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluorotridecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Perfluoroundecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ≎	03/26/21 12:59	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	99		50 - 150			03/25/21 15:04	03/26/21 12:59	1
M2-8:2 FTS	82		50 - 150			03/25/21 15:04	03/26/21 12:59	1
13C2 PFTeDA	72		50 - 150			03/25/21 15:04	03/26/21 12:59	1
13C3 PFBS	80		50 - 150			03/25/21 15:04	03/26/21 12:59	1
13C4 PFBA	81		50 - 150			03/25/21 15:04	03/26/21 12:59	1
13C4 PFHpA	94		50 - 150			03/25/21 15:04	03/26/21 12:59	1
13C5 PFPeA	86		50 - 150			03/25/21 15:04	03/26/21 12:59	1

	· -		**	-
13C3 PFBS	80	50 - 150	03/25/21 15:04 03/26/21 12:59	1
13C4 PFBA	81	50 - 150	03/25/21 15:04 03/26/21 12:59	1
13C4 PFHpA	94	50 - 150	03/25/21 15:04 03/26/21 12:59	1
13C5 PFPeA	86	50 - 150	03/25/21 15:04 03/26/21 12:59	1
13C8 PFOA	94	50 - 150	03/25/21 15:04 03/26/21 12:59	1
13C8 PFOS	89	50 - 150	03/25/21 15:04 03/26/21 12:59	1
d3-NMeFOSAA	21 *5-	50 - 150	03/25/21 15:04 03/26/21 12:59	1
d5-NEtFOSAA	27 *5-	50 - 150	03/25/21 15:04 03/26/21 12:59	1
13C2-PFDoDA	81	50 - 150	03/25/21 15:04 03/26/21 12:59	1
13C3 PFHxS	94	50 - 150	03/25/21 15:04 03/26/21 12:59	1
13C5 PFHxA	87	50 - 150	03/25/21 15:04 03/26/21 12:59	1
13C6 PFDA	88	50 - 150	03/25/21 15:04 03/26/21 12:59	1
13C7 PFUnA	89	50 - 150	03/25/21 15:04 03/26/21 12:59	1
13C9 PFNA	84	50 - 150	03/25/21 15:04 03/26/21 12:59	1

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6.2 Fluorotelomer sulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	₩	03/24/21 15:29	1
8:2 Fluorotelomer sulfonic acid	<0.0018	0.0033	0.0018	0.0018	mg/Kg	☆	03/24/21 15:29	1
NEtFOSAA	<0.00045	0.0022	0.00045	0.00045	mg/Kg	₩	03/24/21 15:29	1
NMeFOSAA	<0.00045	0.0022	0.00045	0.00045	mg/Kg	₩	03/24/21 15:29	1
Perfluorobutanesulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	☆	03/24/21 15:29	1
Perfluorobutanoic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	₩	03/24/21 15:29	1
Perfluorodecanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☆	03/24/21 15:29	1
Perfluorododecanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☆	03/24/21 15:29	1
Perfluoroheptanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	☆	03/24/21 15:29	1
Perfluorohexanesulfonic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	₩	03/24/21 15:29	1
Perfluorohexanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	₩	03/24/21 15:29	1
Perfluorononanoic acid	<0.00045	0.00067	0.00045	0.00045	mg/Kg	₽	03/24/21 15:29	_ 1

Eurofins Lancaster Laboratories Env, LLC

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-32859-1

Project/Site: Aberdeen Proving Ground PFAS S1

0.6 mm

Client Sample ID: APG-WEIDE-1-SO-(0-2)-031721

Lab Sample ID: 410-32859-3 Date Collected: 03/17/21 11:00 **Matrix: Solid**

Date Received: 03/18/21 15:00 Percent Solids: 84.6

ate Received: 03/18/21 15:00							Percent Solic	.5. 0-7
Method: EPA 537(Mod) - PFA			•		D.	11-4 F	.	Dil E
Analyte		Qualifier	LOQ	LOD -	0.00045	Unit E		Dil F
Perfluorooctanesulfonic acid	< 0.00045		0.00067	0.00045				
Perfluorooctanoic acid	<0.00045	IVI	0.00067	0.00045	0.00045			
Perfluoropentanoic acid	<0.00045		0.00067	0.00045	0.00045			
Perfluorotetradecanoic acid	<0.00045		0.00067	0.00045	0.00045			
Perfluorotridecanoic acid	<0.00045		0.00067	0.00045	0.00045			
Perfluoroundecanoic acid	<0.00045		0.00067	0.00045	0.00045	mg/Kg ⊀	03/24/21 15:29	
sotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil F
M2-6:2 FTS	107		50 - 150			03/23/21 20:31	1 03/24/21 15:29	
M2-8:2 FTS	78		50 - 150			03/23/21 20:31	1 03/24/21 15:29	
13C2 PFTeDA	70		50 - 150			03/23/21 20:3	1 03/24/21 15:29	
13C3 PFBS	78		50 ₋ 150			03/23/21 20:31	1 03/24/21 15:29	
13C4 PFBA	72		50 - 150			03/23/21 20:31	1 03/24/21 15:29	
13C4 PFHpA	81		50 - 150			03/23/21 20:31	1 03/24/21 15:29	
13C5 PFPeA	74		50 - 150			03/23/21 20:3	1 03/24/21 15:29	
13C8 PFOA	90		50 - 150			03/23/21 20:31	1 03/24/21 15:29	
13C8 PFOS	83		50 - 150			03/23/21 20:3:	1 03/24/21 15:29	
d3-NMeFOSAA	22 *5	-	50 - 150			03/23/21 20:31	1 03/24/21 15:29	
d5-NEtFOSAA	27 *5	-	50 - 150			03/23/21 20:31	1 03/24/21 15:29	
13C2-PFDoDA	82		50 - 150			03/23/21 20.3	03/24/21 15:29	
13C3 PFHxS	87		50 - 150			03/23/21 20:3	1 03/24/21 15:29	
13C5 PFHxA	72		50 ₋ 150			03/23/21 20:31	1 03/24/21 15:29	
13C6 PFDA	79		50 - 150			03/23/21 20:3:	1 03/24/21 15:29	
13C7 PFUnA	85		50 - 150			03/23/21 20:3	1 03/24/21 15:29	
13C9 PFNA	78		50 - 150			03/23/21 20:31	1 03/24/21 15:29	
General Chemistry								
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D) Analyzed	Dil F
Total Organic Carbon	2330	J-	1770	1180		mg/Kg	- 	4.
Percent Moisture	15.4	0-	1.0		1.0		03/19/21 10:01	
Percent Solids	84.6		1.0		1.0	%	03/19/21 10:01	
General Chemistry - Soluble								
Analyte		Qualifier	LOQ	LOD	DL	Unit E) Analyzed	Dil F
oH	5.2	J	0.01	0.01	0.01	S.U	03/23/21 19:22	
Temperature	20.3		0.01	0.01	0.01	Degrees C	03/23/21 19:22	
Method: D422 - Grain Size								
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit E) Analyzed	Dil F
Gravel	2.0		1.0	1.0	1.0		04/01/21 12:49	
Sand	25.1		1.0	1.0	1.0		04/01/21 12:49	
Silt	46.0		1.0	1.0	1.0		04/01/21 12:49	
Clay	27.0		1.0	1.0	1.0		04/01/21 12:49	
olay 75 mm	100.0		1.0	1.0		% Passing	04/01/21 12:49	
			1.0	1.0		% Passing % Passing	04/01/21 12:49	
37.5 mm	100.0					% Passing % Passing		
19 mm	100		1.0	1.0		0	04/01/21 12:49	
1.75 mm	98.0		1.0	1.0		% Passing	04/01/21 12:49	
3.35 mm	97.9		1.0	1.0		% Passing	04/01/21 12:49	
2.36 mm	97.9		1.0	1.0		% Passing	04/01/21 12:49	
1.18 mm	97.9		1.0	1.0	1.0	% Passing	04/01/21 12:49	

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04/01/21 12:49

1.0 % Passing

1.0

1.0

97.0

Client Sample ID: APG-WEIDE-1-SO-(0-2)-031721

Lab Sample ID: 410-32859-3 Date Collected: 03/17/21 11:00 **Matrix: Solid**

Date Received: 03/18/21 15:00 Percent Solids: 84.6

Method: D422 - Grain Size	e (Continued)								
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
0.3 mm	91.5		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
0.15 mm	79.2		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
0.075 mm	73.0		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
0.064 mm	70.5		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
0.05 mm	65.0		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
0.02 mm	37.0		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
0.005 mm	27.0		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
0.002 mm	12.0		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
0.001 mm	13.0		1.0	1.0	1.0	% Passing		04/01/21 12:49	1

Client Sample ID: APG-WEIDE-1-GW-031721 Lab Sample ID: 410-32859-4

Date Collected: 03/17/21 11:30 **Matrix: Water**

Date Received: 03/18/21 15:00

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	37		6.9	5.5	5.5	ng/L		03/28/21 13:08	1
8:2 Fluorotelomer sulfonic acid	<2.8		4.1	2.8	2.8	ng/L		03/28/21 13:08	1
NEtFOSAA	<1.4		4.1	1.4	1.4	ng/L		03/28/21 13:08	1
NMeFOSAA	<1.7		2.8	1.7	1.7	ng/L		03/28/21 13:08	1
Perfluorobutanesulfonic acid	3.1	M	2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluorobutanoic acid	7.1	M MJ+	6.9	5.5	5.5	ng/L		03/28/21 13:08	1
Perfluorodecanoic acid	1.5	J	2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluorododecanoic acid	<1.4		2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluoroheptanoic acid	11	M	2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluorohexanesulfonic acid	16		2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluorohexanoic acid	22		2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluorononanoic acid	4.9	M	2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluorooctanesulfonic acid	35		2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluorooctanoic acid	17	M	2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluoropentanoic acid	15	₩ MJ+	2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluorotetradecanoic acid	<1.4		2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluorotridecanoic acid	<1.4		2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluoroundecanoic acid	<1.4	M	2.8	1.4	1.4	ng/L		03/28/21 13:08	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS			50 - 150	03/26/21 16:45	03/28/21 13:08	1
M2-8:2 FTS	82		50 - 150	03/26/21 16:45	03/28/21 13:08	1
13C2 PFTeDA	46	*5-	50 - 150	03/26/21 16:45	03/28/21 13:08	1
13C3 PFBS	56		50 - 150	03/26/21 16:45	03/28/21 13:08	1
13C4 PFBA	25	*5-	50 - 150	03/26/21 16:45	03/28/21 13:08	1
13C4 PFHpA	73		50 - 150	03/26/21 16:45	03/28/21 13:08	1
13C5 PFPeA	49	*5-	50 - 150	03/26/21 16:45	03/28/21 13:08	1
13C8 PFOA	76		50 - 150	03/26/21 16:45	03/28/21 13:08	1
13C8 PFOS	72		50 - 150	03/26/21 16:45	03/28/21 13:08	1
d3-NMeFOSAA	78		50 - 150	03/26/21 16:45	03/28/21 13:08	1
d5-NEtFOSAA	82		50 - 150	03/26/21 16:45	03/28/21 13:08	1
13C2-PFDoDA	64		50 - 150	03/26/21 16:45	03/28/21 13:08	1
13C3 PFHxS	72		50 - 150	03/26/21 16:45	03/28/21 13:08	1
13C5 PFHxA	60		50 - 150	03/26/21 16:45	03/28/21 13:08	1
13C6 PFDA	73		50 ₋ 150	03/26/21 16:45	03/28/21 13:08	1

Eurofins Lancaster Laboratories Env, LLC

Client Sample ID: APG-WEIDE-1-GW-031721

Lab Sample ID: 410-32859-4

Date Collected: 03/17/21 11:30 **Matrix: Water** Date Received: 03/18/21 15:00

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

	Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
	13C7 PFUnA	71		50 - 150	03/26/21 16:45	03/28/21 13:08	1
İ	13C9 PFNA	73		50 - 150	03/26/21 16:45	03/28/21 13:08	1

Lab Sample ID: 410-32859-5 Client Sample ID: APG-BLDG-E4081-1-GW-031721

Date Collected: 03/17/21 12:10 Date Received: 03/18/21 15:00

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	14		5.8	4.6	4.6	ng/L		03/28/21 13:19	1
8:2 Fluorotelomer sulfonic acid	<2.3	M	3.5	2.3	2.3	ng/L		03/28/21 13:19	1
NEtFOSAA	<1.2	•	3.5	1.2	1.2	ng/L		03/28/21 13:19	1
NMeFOSAA	<1.4		2.3	1.4	1.4	ng/L		03/28/21 13:19	1
Perfluorobutanesulfonic acid	<1.2	M	2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluorobutanoic acid	<4.6		5.8	4.6	4.6	ng/L		03/28/21 13:19	1
Perfluorodecanoic acid	<1.2	N	2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluorododecanoic acid	<1.2	M	2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluoroheptanoic acid	2.9		2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluorohexanesulfonic acid	4.6		2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluorohexanoic acid	5.7	M	2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluorononanoic acid	2.0	J M	2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluorooctanesulfonic acid	33		2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluorooctanoic acid	5.1	M	2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluoropentanoic acid	3.4		2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluorotetradecanoic acid	<1.2	M	2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluorotridecanoic acid	<1.2	•	2.3	1.2	1.2	ng/L		03/28/21 13:19	1
Perfluoroundecanoic acid	<1.2	M	2.3	1.2	1.2	ng/L		03/28/21 13:19	1

Perfluoroundecanoic acid	<1.2 M	2.3	1.2	1.2 ng/L	03/28/21 13:19	1
Isotope Dilution	%Recovery Quali	fier Limits		Prepar	ed Analyzed	Dil Fac
M2-6:2 FTS	145	50 - 150		03/26/21	16:45 03/28/21 13:19	1
M2-8:2 FTS	103	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1
13C2 PFTeDA	73	50 - 150		03/26/21	16:45 03/28/21 13:19	1
13C3 PFBS	89	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1
13C4 PFBA	86	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1
13C4 PFHpA	106	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1
13C5 PFPeA	100	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1
13C8 PFOA	108	50 - 150		03/26/21	16:45 03/28/21 13:19	1
13C8 PFOS	98	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1
d3-NMeFOSAA	101	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1
d5-NEtFOSAA	98	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1
13C2-PFDoDA	86	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1
13C3 PFHxS	99	50 - 150		03/26/21	16:45 03/28/21 13:19	1
13C5 PFHxA	95	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1
13C6 PFDA	98	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1
13C7 PFUnA	103	50 - 150		03/26/21	16:45 03/28/21 13:19	1
13C9 PFNA	99	50 ₋ 150		03/26/21	16:45 03/28/21 13:19	1

Temperature

Client Sample ID: APG-BLDG-E5180-1-SO-(0-2)-031721 Lab Sample ID: 410-32859-6

Date Collected: 03/17/21 12:30

Matrix: Solid

Percent Solids: 83.8

Made at EDA FORGE III. DES	0.6 0.011.5.0	Table D.						
Method: EPA 537(Mod) - PFA Analyte	•	Table B-1 Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fa
6:2 Fluorotelomer sulfonic acid	0.0030		0.0023	0.0018		mg/Kg	·	
3:2 Fluorotelomer sulfonic acid	0.0028	J	0.0034	0.0018		mg/Kg ☆	03/24/21 15:51	
NEtFOSAA	<0.00045		0.0023	0.00045	0.00045		03/24/21 15:51	
MeFOSAA	<0.00045		0.0023	0.00045	0.00045		03/24/21 15:51	
Perfluorobutanesulfonic acid	<0.0018		0.0023	0.0018		mg/Kg ☆		
Perfluorobutanoic acid	<0.0018		0.0023	0.0018		mg/Kg ☆		
Perfluorodecanoic acid	0.0080		0.00068	0.00045	0.00045			
Perfluorododecanoic acid	0.00081		0.00068	0.00045	0.00045			
Perfluoroheptanoic acid	0.0018		0.00068	0.00045	0.00045			
Perfluorohexanesulfonic acid	<0.00045		0.00068	0.00045	0.00045			
Perfluorohexanoic acid	0.0011		0.00068	0.00045	0.00045			
Perfluorononanoic acid	0.0046		0.00068	0.00045	0.00045			
Perfluorooctanesulfonic acid	0.019		0.00068	0.00045	0.00045			
Perfluorooctanoic acid	0.0016	M	0.00068	0.00045	0.00045			
Perfluoropentanoic acid	0.0010		0.00068	0.00045	0.00045	0 0		
Perfluorotetradecanoic acid	<0.0027		0.00068	0.00045	0.00045		03/24/21 15:51	
Perfluorotridecanoic acid	<0.00045		0.00068	0.00045	0.00045			
Perfluoroundecanoic acid	0.0021		0.00068	0.00045	0.00045		03/24/21 15:51	
sotope Dilution	%Recovery Q	ualifiar	Limits	0.00040	0.00043			Dil F
12-6:2 FTS	98	uaiiiiei	50 - 150			Prepared	Analyzed 03/24/21 15:51	ווט
//2-0.27 73 //2-8:2 FTS	80		50 - 150 50 - 150				03/24/21 15:51	
3C2 PFTeDA	70		50 - 150				03/24/21 15:51	
3C3 PFBS	80		50 - 150 50 - 150				03/24/21 15:51	
	94							
13C4 PFBA	94 94		50 - 150				03/24/21 15:51	
13C4 PFHpA			50 - 150				03/24/21 15:51	
13C5 PFPeA	93		50 - 150				03/24/21 15:51	
13C8 PFOA	88		50 - 150				03/24/21 15:51	
13C8 PFOS	85		50 - 150				03/24/21 15:51	
d3-NMeFOSAA	53		50 - 150				03/24/21 15:51	
d5-NEtFOSAA	67		50 - 150				03/24/21 15:51	
13C2-PFDoDA	80		50 - 150				03/24/21 15:51	
13C3 PFHxS	89		50 - 150				03/24/21 15:51	
13C5 PFHxA	91		50 - 150				03/24/21 15:51	
13C6 PFDA	85		50 - 150			03/23/21 20:31	03/24/21 15:51	
13C7 PFUnA	84		50 - 150				03/24/21 15:51	
13C9 PFNA	84		50 - 150			03/23/21 20:31	03/24/21 15:51	
General Chemistry								
Analyte	Result	Qualifier	LOQ	LOD		Unit D	•	Dil F
Total Organic Carbon	10000	J-	2450	1630	1630	mg/Kg 🛱	03/20/21 16:27	6.
Percent Moisture	16.2		1.0		1.0	%	03/19/21 10:01	
Percent Solids	83.8		1.0		1.0	%	03/19/21 10:01	
General Chemistry - Soluble								
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil F
pH	6.5	J	0.01	0.01	0.01	S.U	03/23/21 19:22	
· -	64.4	-	0.01	0.01	0.01	D	02/22/24 40,22	

03/23/21 19:22

0.01 Degrees C

0.01

21.4

0.01

3

4

6

8

10

12

14

1 **5**

Client Sample ID: APG-BLDG-E5180-1-SO-(0-2)-031721

Lab Sample ID: 410-32859-6 Date Collected: 03/17/21 12:30 **Matrix: Solid** Date Received: 03/18/21 15:00 Percent Solids: 83.8

Method: D422 - Grain Size Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%		03/23/21 01:00	1
Sand	30.6		1.0	1.0	1.0	%		03/23/21 01:00	1
Silt	46.4		1.0	1.0	1.0	%		03/23/21 01:00	1
Clay	23.0		1.0	1.0	1.0	%		03/23/21 01:00	1
75 mm	100.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
19 mm	100		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
4.75 mm	100		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
3.35 mm	99.9		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
2.36 mm	99.8		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
1.18 mm	99.4		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.6 mm	97.6		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.3 mm	87.2		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.15 mm	75.8		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.075 mm	69.4		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.064 mm	66.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.05 mm	61.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.02 mm	45.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.005 mm	23.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.002 mm	21.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.001 mm	22.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1

Client Sample ID: APG-BLDG-E5180-1-GW-031721

Lab Sample ID: 410-32859-7 Date Collected: 03/17/21 13:15 **Matrix: Water** Date Received: 03/18/21 15:00

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit [) Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	790	D		53	42	42	ng/L	03/28/21 13:30	10
8:2 Fluorotelomer sulfonic acid	<21			32	21	21	ng/L	03/28/21 13:30	10
NEtFOSAA	<11			32	11	11	ng/L	03/28/21 13:30	10
NMeFOSAA	<13			21	13	13	ng/L	03/28/21 13:30	10
Perfluorobutanesulfonic acid	830	D		21	11	11	ng/L	03/28/21 13:30	10
Perfluorobutanoic acid	700	D,		53	42	42	ng/L	03/28/21 13:30	10
Perfluorodecanoic acid	<11	M		21	11	11	ng/L	03/28/21 13:30	10
Perfluorododecanoic acid	<11			21	11	11	ng/L	03/28/21 13:30	10
Perfluoroheptanoic acid	970	D		21	11	11	ng/L	03/28/21 13:30	10
Perfluorohexanoic acid	2900	D		21	11	11	ng/L	03/28/21 13:30	10
Perfluorononanoic acid	49	D		21	11	11	ng/L	03/28/21 13:30	10
Perfluorooctanesulfonic acid	530	D		21	11	11	ng/L	03/28/21 13:30	10
Perfluorooctanoic acid	2700	D		21	11	11	ng/L	03/28/21 13:30	10
Perfluoropentanoic acid	2300	D		21	11	11	ng/L	03/28/21 13:30	10
Perfluorotetradecanoic acid	<11			21	11	11	ng/L	03/28/21 13:30	10
Perfluorotridecanoic acid	<11			21	11	11	ng/L	03/28/21 13:30	10
Perfluoroundecanoic acid	<11			21	11	11	ng/L	03/28/21 13:30	10
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	117		50 - 150				03/26/21 16:4	03/28/21 13:30	10
M2-8:2 FTS	111		50 - 150				03/26/21 16:4	5 03/28/21 13:30	10
13C2 PFTeDA	66		50 - 150				03/26/21 16:4	5 03/28/21 13:30	10
13C3 PFBS	84		50 - 150				03/26/21 16:4	5 03/28/21 13:30	10

Eurofins Lancaster Laboratories Env, LLC

Job ID: 410-32859-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-BLDG-E5180-1-GW-031721

Date Collected: 03/17/21 13:15 Date Received: 03/18/21 15:00

Client: ARCADIS U.S., Inc.

Lab Sample ID: 410-32859-7

Matrix: Water

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFBA	96	50 - 150	03/26/21 16:45	03/28/21 13:30	10
13C4 PFHpA	103	50 - 150	03/26/21 16:45	03/28/21 13:30	10
13C5 PFPeA	95	50 - 150	03/26/21 16:45	03/28/21 13:30	10
13C8 PFOA	101	50 - 150	03/26/21 16:45	03/28/21 13:30	10
13C8 PFOS	99	50 - 150	03/26/21 16:45	03/28/21 13:30	10
d3-NMeFOSAA	100	50 - 150	03/26/21 16:45	03/28/21 13:30	10
d5-NEtFOSAA	102	50 - 150	03/26/21 16:45	03/28/21 13:30	10
13C2-PFDoDA	89	50 - 150	03/26/21 16:45	03/28/21 13:30	10
13C3 PFHxS	93	50 - 150	03/26/21 16:45	03/28/21 13:30	10
13C5 PFHxA	94	50 - 150	03/26/21 16:45	03/28/21 13:30	10
13C6 PFDA	111	50 - 150	03/26/21 16:45	03/28/21 13:30	10
13C7 PFUnA	101	50 - 150	03/26/21 16:45	03/28/21 13:30	10
13C9 PFNA	107	50 ₋ 150	03/26/21 16:45	03/28/21 13:30	10

Method: EPA 537(Mod) - PFA	S for QSM 5.3, Table B	-15 - DL					
Analyte	Result Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	4300 D	210	110	110	ng/L	03/28/21 13:41	100
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
13C3 PFHxS	95	50 - 150			03/26/21 16:45	03/28/21 13:41	100

Client Sample ID: APG-BLDG-E5180-2-GW-031721

Date Collected: 03/17/21 14:00

Date Received: 03/18/21 15:00

Lab Sample ID: 410-328	359-8
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Matrix: Water

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	380	D		58	47	47	ng/L	03/28/21 13:52	10
8:2 Fluorotelomer sulfonic acid	<23			35	23	23	ng/L	03/28/21 13:52	10
NEtFOSAA	<12			35	12	12	ng/L	03/28/21 13:52	10
NMeFOSAA	<14			23	14	14	ng/L	03/28/21 13:52	10
Perfluorobutanesulfonic acid	220	D		23	12	12	ng/L	03/28/21 13:52	10
Perfluorobutanoic acid	820	D		58	47	47	ng/L	03/28/21 13:52	10
Perfluorodecanoic acid	<12			23	12	12	ng/L	03/28/21 13:52	10
Perfluorododecanoic acid	<12			23	12	12	ng/L	03/28/21 13:52	10
Perfluoroheptanoic acid	3000	D		23	12	12	ng/L	03/28/21 13:52	10
Perfluorohexanoic acid	3300	D		23	12	12	ng/L	03/28/21 13:52	10
Perfluorononanoic acid	1100	D		23	12	12	ng/L	03/28/21 13:52	10
Perfluoropentanoic acid	3200	D		23	12	12	ng/L	03/28/21 13:52	10
Perfluorotetradecanoic acid	<12			23	12	12	ng/L	03/28/21 13:52	10
Perfluorotridecanoic acid	<12			23	12	12	ng/L	03/28/21 13:52	10
Perfluoroundecanoic acid	<12	N		23	12	12	ng/L	03/28/21 13:52	10
Isotope Dilution	%Recovery Qu	ualifier	Limits				Prepared	Analyzed	Dil Fac
MO 6:0 ETC	0.5		EO 1EO				00/00/04 40:45	02/20/21 12:52	10

Isotope Dilution	%Recovery Qualifier	Limits	Prepared Analyzed	Dil Fac
M2-6:2 FTS	85	50 - 150	03/26/21 16:45 03/28/21 13:5	52 10
M2-8:2 FTS	87	50 - 150	03/26/21 16:45 03/28/21 13:	52 10
13C2 PFTeDA	66	50 - 150	03/26/21 16:45 03/28/21 13:	52 10
13C3 PFBS	74	50 - 150	03/26/21 16:45 03/28/21 13:	52 10
13C4 PFBA	78	50 - 150	03/26/21 16:45 03/28/21 13:	52 10
13C4 PFHpA	71	50 - 150	03/26/21 16:45 03/28/21 13:	52 10
13C5 PFPeA	78	50 - 150	03/26/21 16:45 03/28/21 13:	52 10
13C8 PFOA	72	50 - 150	03/26/21 16:45 03/28/21 13:	52 10

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Client: ARCADIS U.S., Inc.
Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-BLDG-E5180-2-GW-031721

Date Collected: 03/17/21 14:00
Date Received: 03/18/21 15:00

Lab Sample ID: 410-32859-8

Matrix: Water

Method: EPA 537	(Mod) - PFA	S for QSM 5.3,	Table B-15	(Continued)

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C8 PFOS	75	50 - 150	03/26/21 16:45	03/28/21 13:52	10
d3-NMeFOSAA	91	50 - 150	03/26/21 16:45	03/28/21 13:52	10
d5-NEtFOSAA	97	50 - 150	03/26/21 16:45	03/28/21 13:52	10
13C2-PFDoDA	75	50 - 150	03/26/21 16:45	03/28/21 13:52	10
13C3 PFHxS	66	50 - 150	03/26/21 16:45	03/28/21 13:52	10
13C5 PFHxA	78	50 - 150	03/26/21 16:45	03/28/21 13:52	10
13C6 PFDA	85	50 - 150	03/26/21 16:45	03/28/21 13:52	10
13C7 PFUnA	87	50 - 150	03/26/21 16:45	03/28/21 13:52	10
13C9 PFNA	74	50 - 150	03/26/21 16:45	03/28/21 13:52	10

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - DL

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit I	D Analyzed	Dil Fac
Perfluorohexanesulfonic acid	10000	D	230	120	120	ng/L	03/28/21 14:03	100
Perfluorooctanesulfonic acid	9300	D	230	120	120	ng/L	03/28/21 14:03	100
Perfluorooctanoic acid	6500	D	230	120	120	ng/L	03/28/21 14:03	100
Isotone Dilution	%Recovery O	ualifier	l imits			Prenared	Analyzod	Dil Fac

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C8 PFOA	87		50 - 150	03/26/21 16:45	03/28/21 14:03	100
13C8 PFOS	80		50 - 150	03/26/21 16:45	03/28/21 14:03	100
_13C3 PFHxS	85		50 - 150	03/26/21 16:45	03/28/21 14:03	100

Client Sample ID: APG-FB-06-031721

Date Collected: 03/17/21 12:50 Date Received: 03/18/21 15:00 Lab Sample ID: 410-32859-9

Matrix: Water

Wethou. EPA 537 (WOU) - PFAS	ioi Qoivi 5.3,	Table D-15							
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.6	M	4.5	3.6	3.6	ng/L		03/28/21 14:25	1
8:2 Fluorotelomer sulfonic acid	<1.8	`	2.7	1.8	1.8	ng/L		03/28/21 14:25	1
NEtFOSAA	<0.90		2.7	0.90	0.90	ng/L		03/28/21 14:25	1
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L		03/28/21 14:25	1
Perfluorobutanesulfonic acid	<0.90	M	1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluorobutanoic acid	<3.6	•	4.5	3.6	3.6	ng/L		03/28/21 14:25	1
Perfluorodecanoic acid	<0.90		1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluorododecanoic acid	<0.90		1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluoroheptanoic acid	< 0.90	М	1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluorohexanesulfonic acid	<0.90	M	1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluorohexanoic acid	<0.90	M	1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluorononanoic acid	<0.90	•	1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluorooctanesulfonic acid	<0.90	M	1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluorooctanoic acid	< 0.90	M	1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluoropentanoic acid	< 0.90	N	1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluorotetradecanoic acid	<0.90	N1	1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluorotridecanoic acid	<0.90	•	1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluoroundecanoic acid	<0.90		1.8	0.90	0.90	ng/L		03/28/21 14:25	1
						J			

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	116	50 - 150	03/26/21 16:45	03/28/21 14:25	1
M2-8:2 FTS	94	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C2 PFTeDA	72	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C3 PFBS	82	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C4 PFBA	98	50 - 150	03/26/21 16:45	03/28/21 14:25	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-32859-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-FB-06-031721

Lab Sample ID: 410-32859-9 Date Collected: 03/17/21 12:50

Matrix: Water

Date Received: 03/18/21 15:00

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFHpA	104	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C5 PFPeA	102	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C8 PFOA	102	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C8 PFOS	95	50 - 150	03/26/21 16:45	03/28/21 14:25	1
d3-NMeFOSAA	111	50 - 150	03/26/21 16:45	03/28/21 14:25	1
d5-NEtFOSAA	110	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C2-PFDoDA	84	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C3 PFHxS	96	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C5 PFHxA	98	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C6 PFDA	98	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C7 PFUnA	97	50 - 150	03/26/21 16:45	03/28/21 14:25	1
13C9 PFNA	102	50 ₋ 150	03/26/21 16:45	03/28/21 14:25	1



Aberdeen Proving Ground - Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS), TOC and Soil pH Analyses SDGs # 410-33044-1 and 410-33045-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report # 41348R

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Groups (SDGs) # 410-33044-1 and 410-33045-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

SDC-	Comple ID	I ob ID	Banduise	Sample Collection	Downt Commis	Analysis		
SDGs	Sample ID	Lab ID	Matrix Collection Date		Parent Sample	PFAS	тос	рН
	APG-P1-12-2-GW-031821	410-33044-1	Water	3/18/2021		Х		
410-33044-1	APG-DUP-08-031821	410-33044-2	Water	3/18/2021	APG-P1-12-2-GW- 031821	x		
	APG-BLDG-2200-1-GW-031821	410-33044-3	Water	3/18/2021		Х		
	APG-BLDG-E4040-1-SO-(0-2)-031921	410-33045-1	Soil	3/19/2021		Х	Х	Х
	APG-BLDG-E4040-1-GW-031921	410-33045-2	Water	3/19/2021		Х		
410-33045-1	APG-G-STREET-1-SO-(0-2)-031921	410-33045-3	Soil	3/19/2021		Х	Х	X
	APG-G-STREET-1-GW-031921	410-33045-4	Water	3/19/2021		Х		
	APG-CASEY-YARD-1-GW-031921	410-33045-5	Water	3/19/2021		Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-P1-12-2-GW-031821.
- Matrix spike / Matrix spike duplicate (MS/MSD) analysis was performed on sample APG-P1-12-2-GW-031821.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Rep	orted		mance ptable	Not
Items Reviewed		Yes	No	Yes	Required
Sample receipt condition		Х		Х	
2. Requested analyses and sample results		Х		X	
Master tracking list		Х		X	
4. Methods of analysis		Х		Х	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		Х	
11. Narrative summary of QA or sample problems provided		Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

1. The chain of custody states that 2 containers were submitted, whereas the laboratory received 3 containers per sample for the following samples.

SDG	Lab Sample ID	Sample ID
410-33044-1	410-33044-3	APG-BLDG-2200-1-GW-031821
	410-33045-2	APG-BLDG-E4040-1-GW-031921
410-33045-1	410-33045-4	APG-G-STREET-1-GW-031921
	410-33045-5	APG-CASEY-YARD-1-GW-031921

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
APG-BLDG-E4040-1-SO-(0-	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
2)-031921	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 50% but > 20%

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
4500/	Non-detect	No Action
> 150%	Detect	J-
. F00(L. L. 200)	Non-detect	UJ
< 50% but > 20%	Detect	J+
. 0004	Non-detect	UX
< 20%	Detect	X

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint

standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be $\leq 30\%$.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

Sample associated with the MS/MSD analysis exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	Compounds	MS Recovery	MSD Recovery	
	6:2 Fluorotelomer sulfonic acid			
	Perfluorohexanesulfonic acid			
APG-P1-12-2-GW-031821	Perfluorohexanoic acid	SR>4X	SR>4X	
AFG-F1-12-2-GW-031021	Perfluorooctanesulfonic acid			
	Perfluorooctanoic acid			
	Perfluoropentanoic acid			

Note:

SR>4X Sample result is greater than 4 times the added spike

The criteria used to evaluate the MS/MSD recoveries are presented in the following table. In the case of an MS/MSD deviation, the sample results are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
	Non-detect	No Action
> the upper control limit (UL)	Detect	J+
	Non-detect	UJ
< the lower control limit (LL) but > 10%	Detect	J-
1001	Non-detect	UX
< 10%	Detect	J-
SR>4X: Parent sample concentration > four times the MS/MSD spiking solution concentration.	Detect	No Action

7. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The compounds associated with the LCS analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with LCS analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

Results for field duplicate samples are summarized in the following table.

Sample ID/Duplicate ID	Compounds	Sample Result	Duplicate Result	RPD
	6:2 Fluorotelomer sulfonic acid	7900	4200	61 %
	8:2 Fluorotelomer sulfonic acid	610	590	3.3 %
	Perfluorobutanesulfonic acid	480	420	13 %
	Perfluorobutanoic acid	1300	1200	8.0 %
	Perfluorodecanoic acid	12 J	22 J	AC
APG-P1-12-2-GW-031821 /	Perfluoroheptanoic acid	1200	1100	8.6 %
APG-DUP-08-031821	Perfluorohexanesulfonic acid	3100	2800	10 %
	Perfluorohexanoic acid	4800	4300	11 %
	Perfluorononanoic acid	190	180	5.4 %
	Perfluoropentanoic acid	6400	5300	19 %
	Perfluorooctanesulfonic acid	4800	5100	6.1 %
	Perfluorooctanoic acid	1200	1100	8.7 %

Note:

AC Acceptable

The compound 6:2 fluorotelomer sulfonic acid associated with sample locations APG-P1-12-2-GW-031821 and APG-DUP-08-031821 exhibited a field duplicate RPD greater than the control limit. The associated sample results from sample locations for the listed analyte were qualified as estimated.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

All identified compounds met method criteria.

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compounds	Original Analysis	Diluted Analysis	Reported Analysis
	6:2 Fluorotelomer sulfonic acid		7900	7900 D
ADO DA 40 0 000 004004	Perfluorohexanoic acid		4800	4800 D
APG-P1-12-2-GW-031821	Perfluorooctanesulfonic acid		4800	4800 D
	Perfluoropentanoic acid		6400	6400 D
	6:2 Fluorotelomer sulfonic acid		4200	4200 D
	8:2 Fluorotelomer sulfonic acid		590	590 D
	Perfluorobutanesulfonic acid		420	420 D
	Perfluorobutanoic acid		1200	1200 D
	Perfluorodecanoic acid		22 J	22 DJ
.== =:==	Perfluoroheptanoic acid		1100	1100 D
APG-DUP-08-031821	Perfluorohexanesulfonic acid		2800	2800 D
	Perfluorohexanoic acid		4300	4300 D
	Perfluorononanoic acid		180	180 D
	Perfluorooctanoic acid		1100	1100 D
	Perfluorooctanesulfonic acid		5100	5100 D
	Perfluoropentanoic acid		5300	5300 D

Note: the lab didn't report the original analysis; only the diluted result.

The field duplicate APG-DUP-08-031821 was analyzed at 10-fold and 100-fold dilution due to interference from sample matrix. An undiluted analysis was not performed. Therefore, the detection limits are elevated.

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification
Diluted sample result within the calibration range	D
Diluted sample results less than the calibration range	DJ

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Rep	oorted		rmance eptable	Not Required
	No	Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC	/MS/MS)			'
Stage 2 Validation					
Holding times		Х		Х	
Reporting limits (units)		Х		Х	
Blanks					
A. Method blanks		Х		Х	
B. Equipment blanks	Х				Х
C. Field blanks / Source blanks	Х				Х
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х
LCS/LCSD Precision (RPD)	Х				Х
Matrix Spike (MS) %R		Х		Х	
Matrix Spike Duplicate (MSD) %R		Х		Х	
MS/MSD Precision (RPD)		Х		Х	
Field Duplicate (RPD)		Х	Х		
Extracted Internal Standard %R		Х	Х		
Injection Internal Standard %R		Х		Х	
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation					
Instrument tune and performance check		Х		Х	
Initial calibration %RSDs		Х		Х	
Continuing calibration %Ds		Х		Х	
Instrument sensitivity check		Х		Х	
lon transitions used		Х		Х	
Compound identification and quantitation	1	1			ı
A. Reconstructed ion chromatograms		Х		Х	
B. Quantitation Reports		X		Х	
C. RT of sample compounds within the established RT windows		Х		х	

PFAS: 537M/DoD QSM 5.3	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
D. Ion Ratio %R		Х		Х	
E. Transcription/calculations acceptable		Х		Х	
F. Reporting limits adjusted to reflect sample dilutions		х		Х	

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Analyte considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample ID	Holding Time	Criteria
APG-BLDG-E4040-1-SO-(0-2)-031921	4 days from collection; 4 days	< 24 hours of receipt at
APG-G-STREET-1-SO-(0-2)-031921	from receipt	the laboratory

Sample results associated with samples analyzed by analytical method SW-846 9045D were qualified, as specified in the table below.

	Qualification
Criteria	Detected Analytes
Analysis completed past the holding time	J

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995. The initial and continuing calibration verification standard recoveries were within control limits. The calibration verification for pH is within \pm 0.05 su of the true value.

All calibration standard recoveries for pH were within the control limit.

TOC calibration standard recoveries were within control limits of 90 to 110%, with the exception of the analytes presented in the following table.

Sample ID	Initial/Continuing	Analyte	Standard Recovery
APG-BLDG-E4040-1-SO-(0-2)-031921	001/	Total Organia Cauban	670/
APG-G-STREET-1-SO-(0-2)-031921	CCV	Total Organic Carbon	67%

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Control Limit	Sample Result	Qualification
	O F 1.75%	Non-detect UX	UX
	Gross Exceedance < 75%	Detect	J-
	75% to 89%	Non-detect U.	
TOC	75% 10 69%	Detect	J-
	4440/ 1 4050/	Non-detect No Action	No Action
	111% to 125%	Detect	J+

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

All analytes associated with MS recoveries were within control limits with the exception of the following analytes present in the table below.

Sample ID	Analyte	MS Recovery
APG-G-STREET-1-SO-(0-2)-031921	Total Organic Carbon	48%

The criteria used to evaluate MS recoveries are presented in the following table. In the case of an MS deviation, the sample results are qualified. The qualifications are applied to the parent sample result associated with this SDG.

Control limit	Sample Result	Qualification
MO 1 200/ 1 7/0/	Non-detect	UJ
MS percent recovery 30% to 74%	Detect	J-
MO	Non-detect	UX
MS percent recovery <30%	Detect	J-
NO	Non-detect	No Action
MS percent recovery >125%	Detect J+	

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The criteria for pH is ± 0.1 S.U. between the parent sample and lab duplicate results.

The laboratory duplicate results were within the control limit of two times the LOQ.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for TOC and pH.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%. The LCS for pH must be within ± 0.05 S.U. of the true value.

All LCS recoveries were within control limits, with the exception of the analytes associated with sample locations, as presented in the following table.

Sample ID	Analyte	LCS Recovery
APG-BLDG-E4040-1-SO-(0-2)-031921	Tatal Owner is Carls an	700/
APG-G-STREET-1-SO-(0-2)-031921	Total Organic Carbon	70%

The criteria used to evaluate LCS recoveries are presented in the following table. In the case of an LCS deviation, the sample results are qualified.

Control limit	Sample Result	Qualification
% Recovery < lower limit of 80%	Non-detect	UJ

Control limit	Sample Result	Qualification
	Detect	J-
0/ D	Non-detect	No Action
% Recovery > upper limit of 120%	Detect	J+

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Rep	orted		Performance Acceptable		
	No	Yes	No	Yes	Required	
Miscellaneous Instrumentation						
Stage 2 Validation						
Holding times		X	Х			
Reporting limits (units)		X		X		
Blanks						
A. Method blanks		X		Х		
B. Equipment blanks	X				Х	
Laboratory Control Sample (LCS) %R		Х	Х			
Laboratory Control Sample Duplicate (LCSD) %R	X				X	
LCS/LCSD Precision (RPD)	X				X	
Matrix Spike (MS) %R		X	X			
Matrix Spike Duplicate (MSD) %R	Х				Х	
MS/MSD Precision (RPD)	Х				Х	
Lab Duplicate (RPD)		X		Х		
Field Duplicate (RPD)	Х				Х	
Dilution Factor		Х		Х		
Moisture Content		Х		Х		
Stage 3/4 Validation	·					
Initial calibration correlation coefficient (TOC)		X		Х		
Continuing calibration %R		X	Х			
Raw Data		X		Х		
Transcription/calculations acceptable		Х		Х		

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE:

§

gnsm

DATE: May 17, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 26, 2021

Stage 3 / 4 PFAS Calibration Standards

SDG #:410-33044-1Date:5/17/2021Lab:Eurofins LancasterPage:1Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

Perfluoropentanoic acid 3/30/2021 Calibration

Page 710 - 723 of SDG 410-33044-1

- Tage 710 723 01330 110 330 111											
Cal Conc					Calculated		Calc		Calculated	Reported	
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D	
0.2	161692	6144800	10	0.026314	1.3156816	1.087	0.242076	0.2	21.038	21	
0.5	285606	5038151	10	0.056689	1.1337731	1.087	0.521515	0.5	4.303	4.3	
2	1305889	5619070	10	0.232403	1.1620152	1.087	2.138023	2	6.901	6.9	
8	4785784	5687564	10	0.841447	1.0518088	1.087	7.741003	8	-3.237	-3.2	
20	13053657	6579917	10	1.983863	0.9919317	1.087	18.25081	20	-8.746	-8.7	
50	31852513	6422817	10	4.959275	0.9918549	1.087	45.6235	50	-8.753	-8.7	
100	47712199	4961671	10	9.616155	0.9616155	1.087	88.46509	100	-11.535	-11.5	
			•							•	

Match Match Match Match Match Match Match

Avg RF = 1.0869544 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-33044-1Date:5/17/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-108787/9 3/30/2021 12:06

Page 965 - 970 of SDG 410-33044-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	1178996	6528415	10	0.1806	0.9387	1.924	2	-3.81	-3.8
Perfluoropentanoic acid	1317911	6070621	10	0.2171	1.0870	1.997	2	-0.14	-0.1
Perfluorobutanesulfonic acid	1107148	5188592	9.36	0.2134	1.1300	1.767	2	-0.14	0
Perfluorohexanoic acid	1160334	6250885	10	0.1856	0.9490	1.956	2	-2.20	-2.2
Perfluoroheptanoic acid	1497399	7343740	10	0.2039	1.1220	1.817	2	-9.13	-9.2
Perfluorohexanesulfonic acid	947593	5078847	9.46	0.1866	1.0680	1.653	2	-12.56	-12.6
Perfluorooctanesulfonic acid	1037374	5236571	9.57	0.1981	1.1590	1.636	2	-14.36	-14.5

Match Match Match Match Match Match

CCV 410-108879/1 3/30/2021 13:21

Page 980 - 985 of SDG 410-33044-1

	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	281207	5628499	10	0.0500	0.9387	0.532	0.5	6.45	6.5
Perfluoropentanoic acid	313041	5570474	10	0.0562	1.0870	0.517	0.5	3.40	3.4
Perfluorobutanesulfonic acid	271815	4687471	9.36	0.0580	1.1300	0.480	0.4	8.42	8.6
Perfluorohexanoic acid	266289	5310674	10	0.0501	0.9490	0.528	0.5	5.67	5.7
Perfluoroheptanoic acid	351732	6090054	10	0.0578	1.1220	0.515	0.5	2.95	2.9
Perfluorohexanesulfonic acid	221083	4326822	9.46	0.0511	1.0680	0.453	0.5	-0.75	-0.8
Perfluorooctanesulfonic acid	260398	4509932	9.57	0.0577	1.1590	0.477	0.5	2.97	2.9

Match Match Match Match Match Match Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 $\begin{array}{c|cccc} SDG \# & 410\text{-}33044\text{-}1 & Date: & 5/17/2021 \\ Lab: & \hline{Eurofins Lancaster} & Page: & 3 \\ \hline Project: & Aberdeen Proving Ground & Validated by: & SPR \\ \end{array}$

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-108209/2-A

Page 1223 - 1228 of SDG 410-33044-1

Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported	
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	3277546	5354174	10	0.612148	0.9387	26.08	25.6	101.89	102	Match
Perfluoropentanoic acid	3276679	4905426	10	0.66797	1.0870	24.58	25.6	96.02	96	Match
Perfluorobutanesulfonic acid	2946986	4250044	9.36	0.693401	1.1300	22.97	22.7	101.21	101	Match
Perfluorohexanoic acid	2988078	5273129	10	0.566661	0.9490	23.88	25.6	93.30	93	Match
Perfluoroheptanoic acid	4166841	5851646	10	0.71208	1.1220	25.39	25.6	99.16	99	Match
Perfluorohexanesulfonic acid	2530762	3980039	9.46	0.635864	1.0680	22.53	23.3	96.69	96	Match
Perfluorooctanesulfonic acid	2910924	4406614	9.57	0.660581	1.1590	21.82	23.7	92.06	92	Match

Calculated Amount ng/L = ((Peak area ratio/Avg RF) x EIS concentration)/Sample volume)*1000

Stage 3 / 4 PFAS MS/MSD

SDG #:410-33044-1Date:5/17/2021Lab:Eurofins LancasterPage:4Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID APG-P1-12-2-GW-031821 Page 453 - 454 SDG 410-32859-1

ANALYTE Perfluorotetradecanoic acid

REPORTED MS %R 92
REPORTED MSD %R 92
REPORTED RPD 2

Sample Concentration 0 229 MS Concentration MS %R 91.60 MATCH MSD Concentration 233 91.37 MATCH MSD %R MS TV 250 1.73 MATCH RPD MSD TV 255

Differences in %R may be due to rounding of the true value

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-33044-1
 Date:
 5/17/2021

 Lab:
 Eurofins Lancaster
 Page:
 5

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-P1-12-2-GW-031821 Lab ID: 410-33044-1 Page 501 - 508 of SDG 410-33044-1

						Calculated	Final		Final	Reported	1
						Amount	Volume	Sample	Calculated	Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	15509554	4901908	10	3.163983	0.9387	33.71	1	25.4	1327.0	1300	Matc
Perfluoropentanoic acid	9388058	531415	10	17.66615	1.0870	162.52	1	25.4	6398.5	6400	Matc
Perfluorobutanesulfonic acid	6273939	4249057	9.36	1.476549	1.1300	12.23	1	25.4	481.5	480	Mate
Perfluorohexanoic acid	6533922	564657	10	11.57149	0.9490	121.93	1	25.4	4800.5	4800	Mato
Perfluoroheptanoic acid	20427652	5836504	10	3.499981	1.1220	31.19	1	25.4	1228.1	1200	Matc
Perfluorohexanesulfonic acid	34729173	3899150	9.46	8.906857	1.0680	78.89	1	25.4	3106.1	3100	Matc
Perfluorooctanesulfonic acid	6846366	461792	9.57	14.82565	1.1590	122.42	1	25.4	4819.6	4800	Matc

Calculated amount $ng/ml = (Peak \ area \ ratio/Avg \ RF) \ x \ DF \ x \ EIS \ conc \ ng/ml$ Final Calculated amount $ng/L = ((calculated \ ng/ml \ x \ Final \ Volume \ mls) \ / \ sample \ volume \ mls) *1000$ Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

SDG #:410-33044-1Date:5/17/2021Lab:Eurofins LancasterPage:6Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-P1-12-2-GW-031821 Lab ID: 410-32859-2

EIS 13C4 PFBA

REPORTED EIS %R 80

%R = 100 * EIS ConcentrationEIS TV

EIS Concentration 7.96 ng/ml Page 503 of 410-33044-1
EIS TV 10.00
%R 80 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Environmental Analysis Request/Chain of



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For Eurofins Lancaster Laboratories Envir

COC #616540

Lancaster Laboratories Environmental	Acct. #			Group	#		S	ample	# -	410-33	044 (Chain o	f Cus	tody	-		-)		# blb	540
Client Inform	nation					Matrix				-10-				eque	_			For Lab U	se Only	
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ARCADIS					<u>e</u>													SCR#:		
Project Name/#:	PWSID #:				Tissue	Ground												Pres	ervation	Codes
APG PFAS SI					Ĕ	o Par							-					H=HCI		Thiosulfate
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Sample Identification	Date	Time	Grab	S	Soil	Water	Other	Tot	-											
APG-P1-12-2-GW-031821 MS/MS	0 3/18/2	1 1030	×			GW		6	X						\Box			MS	/msp	
APG- DUP- 08-031821		1200	X			GW		2	X											
-APH CASEY YARD-1-CW 03182						GW		2	X.									_		
APG-BLDG-2200-1-GW-03182		1250	X			GW		2	X									1		
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Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • FOR HELP COMPLETING FORM CHECK OUT https://www.eurofinsus.com/coc The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client.

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-33044-1

Project/Site: Aberdeen Proving Ground PFAS S1

Qualifiers

LCMS	
Qualifier	Qualifier Description
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not
	applicable.
D	The reported value is from a dilution.

Ε Result exceeded calibration range. J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Μ Manual integrated compound.

Glossary

Glossary	
Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"

MQL NC

MDA

MDC

MDL

ML MPN

Not Calculated

ND

Not Detected at the reporting limit (or MDL or EDL if shown)

Minimum Detectable Activity (Radiochemistry)

Minimum Detectable Concentration (Radiochemistry)

NEG Negative / Absent POS Positive / Present PQL **Practical Quantitation Limit**

PRES Presumptive QC **Quality Control**

RER Relative Error Ratio (Radiochemistry)

Method Detection Limit Minimum Level (Dioxin)

Most Probable Number

Method Quantitation Limit

Reporting Limit or Requested Limit (Radiochemistry) RL

RPD Relative Percent Difference, a measure of the relative difference between two points

TEF Toxicity Equivalent Factor (Dioxin) **TEQ** Toxicity Equivalent Quotient (Dioxin)

Too Numerous To Count TNTC

3/31/2021

Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-33044-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-P1-12-2-GW-031821

Lab Sample ID: 410-33044-1 Date Collected: 03/18/21 10:30 **Matrix: Water**

Date Received: 03/19/21 17:17

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
8:2 Fluorotelomer sulfonic acid	610		30	20	20	ng/L		03/30/21 14:07	1
NEtFOSAA	<9.8		30	9.8	9.8	ng/L		03/30/21 14:07	1
NMeFOSAA	<12		20	12	12	ng/L		03/30/21 14:07	1
Perfluorobutanesulfonic acid	480		20	9.8	9.8	ng/L		03/30/21 14:07	1
Perfluorobutanoic acid	1300		49	39	39	ng/L		03/30/21 14:07	1
Perfluorodecanoic acid	12	J	20	9.8	9.8	ng/L		03/30/21 14:07	1
Perfluorododecanoic acid	<9.8		20	9.8	9.8	ng/L		03/30/21 14:07	1
Perfluoroheptanoic acid	1200		20	9.8	9.8	ng/L		03/30/21 14:07	1
Perfluorohexanesulfonic acid	3100		20	9.8	9.8	ng/L		03/30/21 14:07	1
Perfluorononanoic acid	190		20	9.8	9.8	ng/L		03/30/21 14:07	1
Perfluorooctanoic acid	1200		20	9.8	9.8	ng/L		03/30/21 14:07	1
Perfluorotetradecanoic acid	<9.8		20	9.8	9.8	ng/L		03/30/21 14:07	1
Perfluorotridecanoic acid	<9.8		20	9.8	9.8	ng/L		03/30/21 14:07	1
Perfluoroundecanoic acid	<9.8		20	9.8	9.8	ng/L		03/30/21 14:07	1

i ciliadicaliacoalidio ada		7.0	20	0.0	0.0 Hg/L		00/00/21 14.07	
Isotope Dilution	%Recovery	Qualifier Lin	nits		Pre	pared	Analyzed	Dil Fac
M2-6:2 FTS	92	50	- 150		03/29/	21 07:57	03/30/21 14:07	1
M2-8:2 FTS	100	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1
13C2 PFTeDA	95	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1
13C3 PFBS	78	50	- 150		03/29/	21 07:57	03/30/21 14:07	1
13C4 PFBA	80	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1
13C4 PFHpA	89	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1
13C5 PFPeA	72	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1
13C8 PFOA	88	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1
13C8 PFOS	82	50	- 150		03/29/	21 07:57	03/30/21 14:07	1
d3-NMeFOSAA	99	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1
d5-NEtFOSAA	103	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1
13C2-PFDoDA	95	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1
13C3 PFHxS	84	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1
13C5 PFHxA	81	50	- 150		03/29/	21 07:57	03/30/21 14:07	1
13C6 PFDA	97	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1
13C7 PFUnA	97	50	- 150		03/29/	21 07:57	03/30/21 14:07	1
13C9 PFNA	82	50	₋ 150		03/29/	21 07:57	03/30/21 14:07	1

Analyte	Res	ult Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	79	00 🗹 DJ	490	390	390	ng/L	03/30/21 14:18	10
Perfluorohexanoic acid	48	00 D	200	98	98	ng/L	03/30/21 14:18	10
Perfluorooctanesulfonic acid	48	00 D	200	98	98	ng/L	03/30/21 14:18	10
Perfluoropentanoic acid	64	00 D	200	98	98	ng/L	03/30/21 14:18	10
Isotope Dilution	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	120		50 - 150			03/29/21 07:57	03/30/21 14:18	10
13C5 PFPeA	92		50 - 150			03/29/21 07:57	03/30/21 14:18	10
13C8 PFOS	92		50 - 150			03/29/21 07:57	03/30/21 14:18	10
13C5 PFHxA	96		50 - 150			03/29/21 07:57	03/30/21 14:18	10

Job ID: 410-33044-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-DUP-08-031821

Date Collected: 03/18/21 12:00 Date Received: 03/19/21 17:17

Client: ARCADIS U.S., Inc.

Lab Sample ID: 410-33044-2

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	4200	D J	60	48	48	ng/L	03/29/21 12:13	10
8:2 Fluorotelomer sulfonic acid	590	D	36	24	24	ng/L	03/29/21 12:13	10
NEtFOSAA	<12		36	12	12	ng/L	03/29/21 12:13	10
NMeFOSAA	<14		24	14	14	ng/L	03/29/21 12:13	10
Perfluorobutanesulfonic acid	420	D	24	12	12	ng/L	03/29/21 12:13	10
Perfluorobutanoic acid	1200	D	60	48	48	ng/L	03/29/21 12:13	10
Perfluorodecanoic acid	22	J ₽ DJ	24	12	12	ng/L	03/29/21 12:13	10
Perfluorododecanoic acid	<12		24	12	12	ng/L	03/29/21 12:13	10
Perfluoroheptanoic acid	1100	D	24	12	12	ng/L	03/29/21 12:13	10
Perfluorohexanesulfonic acid	2800	D	24	12	12	ng/L	03/29/21 12:13	10
Perfluorohexanoic acid	4300	D	24	12	12	ng/L	03/29/21 12:13	10
Perfluorononanoic acid	180	D	24	12	12	ng/L	03/29/21 12:13	10
Perfluorooctanoic acid	1100	D	24	12	12	ng/L	03/29/21 12:13	10
Perfluorotetradecanoic acid	<12		24	12	12	ng/L	03/29/21 12:13	10
Perfluorotridecanoic acid	<12		24	12	12	ng/L	03/29/21 12:13	10
Perfluoroundecanoic acid	<12		24	12	12	ng/L	03/29/21 12:13	10
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac

i cilidorodilaccariole acid	•	12	24	12	12 11g/L	03/23/21 12.13	10
Isotope Dilution	%Recovery	Qualifier	Limits		Prepared	Analyzed	Dil Fac
M2-6:2 FTS	148		50 - 150		03/26/21 21:05	03/29/21 12:13	10
M2-8:2 FTS	95		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C2 PFTeDA	54		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C3 PFBS	71		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C4 PFBA	77		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C4 PFHpA	82		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C5 PFPeA	72		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C8 PFOA	82		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C8 PFOS	81		50 - 150		03/26/21 21:05	03/29/21 12:13	10
d3-NMeFOSAA	79		50 - 150		03/26/21 21:05	03/29/21 12:13	10
d5-NEtFOSAA	76		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C2-PFDoDA	67		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C3 PFHxS	79		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C5 PFHxA	74		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C6 PFDA	81		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C7 PFUnA	80		50 - 150		03/26/21 21:05	03/29/21 12:13	10
13C9 PFNA	80		50 - 150		03/26/21 21:05	03/29/21 12:13	10

_ Method: EPA 537(Mod) - PFA	AS for QSM 5.3,	Table B-	15 - DL					
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorooctanesulfonic acid	5100	D	240	120	120	ng/L	03/29/21 12:24	100
Perfluoropentanoic acid	5300	D	240	120	120	ng/L	03/29/21 12:24	100
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac
13C5 PFPeA	85		50 - 150			03/26/21 21:05	03/29/21 12:24	100
13C8 PFOS	89		50 - 150			03/26/21 21:05	03/29/21 12:24	100

Lab Sample ID: 410-33044-3 Client Sample ID: APG-BLDG-2200-1-GW-031821

Date Collected: 03/18/21 12:50 Date Received: 03/19/21 17:17

Method: EPA 537(Mod) - PFAS fo	r QSM 5.3,	Table B-15							
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	19		5.2	4.1	4.1	ng/L		03/25/21 09:21	1

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Matrix: Water

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-33044-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-BLDG-2200-1-GW-031821

Lab Sample ID: 410-33044-3 **Matrix: Water**

Date Collected: 03/18/21 12:50 Date Received: 03/19/21 17:17

Analyte	Result	Qualifier	L	_OQ	LOD	DL	Unit	D	Analyzed	Dil Fac
8:2 Fluorotelomer sulfonic acid	4.0			3.1	2.1	2.1	ng/L	_	03/25/21 09:21	1
NEtFOSAA	<1.0			3.1	1.0	1.0	ng/L		03/25/21 09:21	1
NMeFOSAA	<1.2			2.1	1.2	1.2	ng/L		03/25/21 09:21	1
Perfluorobutanesulfonic acid	41			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluorobutanoic acid	86			5.2	4.1	4.1	ng/L		03/25/21 09:21	1
Perfluorodecanoic acid	4.4			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluorododecanoic acid	<1.0			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluoroheptanoic acid	140			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluorohexanesulfonic acid	340			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluorohexanoic acid	290			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluorononanoic acid	15			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluorooctanesulfonic acid	180			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluorooctanoic acid	66	M		2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluoropentanoic acid	280			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluorotetradecanoic acid	<1.0			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluorotridecanoic acid	<1.0			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Perfluoroundecanoic acid	<1.0			2.1	1.0	1.0	ng/L		03/25/21 09:21	1
Isotope Dilution	%Recovery Qu	ualifier	Limits				Prepared	,	Analyzed	Dil Fac

			· ·		
Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	118	50 - 150	03/24/21 07:53	03/25/21 09:21	1
M2-8:2 FTS	88	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C2 PFTeDA	60	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C3 PFBS	79	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C4 PFBA	78	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C4 PFHpA	82	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C5 PFPeA	81	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C8 PFOA	87	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C8 PFOS	80	50 - 150	03/24/21 07:53	03/25/21 09:21	1
d3-NMeFOSAA	84	50 - 150	03/24/21 07:53	03/25/21 09:21	1
d5-NEtFOSAA	92	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C2-PFDoDA	72	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C3 PFHxS	80	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C5 PFHxA	80	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C6 PFDA	80	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C7 PFUnA	82	50 - 150	03/24/21 07:53	03/25/21 09:21	1
13C9 PFNA	79	50 - 150	03/24/21 07:53	03/25/21 09:21	1

Environmental Analysis Request/Chain of Custod

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Lancaster Laboratories

cct. # _____ Group # ___

0-33045 Chain of Custody

Environmental Analysis Requested Client Information For Lab Use Only Matrix Client: **Preservation and Filtration Codes** FSC: Acct. #: $\sqrt{}$ ARIADIS SCR#: Surface PWSID #: Project Name/#: Ground **Preservation Codes** APG PFAS H=HCI T=Thiosulfate Project Manager: N=HNO₃ B=NaOH Total # of Containers 30001996.3BX50 S=H2SO4 P=H₃PO₄ Soil X Sediment F=Field Filtered O=Other NPDES Potable Remarks For Compliance: Composite Yes No 🗆 MD Other: Water Collected Grab Sample Identification Date Time X 50 4 APG-BIDG-E4040-1-50-(0-2)-031921 3/19/21 X X 0900 2 GW 150150-WO-1-0404-191921 0940 4 ADG- G-Street-1-50-(0-2)-031921 1030 GW 2 X 1110 APG-G-Street-1-GW-031921 X 2 × GW 1200 APG-CASEY-YARD-1-6W-031921 Relinquished by Turnaround Time (TAT) Requested (please circle) Received by 3/19/21 1500 Rush Belinguished by (Rush TAT is subject to laboratory approval and surcharge.) 16:43 Relinquished by Received by Requested TAT in business days: Marthur BIOUC DARLADIS. COM E-mail address: 14:46 Shephird DARLADIS COM Relinquished by Date Date Received by Data Package Options (circle if required) Relinquished by Date Time Time Type I (EPA Level 3 Type VI (Raw Data Only) 17:17 Equivalent/non-CLP) EDD Required? Yes Relinguished by Commercial Carrier: Type III (Reduced non-CLP) NJ DKQP TX TRRP-13 UPS FedEx If yes, format: Site-Specific QC (MS/MSD/Dup)? Yes No NYSDEC Category A or B MA MCP CT RCP Temperature upon receipt $^{\circ}C$ (If yes, indicate QC sample and submit triplicate sample volume.)

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The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client.

4/2/2021

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-33045-1

Project/Site: Aberdeen Proving Ground PFAS S1

Qualifiers

1.	N/A	C
ш	V	J

Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.

Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value. J

Manual integrated compound.

General Chemistry

FL MS and/or MSD recovery below control limits.

Glossary

Abbreviation	These commonly	used abbreviations may	or may	not be	present in this report
ADDIGVICTOR	THESE COMMISSIONS	, asea abbieviations ina	, oi iiia	, iiot be	present in tins report

Listed under the "D" column to designate that the result is reported on a dry weight basis

%R Percent Recovery

1C Result is from the primary column on a dual-column method. 2C Result is from the confirmation column on a dual-column method.

CFL Contains Free Liquid CFU Colony Forming Unit **CNF** Contains No Free Liquid

DER Duplicate Error Ratio (normalized absolute difference)

Dil Fac **Dilution Factor**

Detection Limit (DoD/DOE) DΙ

DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample

DLC Decision Level Concentration (Radiochemistry)

Estimated Detection Limit (Dioxin) EDL LOD Limit of Detection (DoD/DOE) LOQ Limit of Quantitation (DoD/DOE)

EPA recommended "Maximum Contaminant Level" MCL MDA Minimum Detectable Activity (Radiochemistry) MDC Minimum Detectable Concentration (Radiochemistry)

MDL Method Detection Limit Minimum Level (Dioxin) ML Most Probable Number MPN MQL Method Quantitation Limit

NC Not Calculated

Not Detected at the reporting limit (or MDL or EDL if shown) ND

NEG Negative / Absent POS Positive / Present

Practical Quantitation Limit PQL

PRES Presumptive **Quality Control** QC

RER Relative Error Ratio (Radiochemistry)

Reporting Limit or Requested Limit (Radiochemistry) RL

RPD Relative Percent Difference, a measure of the relative difference between two points

TEF Toxicity Equivalent Factor (Dioxin) Toxicity Equivalent Quotient (Dioxin) TEQ

TNTC Too Numerous To Count

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4/2/2021

Client: ARCADIS U.S., Inc. Job ID: 410-33045-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-BLDG-E4040-1-SO-(0-2)-031921 Lab Sample ID: 410-33045-1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg	03/26/21 13:10	1
8:2 Fluorotelomer sulfonic acid	<0.0017		0.0032	0.0017	0.0017	mg/Kg ☆	03/26/21 13:10	1
NEtFOSAA	<0.00043	UJ	0.0021	0.00043	0.00043	mg/Kg ☆	03/26/21 13:10	1
NMeFOSAA	<0.00043	UJ	0.0021	0.00043	0.00043	mg/Kg ☆	03/26/21 13:10	1
Perfluorobutanesulfonic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg ☆	03/26/21 13:10	1
Perfluorobutanoic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg ☆	03/26/21 13:10	1
Perfluorodecanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg ☆	03/26/21 13:10	1
Perfluorododecanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg ☆	03/26/21 13:10	1
Perfluoroheptanoic acid	< 0.00043		0.00064	0.00043	0.00043	mg/Kg ☆	03/26/21 13:10	1
Perfluorohexanesulfonic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg ☆	03/26/21 13:10	1
Perfluorohexanoic acid	< 0.00043		0.00064	0.00043	0.00043	mg/Kg ☆	03/26/21 13:10	1
Perfluorononanoic acid	< 0.00043		0.00064	0.00043	0.00043	mg/Kg ☆	03/26/21 13:10	1
Perfluorooctanesulfonic acid	0.00051	J	0.00064	0.00043	0.00043	mg/Kg ☆	03/26/21 13:10	1
Perfluorooctanoic acid	< 0.00043	M	0.00064	0.00043	0.00043	mg/Kg ⇔	03/26/21 13:10	1
Perfluoropentanoic acid	< 0.00043	1	0.00064	0.00043	0.00043	mg/Kg ⇔	03/26/21 13:10	1
Perfluorotetradecanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg ☆	03/26/21 13:10	1
Perfluorotridecanoic acid	< 0.00043		0.00064	0.00043	0.00043	mg/Kg ⇔	03/26/21 13:10	1
Perfluoroundecanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg ☆	03/26/21 13:10	1
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	100		50 - 150			03/25/21 15:04	03/26/21 13:10	1
M2-8:2 FTS	83		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C2 PFTeDA	78		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C3 PFBS	83		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C4 PFBA	87		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C4 PFHpA	102		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C5 PFPeA	91		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C8 PFOA	95		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C8 PFOS	92		50 - 150			03/25/21 15:04	03/26/21 13:10	1
d3-NMeFOSAA	35 *5	-	50 - 150			03/25/21 15:04	03/26/21 13:10	1
d5-NEtFOSAA	46 *5	-	50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C2-PFDoDA	83		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C3 PFHxS	103		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C5 PFHxA	89		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C6 PFDA	88		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C7 PFUnA	93		50 - 150			03/25/21 15:04	03/26/21 13:10	1
13C9 PFNA	89		50 ₋ 150			03/25/21 15:04	03/26/21 13:10	1

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	-	03/24/21 16:02	1
8:2 Fluorotelomer sulfonic acid	<0.0018	0.0033	0.0018	0.0018	mg/Kg	₩	03/24/21 16:02	1
NEtFOSAA	<0.00044	0.0022	0.00044	0.00044	mg/Kg	₩	03/24/21 16:02	1
NMeFOSAA	<0.00044	0.0022	0.00044	0.00044	mg/Kg	₩	03/24/21 16:02	1
Perfluorobutanesulfonic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	₩	03/24/21 16:02	1
Perfluorobutanoic acid	<0.0018	0.0022	0.0018	0.0018	mg/Kg	₩	03/24/21 16:02	1
Perfluorodecanoic acid	<0.00044	0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 16:02	1
Perfluorododecanoic acid	<0.00044	0.00066	0.00044	0.00044	mg/Kg	*	03/24/21 16:02	1
Perfluoroheptanoic acid	<0.00044	0.00066	0.00044	0.00044	mg/Kg	₩	03/24/21 16:02	1
Perfluorohexanesulfonic acid	<0.00044	0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 16:02	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-33045-1

Project/Site: Aberdeen Proving Ground PFAS S1

2.36 mm

Client Sample ID: APG-BLDG-E4040-1-SO-(0-2)-031921 Lab Sample ID: 410-33045-1

Date Collected: 03/19/21 09:00

Matrix: Solid

Date Received: 03/19/21 17:17

Percent Solids: 90.1

Analyte	for QSM 5.3,	Qualifier	LOQ	LOD	וח	Unit	D	Analyzed	Dil F
Perfluorohexanoic acid		Qualifier	0.00066	0.00044	0.00044		– "		
Perfluorononanoic acid	<0.00044		0.00066	0.00044	0.00044		₩	03/24/21 16:02	
Perfluorooctanesulfonic acid	<0.00044		0.00066	0.00044	0.00044			03/24/21 16:02	
erfluorooctanoic acid	<0.00044	M	0.00066	0.00044	0.00044			03/24/21 16:02	
erfluoropentanoic acid	<0.00044		0.00066	0.00044	0.00044	0 0	☆	03/24/21 16:02	
		IVI					.		
Perfluorotetradecanoic acid	<0.00044		0.00066	0.00044	0.00044	0 0		03/24/21 16:02	
Perfluorotridecanoic acid	<0.00044		0.00066	0.00044	0.00044		₩	03/24/21 16:02	
Perfluoroundecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	; Q:	03/24/21 16:02	
sotope Dilution	%Recovery Q	ualifier	Limits			Prepar		Analyzed	Dil F
12-6:2 FTS	87		50 - 150			03/23/21	20:31	03/24/21 16:02	
12-8:2 FTS	77		50 - 150			03/23/21	20:31	03/24/21 16:02	
3C2 PFTeDA	69		50 - 150			03/23/21	20:31	03/24/21 16:02	
3C3 PFBS	82		50 - 150			03/23/21	20:31	03/24/21 16:02	
3C4 PFBA	78		50 - 150			03/23/21	20:31	03/24/21 16:02	
3C4 PFHpA	88		50 - 150			03/23/21	20:31	03/24/21 16:02	
3C5 PFPeA	79		50 - 150			03/23/21	20:31	03/24/21 16:02	
3C8 PFOA	87		50 - 150			03/23/21	20:31	03/24/21 16:02	
3C8 PFOS	89		50 - 150			03/23/21	20:31	03/24/21 16:02	
3-NMeFOSAA	21 *5	- -	50 - 150			03/23/21	20:31	03/24/21 16:02	
5-NEtFOSAA	25 *5	_	50 - 150			03/23/21	20:31	03/24/21 16:02	
3C2-PFDoDA	79		50 ₋ 150			03/23/21	20:31	03/24/21 16:02	
3C3 PFHxS	92		50 - 150			03/23/21	20:31	03/24/21 16:02	
3C5 PFHxA	80		50 ₋ 150			03/23/21	20:31	03/24/21 16:02	
3C6 PFDA	85		50 - 150					03/24/21 16:02	
3C7 PFUnA	80		50 - 150					03/24/21 16:02	() · · · ·
3C9 PFNA	82		50 - 150					03/24/21 16:02	
Seneral Chemistry									
nalyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil F
otal Organic Carbon	4320	J-	2450	1640	1640	mg/Kg	<u></u>	03/24/21 18:25	7
ercent Moisture	9.9		1.0		1.0	%		03/20/21 09:30	
ercent Solids	90.1		1.0		1.0	%		03/20/21 09:30	
General Chemistry - Soluble									
nalyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil F
H	7.0	J	0.01	0.01	0.01	S.U.		03/23/21 19:22	
emperature	19.6		0.01	0.01		Degrees C		03/23/21 19:22	
lethod: D422 - Grain Size									
nalyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil F
ravel	6.1		1.0	1.0	1.0			03/23/21 01:00	
and	45.0		1.0	1.0	1.0			03/23/21 01:00	
ilt	34.0		1.0	1.0	1.0			03/23/21 01:00	
lay	15.0		1.0	1.0	1.0			03/23/21 01:00	
5 mm	100.0		1.0	1.0		% Passing		03/23/21 01:00	
7.5 mm	100.0		1.0	1.0		% Passing		03/23/21 01:00	
min 6.7	100.0					. .			
	400		4 ^	4 //	4.0			U3/J3/J4 U4·U4	
	100		1.0	1.0		% Passing		03/23/21 01:00	
9 mm .75 mm .35 mm	100 93.9 93.7		1.0 1.0 1.0	1.0 1.0 1.0	1.0	% Passing% Passing% Passing		03/23/21 01:00 03/23/21 01:00 03/23/21 01:00	

1.0

1.0

93.6

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03/23/21 01:00

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1.0 % Passing

2

3

6

8

10

12

14

15

Job ID: 410-33045-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client: ARCADIS U.S., Inc.

Client Sample ID: APG-BLDG-E4040-1-SO-(0-2)-031921

Lab Sample ID: 410-33045-1 Date Collected: 03/19/21 09:00 **Matrix: Solid**

Percent Solids: 90.1 Date Received: 03/19/21 17:17

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
1.18 mm	93.1		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.6 mm	89.8		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.3 mm	75.5		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.15 mm	55.6		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.075 mm	49.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.064 mm	44.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.05 mm	39.5		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.02 mm	30.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.005 mm	15.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.002 mm	9.5		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.001 mm	7.0		1.0	1.0	1.0	% Passing		03/23/21 01:00	1

Client Sample ID: APG-BLDG-E4040-1-GW-031921 Lab Sample ID: 410-33045-2

Date Collected: 03/19/21 09:40 Matrix: Water

Date Received: 03/19/21 17:17

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	4.6	J	5.4	4.3	4.3	ng/L	03/25/21 09:32	1
8:2 Fluorotelomer sulfonic acid	<2.1		3.2	2.1	2.1	ng/L	03/25/21 09:32	1
NEtFOSAA	<1.1		3.2	1.1	1.1	ng/L	03/25/21 09:32	1
NMeFOSAA	<1.3		2.1	1.3	1.3	ng/L	03/25/21 09:32	1
Perfluorobutanesulfonic acid	2.0	J	2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluorobutanoic acid	8.2	M	5.4	4.3	4.3	ng/L	03/25/21 09:32	1
Perfluorodecanoic acid	<1.1		2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluorododecanoic acid	<1.1		2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluoroheptanoic acid	11		2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluorohexanesulfonic acid	7.5		2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluorohexanoic acid	14		2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluorononanoic acid	<1.1		2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluorooctanesulfonic acid	5.0		2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluorooctanoic acid	15	M	2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluoropentanoic acid	17		2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluorotetradecanoic acid	<1.1		2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluorotridecanoic acid	<1.1		2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Perfluoroundecanoic acid	<1.1		2.1	1.1	1.1	ng/L	03/25/21 09:32	1
Isotone Dilution	%Recovery O	ualifior	l imits			Prenared	Analyzed	Dil Fac

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	136	50 - 150	03/24/21 07:53	03/25/21 09:32	1
M2-8:2 FTS	94	50 - 150	03/24/21 07:53	03/25/21 09:32	1
13C2 PFTeDA	58	50 - 150	03/24/21 07:53	03/25/21 09:32	1
13C3 PFBS	79	50 - 150	03/24/21 07:53	03/25/21 09:32	1
13C4 PFBA	80	50 - 150	03/24/21 07:53	03/25/21 09:32	1
13C4 PFHpA	88	50 - 150	03/24/21 07:53	03/25/21 09:32	1
13C5 PFPeA	87	50 - 150	03/24/21 07:53	03/25/21 09:32	1
13C8 PFOA	90	50 ₋ 150	03/24/21 07:53	03/25/21 09:32	1
13C8 PFOS	84	50 ₋ 150	03/24/21 07:53	03/25/21 09:32	1
d3-NMeFOSAA	83	50 - 150	03/24/21 07:53	03/25/21 09:32	1
d5-NEtFOSAA	85	50 ₋ 150	03/24/21 07:53	03/25/21 09:32	1
13C2-PFDoDA	68	50 - 150	03/24/21 07:53	03/25/21 09:32	1
13C3 PFHxS	86	50 - 150	03/24/21 07:53	03/25/21 09:32	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-33045-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-BLDG-E4040-1-GW-031921

Lab Sample ID: 410-33045-2 Date Collected: 03/19/21 09:40 **Matrix: Water**

Date Received: 03/19/21 17:17

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

,				
Isotope Dilution	%Recovery Qualifier	Limits	Prepared An	alyzed Dil Fac
13C5 PFHxA	85	50 - 150	03/24/21 07:53 03/25	721 09:32 1
13C6 PFDA	79	50 - 150	03/24/21 07:53 03/25	V21 09:32 1
13C7 PFUnA	77	50 - 150	03/24/21 07:53 03/25	/21 09:32 1
13C9 PFNA	83	50 - 150	03/24/21 07:53 03/25	/21 09:32 1

Client Sample ID: APG-G-Street-1-SO-(0-2)-031921 Lab Sample ID: 410-33045-3

Date Collected: 03/19/21 10:30 **Matrix: Solid** Date Received: 03/19/21 17:17 Percent Solids: 84.0

Method: EPA 537(Mod) - PF Analyte	•	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017	-	0.0022	0.0017	0.0017	mg/Kg 😇	03/24/21 16:13	1
8:2 Fluorotelomer sulfonic acid	<0.0017		0.0033	0.0017	0.0017	mg/Kg ⇔	03/24/21 16:13	1
NEtFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg ☆	03/24/21 16:13	1
NMeFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg ☆	03/24/21 16:13	1
Perfluorobutanesulfonic acid	<0.0017		0.0022	0.0017	0.0017	mg/Kg ⇔	03/24/21 16:13	1
Perfluorobutanoic acid	< 0.0017		0.0022	0.0017	0.0017	mg/Kg ☆	03/24/21 16:13	1
Perfluorodecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ♯	03/24/21 16:13	1
Perfluorododecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ⇔	03/24/21 16:13	1
Perfluoroheptanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ⇔	03/24/21 16:13	1
Perfluorohexanesulfonic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ☆	03/24/21 16:13	1
Perfluorohexanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ⇔	03/24/21 16:13	1
Perfluorononanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ≎	03/24/21 16:13	1
Perfluorooctanesulfonic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ☆	03/24/21 16:13	1
Perfluorooctanoic acid	<0.00044	M	0.00066	0.00044	0.00044	mg/Kg ⇔	03/24/21 16:13	1
Perfluoropentanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ⇔	03/24/21 16:13	1
Perfluorotetradecanoic acid	<0.00044	М	0.00066	0.00044	0.00044	mg/Kg ♯	03/24/21 16:13	1
Perfluorotridecanoic acid	<0.00044	'	0.00066	0.00044	0.00044	mg/Kg ⇔	03/24/21 16:13	1
Perfluoroundecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ⇔	03/24/21 16:13	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS			50 - 150			03/23/21 20:31	03/24/21 16:13	1
M2-8:2 FTS	89		50 - 150			03/23/21 20:31	03/24/21 16:13	1

i cilidolodilaccariole acid	٠٠.٥٥٥٠	0.00000	0.000	0.00044 Hig/Ng	03/24/21 10.13	
Isotope Dilution	%Recovery Qualifier	Limits		Prepared	Analyzed	Dil Fac
M2-6:2 FTS	107	50 - 150		03/23/21 20:31	03/24/21 16:13	1
M2-8:2 FTS	89	50 - 150		03/23/21 20:31	03/24/21 16:13	1
13C2 PFTeDA	71	50 - 150		03/23/21 20:31	03/24/21 16:13	1
13C3 PFBS	77	50 - 150		03/23/21 20:31	03/24/21 16:13	1
13C4 PFBA	91	50 ₋ 150		03/23/21 20:31	03/24/21 16:13	1
13C4 PFHpA	97	50 - 150		03/23/21 20:31	03/24/21 16:13	1
13C5 PFPeA	87	50 ₋ 150		03/23/21 20:31	03/24/21 16:13	1
13C8 PFOA	89	50 - 150		03/23/21 20:31	03/24/21 16:13	1
13C8 PFOS	84	50 - 150		03/23/21 20:31	03/24/21 16:13	1
d3-NMeFOSAA	58	50 - 150		03/23/21 20:31	03/24/21 16:13	1
d5-NEtFOSAA	64	50 - 150		03/23/21 20:31	03/24/21 16:13	1
13C2-PFDoDA	79	50 ₋ 150		03/23/21 20:31	03/24/21 16:13	1
13C3 PFHxS	89	50 - 150		03/23/21 20:31	03/24/21 16:13	1
13C5 PFHxA	88	50 ₋ 150		03/23/21 20:31	03/24/21 16:13	1
13C6 PFDA	85	50 - 150		03/23/21 20:31	03/24/21 16:13	1
13C7 PFUnA	82	50 - 150		03/23/21 20:31	03/24/21 16:13	1
13C9 PFNA	79	50 ₋ 150		03/23/21 20:31	03/24/21 16:13	1

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-33045-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-G-Street-1-SO-(0-2)-031921

Date Collected: 03/19/21 10:30

Date Received: 03/19/21 17:17

Lab Sample ID: 410-33045-3

Matrix: Solid

Percent Solids: 84.0

General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	1580	Ft J-	1350	898	898	mg/Kg	☼	03/24/21 17:47	3.77
Percent Moisture	16.0		1.0		1.0	%		03/20/21 09:30	1
Percent Solids	84.0		1.0		1.0	%		03/20/21 09:30	1
General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	7.8	J	0.01	0.01	0.01	S.U.		03/23/21 19:22	1
Temperature	19.9		0.01	0.01	0.01	Degrees C		03/23/21 19:22	1
Method: D422 - Grain Size									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	6.3	1.0	1.0	1.0	%		03/23/21 01:00	1
Sand	44.9	1.0	1.0	1.0	%		03/23/21 01:00	1
Silt	33.7	1.0	1.0	1.0	%		03/23/21 01:00	1
Clay	15.0	1.0	1.0	1.0	%		03/23/21 01:00	1
75 mm	100.0	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
37.5 mm	100.0	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
19 mm	100.0	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
4.75 mm	93.7	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
3.35 mm	93.2	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
2.36 mm	92.6	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
1.18 mm	92.0	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.6 mm	86.0	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.3 mm	70.3	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.15 mm	55.3	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.075 mm	48.7	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.064 mm	47.0	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.05 mm	44.0	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.02 mm	33.0	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.005 mm	15.0	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.002 mm	10.5	1.0	1.0	1.0	% Passing		03/23/21 01:00	1
0.001 mm	10.0	1.0	1.0	1.0	% Passing		03/23/21 01:00	1

Client Sample ID: APG-G-Street-1-GW-031921

Date Collected: 03/19/21 11:10

Date Received: 03/19/21 17:17

Lab	Sample	ID:	410-33045-4

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<4.4		5.5	4.4	4.4	ng/L		03/27/21 15:09	1
8:2 Fluorotelomer sulfonic acid	<2.2		3.3	2.2	2.2	ng/L		03/27/21 15:09	1
NEtFOSAA	<1.1		3.3	1.1	1.1	ng/L		03/27/21 15:09	1
NMeFOSAA	<1.3		2.2	1.3	1.3	ng/L		03/27/21 15:09	1
Perfluorobutanesulfonic acid	20	M	2.2	1.1	1.1	ng/L		03/27/21 15:09	1
Perfluorobutanoic acid	11		5.5	4.4	4.4	ng/L		03/27/21 15:09	1
Perfluorodecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/27/21 15:09	1
Perfluorododecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/27/21 15:09	1
Perfluoroheptanoic acid	9.3	M	2.2	1.1	1.1	ng/L		03/27/21 15:09	1
Perfluorohexanesulfonic acid	110		2.2	1.1	1.1	ng/L		03/27/21 15:09	1
Perfluorohexanoic acid	47	M	2.2	1.1	1.1	ng/L		03/27/21 15:09	1

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Client: ARCADIS U.S., Inc. Job ID: 410-33045-1

Project/Site: Aberdeen Proving Ground PFAS S1

13C9 PFNA

Client Sample ID: APG-G-Street-1-GW-031921 Lab Sample ID: 410-33045-4

Date Collected: 03/19/21 11:10 **Matrix: Water** Date Received: 03/19/21 17:17

Analyte	Resul	t Qualifier	LOQ	LOD	DL	Unit I) Analyzed	Dil Fac
Perfluorononanoic acid	<1.1		2.2	1.1	1.1	ng/L	03/27/21 15:09	1
Perfluorooctanesulfonic acid	5.0)	2.2	1.1	1.1	ng/L	03/27/21 15:09	1
Perfluorooctanoic acid	58	}	2.2	1.1	1.1	ng/L	03/27/21 15:09	1
Perfluoropentanoic acid	18	B M	2.2	1.1	1.1	ng/L	03/27/21 15:09	1
Perfluorotetradecanoic acid	<1.1		2.2	1.1	1.1	ng/L	03/27/21 15:09	1
Perfluorotridecanoic acid	<1.1		2.2	1.1	1.1	ng/L	03/27/21 15:09	1
Perfluoroundecanoic acid	<1.1		2.2	1.1	1.1	ng/L	03/27/21 15:09	1
Isotope Dilution	%Recovery G	Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	118		50 - 150			03/25/21 17:1	03/27/21 15:09	1
M2-8:2 FTS	87		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C2 PFTeDA	63		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C3 PFBS	74		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C4 PFBA	52		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C4 PFHpA	81		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C5 PFPeA	69		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C8 PFOA	88		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C8 PFOS	84		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
d3-NMeFOSAA	85		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
d5-NEtFOSAA	88		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C2-PFDoDA	75		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C3 PFHxS	81		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C5 PFHxA	72		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C6 PFDA	82		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1
13C7 PFUnA	80		50 - 150			03/25/21 17:1	7 03/27/21 15:09	1

Client Sample ID: APG-CASEY-YARD-1-GW-031921 Lab Sample ID: 410-33045-5

50 - 150

87

Date Collected: 03/19/21 12:00 **Matrix: Water** Date Received: 03/19/21 17:17

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<4.1	5.1	4.1	4.1 ng/L		03/25/21 09:54	1
8:2 Fluorotelomer sulfonic acid	<2.0	3.1	2.0	2.0 ng/L		03/25/21 09:54	1
NEtFOSAA	<1.0	3.1	1.0	1.0 ng/L		03/25/21 09:54	1
NMeFOSAA	<1.2	2.0	1.2	1.2 ng/L		03/25/21 09:54	1
Perfluorobutanesulfonic acid	18	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluorobutanoic acid	8.8	5.1	4.1	4.1 ng/L		03/25/21 09:54	1
Perfluorodecanoic acid	<1.0	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluorododecanoic acid	<1.0	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluoroheptanoic acid	4.5	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluorohexanesulfonic acid	120	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluorohexanoic acid	25	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluorononanoic acid	<1.0 M	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluorooctanesulfonic acid	130	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluorooctanoic acid	9.5 M	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluoropentanoic acid	7.7	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluorotetradecanoic acid	<1.0	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluorotridecanoic acid	<1.0	2.0	1.0	1.0 ng/L		03/25/21 09:54	1
Perfluoroundecanoic acid	<1.0	2.0	1.0	1.0 ng/L		03/25/21 09:54	1

Eurofins Lancaster Laboratories Env, LLC

03/25/21 17:17 03/27/21 15:09

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Client Sample Results

Client: ARCADIS U.S., Inc. Job ID: 410-33045-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-CASEY-YARD-1-GW-031921 Lab Sample ID: 410-33045-5

Date Collected: 03/19/21 12:00 **Matrix: Water**

Date Received: 03/19/21 17:17

Isotope Dilution	%Recovery Qua	lifier Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	120	50 - 150	03/24/21 07:53	03/25/21 09:54	1
M2-8:2 FTS	96	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C2 PFTeDA	61	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C3 PFBS	78	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C4 PFBA	65	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C4 PFHpA	89	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C5 PFPeA	74	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C8 PFOA	94	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C8 PFOS	82	50 - 150	03/24/21 07:53	03/25/21 09:54	1
d3-NMeFOSAA	87	50 - 150	03/24/21 07:53	03/25/21 09:54	1
d5-NEtFOSAA	90	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C2-PFDoDA	75	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C3 PFHxS	86	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C5 PFHxA	84	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C6 PFDA	80	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C7 PFUnA	83	50 - 150	03/24/21 07:53	03/25/21 09:54	1
13C9 PFNA	79	50 - 150	03/24/21 07:53	03/25/21 09:54	1



Aberdeen Proving Ground – Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS) Analyses SDG # 410-33396-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report # 41349R

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-33396-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

Sample ID	Lab ID	Matrix	Sample Collection	Barrant Carralla	Analysis		
Sample ID	Lab ID	Matrix	Date	Parent Sample	PFAS	тос	рН
APG-WES-M09-032021	410-33396-1	Water	3/20/2021		Х		
APG-WES-M14-032021	410-33396-2	Water	3/20/2021		Х		
APG-WES-M17-032021	410-33396-3	Water	3/20/2021		Х		
APG-WES-M18-032021	410-33396-4	Water	3/20/2021		Х		
APG-WES-M21-032021	410-33396-5	Water	3/20/2021		Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-WES-M09-032021.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was not performed on sample location associated with this SDG.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Rep	orted	Performance Acceptable		Not	
Items Reviewed	No	Yes	No	Yes	Required	
Sample receipt condition		Х		Х		
2. Requested analyses and sample results		Х		X		
Master tracking list		Х		X		
4. Methods of analysis		Х		Х		
5. Reporting limits		Х		Х		
6. Sample collection date		Х		Х		
7. Laboratory sample received date		Х		Х		
8. Sample preservation verification (as applicable)		Х		Х		
Sample preparation/extraction/analysis dates		Х		Х		
10. Fully executed Chain-of-Custody (COC) form		Х		Х		
11. Narrative summary of QA or sample problems provided		Х		Х		
12. Data Package Completeness and Compliance		Х		Х		

Note:

QA - Quality Assurance

1. The chain of custody states that 2 containers were submitted, whereas the laboratory received 3 containers per sample for the following samples. Each sample had an extra bottle received labelled as "Lab QC".

Lab ID	Sample ID
410-33396-1	APG-WES-M09-032021
410-33396-2	APG-WES-M14-032021
410-33396-3	APG-WES-M17-032021
410-33396-4	APG-WES-M18-032021
410-33396-5	APG-WES-M21-032021

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified 537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
APG-WES-M09-032021	13C4 PFBA	Perfluorobutanoic acid	< 50% but > 20%	< 50% but > 20%
APG-WES-M14-032021	M2-6:2 FTS	6:2 Fluorotelomer sulfonic acid	> 150%	AC
	M2-8:2 FTS	8:2 Fluorotelomer sulfonic acid	< 50% but > 20%	AC
	13C2 PFTeDA	Perfluorotetradecanoic acid	< 20%	< 50% but > 20%
	13C4 PFBA	Perfluorobutanoic acid	< 50% but > 20%	< 50% but > 20%
	13C8 PFOS	Perfluorooctanesulfonic acid	< 50% but > 20%	AC
	d3-NMeFOSAA	NMeFOSAA	< 20%	< 50% but > 20%
APG-WES-M21-032021	d5-NEtFOSAA	NEtFOSAA	< 20%	< 50% but > 20%
	1000 050 01	Perfluorododecanoic acid	000/	
	13C2 PFDoDA	Perfluorotridecanoic acid	< 20%	< 50% but > 20%
	13C6 PFDA	Perfluorodecanoic acid	< 50% but > 20%	AC
	13C7 PFUnA	Perfluoroundecanoic acid	< 20%	AC
	13C9 PFNA	Perfluorononanoic acid	< 50% but > 20%	AC

NOTE:

AC Acceptable

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
A 4500/	Non-detect	No Action
> 150%	Detect J-	J-
500/ 1	Non-detect UJ	UJ
< 50% but > 20%	Detect	J+
	Non-detect	UX
< 20%	Detect	Х

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be $\leq 30\%$.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

The MS/MSD analysis was not performed on sample location associated with this SDG.

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

A field duplicate was not collected for a sample location associated with this SDG.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

All identified compounds met method criteria.

Sample results associated with compounds reported from a diluted analysis are summarized in the following table.

Sample ID	Compound	Original Analysis	Diluted Analysis	Reported Analysis
APG-WES-M17-032021	Perfluorobutanoic acid	500 E	390	390 D

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification
Diluted sample result within the calibration range	D

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Rep	oorted		rmance eptable	Not Required	
	No	Yes	No	Yes	Nequireu	
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC	MS/MS)	<u> </u>			
Stage 2 Validation						
Holding times		Х		Х		
Reporting limits (units)		Х		Х		
Blanks			·			
A. Method blanks		Х		Х		
B. Equipment blanks	Х				Х	
C. Field blanks / Source blanks	Х				Х	
Laboratory Control Sample (LCS) %R		Х		Х		
Laboratory Control Sample Duplicate (LCSD) %R		Х		Х		
LCS/LCSD Precision (RPD)		Х		Х		
Matrix Spike (MS) %R	Х				Х	
Matrix Spike Duplicate (MSD) %R	Х				Х	
MS/MSD Precision (RPD)	Х				Х	
Field Duplicate (RPD)	Х				Х	
Extracted Internal Standard %R		Х	Х			
Injection Internal Standard %R		Х		Х		
Dilution Factor		Х		Х		
Moisture Content	Х				Х	
Stage 3/4 Validation		ı				
Instrument tune and performance check		Х		Х		
Initial calibration %RSDs		Х		Х		
Continuing calibration %Ds		Х		Х		
Instrument sensitivity check		Х		Х		
Ion transitions used		Х		Х		
Compound identification and quantitation	1	1		1	1	
A. Reconstructed ion chromatograms		Х		Х		
B. Quantitation Reports		Х		Х		
C. RT of sample compounds within the established RT windows		Х		х		

PFAS: 537M/DoD QSM 5.3		oorted		mance ptable	Not Required					
	No	Yes	No	Yes						
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)										
D. Ion Ratio %R		Х		Х						
E. Transcription/calculations acceptable		Х		Х						
F. Reporting limits adjusted to reflect sample dilutions		х		Х						

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE:

DATE: May 17, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 24, 2021

Stage 3 / 4 **PFAS Calibration Standards**

SDG #: 410-33396-1 Date: 5/17/2021 Lab: Eurofins Lancaster Page: 1 Project:

Aberdeen Proving Ground SPR Validated by:

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

Perfluoropentanoic acid 3/30/2021 Calibration

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1 4 6 6 6 5 5 6 1 1 6 6 6 5 5 6 1 1 6 6 6 6										
Cal Conc					Calculated		Calc		Calculated	Reported
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D
0.2	161692	6144800	10	0.026314	1.3156816	1.087	0.242076	0.2	21.038	21
0.5	285606	5038151	10	0.056689	1.1337731	1.087	0.521515	0.5	4.303	4.3
2	1305889	5619070	10	0.232403	1.1620152	1.087	2.138023	2	6.901	6.9
8	4785784	5687564	10	0.841447	1.0518088	1.087	7.741003	8	-3.237	-3.2
20	13053657	6579917	10	1.983863	0.9919317	1.087	18.25081	20	-8.746	-8.7
50	31852513	6422817	10	4.959275	0.9918549	1.087	45.6235	50	-8.753	-8.7
100	47712199	4961671	10	9.616155	0.9616155	1.087	88.46509	100	-11.535	-11.5

Match Match Match Match Match Match

Match

Avg RF = 1.0869544 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG#:410-33396-1Date:5/17/2021Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-108787/9 3/30/2021 12:06

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	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	1178996	6528415	10	0.1806	0.9387	1.924	2	-3.81	-3.8
Perfluoropentanoic acid	1317911	6070621	10	0.2171	1.0870	1.997	2	-0.14	-0.1
Perfluorobutanesulfonic acid	1107148	5188592	9.36	0.2134	1.1300	1.767	2	-0.14	0
Perfluorohexanoic acid	1160334	6250885	10	0.1856	0.9490	1.956	2	-2.20	-2.2
Perfluoroheptanoic acid	1497399	7343740	10	0.2039	1.1220	1.817	2	-9.13	-9.2
Perfluorohexanesulfonic acid	947593	5078847	9.46	0.1866	1.0680	1.653	2	-12.56	-12.6
Perfluorooctanesulfonic acid	1037374	5236571	9.57	0.1981	1.1590	1.636	2	-14.36	-14.5

Match Match Match Match Match Match

Match

CCV 410-109847/19 4/01/2021 14:33

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	Analyte					Calc		Calculated	Reported
Compounds	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluorobutanoic acid	4412153	6141623	10	0.7184	0.9387	7.653	8.0	-4.34	-4.3
Perfluoropentanoic acid	4704340	5739454	10	0.8196	1.0870	7.540	8.0	-5.74	-5.7
Perfluorobutanesulfonic acid	4037836	5286268	9.36	0.7638	1.1300	6.327	7.1	-10.64	-10.6
Perfluorohexanoic acid	4089632	5725133	10	0.7143	0.9490	7.527	8.0	-5.91	-5.9
Perfluoroheptanoic acid	5791697	6849129	10	0.8456	1.1220	7.537	8.0	-5.79	-5.8
Perfluorohexanesulfonic acid	3580570	4570733	9.46	0.7834	1.0680	6.939	7.3	-4.95	-4.9
Perfluorooctanesulfonic acid	4008014	4805724	9.57	0.8340	1.1590	6.887	7.4	-7.06	-7.1

Match Match Match Match Match Match Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 SDG #:
 410-33396-1
 Date:
 5/17/2021

 Lab:
 Eurofins Lancaster
 Page:
 3

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-109803/2-A

Page 1531 - 1536 of SDG 410-33396-1

Sample volume = 250 ml Final volume = 1ml

						Calculated		Calculated	Reported	
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	
Perfluorobutanoic acid	2500583	4325268	10	0.578134	0.9387	24.64	25.6	96.23	96	Match
Perfluoropentanoic acid	2434039	4026101	10	0.604565	1.0870	22.25	25.6	86.90	87	Match
Perfluorobutanesulfonic acid	2132536	3159060	9.36	0.675054	1.1300	22.37	22.7	98.53	99	Match
Perfluorohexanoic acid	2218499	4037069	10	0.549532	0.9490	23.16	25.6	90.48	90	Match
Perfluoroheptanoic acid	3111381	4583260	10	0.678858	1.1220	24.20	25.6	94.54	94	Match
Perfluorohexanesulfonic acid	1733887	2856976	9.46	0.606896	1.0680	21.50	23.3	92.29	92	Match
Perfluorooctanesulfonic acid	1811181	2739730	9.57	0.66108	1.1590	21.83	23.7	92.13	92	Match

LCSD 410-109803/3-A

Page 1560 - 1565 of SDG 410-33396-1

Sample volume = 250 ml

Final volume = 1ml

						Calculated		Calculated	Reported	
						Amount	True Value	Percent	Percent	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/L	ng/L	Recovery	Recovery	j
Perfluorobutanoic acid	2615926	4407215	10	0.593555	0.9387	25.29	25.6	98.80	99	Match
Perfluoropentanoic acid	2665023	3910277	10	0.681543	1.0870	25.08	25.6	97.97	98	Match
Perfluorobutanesulfonic acid	2387998	3503744	9.36	0.681556	1.1300	22.58	22.7	99.48	100	Match
Perfluorohexanoic acid	2339700	4113085	10	0.568843	0.9490	23.98	25.6	93.66	94	Match
Perfluoroheptanoic acid	3362575	4854428	10	0.692682	1.1220	24.69	25.6	96.46	96	Match
Perfluorohexanesulfonic acid	2023971	3202440	9.46	0.632009	1.0680	22.39	23.3	96.11	96	Match
Perfluorooctanesulfonic acid	2355990	3465246	9.57	0.679891	1.1590	22.46	23.7	94.75	95	Match

Calculated Amount ng/L = ((Peak area ratio/Avg RF) x EIS concentration)/Sample volume)*1000

				Reported	
	LCS Calc	LCSD Calc	LCS/LCSD	LCS/LCSD	
Compounds	Amount	Amount	Calc RPD	RPD	
Perfluorobutanoic acid	24.64	25.29	2.6	3	Match
Perfluoropentanoic acid	22.25	25.08	12.0	12	Match
Perfluorobutanesulfonic acid	22.37	22.58	1.0	1	Match
Perfluorohexanoic acid	23.16	23.98	3.5	3	Match
Perfluoroheptanoic acid	24.20	24.69	2.0	2	Match
Perfluorohexanesulfonic acid	21.50	22.39	4.1	4	Match
Perfluorooctanesulfonic acid	21.83	22.46	2.8	3	Match

Stage 3 / 4 PFAS Sample Concentration

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-WES-M09-032021 Lab ID: 410-33396-1 Page 610 - 614 of SDG 410-33396-1

						Calculated	Final		Final	Reported	
						Amount	Volume	Sample	Calculated	Value	
Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mls	Volume mls	ng/L	ng/L	
Perfluorobutanoic acid	3239713	2177508	10	1.487808	0.9387	15.85	1	297.1	53.3	53	Matc
Perfluoropentanoic acid	2092464	3081671	10	0.679003	1.0870	6.25	1	297.1	21.0	21	Matc
Perfluorobutanesulfonic acid	1009973	3171031	9.36	0.3185	1.1300	2.64	1	297.1	8.9	8.9	Matc
Perfluorohexanoic acid	3809882	3678569	10	1.035697	0.9490	10.91	1	297.1	36.7	37	Matc
Perfluoroheptanoic acid	2485680	4813654	10	0.516381	1.1220	4.60	1	297.1	15.5	15	Matc
Perfluorohexanesulfonic acid	1810839	3482132	9.46	0.520037	1.0680	4.61	1	297.1	15.5	16	Matc
Perfluorooctanesulfonic acid	4628748	3807558	9.57	1.215674	1.1590	10.04	1	297.1	33.8	34	Matc

Calculated amount ng/ml = (Peak area ratio/Avg RF) x DF x EIS conc <math>ng/mlFinal Calculated amount ng/L = ((calculated ng/ml x Final Volume mls) / sample volume mls) *1000Differences in results may be due to rounding of the reported result

Stage 3 / 4 PFAS EIS

 SDG #:
 410-33396-1
 Date:
 5/17/2021

 Lab:
 Eurofins Lancaster
 Page:
 5

 Project:
 Aberdeen Proving Ground
 Validated by:
 SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-WES-M09-032021 Lab ID: 410-32396-1

EIS 13C5 PFPeA

REPORTED EIS %R 53

%R = 100 * EIS ConcentrationEIS TV

EIS Concentration 5.33 ng/ml Page 612 of 410-33396-1
EIS TV 10.00
%R 53.3 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

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The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client.

4/6/2021

CB

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-33396-1

Project/Site: Aberdeen Proving Ground PFAS S1

Qualifiers

Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
*5+	Isotope dilution analyte is outside acceptance limits, high biased.
D	The reported value is from a dilution.
E	Result exceeded calibration range.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
M	Manual integrated compound.

IVI	wandar integrated compound.
Glossary	
Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)

MQL NC

MDL

MPN

ML

Not Calculated

ND Not Detected at the reporting limit (or MDL or EDL if shown)

NEG Negative / Absent POS Positive / Present

PQL **Practical Quantitation Limit**

PRES Presumptive QC **Quality Control**

RER Relative Error Ratio (Radiochemistry)

Method Detection Limit

Minimum Level (Dioxin)

Most Probable Number Method Quantitation Limit

RLReporting Limit or Requested Limit (Radiochemistry)

RPD Relative Percent Difference, a measure of the relative difference between two points

TEF Toxicity Equivalent Factor (Dioxin) TEQ Toxicity Equivalent Quotient (Dioxin)

TNTC Too Numerous To Count

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Client: ARCADIS U.S., Inc. Job ID: 410-33396-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-WES-M09-032021

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - RE

18

17

Perfluoroheptanoic acid

Perfluorohexanesulfonic acid

Lab Sample ID: 410-33396-1

Date Collected: 03/20/21 08:20 **Matrix: Water** Date Received: 03/23/21 18:20

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.4			4.2	3.4	3.4	ng/L	04/01/21 21:02	1
8:2 Fluorotelomer sulfonic acid	<1.7	1		2.5	1.7	1.7	ng/L	04/01/21 21:02	1
NEtFOSAA	<0.84	M		2.5	0.84	0.84	ng/L	04/01/21 21:02	1
NMeFOSAA	<1.0			1.7	1.0	1.0	ng/L	04/01/21 21:02	1
Perfluorobutanesulfonic acid	8.9	M		1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluorobutanoic acid	53	J+		4.2	3.4	3.4	ng/L	04/01/21 21:02	1
Perfluorodecanoic acid	<0.84	Ŋ		1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluorododecanoic acid	<0.84			1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluoroheptanoic acid	15	M		1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluorohexanesulfonic acid	16			1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluorohexanoic acid	37	M		1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluorononanoic acid	3.8			1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluorooctanesulfonic acid	34			1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluorooctanoic acid	52	M		1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluoropentanoic acid	21			1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluorotetradecanoic acid	<0.84			1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluorotridecanoic acid	<0.84			1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Perfluoroundecanoic acid	<0.84			1.7	0.84	0.84	ng/L	04/01/21 21:02	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	93		50 - 150				04/01/21 08:23	04/01/21 21:02	1
M2-8:2 FTS	84		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C2 PFTeDA	76		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C3 PFBS	58		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C4 PFBA	35 *5	i-	50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C4 PFHpA	74		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C5 PFPeA	53		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C8 PFOA	76		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C8 PFOS	76		50 - 150				04/01/21 08:23	04/01/21 21:02	1
d3-NMeFOSAA	76		50 - 150				04/01/21 08:23	04/01/21 21:02	1
d5-NEtFOSAA	86		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C2-PFDoDA	78		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C3 PFHxS	75		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C5 PFHxA	62		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C6 PFDA	82		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C7 PFUnA	83		50 - 150				04/01/21 08:23	04/01/21 21:02	1
13C9 PFNA	80		50 ₋ 150				04/01/21 08:23	04/01/21 21:02	1

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5	4.4	3.5	3.5 ng/L	03/27/21 12:01	1
8:2 Fluorotelomer sulfonic acid	<1.7	2.6	1.7	1.7 ng/L	03/27/21 12:01	1
NEtFOSAA	<0.87 M	2.6	0.87	0.87 ng/L	03/27/21 12:01	1
NMeFOSAA	<1.0 M	1.7	1.0	1.0 ng/L	03/27/21 12:01	1
Perfluorobutanesulfonic acid	9.9 M	1.7	0.87	0.87 ng/L	03/27/21 12:01	1
Perfluorobutanoic acid	59 M	4.4	3.5	3.5 ng/L	03/27/21 12:01	1
Perfluorodecanoic acid	<0.87 M	1.7	0.87	0.87 ng/L	03/27/21 12:01	1
Perfluorododecanoic acid	<0.87	17	0.87	0.87 ng/l	03/27/21 12:01	1

1.7

1.7

0.87

0.87

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03/27/21 12:01

03/27/21 12:01

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0.87 ng/L

0.87 ng/L

Job ID: 410-33396-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-WES-M09-032021

Date Collected: 03/20/21 08:20 Date Received: 03/23/21 18:20

Client: ARCADIS U.S., Inc.

Lab Sample ID: 410-33396-1

Matrix: Water

Method: EPA 537(Mod) - PFA Analyte		Qualifier	LOQ	LOD	DI	Unit D	Analyzed	Dil Fac
Perfluorohexanoic acid	44			0.87		ng/L	03/27/21 12:01	- Dii Fac
			1.7	0.87		ng/L	03/27/21 12:01	1
Perfluorononanoic acid	3.9		1.7	0.87				
Perfluorooctanesulfonic acid	38					ng/L	03/27/21 12:01	1
Perfluorooctanoic acid		M	1.7	0.87		ng/L	03/27/21 12:01	1
Perfluoropentanoic acid		M	1.7	0.87		ng/L	03/27/21 12:01	1
Perfluorotetradecanoic acid	<0.87		1.7	0.87		ng/L	03/27/21 12:01	1
Perfluorotridecanoic acid	<0.87		1.7	0.87		ng/L	03/27/21 12:01	1
Perfluoroundecanoic acid	<0.87	M	1.7	0.87	0.87	ng/L	03/27/21 12:01	1
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	132		50 - 150			03/25/21 16:55	03/27/21 12:01	1
M2-8:2 FTS	97		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C2 PFTeDA	57		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C3 PFBS	76		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C4 PFBA	49 *5	-	50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C4 PFHpA	92		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C5 PFPeA	75		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C8 PFOA	90		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C8 PFOS	85		50 - 150			03/25/21 16:55	03/27/21 12:01	1
d3-NMeFOSAA	90		50 - 150			03/25/21 16:55	03/27/21 12:01	1
d5-NEtFOSAA	94		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C2-PFDoDA	79		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C3 PFHxS	89		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C5 PFHxA	77		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C6 PFDA	87		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C7 PFUnA	87		50 - 150			03/25/21 16:55	03/27/21 12:01	1
13C9 PFNA	90		50 ₋ 150			03/25/21 16:55	03/27/21 12:01	7

Client Sample ID: APG-WES-M14-032021

Date Collected: 03/20/21 11:00 Date Received: 03/23/21 18:20 Lab Sample ID: 410-33396-2

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5		4.3	3.5	3.5	ng/L		03/27/21 12:12	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.6	1.7	1.7	ng/L		03/27/21 12:12	1
NEtFOSAA	<0.87		2.6	0.87	0.87	ng/L		03/27/21 12:12	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L		03/27/21 12:12	1
Perfluorobutanesulfonic acid	5.6	M	1.7	0.87	0.87	ng/L		03/27/21 12:12	1
Perfluorobutanoic acid	27	M	4.3	3.5	3.5	ng/L		03/27/21 12:12	1
Perfluorodecanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/27/21 12:12	1
Perfluorododecanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/27/21 12:12	1
Perfluoroheptanoic acid	7.3	M	1.7	0.87	0.87	ng/L		03/27/21 12:12	1
Perfluorohexanesulfonic acid	21		1.7	0.87	0.87	ng/L		03/27/21 12:12	1
Perfluorohexanoic acid	17	M	1.7	0.87	0.87	ng/L		03/27/21 12:12	1
Perfluorononanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/27/21 12:12	1
Perfluorooctanesulfonic acid	36		1.7	0.87	0.87	ng/L		03/27/21 12:12	1
Perfluorooctanoic acid	29	M	1.7	0.87	0.87	ng/L		03/27/21 12:12	1
Perfluoropentanoic acid	9.4	M	1.7	0.87	0.87	ng/L		03/27/21 12:12	1
Perfluorotetradecanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/27/21 12:12	1
Perfluorotridecanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/27/21 12:12	1

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Client: ARCADIS U.S., Inc. Job ID: 410-33396-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-WES-M14-032021

Date Collected: 03/20/21 11:00

Date Received: 03/23/21 18:20

Lab Sample ID: 410-33396-2

Matrix: Water

Analyte	Result Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluoroundecanoic acid	<0.87	1.7	0.87	0.87	ng/L	03/27/21 12:12	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	154 *5+	50 - 150			03/25/21 16:55	03/27/21 12:12	1
M2-8:2 FTS	112	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C2 PFTeDA	59	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C3 PFBS	86	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C4 PFBA	59	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C4 PFHpA	102	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C5 PFPeA	88	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C8 PFOA	102	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C8 PFOS	99	50 - 150			03/25/21 16:55	03/27/21 12:12	1
d3-NMeFOSAA	104	50 - 150			03/25/21 16:55	03/27/21 12:12	1
d5-NEtFOSAA	114	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C2-PFDoDA	74	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C3 PFHxS	101	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C5 PFHxA	84	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C6 PFDA	97	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C7 PFUnA	92	50 - 150			03/25/21 16:55	03/27/21 12:12	1
13C9 PFNA	105	50 - 150			03/25/21 16:55	03/27/21 12:12	1

Analyte	Result	Qualifier	L	.OQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.4			4.3	3.4	3.4	ng/L		04/01/21 21:13	1
8:2 Fluorotelomer sulfonic acid	<1.7			2.6	1.7	1.7	ng/L		04/01/21 21:13	1
NEtFOSAA	<0.85			2.6	0.85	0.85	ng/L		04/01/21 21:13	1
NMeFOSAA	<1.0			1.7	1.0	1.0	ng/L		04/01/21 21:13	1
Perfluorobutanesulfonic acid	5.2	M		1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluorobutanoic acid	23	M		4.3	3.4	3.4	ng/L		04/01/21 21:13	1
Perfluorodecanoic acid	<0.85			1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluorododecanoic acid	<0.85			1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluoroheptanoic acid	6.8	M		1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluorohexanesulfonic acid	20			1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluorohexanoic acid	14	M		1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluorononanoic acid	<0.85			1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluorooctanesulfonic acid	33			1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluorooctanoic acid	27	M		1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluoropentanoic acid	8.5	M		1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluorotetradecanoic acid	<0.85			1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluorotridecanoic acid	<0.85			1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Perfluoroundecanoic acid	<0.85			1.7	0.85	0.85	ng/L		04/01/21 21:13	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepare	ed	Analyzed	Dil Fac
140 C O ETO			FO 4FO	-			24/04/04	0.00	04/04/04 04:40	

	,			, . ,	
M2-6:2 FTS	99	50 - 150	04/01/21 08:23	04/01/21 21:13	1
M2-8:2 FTS	79	50 - 150	04/01/21 08:23	04/01/21 21:13	1
13C2 PFTeDA	71	50 - 150	04/01/21 08:23	04/01/21 21:13	1
13C3 PFBS	66	50 - 150	04/01/21 08:23	04/01/21 21:13	1
13C4 PFBA	48	*5- 50 - 150	04/01/21 08:23	04/01/21 21:13	1
13C4 PFHpA	79	50 - 150	04/01/21 08:23	04/01/21 21:13	1
13C5 PFPeA	70	50 - 150	04/01/21 08:23	04/01/21 21:13	1
13C8 PFOA	85	50 - 150	04/01/21 08:23	04/01/21 21:13	1

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4/6/2021

Client: ARCADIS U.S., Inc. Job ID: 410-33396-1

Project/Site: Aberdeen Proving Ground PFAS S1

13C9 PFNA

Client Sample ID: APG-WES-M14-032021

Lab Sample ID: 410-33396-2

Date Collected: 03/20/21 11:00 **Matrix: Water** Date Received: 03/23/21 18:20

Isotope Dilut ion	%Recovery Quali	fier Limits	Prepared	Analyzed	Dil Fac
13C8 PFOS	74	50 - 150	04/01/21 08:23	04/01/21 21:13	1
d3-NMeFOSAA	74	50 - 150	04/01/21 08:23	04/01/21 21:13	1
d5-NEtFOSAA	83	50 - 150	04/01/21 08:23	04/01/21 21:13	1
13C2-PFDoDA	72	50 - 150	04/01/21 08:23	04/01/21 21:13	1
13C3 PFHxS	77	50 - 150	04/01/21 08:23	04/01/21 21:13	1
13C5 PFHxA	67	50 - 150	04/01/21 08:23	04/01/21 21:13	1
13C6 PFDA	77	50 ₋ 150	04/01/21 08:2 3	04/01/21 21:13	1
13C7 PFUnA	80	50 ₋ 150	04/01/21 08:23	04/01/21 21:13	1

Client Sample ID: APG-WES-M17-032021 Lab Sample ID: 410-33396-3

50 - 150

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Date Collected: 03/20/21 10:30 **Matrix: Water** Date Received: 03/23/21 18:20

Analyte	Result	Qualifier	l	_OQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5		_	4.4	3.5	3.5	ng/L	04/01/21 21:24	1
8:2 Fluorotelomer sulfonic acid	<1.8			2.6	1.8	1.8	ng/L	04/01/21 21:24	1
NEtFOSAA	<0.88			2.6	0.88	0.88	ng/L	04/01/21 21:24	1
NMeFOSAA	<1.1			1.8	1.1	1.1	ng/L	04/01/21 21:24	1
Perfluorobutanesulfonic acid	4.9	M		1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluorodecanoic acid	<0.88			1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluorododecanoic acid	<0.88			1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluoroheptanoic acid	17			1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluorohexanesulfonic acid	11	M		1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluorohexanoic acid	35	M		1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluorononanoic acid	<0.88			1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluorooctanesulfonic acid	5.8	M		1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluorooctanoic acid	54	M		1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluoropentanoic acid	12	M		1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluorotetradecanoic acid	<0.88			1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluorotridecanoic acid	<0.88			1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Perfluoroundecanoic acid	<0.88			1.8	0.88	0.88	ng/L	04/01/21 21:24	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared Analyzed	Dil Fac
M2-6:2 FTS	111		50 - 150	04/01/21 08:23 04/01/21 21:24	1
M2-8:2 FTS	88		50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C2 PFTeDA	69		50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C3 PFBS	55		50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C4 PFBA	23	*5-	50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C4 PFHpA	75		50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C5 PFPeA	52		50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C8 PFOA	78		50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C8 PFOS	83		50 - 150	04/01/21 08:23 04/01/21 21:24	1
d3-NMeFOSAA	74		50 - 150	04/01/21 08:23 04/01/21 21:24	1
d5-NEtFOSAA	79		50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C2-PFDoDA	75		50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C3 PFHxS	77		50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C5 PFHxA	57		50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C6 PFDA	80		50 - 150	04/01/21 08:23 04/01/21 21:24	1
13C7 PFUnA	86		50 - 150	04/01/21 08:23 04/01/21 21:24	1

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04/01/21 08:23 04/01/21 21:13

4/6/2021

Client: ARCADIS U.S., Inc. Job ID: 410-33396-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-WES-M17-032021

Lab Sample ID: 410-33396-3

Date Collected: 03/20/21 10:30

Date Received: 03/23/21 18:20

Method: EPA 537(Mod) - PFAS for QSM 5.3	B, Table B-15 (Continued)

isotope Dilution	%Recovery Qualifier	Limits	Prepared	Anaiyzea	DII Fac
13C9 PFNA	85	50 - 150	04/01/21 08:23	04/01/21 21:24	1

Analyte	Result Qualifie	r LOQ	LOD	DL Unit	D Analyzed	Dil Fac
Perfluorobutanoic acid	390 D	44	35	35 ng/L	04/02/21 09:13	10

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFBA	72	50 - 150	04/01/21 08:23	04/02/21 09:13	10

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 - RE

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.6		4.5	3.6	3.6	ng/L		03/27/21 12:23	1
8:2 Fluorotelomer sulfonic acid	<1.8		2.7	1.8	1.8	ng/L		03/27/21 12:23	1
NEtFOSAA	< 0.90		2.7	0.90	0.90	ng/L		03/27/21 12:23	1
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L		03/27/21 12:23	1
Perfluorobutanesulfonic acid	6.1	M	1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluorobutanoic acid	500	E	4.5	3.6	3.6	ng/L		03/27/21 12:23	1
Perfluorodecanoic acid	<0.90		1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluorododecanoic acid	<0.90		1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluoroheptanoic acid	20		1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluorohexanesulfonic acid	15	M	1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluorohexanoic acid	46	M	1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluorononanoic acid	<0.90	M	1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluorooctanesulfonic acid	11		1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluorooctanoic acid	67		1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluoropentanoic acid	14	М	1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluorotetradecanoic acid	<0.90		1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluorotridecanoic acid	<0.90		1.8	0.90	0.90	ng/L		03/27/21 12:23	1
Perfluoroundecanoic acid	<0.90		1.8	0.90	0.90	ng/L		03/27/21 12:23	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	141		50 - 150	03/25/21 16:55	03/27/21 12:23	1
M2-8:2 FTS	90		50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C2 PFTeDA	2	*5-	50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C3 PFBS	68		50 - 150	 03/25/21 16:55	03/27/21 12:23	1
13C4 PFBA	25	*5-	50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C4 PFHpA	83		50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C5 PFPeA	61		50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C8 PFOA	81		50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C8 PFOS	72		50 - 150	03/25/21 16:55	03/27/21 12:23	1
d3-NMeFOSAA	47	*5-	50 - 150	03/25/21 16:55	03/27/21 12:23	1
d5-NEtFOSAA	41	*5-	50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C2-PFDoDA	17	*5-	50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C3 PFHxS	81		50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C5 PFHxA	62		50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C6 PFDA	56		50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C7 PFUnA	38	*5-	50 - 150	03/25/21 16:55	03/27/21 12:23	1
13C9 PFNA	78		50 - 150	03/25/21 16:55	03/27/21 12:23	1

Matrix: Water

Job ID: 410-33396-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client: ARCADIS U.S., Inc.

Client Sample ID: APG-WES-M18-032021

Lab Sample ID: 410-33396-4

Date Collected: 03/20/21 10:05 **Matrix: Water** Date Received: 03/23/21 18:20

Analyte	Result	Qualifier	LO	OQ	LOD	DL	Unit [) Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.8			4.7	3.8	3.8	ng/L	04/01/21 21:35	1
8:2 Fluorotelomer sulfonic acid	<1.9			2.8	1.9	1.9	ng/L	04/01/21 21:35	1
NEtFOSAA	<0.94			2.8	0.94	0.94	ng/L	04/01/21 21:35	1
NMeFOSAA	<1.1			1.9	1.1	1.1	ng/L	04/01/21 21:35	1
Perfluorobutanesulfonic acid	<0.94	M		1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluorobutanoic acid	<3.8	M		4.7	3.8	3.8	ng/L	04/01/21 21:35	1
Perfluorodecanoic acid	<0.94			1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluorododecanoic acid	<0.94			1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluoroheptanoic acid	<0.94			1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluorohexanesulfonic acid	3.6			1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluorohexanoic acid	<0.94	M		1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluorononanoic acid	<0.94	1		1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluorooctanesulfonic acid	1.0	JM		1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluorooctanoic acid	2.5	M		1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluoropentanoic acid	<0.94	M		1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluorotetradecanoic acid	<0.94			1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluorotridecanoic acid	<0.94			1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Perfluoroundecanoic acid	<0.94			1.9	0.94	0.94	ng/L	04/01/21 21:35	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	91		50 - 150				04/01/21 08:23	04/01/21 21:35	1
M2-8:2 FTS	81		50 - 150				04/01/21 08:23	3 04/01/21 21:35	1
13C2 PFTeDA	77		50 - 150				04/01/21 08:23	3 04/01/21 21:35	1
13C3 PFBS	68		50 - 150				04/01/21 08:2	3 04/01/21 21:35	1
13C4 PFBA	66		50 - 150				04/01/21 08:23	3 04/01/21 21:35	1
13C4 PFHpA	79		50 - 150				04/01/21 08:23	3 04/01/21 21:35	1
13C5 PFPeA	73		50 - 150				04/01/21 08:2	3 04/01/21 21:35	1
13C8 PFOA	85		50 - 150				04/01/21 08:23	3 04/01/21 21:35	1
13C8 PFOS	77		50 - 150				04/01/21 08:23	3 04/01/21 21:35	1
d3-NMeFOSAA	77		50 - 150				04/01/21 08:2	3 04/01/21 21:35	1
d5-NEtFOSAA	83		50 - 150				04/01/21 08:2	3 04/01/21 21:35	1
13C2-PFDoDA	82		50 - 150				04/01/21 08:2	3 04/01/21 21:35	1
13C3 PFHxS	77		50 - 150				04/01/21 08:2	3 04/01/21 21:35	1
13C5 PFHxA	74		50 - 150				04/01/21 08:2	3 04/01/21 21:35	1
13C6 PFDA	82		50 - 150				04/01/21 08:23	3 04/01/21 21:35	1
13C7 PFUnA	86		50 - 150				04/01/21 08:2	3 04/01/21 21:35	1
13C9 PFNA	82		50 ₋ 150				04/01/21 08:2	3 04/01/21 21:35	1

Client Sample ID: APG-WES-M21-032021

Lab Sample ID: 410-33396-5 Date Collected: 03/20/21 09:45 **Matrix: Water**

Date Received: 03/23/21 18:20

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.6	4.5	3.6	3.6 ng/L	03/27/21 15:20	1
8 :2 Fluorotelomer sulfonic acid	<1.8	2.7	1.8	1.8 ng/L	03/27/21 15:20	
NEtFOSAA	<0.90	2.7	0.90	0.90 ng/L	03/27/21 15:20	1
NMeFOSAA	<1.1	1.8	1.1	1.1 ng/L	03/27/21 15:20	
Perfluorobutanesulfonic acid	2.5	1.8	0.90	0.90 ng/L	03/27/21 15:20	1
Perfluorobutanoic acid	5.1 J+	4.5	3.6	3.6 ng/L	03/27/21 15:20	1
Perfluorodecanoic acid	<0.90	1.8	0.90	0.90 ng/L	03/27/21 15:20	1

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Client: ARCADIS U.S., Inc. Job ID: 410-33396-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-WES-M21-032021

Lab Sample ID: 410-33396-5 Date Collected: 03/20/21 09:45 **Matrix: Water**

Date Received: 03/23/21 18:20

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluerededecanoic acid	<0.90			1.8	0.90	0.90	ng/L	03/27/21 15:20	1
Perfluoroheptanoic acid	8.5			1.8	0.90	0.90	ng/L	03/27/21 15:20	1
Perfluorohexanesulfonic acid	5.9			1.8	0.90	0.90	ng/L	03/27/21 15:20	1
Perfluorohexanoic acid	16			1.8	0.90	0.90	ng/L	03/27/21 15:20	1
Perfluorononanoic acid	<0.90	M		1.8	0.90	0.90	ng/L	03/27/21 15:20	1
Perfluorooctanesulfonic acid	2.7			1.8	0.90	0.90	ng/L	03/27/21 15:20	1
Perfluorooctanoic acid	8.6	M		1.8	0.90	0.90	ng/L	03/27/21 15:20	1
Perfluoropentanoic acid	12	M		1.8	0.90	0.90	ng/L	03/27/21 15:20	1
Perfluorotetradecanoic acid	<0.90			1.8	0.90	0.90	ng/L	03/27/21 15:20	1
Perflueretridecanoic acid	<0.90			1.8	0.90	0.90	ng/L	03/27/21 15:20	1
Perfluoroundecanoic acid	<0.90			1.8	0.90	0.90	ng/L	03/27/21 15:20	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	80		50 - 150				03/25/21 17:17	03/27/21 15:20	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	80		50 - 150	03/25/21 17:17	03/27/21 15:20	1
M2-8:2 FTS	32	*5-	50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C2 PFTeDA	1	*5-	50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C3 PFBS	56		50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C4 PFBA	45	*5-	50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C4 PFHpA	72		50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C5 PFPeA	65		50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C8 PFOA	64		50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C8 PFOS	34	*5-	50 - 150	03/25/21 17:17	03/27/21 15:20	1
d3-NMeFOSAA	18	*5-	50 - 150	03/25/21 17:17	03/27/21 15:20	1
d5-NEtFOSAA	15	*5-	50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C2-PFDoDA	3	*5-	50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C3 PFHxS	63		50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C5 PFHxA	63		50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C6 PFDA	22	*5-	50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C7 PFUnA	9	*5-	50 - 150	03/25/21 17:17	03/27/21 15:20	1
13C9 PFNA	41	*5-	50 - 150	03/25/21 17:17	03/27/21 15:20	1

Method: EPA 537(Mod) - PFAS fo	or OSM 5.3 1	Table B-15 - RF
Method. Ll A 33/11	110ui - I I AO II	JI WOIN J.J. I	able D-13 - IXE

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<4.0	5.0	4.0	4.0 ng/L	03/31/21 13:49	1
8:2 Fluorotelomer sulfonic acid	<2.0	3.0	2.0	2.0 ng/L	03/31/21 13:49	1
NEtFOSAA	<1.0 UJ	3.0	1.0	1.0 ng/L	03/31/21 13:49	1
NMeFOSAA	<1.2 UJ	2.0	1.2	1.2 ng/L	03/31/21 13:49	1
Perfluorobutanesulfonic acid	2.3	2.0	1.0	1.0 ng/L	03/31/21 13:49	1
Perfluorobutanoic acid	4.7 J	5.0	4.0	4.0 ng/L	03/31/21 13:49	1
Perfluorodecanoic acid	<1.0	2.0	1.0	1.0 ng/L	03/31/21 13:49	1
Perfluorododecanoic acid	<1.0 UJ	2.0	1.0	1.0 ng/L	03/31/21 13:49	1
Perfluoroheptanoic acid	8.3	2.0	1.0	1.0 ng/L	03/31/21 13:49	1
Perfluorohexanesulfonic acid	5.3 M	2.0	1.0	1.0 ng/L	03/31/21 13:49	1
Perfluorohexanoic acid	15	2.0	1.0	1.0 ng/L	03/31/21 13:49	1
Perfluorononanoic acid	<1.0	2.0	1.0	1.0 ng/L	03/31/21 13:49	1
Perfluorooctanesulfonic acid	2.9	2.0	1.0	1.0 ng/L	03/31/21 13:49	1
Perfluorooctanoic acid	8.9 M	2.0	1.0	1.0 ng/L	03/31/21 13:49	1
Perfluoropentanoic acid	12 M	2.0	1.0	1.0 ng/L	03/31/21 13:49	1
Perfluorotetradecanoic acid	<1.0 UJ	2.0	1.0	1.0 ng/L	03/31/21 13:49	1
Perfluorotridecanoic acid	<1.0 UJ	2.0	1.0	1.0 ng/L	03/31/21 13:49	1

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Client: ARCADIS U.S., Inc. Job ID: 410-33396-1

Project/Site: Aberdeen Proving Ground PFAS S1

Client Sample ID: APG-WES-M21-032021

Lab Sample ID: 410-33396-5

Date Collected: 03/20/21 09:45 **Matrix: Water** Date Received: 03/23/21 18:20

Analyte	Res	ult Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluoroundecanoic acid	<	1.0	2.0	1.0	1.0	ng/L	03/31/21 13:49	1
Isotope Dilution	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	86		50 - 150			03/30/21 18:47	03/31/21 13:49	1
M2-8:2 FTS	70		50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C2 PFTeDA	49	*5-	50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C3 PFBS	57		50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C4 PFBA	41	*5-	50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C4 PFHpA	70		50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C5 PFPeA	58		50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C8 PFOA	70		50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C8 PFOS	65		50 - 150			03/30/21 18:47	03/31/21 13:49	1
d3-NMeFOSAA	45	*5-	50 - 150			03/30/21 18:47	03/31/21 13:49	1
d5-NEtFOSAA	47	*5-	50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C2-PFDoDA	46	*5-	50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C3 PFHxS	69		50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C5 PFHxA	64		50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C6 PFDA	59		50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C7 PFUnA	53		50 - 150			03/30/21 18:47	03/31/21 13:49	1
13C9 PFNA	65		50 - 150			03/30/21 18:47	03/31/21 13:49	1

Eurofins Lancaster Laboratories Env, LLC



Aberdeen Proving Ground – Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl Substances (PFAS) Analyses SDG # 410-37146-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

Report # 41360R

Review Level: Stage 3/4 Project: 30001996.3BX50

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # 410-37146-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

Sample ID	LabilD	Bartuine	Sample Collection	Parent Sample	Aı	Analysis		
Sample ID	Lab ID	Matrix	Date	Parent Sample	PFAS	тос	рН	
APG-BLDG-E5005-1-GW-042221	410-37146-1	Water	4/22/2021		Х			
APG-BLDG-E5005-1-SO-042221	410-37146-2	Soil	4/22/2021		Х			
APG-BLDG-E5005-2-SO-042221	410-37146-3	Soil	4/22/2021		Х			
APG-BLDG-E5005-3-SO-042221	410-37146-4	Soil	4/22/2021		Х			
APG-SB-2-042221	410-37146-5	Water	4/22/2021		Х			

Notes:

- 1. Stage 4 validation was performed on sample APG-BLDG-E5005-2-SO-042221.
- 2. Matrix spike / Matrix spike duplicate (MS/MSD) analysis was not performed on sample location associated with this SDG.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

	Rep	orted	Performance Acceptable		Not
Items Reviewed	No	Yes	No	Yes	Required
Sample receipt condition		Х		X	
Requested analyses and sample results		Х		X	
Master tracking list		Х		X	
4. Methods of analysis		Х		X	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		Х	
11. Narrative summary of QA or sample problems provided		Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

1. The samples APG-IDW-WW-1 and APG-IDW-SO-1 were listed on chain of custody. These sample results were reported in lab report 410-37160.

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.1.1 and 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Compound considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified 537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with CCV %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Isotopically labeled Standards

5.1 Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
APG-BLDG-E5005-1-	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
SO-042221	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 50% but > 20%

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
. 4500/	Non-detect	No Action
> 150%	Detect	J-
.500/ 1. 1. 000/	Non-detect	UJ
< 50% but > 20%	Detect	J+
000/	Non-detect	UX
< 20%	Detect	X

5.2 Injection Internal Standards

Injection internal standards must be added to the aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. When an ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.

All internal standard responses were within control limits.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be ≤ 30%.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

The MS/MSD analysis was not performed on sample location associated with this SDG.

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

A field duplicate was not collected for a sample location associated with this SDG.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

All identified compounds met method criteria.

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Rep	oorted		rmance eptable	Not Required
	No	Yes	No	Yes	Required
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC	MS/MS)			
Stage 2 Validation					
Holding times		Х		Х	
Reporting limits (units)		Х		Х	
Blanks					
A. Method blanks		X		Х	
B. Equipment blanks	Х				Х
C. Source blanks		Х		Х	
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate (LCSD) %R		Х		Х	
LCS/LCSD Precision (RPD)		Х		Х	
Matrix Spike (MS) %R	Х				Х
Matrix Spike Duplicate (MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				Х
Field Duplicate (RPD)	Х				Х
Extracted Internal Standard %R		Х	Х		
Injection Internal Standard %R		Х		Х	
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation		ı			
Instrument tune and performance check		Х		Х	
Initial calibration %RSDs		Х		Х	
Continuing calibration %Ds		Х		Х	
Instrument sensitivity check		Х		Х	
Ion transitions used		Х		Х	
Compound identification and quantitation	1	1		1	1
A. Reconstructed ion chromatograms		Х		Х	
B. Quantitation Reports		Х		Х	
RT of sample compounds within the established RT windows		Х		Х	

PFAS: 537M/DoD QSM 5.3	Rep	oorted		mance ptable	Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROME	TRY (LC	MS/MS)			
D. Ion Ratio %R		Х		Х	
E. Transcription/calculations acceptable		Х		Х	
F. Reporting limits adjusted to reflect sample dilutions		х		Х	

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE:

DATE: May 18, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: June 3, 2021

Stage 3 / 4 PFAS Calibration Standards

SDG #:410-37146-1Date:5/18/2021Lab:Eurofins LancasterPage:1Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 29347

PFOS 4/27/2021 Calibration

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Match Match Match Match Match Match Match

	1456 750 755 01550 115 57 115 1									
Cal Conc					Calculated		Calc		Calculated	Reported
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D
0.1851	105782	4567586	9.565	0.023159	1.1967504	1.0568	0.209613	0.1851	13.243	13.2
0.46275	247647	4572168	9.565	0.054164	1.1195653	1.0568	0.490234	0.46275	5.939	5.9
1.851	961549	4422834	9.565	0.217406	1.1234386	1.0568	1.967718	1.851	6.306	6.3
7.404	3131270	3888004	9.565	0.805367	1.0404288	1.0568	7.289303	7.404	-1.549	-1.5
18.51	8781415	4240475	9.565	2.070856	1.0701103	1.0568	18.74313	18.51	1.259	1.3
46.275	18512854	4223575	9.565	4.383219	0.9060073	1.0568	39.67211	46.275	-14.269	-14.3
92.55	36279476	3984169	9.565	9.105908	0.9410914	1.0568	82.41674	92.55	-10.949	-10.9
	•	•						•		•

Avg RF = 1.0567703 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

 SDG #:
 410-37146-1
 Date:
 5/18/2021

 Lab:
 Eurofins Lancaster
 Page:
 2

Project: Aberdeen Proving Ground Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-119466/9 4/27/2021 12:27

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	Analyte					Calc		Calculated	Reported
Analyte	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluoropentanoic acid	644572	3165916	10	0.2036	1.0270	1.982	2	-0.88	-0.9
Perfluorohexanoic acid	615425	3951467	10	0.1557	0.8612	1.808	2	-9.58	-9.6
Perfluoroheptanoic acid	776228	3475935	10	0.2233	1.1200	1.994	2	-0.31	-0.3
Perfluorooctanoic acid	730753	4181822	10	0.1747	0.9046	1.932	2	-3.41	-3.4
Perfluorooctanesulfonic acid	749384	4201064	9.57	0.1784	1.0570	1.615	2	-15.44	-15.6
Perfluorononanoic acid	657053	3808288	10	0.1725	0.9553	1.806	2	-9.70	-9.7

Match Match Match Match Match

Match

CCVIS 410-120060/1 4/28/2021 13:07

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	Analyte					Calc		Calculated	Reported
Analyte	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
Perfluoropentanoic acid	168494	3557133	10	0.0474	1.0270	0.461	0.5	-7.75	-7.8
Perfluorohexanoic acid	208106	4576635	10	0.0455	0.8612	0.528	0.5	5.60	5.6
Perfluoroheptanoic acid	229663	3938266	10	0.0583	1.1200	0.521	0.5	4.14	4.2
Perfluorooctanoic acid	218565	4639391	10	0.0471	0.9046	0.521	0.5	4.16	4.2
Perfluorooctanesulfonic acid	239845	4457704	9.57	0.0538	1.0570	0.487	0.46	5.21	5.2
Perfluorononanoic acid	213442	4113826	10	0.0519	0.9553	0.543	0.5	8.62	8.6

Match Match Match Match Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS LCS

 $\begin{array}{c|ccccc} SDG \# & 410\text{-}37146\text{-}1 & Date: & 5/18/2021 \\ Lab: & \hline{Eurofins Lancaster} & Page: & 3 \\ \hline Project: & Aberdeen Proving Ground & Validated by: & SPR \\ \end{array}$

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-119816/2-B

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Final volume = 4ml; Weight = 1.00 gm; TS = 100%

Extract: 2 mls concentrated to 1 ml

						Calculated	Dry Weight		Calculated	Reported	
						Amount	Value	True Value	Percent	Percent	
Analyte	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mg/kg	mg/kg	Recovery	Recovery	
Perfluoropentanoic acid	3195118	2520352	10	1.267727	1.0270	24.69	0.0247	0.025	98.75	99	Match
Perfluorohexanoic acid	3705649	3338689	10	1.109911	0.8612	25.78	0.0258	0.025	103.10	103	Match
Perfluoroheptanoic acid	4407313	2980634	10	1.47865	1.1200	26.40	0.0264	0.025	105.62	106	Match
Perfluorooctanoic acid	4006225	3711178	10	1.079502	0.9046	23.87	0.0239	0.025	95.47	95	Match
Perfluorooctanesulfonic acid	4738805	3583111	9.57	1.322539	1.0570	23.95	0.0239	0.023	103.67	103	Match
Perfluorononanoic acid	4377119	3201882	10	1.367046	0.9553	28.62	0.0286	0.025	114.48	114	Match

LCSD 410-119816/3-B

Page 1521 - 1526 of SDG 410-37146-1

Final volume = 4ml; Weight = 1.00 gm; TS = 100%

Extract: 2 mls concentrated to 1 ml

						Calculated	Dry Weight		Calculated	Reported	
						Amount	Value	True Value	Percent	Percent	
Analyte	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mg/kg	mg/kg	Recovery	Recovery	
Perfluoropentanoic acid	3182749	2383657	10	1.335238	1.0270	26.00	0.0260	0.025	104.01	104	Match
Perfluorohexanoic acid	3729426	3188304	10	1.169721	0.8612	27.16	0.0272	0.025	108.66	109	Match
Perfluoroheptanoic acid	4875656	3146319	10	1.549638	1.1200	27.67	0.0277	0.025	110.69	111	Match
Perfluorooctanoic acid	4273108	3762836	10	1.135608	0.9046	25.11	0.0251	0.025	100.43	100	Match
Perfluorooctanesulfonic acid	5201145	3715391	9.57	1.399892	1.0570	25.35	0.0253	0.023	109.74	109	Match
Perfluorononanoic acid	4425303	3376564	10	1.310594	0.9553	27.44	0.0274	0.025	109.75	110	Match

Analyte		LCSD Calc Amount	RPD	Reported RPD
Perfluoropentanoic acid	0.025	0.026	5.2	5
Perfluorohexanoic acid	0.026	0.027	5.2	5
Perfluoroheptanoic acid	0.026	0.028	4.7	5
Perfluorooctanoic acid	0.024	0.025	5.1	5
Perfluorooctanesulfonic acid	0.024	0.025	5.7	6
Perfluorononanoic acid	0.029	0.027	4.2	4

Calculated Amount ng/ml = (Peak area ratio/Avg RF) x DF x EIS concentration Calculated mg/kg = $4 \times (Calc \ amt \ ng/ml \times 0.5)$ / sample weight g) / 1000 Dry Weight Amount = [Calculated mg/kg / (TS/100)]

Stage 3 / 4 PFAS Sample Concentration

 $\begin{array}{c|cccc} \text{SDG \#:} & 410\text{-}37146\text{-}1 & \text{Date:} & 5/18/2021 \\ \text{Lab:} & \overline{\text{Eurofins Lancaster}} & \text{Page:} & 4 \\ \hline \text{Project:} & \text{Aberdeen Proving Ground} & \text{Validated by:} & \text{SPR} \\ \end{array}$

Lab ID: 410-37146-3

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-BLDG-E5005-2-SO-042221

Page 715 - 719 of SDG 410-37146-1 TS=75.6%, FV= 4ml Sample Weight=1.02 g

Extract: 2 mls concentrated to 1 ml

										_
								Calculated		
						Calculated		Amount Dry	Reported	
	Analyte					Amount	Calculated	Weight	Value	
Analyte	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mg/kg	mg/kg	mg/kg	
Perfluoropentanoic acid	122381	2594559	10	0.047168	1.0270	0.46	0.0009	0.00119	0.0012	Matc
Perfluorohexanoic acid	85078	3601363	10	0.023624	0.8612	0.27	0.0005	0.00071	0.00071 J	Matc
Perfluoroheptanoic acid	259692	3290915	10	0.078912	1.1200	0.70	0.0014	0.00183	0.0018	Matc
Perfluorooctanoic acid	289698	3874428	10	0.074772	0.9046	0.83	0.0016	0.00214	0.0021	Matc
Perfluorooctanesulfonic acid	1631503	3644522	9.57	0.447659	1.0570	4.05	0.0079	0.01051	0.01	Matc
Perfluorononanoic acid	359050	3343212	10	0.107397	0.9553	1.12	0.0022	0.00292	0.0029	Matc

Calculated Amount ng/ml = (Peak area ratio/Avg RF) x DF x EIS concentration Calculated mg/kg = $4 \times (Calc \text{ amt ng/ml } \times 0.5)$ / sample weight g) / 1000 Dry Weight Amount = [Calculated mg/kg / (TS/100)]

Stage 3 / 4 PFAS EIS

SDG #:410-37146-1Date:5/18/2021Lab:Eurofins LancasterPage:5Project:Aberdeen Proving GroundValidated by:SPR

Method: EPA modified 537 per DoD QSM 5.3

Field Sample ID: APG-BLDG-E5005-2-SO-042221 Lab ID: 410-37146-3

EIS 13C8 PFOS

REPORTED EIS %R 85

%R = 100 * EIS ConcentrationEIS TV

EIS Concentration 8.16 ng/ml Page 718 of 410-37146-1

EIS TV 9.57

%R 85.3 MATCH

Differences in %R may be due to rounding of the true value

CHAIN OF CUSTODY CORRECTED SAMPLE ANALYSIS DATA SHEETS

Chain of Custody Record

🔆 eurofin	
•	En your ment Testing
-	An grow

	15							HHI	HIMIN							_			
Client Information	Sampler Matt	hew Blo	wer		don, S	Stepho	en	410-	3714	6 Cha	in of C	ustod	у			COC No 410-19163-6763 1			
Client Contact Mr Dale Lynch / Matthew Blower	Phone (703)	-819-12	40	E-M. Ste		Gordon@eurofinset.com				MD	0			F	Page Page 1 of 2				
Company ARCADIS U.S. Inc			PWSID			Analysis Requested							Job#						
Address	Due Date Reques	ted:			(A)			II		Í							Preservation Co	des:	
7550 Teague Road Suite 210	4/30/21					- 1			- 1							200	A - HCL	M - Hexa	ine
City Hanover	TAT Requested (c	lays):					FAS										B - NaOH C - Zn Acetate	N - None O - AsNa	•
State, Zip MD, 21076	Compliance Project: Δ Yes Δ No					4s	24 P										D - Nitric Acid E - NaHSO4	P - Na20 Q - Na2S	
Phone.	PO#	DA (C)				24 PF	B-15										F - MeOH G - Amchlor	R - Na2S S - H2SC	
Email	D18-218 PFAS	PA/SI			2	9	Table										H - Ascorbic Acid I - Ice	T - TSP [U - Aceto	Dodecahydrate one
dale lynch@arcadis com Project Name	30001993.3CH Project#	20	·		(Yes or N	ble B	45.1										J - DI Water K - EDTA	V - MCA/ W - pH 4	
Aberdeen Proving Ground	41005401				<u> </u>	1.5 Ta	100									dain	L - EDA	Z - other	(specify)
Site	SSOW#				Samp	OSM	(MOD									of cor	Other:		
Sample Identification	Sample Date	Sample Time		Matrix (Wewster, Sesolid, Oewaste/oil, BTeTissue, A-Air	Fight Filtaned 8	PFC_IDA_D5.3 - QSM5.1 Table B-16- 24 PFAS	Z PFC_IDA_D5.3 - (MOD) QSM5.1 Table B-15- 24 PFAS		7		300					X Total Number	Special I	nstruction	ns/Note:
APG-IDW-WW-1 APG-IDW-50-1	4/22/21	11:05	C	Solid	T	X										1			
7(10 2000 0000 77(10 0000				Solid			-		+	-							•		
APG-IDW-WW-1	4/22/21	11:05	C	Water		X										2			
				Water	++	+	1		-	+	-	+		-	-	-			
APG-BLDG-E5005-1-6W-042221	4/22/21	10:05	G	Water		X										3	Run as sep	ante j	iob
APG-BLDG-E5005-1-50-042221	4/22/21	09:45	E	Soil	Ш	X													
APG- BLDG-E5005-2-50-042221	4/22/21	09:00	6	Soil		X										2			
APG-BLDG-E5005-3-50-042221	4/22/21	08.45	C	Soil		X										21			
APG-5B-2-042221	4/22/21	10:15	G	Water	П	X										2	4	,	
Possible Hazard Identification	E				S					e may	be ass	essec	if san	nples a			d longer than		
Non-Hazard Flammable Skin Imitant Pois Deliverable Requested: I, II, III, IV, Other (specify)	son B Unkr	nown - I	Radiologica	1	- 5			n To C		Requir	Dis	posal	By Lab		A	rchiv	re For	Monti	hs
		In-t-					111311	uction	3/40	requii	CITICILE		h - d - d C					_	
Empty Kit Relinquished by Relinquished by	Date/Time /	Date		Companyo	Time		ceived I	by				Met	hod of S	Date/Time		_		Company	v
Jour	4/21/21	12:	35 E	Company 1			ceived	RI	A	17.	25			4/21	121	17:	25	Arcad	is
Relinquished by	Date/Time 4/22/21	18:15	5	Arcaelis			ceived !	1		VI				Date/Time	4/r	<u> 3/</u>	21 15:00		
Relinquished by	Date Trime	21 1	7:30	Company	LE	Rec	cerved I	by	-	-2				Date/Time	3-2	1	1753	Company	É
Custody Seals Intact: Custody Seal No.:						Cod	oler Ter	mperatu	re(s) °C	and Ot	ner Rem	arks					1.9-2	.50	

5/4/2021

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-37146-1

Project/Site: Aberdeen Proving Ground

Qualifiers

1	\sim	N/A	C
ш	U	IV	J

Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
M	Manual integrated compound.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Foo	Dilution Factor

Dil Fac	Dilution Factor

DL	_	Detec	tion L	.imit	(Do	טט	/D	OI	=)

DL, RA, RE, IN Indicate	s a Dilution, Re-analysis,	Re-extraction,	or additional Initial	metals/anion analysis	of the sample
-------------------------	----------------------------	----------------	-----------------------	-----------------------	---------------

DLC	Decision L	_evel C	concentra	ation (F	Radiocl	nemist	ry)
-----	------------	---------	-----------	----------	---------	--------	-----

EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)

EPA recommended "Maximum Contaminant Level" MCL MDA Minimum Detectable Activity (Radiochemistry) Minimum Detectable Concentration (Radiochemistry) MDC

MDL Method Detection Limit ML Minimum Level (Dioxin) MPN Most Probable Number Method Quantitation Limit MQL

NC Not Calculated

Not Detected at the reporting limit (or MDL or EDL if shown) ND

Negative / Absent NEG POS Positive / Present

PQL **Practical Quantitation Limit**

PRES Presumptive QC **Quality Control**

RER Relative Error Ratio (Radiochemistry)

RLReporting Limit or Requested Limit (Radiochemistry)

Relative Percent Difference, a measure of the relative difference between two points **RPD**

TEF Toxicity Equivalent Factor (Dioxin) **TEQ** Toxicity Equivalent Quotient (Dioxin)

TNTC Too Numerous To Count

Page 4 of 33

Job ID: 410-37146-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-E5005-1-GW-042221

Lab Sample ID: 410-37146-1 Date Collected: 04/22/21 10:05 **Matrix: Water**

Date Received: 04/23/21 17:53

Client: ARCADIS U.S., Inc.

Analyte	Result	Qualifier	L	OQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<5.3			6.6	5.3	5.3	ng/L	04/27/21 19:15	1
8:2 Fluorotelomer sulfonic acid	<2.7			4.0	2.7	2.7	ng/L	04/27/21 19:15	1
NEtFOSAA	<1.3			4.0	1.3	1.3	ng/L	04/27/21 19:15	1
NMeFOSAA	<1.6			2.7	1.6	1.6	ng/L	04/27/21 19:15	1
Perfluorobutanesulfonic acid	<1.3	M		2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluorobutanoic acid	6.1	J		6.6	5.3	5.3	ng/L	04/27/21 19:15	1
Perfluorodecanoic acid	1.5	J M		2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluorododecanoic acid	<1.3			2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluoroheptanoic acid	4.4	M		2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluorohexanesulfonic acid	22			2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluorohexanoic acid	5.4	M		2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluorononanoic acid	5.6	M		2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluorooctanesulfonic acid	67			2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluorooctanoic acid	15	M		2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluoropentanoic acid	4.9	M		2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluorotetradecanoic acid	<1.3			2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluorotridecanoic acid	<1.3			2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Perfluoroundecanoic acid	<1.3			2.7	1.3	1.3	ng/L	04/27/21 19:15	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	125		50 - 150				04/26/21 15:23	04/27/21 19:15	1
M2-8:2 FTS	129		50 - 150				04/26/21 15:23	04/27/21 19:15	1

Isotope Dilution	%Recovery Q	ualifier Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	125	50 - 150	04/26/21 15:23	04/27/21 19:15	1
M2-8:2 FTS	129	50 - 150	04/26/21 15:23	04/27/21 19:15	1
13C2 PFTeDA	93	50 - 150	04/26/21 15:23	04/27/21 19:15	1
13C3 PFBS	111	50 - 150	04/26/21 15:23	04/27/21 19:15	1
13C4 PFBA	94	50 - 150	04/26/21 15:23	04/27/21 19:15	1
13C4 PFHpA	97	50 - 150	04/26/21 15:23	04/27/21 19:15	1
13C5 PFPeA	90	50 - 150	04/26/21 15:23	04/27/21 19:15	1
13C8 PFOA	101	50 ₋ 150	04/26/21 15:23	04/27/21 19:15	1
13C8 PFOS	98	50 - 150	04/26/21 15:23	04/27/21 19:15	1
d3-NMeFOSAA	95	50 - 150	04/26/21 15:23	04/27/21 19:15	1
d5-NEtFOSAA	102	50 ₋ 150	04/26/21 15:23	04/27/21 19:15	1
13C2-PFDoDA	93	50 - 150	04/26/21 15:23	04/27/21 19:15	1
13C3 PFHxS	101	50 - 150	04/26/21 15:23	04/27/21 19:15	1
13C5 PFHxA	101	50 ₋ 150	04/26/21 15:23	04/27/21 19:15	1
13C6 PFDA	102	50 - 150	04/26/21 15:23	04/27/21 19:15	1
13C7 PFUnA	101	50 - 150	04/26/21 15:23	04/27/21 19:15	1
13C9 PFNA	99	50 ₋ 150	04/26/21 15:23	04/27/21 19:15	1

Client Sample ID: APG-BLDG-E5005-1-SO-042221

Lab Sample ID: 410-37146-2 Date Collected: 04/22/21 09:45 **Matrix: Solid** Date Received: 04/23/21 17:53 Percent Solids: 92.3

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15											
Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac				
<0.0016	0.0020	0.0016	0.0016	mg/Kg	<u></u>	04/28/21 14:10	1				
<0.0016	0.0031	0.0016	0.0016	mg/Kg	₩	04/28/21 14:10	1				
<0.00041 UJ	0.0020	0.00041	0.00041	mg/Kg	₩	04/28/21 14:10	1				
<0.00041 _{UJ}	0.0020	0.00041	0.00041	mg/Kg	₩	04/28/21 14:10	1				
<0.0016	0.0020	0.0016	0.0016	mg/Kg	₩	04/28/21 14:10	1				
<0.0016	0.0020	0.0016	0.0016	mg/Kg	₩	04/28/21 14:10	1				
<0.00041	0.00061	0.00041	0.00041	mg/Kg	₽	04/28/21 14:10	1				
	Result Qualifier <0.0016 <0.0016 <0.00041 UJ <0.00041 UJ <0.0016 <0.0016	Result Qualifier LOQ <0.0016	Result Qualifier LOQ LOD <0.0016	Result Qualifier LOQ LOD DL <0.0016	Result Qualifier LOQ LOD DL Unit <0.0016	Result Qualifier LOQ LOD DL Unit D <0.0016	Result Qualifier LOQ LOD DL Unit D 4/28/21 14:10 <0.0016				

Eurofins Lancaster Laboratories Env, LLC

Client: ARCADIS U.S., Inc. Job ID: 410-37146-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-E5005-1-SO-042221

Date Collected: 04/22/21 09:45

Lab Sample ID: 410-37146-2 **Matrix: Solid**

Date Received: 04/23/21 17:53 Percent Solids: 92.3

Method: EPA 537(Mod) - PFA Analyte	•	Qualifier	LOQ	LOD	DL	Unit I	O Analyzed	Dil Fac
Perfluorododecanoic acid	<0.00041		0.00061	0.00041	0.00041	mg/Kg	04/28/21 14:10	1
Perfluoroheptanoic acid	< 0.00041		0.00061	0.00041	0.00041	mg/Kg ∃	÷ 04/28/21 14:10	1
Perfluorohexanesulfonic acid	<0.00041	M	0.00061	0.00041	0.00041	mg/Kg →	04/28/21 14:10	1
Perfluorohexanoic acid	< 0.00041	N	0.00061	0.00041	0.00041	mg/Kg ∃	÷ 04/28/21 14:10	1
Perfluorononanoic acid	< 0.00041	•	0.00061	0.00041	0.00041	mg/Kg ∃	÷ 04/28/21 14:10	1
Perfluorooctanesulfonic acid	0.0028		0.00061	0.00041	0.00041	mg/Kg ∃	04/28/21 14:10	1
Perfluorooctanoic acid	0.00044	J M	0.00061	0.00041	0.00041	mg/Kg ∃	÷ 04/28/21 14:10	1
Perfluoropentanoic acid	< 0.00041		0.00061	0.00041	0.00041	mg/Kg ∃	÷ 04/28/21 14:10	1
Perfluorotetradecanoic acid	<0.00041		0.00061	0.00041	0.00041	mg/Kg ∃	04/28/21 14:10	1
Perfluorotridecanoic acid	< 0.00041		0.00061	0.00041	0.00041	mg/Kg ∃	÷ 04/28/21 14:10	1
Perfluoroundecanoic acid	< 0.00041		0.00061	0.00041	0.00041	mg/Kg	© 04/28/21 14:10	1
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	93		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
M2-8:2 FTS	88		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C2 PFTeDA	89		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C3 PFBS	95		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C4 PFBA	82		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C4 PFHpA	84		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C5 PFPeA	82		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C8 PFOA	91		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C8 PFOS	87 M		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
d3-NMeFOSAA	29 *5	j -	50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
d5-NEtFOSAA	35 *5	5-	50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C2-PFDoDA	80		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C3 PFHxS	87		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C5 PFHxA	84		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C6 PFDA	88		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C7 PFUnA	93		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1
13C9 PFNA	83		50 - 150			04/27/21 23:0	9 04/28/21 14:10	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		0.0021	0.0017	0.0017	mg/Kg	₩	05/03/21 14:27	1
8:2 Fluorotelomer sulfonic acid	< 0.0017		0.0031	0.0017	0.0017	mg/Kg	₩	05/03/21 14:27	1
NEtFOSAA	<0.00041		0.0021	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	1
NMeFOSAA	<0.00041		0.0021	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	1
Perfluorobutanesulfonic acid	<0.0017	M	0.0021	0.0017	0.0017	mg/Kg	₩	05/03/21 14:27	1
Perfluorobutanoic acid	< 0.0017		0.0021	0.0017	0.0017	mg/Kg	₩	05/03/21 14:27	1
Perfluorodecanoic acid	<0.00041		0.00062	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	1
Perfluorododecanoic acid	<0.00041		0.00062	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	1
Perfluoroheptanoic acid	<0.00041		0.00062	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	1
Perfluorohexanesulfonic acid	<0.00041	М	0.00062	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	1
Perfluorohexanoic acid	<0.00041	M	0.00062	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	1
Perfluorononanoic acid	<0.00041		0.00062	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	1
Perfluorooctanesulfonic acid	0.0026		0.00062	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	1
Perfluorooctanoic acid	<0.00041	M	0.00062	0.00041	0.00041	mg/Kg	3.25	05/03/21 14:27	1
Perfluoropentanoic acid	<0.00041	M	0.00062	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	1
Perfluorotetradecanoic acid	<0.00041		0.00062	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	1
Perfluorotridecanoic acid	< 0.00041		0.00062	0.00041	0.00041	mg/Kg	₩	05/03/21 14:27	

Eurofins Lancaster Laboratories Env, LLC

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Client: ARCADIS U.S., Inc. Job ID: 410-37146-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-E5005-1-SO-042221

Lab Sample ID: 410-37146-2 Date Collected: 04/22/21 09:45 **Matrix: Solid** Date Received: 04/23/21 17:53

Percent Solids: 92.3

Analyte	Result Quali	fier LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluoroundecanoic acid	<0.00041	0.00062	0.00041	0.00041	mg/Kg	05/03/21 14:27	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	112	50 - 150			04/29/21 23:18	05/03/21 14:27	1
M2-8:2 FTS	108	50 - 150			04/29/21 23:18	05/03/21 14:27	1
13C2 PFTeDA	107	50 ₋ 150			04/29/21 23:18	05/03/21 14:27	1
13C3 PFBS	113	50 - 150			04/29/21 23:18	05/03/21 14:27	1
13C4 PFBA	85	50 - 150			04/29/21 23:18	05/03/21 14:27	1
13C4 PFHpA	98	50 - 150			04/29/21 23:18	05/03/21 14:27	1
13C5 PFPeA	87	50 - 150			04/29/21 23:18	05/03/21 14:27	1
13C8 PFOA	104	50 - 150			04/29/21 23:18	05/03/21 14:27	1
13C8 PFOS	100	50 - 150			04/29/21 23:18	05/03/21 14:27	1
d3-NMeFOSAA	38 *5-	50 - 150			04/29/21 23:18	05/03/21 14:27	1
d5-NEtFOSAA	44 *5-	50 - 150			04/29/21 23:18	05/03/21 14:27	1
13C2-PFDoDA	100	50 - 150			04/29/21 23:18	05/03/21 14:27	1
13C3 PFHxS	95	50 - 150			04/29/21 23:18	05/03/21 14:27	1
13C5 PFHxA	98	50 ₋ 150			04/29/21 23:18	05/03/21 14:27	1
13C6 PFDA	104	50 - 150			04/29/21 23:18	05/03/21 14:27	1
13C7 PFUnA	99	50 - 150			04/29/21 23:18	05/03/21 14:27	1
13C9 PFNA	100	50 - 150			04/29/21 23:18	05/03/21 14:27	1

General Chemistry Analyte Result Qualifier LOQ LOD DL Unit Analyzed **Percent Moisture** 1.0 1.0 % 04/24/21 14:43 7.7 1.0 % 04/24/21 14:43 **Percent Solids** 92.3 1.0

Client Sample ID: APG-BLDG-E5005-2-SO-042221 Lab Sample ID: 410-37146-3 Date Collected: 04/22/21 09:00 **Matrix: Solid**

Date Received: 04/23/21 17:53 Percent Solids: 75.6

Analyte	Result Qualifi	er LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0021	0.0026	0.0021	0.0021	mg/Kg	☆	04/28/21 14:20	1
8:2 Fluorotelomer sulfonic acid	<0.0021	0.0039	0.0021	0.0021	mg/Kg	☆	04/28/21 14:20	1
NEtFOSAA	<0.00052	0.0026	0.00052	0.00052	mg/Kg	☼	04/28/21 14:20	1
NMeFOSAA	<0.00052	0.0026	0.00052	0.00052	mg/Kg	☆	04/28/21 14:20	1
Perfluorobutanesulfonic acid	<0.0021	0.0026	0.0021	0.0021	mg/Kg	☼	04/28/21 14:20	1
Perfluorobutanoic acid	<0.0021	0.0026	0.0021	0.0021	mg/Kg	☆	04/28/21 14:20	1
Perfluorodecanoic acid	0.0026	0.00078	0.00052	0.00052	mg/Kg	₩	04/28/21 14:20	1
Perfluorododecanoic acid	<0.00052	0.00078	0.00052	0.00052	mg/Kg	☼	04/28/21 14:20	1
Perfluoroheptanoic acid	0.0018	0.00078	0.00052	0.00052	mg/Kg	☆	04/28/21 14:20	1
Perfluorohexanesulfonic acid	0.0012	0.00078	0.00052	0.00052	mg/Kg	₩	04/28/21 14:20	1
Perfluorohexanoic acid	0.00071 J	0.00078	0.00052	0.00052	mg/Kg	☆	04/28/21 14:20	1
Perfluorononanoic acid	0.0029	0.00078	0.00052	0.00052	mg/Kg	☼	04/28/21 14:20	1
Perfluorooctanesulfonic acid	0.010	0.00078	0.00052	0.00052	mg/Kg	☼	04/28/21 14:20	1
Perfluorooctanoic acid	0.0021 M	0.00078	0.00052	0.00052	mg/Kg	☆	04/28/21 14:20	1
Perfluoropentanoic acid	0.0012	0.00078	0.00052	0.00052	mg/Kg	₩	04/28/21 14:20	1
Perfluorotetradecanoic acid	<0.00052	0.00078	0.00052	0.00052	mg/Kg	₩	04/28/21 14:20	1
Perfluorotridecanoic acid	< 0.00052	0.00078	0.00052	0.00052	mg/Kg	₩	04/28/21 14:20	1
Perfluoroundecanoic acid	0.0013	0.00078	0.00052	0.00052	mg/Kg	₩	04/28/21 14:20	1

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Page 9 of 33 5/4/2021 Client: ARCADIS U.S., Inc. Job ID: 410-37146-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-BLDG-E5005-2-SO-042221

Date Collected: 04/22/21 09:00 Date Received: 04/23/21 17:53 Lab Sample ID: 410-37146-3

Matrix: Solid

Percent Solids: 75.6

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	97	50 - 150	04/27/21 23:09	04/28/21 14:20	1
M2-8:2 FTS	99	50 - 150	04/27/21 23:09	04/28/21 14:20	1
13C2 PFTeDA	91	50 ₋ 150	04/27/21 23:09	04/28/21 14:20	1
13C3 PFBS	97	50 - 150	04/27/21 23:09	04/28/21 14:20	1
13C4 PFBA	77	50 ₋ 150	04/27/21 23:09	04/28/21 14:20	1
13C4 PFHpA	87	50 - 150	04/27/21 23:09	04/28/21 14:20	1
13C5 PFPeA	77	50 - 150	04/27/21 23:09	04/28/21 14:20	1
13C8 PFOA	92	50 ₋ 150	04/27/21 23:09	04/28/21 14:20	1
13C8 PFOS	85	50 - 150	04/27/21 23:09	04/28/21 14:20	1
d3-NMeFOSAA	69	50 ₋ 150	04/27/21 23:09	04/28/21 14:20	1
d5-NEtFOSAA	80	50 - 150	04/27/21 23:09	04/28/21 14:20	1
13C2-PFDoDA	82	50 - 150	04/27/21 23:09	04/28/21 14:20	1
13C3 PFHxS	87	50 - 150	04/27/21 23:09	04/28/21 14:20	1
13C5 PFHxA	88	50 ₋ 150	04/27/21 23:09	04/28/21 14:20	1
13C6 PFDA	87	50 - 150	04/27/21 23:09	04/28/21 14:20	1
13C7 PFUnA	92	50 - 150	04/27/21 23:09	04/28/21 14:20	1
13C9 PFNA	84	50 - 150	04/27/21 23:09	04/28/21 14:20	1

General Chemistry

M2-8:2 FTS

13C2 PFTeDA

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac
Percent Moisture	24.4	1.0		1.0 %		04/24/21 14:43	1
Percent Solids	75.6	1.0		1.0 %		04/24/21 14:43	1

Client Sample ID: APG-BLDG-E5005-3-SO-042221

Date Collected: 04/22/21 08:45 Date Received: 04/23/21 17:53

Lab Sample ID: 410-37146-4

Matrix: Solid Percent Solids: 82.3

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg 🛱	04/28/21 14:31	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0033	0.0018	0.0018	mg/Kg ☆	04/28/21 14:31	1
NEtFOSAA	<0.00045		0.0022	0.00045	0.00045	mg/Kg ☆	04/28/21 14:31	1
NMeFOSAA	<0.00045		0.0022	0.00045	0.00045	mg/Kg ♯	04/28/21 14:31	1
Perfluorobutanesulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg ☆	04/28/21 14:31	1
Perfluorobutanoic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg ☆	04/28/21 14:31	1
Perfluorodecanoic acid	0.00060	JM	0.00067	0.00045	0.00045	mg/Kg ☆	04/28/21 14:31	1
Perfluorododecanoic acid	<0.00045		0.00067	0.00045	0.00045	mg/Kg ☆	04/28/21 14:31	1
Perfluoroheptanoic acid	<0.00045		0.00067	0.00045	0.00045	mg/Kg ☆	04/28/21 14:31	1
Perfluorohexanesulfonic acid	0.0018		0.00067	0.00045	0.00045	mg/Kg ☆	04/28/21 14:31	1
Perfluorohexanoic acid	<0.00045	M	0.00067	0.00045	0.00045	mg/Kg ☆	04/28/21 14:31	1
Perfluorononanoic acid	0.00048	J,	0.00067	0.00045	0.00045	mg/Kg ⇔	04/28/21 14:31	1
Perfluorooctanesulfonic acid	0.0093		0.00067	0.00045	0.00045	mg/Kg ☆	04/28/21 14:31	1
Perfluorooctanoic acid	0.00052	J M	0.00067	0.00045	0.00045	mg/Kg ⇔	04/28/21 14:31	1
Perfluoropentanoic acid	0.00046	J M	0.00067	0.00045	0.00045	mg/Kg ⇔	04/28/21 14:31	1
Perfluorotetradecanoic acid	<0.00045		0.00067	0.00045	0.00045	mg/Kg ☆	04/28/21 14:31	1
Perfluorotridecanoic acid	0.00054	J	0.00067	0.00045	0.00045	mg/Kg ⇔	04/28/21 14:31	1
Perfluoroundecanoic acid	0.0011		0.00067	0.00045	0.00045	mg/Kg ⇔	04/28/21 14:31	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	93		50 - 150			04/27/21 23:09	04/28/21 14:31	1

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04/27/21 23:09 04/28/21 14:31

04/27/21 23:09 04/28/21 14:31

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50 - 150

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93

95

Job ID: 410-37146-1 Client: ARCADIS U.S., Inc.

Project/Site: Aberdeen Proving Ground

13C5 PFHxA

13C6 PFDA

13C7 PFUnA

13C9 PFNA

Client Sample ID: APG-BLDG-E5005-3-SO-042221 Lab Sample ID: 410-37146-4

85

88 97

86

Date Collected: 04/22/21 08:45 **Matrix: Solid** Date Received: 04/23/21 17:53 Percent Solids: 82.3

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 PFBS	93	50 - 150	04/27/21 23:09	04/28/21 14:31	1
13C4 PFBA	82	50 - 150	04/27/21 23:09	04/28/21 14:31	1
13C4 PFHpA	86	50 - 150	04/27/21 23:09	04/28/21 14:31	1
13C5 PFPeA	79	50 - 150	04/27/21 23:09	04/28/21 14:31	1
13C8 PFOA	93	50 - 150	04/27/21 23:09	04/28/21 14:31	1
13C8 PFOS	89	50 - 150	04/27/21 23:09	04/28/21 14:31	1
d3-NMeFOSAA	52	50 - 150	04/27/21 23:09	04/28/21 14:31	1
d5-NEtFOSAA	66	50 - 150	04/27/21 23:09	04/28/21 14:31	1
13C2-PFDoDA	77	50 - 150	04/27/21 23:09	04/28/21 14:31	1
13C3 PFHxS	90	50 - 150	04/27/21 23:09	04/28/21 14:31	1

General Chemistry Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	17.7		1.0		1.0	%		04/24/21 14:43	1
Percent Solids	82.3		1.0		1.0	%		04/24/21 14:43	1

50 - 150

50 - 150

50 - 150

50 - 150

Client Sample ID: APG-SB-2-042221 Lab Sample ID: 410-37146-5

Date Collected: 04/22/21 10:15 **Matrix: Water** Date Received: 04/23/21 17:53

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.6		4.5	3.6	3.6	ng/L		04/27/21 19:26	1
8:2 Fluorotelomer sulfonic acid	<1.8		2.7	1.8	1.8	ng/L		04/27/21 19:26	1
NEtFOSAA	<0.89		2.7	0.89	0.89	ng/L		04/27/21 19:26	1
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L		04/27/21 19:26	1
Perfluorobutanesulfonic acid	<0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluorobutanoic acid	<3.6		4.5	3.6	3.6	ng/L		04/27/21 19:26	1
Perfluorodecanoic acid	<0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluorododecanoic acid	<0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluoroheptanoic acid	< 0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluorohexanesulfonic acid	<0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluorohexanoic acid	<0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluorononanoic acid	< 0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluorooctanesulfonic acid	<0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluorooctanoic acid	<0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluoropentanoic acid	<0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluorotetradecanoic acid	<0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluorotridecanoic acid	<0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1
Perfluoroundecanoic acid	<0.89		1.8	0.89	0.89	ng/L		04/27/21 19:26	1

Isotope Dilution	%Recovery Qual	ifier Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	121	50 - 150	04/26/21 15:23	04/27/21 19:26	1
M2-8:2 FTS	121	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C2 PFTeDA	103	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C3 PFBS	105	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C4 PFBA	98	50 - 150	04/26/21 15:23	04/27/21 19:26	1

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04/27/21 23:09 04/28/21 14:31

04/27/21 23:09 04/28/21 14:31

04/27/21 23:09 04/28/21 14:31

04/27/21 23:09 04/28/21 14:31

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Client: ARCADIS U.S., Inc. Job ID: 410-37146-1

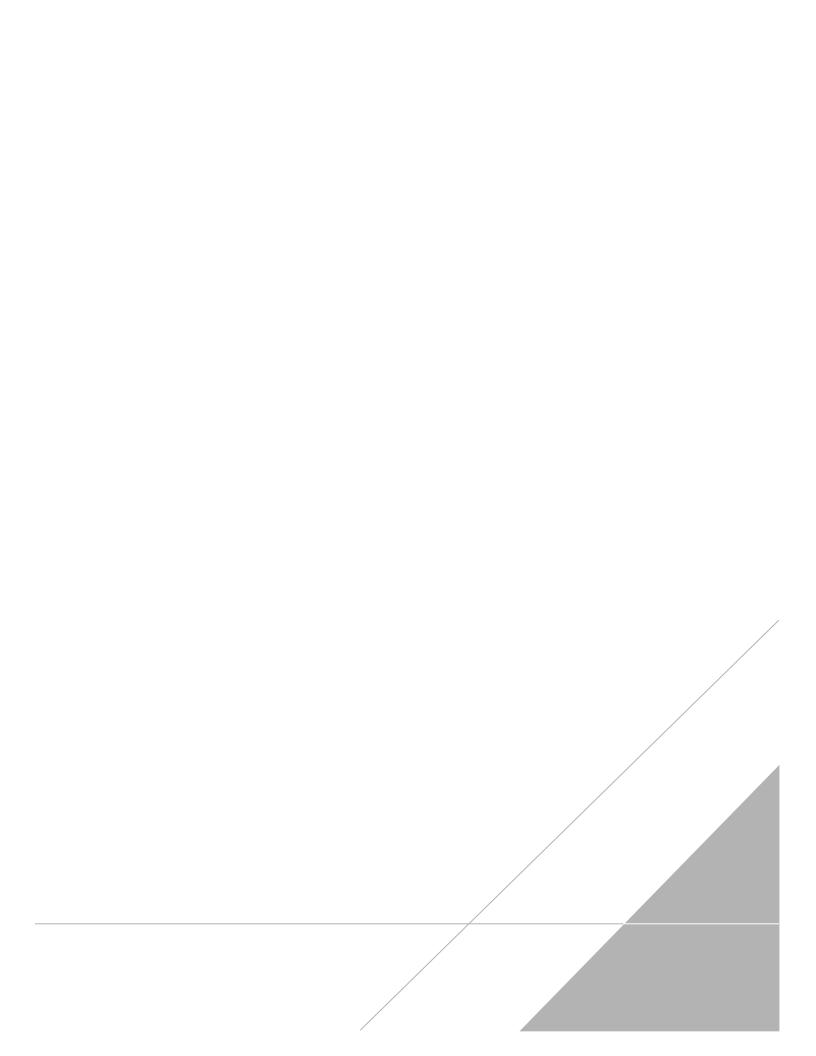
Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-SB-2-042221

Lab Sample ID: 410-37146-5 Date Collected: 04/22/21 10:15 **Matrix: Water**

Date Received: 04/23/21 17:53

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFHpA	100	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C5 PFPeA	95	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C8 PFOA	103	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C8 PFOS	97	50 - 150	04/26/21 15:23	04/27/21 19:26	1
d3-NMeFOSAA	94	50 - 150	04/26/21 15:23	04/27/21 19:26	1
d5-NEtFOSAA	108	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C2-PFDoDA	98	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C3 PFHxS	95	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C5 PFHxA	104	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C6 PFDA	107	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C7 PFUnA	106	50 - 150	04/26/21 15:23	04/27/21 19:26	1
13C9 PFNA	99	50 ₋ 150	04/26/21 15:23	04/27/21 19:26	1





USACE Baltimore PFAS PA/SI Aberdeen Proving Ground, Maryland

DATA USABILITY SUMMARY REPORT

December 2021-January 2022 Sampling Event

March 22, 2022

DATA USABILITY SUMMARY REPORT

December 2021-January 2022 Sampling Event

Prepared for:

U.S. Army Environmental Command
U.S. Army Corps of Engineers Baltimore District
Aberdeen Proving Ground, Maryland

Program Chemist

Good le hood

Lyndi Mott

Prepared by:

Arcadis U.S., Inc.

10205 Westheimer Road

Suite 800

Houston

Texas 77042

Tel 713 953 4800

Our Ref.:

Contract W912DR-13-D-0019 Arcadis Project: 30001975

Date: March 22, 2022

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TABLES

Table 1. Data Usability Summary Table

ATTACHMENTS

Arcadis Data Validation Reports

ACRONYMS AND ABBREVIATIONS

%D percent difference

%R percent recovery

APG Aberdeen Proving Ground

Arcadis U.S., Inc.

DoD Department of Defense

DUA data usability assessment

DUSR data usability summary report

DVR data validation report

EIS extracted internal standards

ELAP Environmental Laboratory Approval Program

ELLE Eurofins Lancaster Laboratories Environmental

ICV/CCV initial calibration verification/continuing calibration verification

LCS/LCSD laboratory control sample/laboratory control sample duplicate

LOQ limit of quantitation

MS/MSD matrix spike/matrix spike duplicate

NELAP National Environmental Laboratory Accreditation Program

PFAS per/polyfluoroalkyl substances

PQAPP Programmatic Uniform Federal Policy-Quality Assurance Project Plan

QAPP Quality Assurance Project Plan

QC quality control

QSM Quality System Manual

RPD relative percent difference

SDG sample delivery group

TOC total organic carbon

USDOD United States Department of Defense

USEPA United States Environmental Protection Agency

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EXECUTIVE SUMMARY

This Data Usability Summary Report (DUSR) for Aberdeen Proving Ground (APG) Edgewood located Maryland for the December 2021 through January 2022 sampling event describes the findings of the data review and validation and is provided to document the quality of the analytical data used for project decisions. A Data Usability Summary Table at the end of this DUSR lists the data that was qualified and the reason for qualification. Only the sample locations associated with this site and sampling event in the associated laboratory data packages and data validation reports are addressed in this report. The text below adds details where further discussion is warranted. The project-specific sampling and analysis, overall quality control (QC), and quality assurance protocols are presented in the Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP Arcadis 2019), and the Uniform Federal Policy-Quality Assurance Project Plan Addendum for Aberdeen Proving Ground, Maryland (QAPP Addendum Arcadis 2021).

Samples were shipped to Eurofins Lancaster Laboratory Environmental (ELLE) located in Lancaster, Pennsylvania for analysis. ELLE is a United States Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) and National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory. The analytical sample delivery groups (SDGs) and associated Arcadis validation reports are listed in the table below. Summaries of the sample IDs and their associated laboratory IDs, SDGs, sampling dates, and analyses performed are provided in the laboratory reports and data validation reports (DVRs). Note the result pages in the DVRs may have a red line through specific or all compounds to indicate those results are not reportable. Results will be reported from either the initial, diluted, or re-extracted analysis.

In accordance with the project QAPP data review requirements, Stage 3, and 10 percent Stage 4 validation of the analytical data was performed by Arcadis project chemists that are independent of the project team. The validation was performed in accordance with the guidelines and control criteria specified in the following documents:

USDOD. Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 May 2019.

USDOD. DoD General Data Validation Guidelines, November 2019.

USDOD. DoD Final Data Validation Guidelines Module 3: PFAS, May 2020.

Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP Arcadis 2019).

The laboratory data packages and validation reports that were reviewed for this DUSR are listed below.

Sample Delivery Groups (SDG)	Validation Report	Matrix	Parameters	Validation Level
410-67825-1 410-71439-1	44619R	Soil/ Water	PFAS, TOC, Soil pH	Stage 3: 13 field samples 2 field duplicates Stage 4: 1 field sample

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PRECISION

Precision is expressed as a relative percent difference (RPD) between the results of replicate sample analyses: sample duplicates, laboratory control sample duplicates (LCSDs), and matrix spike duplicates (MSDs). The RPD limit for LCSDs and MSDs is 30 percent. Field duplicates were collected at a frequency of 5 percent. Unless documented below or in the Data Usability Summary table, the RPD between the parent samples and associated field duplicates were within acceptable limits of 35 percent for water matrix and 50 percent for soil matrix.

Groundwater sample APG-ATC2-1-GW-121521 was identified as the parent sample to field duplicate APG-FD-1-GW-121521. The evaluation of the parent sample and field duplicate indicate precision was within criteria of 35 percent RPD.

Soil sample APG-S1A-1-SO-(0.5-2)-121621 was identified as the parent sample to field duplicate APG-FD-1-SO-121621. The evaluation of the parent sample and field duplicate indicate precision was within criteria of 50 percent RPD.

ACCURACY

Accuracy is demonstrated by recovery of target analytes from fortified blank and sample matrices, LCS/LCSDs and MS/MSDs, respectively. The recovery of target analytes from fortified samples is compared to acceptance criteria. The criteria are listed in DoD QSM 5.3 Appendix C, Table C-44 and C-45. The criteria for EIS recoveries are 50 to 150 percent. In addition, Stage 4 validation of initial and continuing calibration results provide information on analytical accuracy. Unless documented below or in the Data Usability Summary table, the recoveries of LCS, MS/MSD, and extracted internal standards (EIS), and calibration criteria, were within acceptable limits.

REPRESENTATIVENESS

Representativeness is the degree to which sample data accurately and precisely represent site conditions and is dependent on sampling and analytical variability and the variability (or homogeneity) of the site itself. The use of the prescribed field and laboratory analytical methods with associated holding times and preservation requirements are intended to provide representative data.

All samples were collected in accordance with the procedures and sampling plan specified in the site QAPP and field SOPs. However, for the samples collected in December 2021, the transfer of samples from the field crew to the lab courier was delayed due to miscommunication. The field crew released the samples on 12/16/2021 as noted on the chain of custody (COC) and anticipated the lab courier would pick them up the next day on 12/17/2021. The field crew discovered the coolers were still in the office on Monday morning, 12/20/2021. More ice was added to the coolers at that time. The lab courier picked up the coolers on 12/21/2021 and delivered them to the lab. The lab noted that when the samples were received that the ice had melted, and the sample temperatures were recorded at 18.8°C and 19.9°C. All results for associated samples are qualified as estimated as noted in the Data Usability Summary Table. The samples collected in January 2022 were collected and submitted to the laboratory for analysis in accordance with the procedures and sampling plan specified in the site QAPP and field SOPs.

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Analysis of samples was in accordance with the USACE PFAS PA/SI PQAPP, DoD QSM, and laboratory SOPs. All hold times were met except for soil pH as noted in the Data Usability Summary Table.

SENSITIVITY

Sensitivity describes the relationship between the laboratory quantitation limits and the project action limits. Reported laboratory quantitation limits are compared to the project detection limits to ensure that the analytical methods are capable of quantifying target analytes to a level that would satisfy DQOs.

The detection limits for the soil samples were elevated due to correction for percent moisture.

COMPLETENESS

The completeness for this data set met the criteria of 90 percent. No results were qualified as potentially unusable with an "X" qualifier.

CONCLUSIONS

The overall assessment of the field samples, QA/QC data review by manual validation of the December 2021 through January 2022 data set from APG Edgewood met project requirements and completeness goals. Based upon the Stage 3 and Stage 4 data validation, all results are considered valid and usable. The results that are qualified as estimated are usable with caution. As the goal of these sampling events is to determine the presence or absence of PFAS, the detections are valid, but the reported concentration may be biased. If the data is evaluated against screening criteria, qualified results at or near the screening criteria should be evaluated considering the possible bias in the reported results.

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DATA USABILITY SUMMARY TABLE Aberdeen Proving Ground Edgewood; December 2021-January 2022 Sampling Event

Sample Locations	Compound	Qualifier	Reason
APG-ATC-1-SO-(0.5-2)-121621 APG-S1A-1-SO-(0.5-2)-121621	All target PFAS compounds	UJ non- detects J detects	Temperature Exceedance.
APG-E4-1-SO-(0.5-2)-121621	N-MeFOSAA N-EtFOSAA	UJ	Extracted Internal Standard (EIS) %R less than 50%
APG-FD-1-SO-(0.5-2)-121621	All target PFAS compounds	UJ non- detects J detects	Temperature Exceedance.
APG-S3-1-SO-(0.5-2)-121621	N-MeFOSAA	UJ	EIS %R less than 50%
APG-S3-1-GW-121521	All target PFAS compounds	UJ non- detects J detects	Temperature Exceedance.
	Perfluorooctanesulfonic acid	J	Ion Ratio %R > 150%
APG-ATC1-1-GW-121521 APG-ATC2-1-SO-(0.5-2)-121621 APG-ATC2-1-GW-121521 APG-S1A-1-GW-121521 APG-FD-1-GW-121521 APG-E3-1-SO-(0.5-2)-121621 APG-E3-1-GW-121621 APG-E4-1-GW-121621 APG-FB-1-121621	All target PFAS compounds	UJ non- detects J detects	Temperature Exceedance.
APG-ATC1-1-SO-(0.5-2)-121621 APG-ATC2-1-SO-(0.5-2)-121621	тос	J-	Temperature Exceedance.
APG-S1A-1-SO-(0.5-2)-121621 APG-S3-1-SO-(0.5-2)-121621 APG-E3-1-SO-(0.5-2)-121621 APG-E4-1-SO-(0.5-2)-121621	рН	J	Temperature and hold time exceedance CCV greater than ± 0.05 SU

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however, the reported concentration is estimated due to non-conformances discovered during data validation.
- J+ (Estimated; may be biased high): The compound or analyte was analyzed for and positively identified by the laboratory; however, the reported concentration is estimated due to non-conformances discovered during data validation and may be biased high.
- J- (Estimated; may be biased low): The compound or analyte was analyzed for and positively identified by the laboratory; however, the reported concentration is estimated due to non-conformances discovered during data validation and may be biased low.
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however, the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.





Aberdeen Proving Ground – Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perf Iuoroalkyl Substances (PFAS), Total Organic Carbon, and Soil pH Analyses SDGs # 410-67825-1 and 410-71439-1

Analyses Performed By: Eurofins Lancaster Laboratories Environmental Lancaster, Pennsylvania

And

CT Laboratories Baraboo, Wisconsin

Report # 44619R

Review Level: Stage 3/4 Project: 30001975.8AC00

SUMMARY

This data quality assessment summarizes the review of Sample Delivery Groups (SDGs) # 410-67825-1 and 410-71439-1 for samples collected in association with the Aberdeen Proving Ground Edgewood Site. The review was conducted as a Stage 3/4 evaluation and included review of data package completeness. Only analytical data associated with constituents of concern were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

0 1 10		Sample Matrix Collection		2 (2)	Analysis		
Sample ID	Lab ID	Matrix	Date	Parent Sample	PFAS	тос	рН
APG-ATC1-1-SO-(0.5-2)-121621	410-67825-1	Soil	12/16/2021		Х	Х	X
APG-ATC1-1-GW-121521	410-67825-2	Water	12/15/2021		Х		
APG-ATC2-1-SO-(0.5-2)-121621	410-67825-3	Soil	12/16/2021		Х	Х	X
APG-ATC2-1-GW-121521	410-67825-4	Water	12/15/2021		Х		
APG-S1A-1-SO-(0.5-2)-121621	410-67825-5	Soil	12/16/2021		Х	Х	X
APG-S1A-1-GW-121521	410-67825-6	Water	12/15/2021		Х		
APG-FD-1-SO-(0.5-2)-121621	410-67825-7	Soil	12/16/2021	APG-S1A-1-SO-(0.5-2)- 121621	х		
APG-FD-1-GW-121521	410-67825-8	Water	12/15/2021	APG-ATC2-1-GW- 121521	х		
APG-S3-1-SO-(0.5-2)-121621	410-67825-9	Soil	12/16/2021		Х	Х	Х
APG-S3-1-GW-121521	410-67825-10	Water	12/15/2021		Х		
APG-E3-1-SO-(0.5-2)-121621	410-67825-11	Soil	12/16/2021		Х	Х	Х
APG-E3-1-GW-121621	410-67825-12	Water	12/16/2021		Х		
APG-E4-1-GW-121621	410-67825-13	Water	12/16/2021		Х		
APG-E4-1-SO-(0.5-2)-121621	410-67825-14	Soil	12/16/2021		Х	Х	Х
APG-FB-1-121621	410-67825-15	Water	12/16/2021		Х		
APG-FF3-1-GW-013122	410-71439-1	Water	1/31/2022		Х		
APG-FF2-1-GW-013122	410-71439-2	Water	1/31/2022		Х		

Notes:

- 1. Stage 4 validation was performed on sample APG-S3-1-GW-121521.
- 2. Matrix spike/matrix spike duplicate (MS/MSD) analysis was performed on sample locations APG-ATC1-1-GW-121521 and APG-E3-1-SO-(0.5-2)-121621.
- 3. Total Organic Carbon (TOC) analysis was subcontracted to CT Laboratories.

ANALYTICAL DATA PACKAGE DOCUMENTATION

The table below is the evaluation of the data package completeness.

		orted		mance ptable	Not
Items Reviewed	No	Yes	No	Yes	Required
1. Sample receipt condition		X	Х		
2. Requested analyses and sample results		Х		Х	
Master tracking list		Х		Х	
4. Methods of analysis		Х		Х	
5. Reporting limits		Х		Х	
6. Sample collection date		Х		Х	
7. Laboratory sample received date		Х		Х	
8. Sample preservation verification (as applicable)		Х		Х	
9. Sample preparation/extraction/analysis dates		Х		Х	
10. Fully executed Chain-of-Custody (COC) form		Х		Х	
11. Narrative summary of QA or sample problems pro	vided	Х		Х	
12. Data Package Completeness and Compliance		Х		Х	

Note:

QA - Quality Assurance

1. 410-67825-1: The samples were received above the temperature criteria. The laboratory recorded the sample temperatures of 18.8°C and 19.9°C. There was a delay between release of the samples on 12/16/2021 and receipt at the lab 12/21/2021. The coolers had been packed ice on 12/16/2021, however, the ice was melted when the lab received the coolers.

ORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) Modified Method 537. Data were reviewed in accordance with USEPA Method 537, ELLE SOPs T-PFAS-WI12031 and T-PFAS-WI14355, Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, DoD Final Data Validation Guidelines Module 3: PFAS, May 2020, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified, and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Per DoD General Data Validation Guidelines November 2019 Revision 1 Section 4.8 states; "The following provides a brief explanation of the DoD data validation qualifiers assigned to results during the data review process by a data validator. The reviewer should use these qualifiers, as applicable, unless other data qualifiers are specified in a project related document, such as a QAPP. If other qualifiers are used, a complete explanation of those qualifiers should accompany the data validation report." Below are the qualifier codes that may be applied in this validation report:

Concentration (C) Qualifiers

- U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
- B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.

Quantitation (Q) Qualifiers

- E The compound was quantitated above the calibration range.
- D Concentration is based on a diluted sample analysis.

Validation Qualifiers

- J The reported result was an estimated value with an unknown bias.
- J+ The result was an estimated quantity, but the result may be biased high.
- J- The result was an estimated quantity, but the result may be biased low.
- UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
- UB Compound considered non-detect at the listed value due to associated blank contamination.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

PERFLUOROALKYL SUBSTANCES (PFAS) ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
USEPA modified 537	Water	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

The holding time has been changed from the original holding time documented in EPA 537 of 14 days for extraction to 28 days. This was documented in EPA Technical Brief EPA/600/F-17/022h Updated January 2020. Utilizing the new guidance of 28 days all samples were analyzed within the specified holding time criteria.

EPA method 537 version 1.1 states that samples submitted for PFAS analysis must not exceed 10°C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 10°C when the samples are received at the laboratory.

The analyses that exceeded the temperature preservation are presented in the following table.

Sample Locations	Temperature	Criteria
All samples associated with this SDG	17.7°C and 19.9°C	< 10°C

Sample results associated with sample locations analyzed by analytical method USEPA modified method 537 were qualified, as specified in the table below.

	Qualification		
Criteria	Detected Analytes	Non-detect Analytes	
Temperature greater than the criteria of 10°C	J	UJ	

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, instrument, and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Instrument blanks measure carryover in the instrument from one sample to another. Method blanks measure laboratory contamination. Equipment rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Mass Calibration

Mass calibration and system performance were acceptable.

4. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

4.1 Initial Calibration

The percent relative standard deviation (%RSD) of the response factors (RF) must be less than 20%, or for linear calibration, $r^2 \ge 0.99$. Analytes must be within 70-130% of their true value for each calibration standard.

All compounds associated with initial calibration, calibration standard recoveries, and initial calibration verification (ICV) standard recoveries were within the control limits.

4.2 Continuing Calibration

All target compounds associated with the continuing calibration standard must exhibit a percent difference (%D) less than the control limit of 30%.

All compounds associated with continuing calibration verification standard %D were within control limits.

4.3 Instrument Sensitivity Check (ISC)

The ISC concentration must be at the LOQ. All target compounds associated with the ISC must exhibit a percent recovery (%R) of 70 to 130%.

All compounds associated with ISC recoveries were within control limits.

4.4 Ion Transitions

Quantitation of analytes must use the ion transitions documented in DoD QSM 5.3 Table B-15.

The ion transitions were as specified in DoD QSM 5.3.

5. Extracted Internal Standards (EIS)

Labeled standards must be added to all field samples and QC samples prior to extraction. EIS recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when ICAL not performed.

Samples associated with EIS exhibiting recoveries outside of the control limits are presented in the following table.

Sample ID	EIS	Associated Compounds	%R	RE %R
APG-ATC-1-SO-(0.5-2)-	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%
121621	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 50% but > 20%
APG-S1A-1-SO-(0.5-2)-	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 20%
121621	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 20%
APG-E4-1-SO-(0.5-2)-	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 20%
121621	d5-NEtFOSAA	NEtFOSAA	< 50% but > 20%	< 20%

Sample ID	EIS	Associated Compounds	%R	RE %R
APG-FD-1-SO-(0.5-2)- 121621	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 20%
APG-S3-1-SO-(0.5-2)- 121621	d3-NMeFOSAA	NMeFOSAA	< 50% but > 20%	< 50% but > 20%

Where a re-extracted analysis was performed, results are reported from the analysis in bold above.

The criteria used to evaluate the EIS recoveries are presented in the following table. In the case of an EIS deviation, the sample results associated with the EIS are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
45004	Non-detect	No Action
> 150%	Detect	J-
	Non-detect	UJ
< 50% but > 20%	Detect	J+
	Non-detect	UX
< 20%	Detect	Х

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must be ≤ 30%.

The MS/MSD analysis performed on sample locations APG-ATC1-1-GW-121521 and APG-E3-1-SO-(0.5-2)-121621 exhibited recoveries and RPD between recoveries within the control limits.

7. Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS / LCSD) Analysis

The LCS/LCSD analysis is used to assess the accuracy and precision of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the DoD QSM 5.3 acceptance limits.

All compounds associated with the LCS/LCSD analysis exhibited recoveries within the control limits.

8. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 35% for water matrices and 50% for soils is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of two times the LOQ is applied for water matrices and three time the LOQ for soil matrices.

Results for field duplicate samples are summarized in the following table.

Sample ID/Duplicate ID	Compound	Sample Result	Duplicate Result	RPD
APG-S1A-1-SO-(0.5-2)-121621/ APG-FD-1-SO-(0.5-2)-121621	All target PFAS compounds	U	U	AC
APG-ATC2-1-GW-121521/ APG-FD-1-GW-121521	Perfluoro octanoic acid	1.0 J	1.0 J	AC

Notes:

AC Acceptable

The results between the parent sample and their associated field duplicate were acceptable.

9. Compound Identification

PFC analytes are identified by using the compound's ion abundance ratios, signal-to-noise values, and relative retention times.

Sample locations associated with ion ratios outside of the control limits of 50% to 150% recovery (%R) are presented in the following table.

Sample Locations	Compound	Ion Ratio %R
APG-S3-1-GW-121521	Perfluoro o ctan esulfonic acid	185%

In the case of an ion ratio deviation, the sample results are qualified as documented in the table below.

Control limit	Sample Result	Qualification
< 50% or > 150% R	Detect	J

Note a number of results were manually integrated which were spot checked. The manual quantitation (M) laboratory qualifier has been preserved with the data as informational data for the end user; there was no impact on the data usability. The manual quantitation (M) laboratory qualifier associated with data reported as non-detect have been removed.

10. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR PFAS

PFAS: 537M/DoD QSM 5.3	Rep	oorted	Performance Acceptable		Not Required
	No	Yes	No	Yes	rtoquirou
LIQUID CHROMATOGRAPHY/MASS SPECTROME	ETRY (LC	/MS/MS)			
Stage 2 Validation					
Holding times/Temperature		Х	Х		
Reporting limits (units)		Х		Х	
Blanks					
A. Method blanks		X		Х	
B. Equipment blanks	Х				Х
C. Field blanks		Х		Х	
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate (LCSD) %R		Х		Х	
LCS/LCSD Precision (RPD)		Х		Х	
Matrix Spike (MS) %R		Х		Х	
Matrix Spike Duplicate (MSD) %R		Х		Х	
MS/MSD Precision (RPD)		Х		Х	
Field Duplicate (RPD)		Х		Х	
Extracted Internal Standard %R		Х	Х		
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation					
Instrument tune and performance check		Х		Х	
Initial calibration %RSDs		Х		Х	
Continuing calibration %Ds		Х		Х	
Instrument sensitivity check		Х		Х	
Ion transitions used		Х		Х	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		Х		Х	
B. Quantitation Reports		Х		Х	
C. RT of sample compounds within the established RT windows		х		Х	
D. Ion Ratio %R		Х	Х		

PFAS: 537M/DoD QSM 5.3		Rep	orted		mance ptable	Not Required			
		No	Yes	No	Yes	110 40111001			
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)									
E.	Transcription/calculations acceptable		Х		Х				
F.	F. Reporting limits adjusted to reflect sample dilutions		Х		Х				

Notes:

%RSD Relative standard deviation

%R Percent recovery

RPD Relative percent difference

%D Percent difference

INORGANIC ANALYSIS INTRODUCTION

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Methods 9045D and 9060A. Data were reviewed in accordance with Department of Defense (DoD) Quality Systems Manual (QSM) 5.3, DoD General Data Validation Guidelines, November 2019, and Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan USAEC PFAS PA/SI Active Army Installations, October 2019 (Arcadis).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and that it was already subjected to adequate and sufficient quality review prior to submission.

During the review process, laboratory qualified and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes:

- Concentration (C) Qualifiers
 - U The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
 - J The reported value was obtained from a reading less than the limit of detection (LOQ), but greater than or equal to the detection limit (DL).
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
- Validation Qualifiers
 - J The reported result was an estimated value with an unknown bias.
 - J+ The result was an estimated quantity, but the result may be biased high.
 - J- The result was an estimated quantity, but the result may be biased low.
 - UJ The analyte was not detected and was reported as less than the LOD. However, the associated numerical value is approximate.
 - UB Analyte considered non-detect at the listed value due to associated blank contamination.
 - X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

A fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

GENERAL CHEMISTRY ANALYSES

1. Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
Total Organic Carbon (TOC) by SW846 9060A	Soil	28 days from collection to analysis	Cool to <6 °C.
pH by SW846 9045D	Soil	Within 24 hours of receipt at laboratory	Cool to <6 °C.

The analyses that exceeded the holding time are presented in the following table.

Sample Locations	Holding Time	Criteria
APG-ATC1-1-SO-(0.5-2)-121621 APG-ATC2-1-SO-(0.5-2)-121621 APG-S1A-1-SO-(0.5-2)-121621 APG-S3-1-SO-(0.5-2)-121621 APG-E3-1-SO-(0.5-2)-121621 APG-E4-1-SO-(0.5-2)-121621	Analyzed 7 days from receipt	< 24 hours from receipt

Sample results associated with sample locations analyzed by analytical method SW-846 9045 were qualified, as specified in the table below. All other holding times were met.

	Qualification
Criteria	Detected Analytes
Analysis completed past holding time	J

The analyses that exceeded the temperature preservation are presented in the following table.

Sample Locations	Temperature	Criteria
All samples associated with this SDG	17.7°C and 19.9°C	< 6°C

Sample results associated with sample locations analyzed by analytical method USEPA method 9060 were qualified, as specified in the table below. Sample pH results were qualified J.

	Qualification			
Criteria	Detected Analytes	Non-detect Analytes		
Temperature greater than the criteria of 6°C	J-	UJ		
Temperature greater than 10°C	J-	R		

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method and rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank is calculated for QA blanks containing concentrations greater than the detection limit (DL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

TOC was not detected above the DL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Calibration

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. The continuing calibration verifies that the instrument daily performance is satisfactory.

The correct number and type of standards were analyzed. The correlation coefficient of the initial calibration was greater than 0.995 and all initial calibration verification standard recoveries were within control limits. The calibration verification limit for pH is within \pm 0.05 su of the true value.

The initial calibration and all calibration verification standard (CCV) recoveries for TOC were within the control limits.

Soil pH calibration verification standards are presented in the following table.

Sample Locations	Continuing Calibration	Analytes	Standard Reading	True Value
APG-ATC1-1-SO-(0.5-2)-121621				
APG-ATC2-1-SO-(0.5-2)-121621				
APG-S1A-1-SO-(0.5-2)-121621				
APG-S3-1-SO-(0.5-2)-121621	CCV	SoilpH	7.12 SU	7.0 SU
APG-E3-1-SO-(0.5-2)-121621				
APG-E4-1-SO-(0.5-2)-121621				

The criteria used to evaluate the initial and continuing calibration are presented in the following table. In the case of a calibration deviation, the sample results are qualified.

Analytes	Analytes Control Limit		Qualification	
Soil pH	± 0.05 SU	Detect	J	

4. Matrix Spike (MS)/Laboratory Duplicate Analysis

MS and laboratory duplicate data are used to assess the precision and accuracy of the analytical method.

4.1 MS Analysis

All analytes must exhibit a percent recovery within the established acceptance limits of 75% to 125%. The MS recovery control limits do not apply for MS performed on sample locations where the analyte's concentration detected in the parent sample exceeds the MS concentration by a factor of four or greater.

A MS analysis was not performed on a sample location associated with this SDG for TOC.

4.2 Laboratory Duplicate Analysis

The laboratory duplicate relative percent difference (RPD) criterion is applied when parent and duplicate sample concentrations are greater than or equal to 5 times the LOQ. A control limit of 20% for water matrices and 35% for soil matrices is applied when the criteria above is true. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of one time the LOQ is applied for water matrices and two times the LOQ for soil matrices. The laboratory duplicate control limits for soil pH is ≤ 0.1 su.

The laboratory duplicate analysis for soil pH performed on sample location APG-S3-1-SO-(0.5-2)-121621 exhibited results within the control limit.

5. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the LOQ, a control limit of three times the LOQ is applied for soil matrices.

A field duplicate was not collected for soil pH and TOC analysis.

6. Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the precision and accuracy of the analytical method independent of matrix interferences. The analytes associated with the LCS analysis must exhibit a percent recovery between the control limits of 80% and 120%.

The LCS analysis exhibited recoveries within the control limits.

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

General Chemistry: SW846 9045D/9060A	Rep	orted		mance ptable	Not
	No	Yes	No	Yes	Required
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times/Temperature		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		Х		х	
B. Equipment blanks	Х				Х
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate(LCSD) %R	Х				Х
LCS/LCSD Precision (RPD)	Х				Х
Matrix Spike (MS) %R	Х				X
Matrix Spike Duplicate(MSD) %R	Х				Х
MS/MSD Precision (RPD)	Х				Х
Lab Duplicate (RPD)		Х		Х	
Field Duplicate (RPD)	Х				Х
Dilution Factor		Х		Х	
Moisture Content		Х		Х	
Stage 3/4 Validation					
Initial calibration correlation coefficient		Х		Х	
Continuing calibration %R		Х	Х		
Raw Data		Х		Х	
Transcription acceptable		Х		Х	
Reporting limits adjusted to reflect sample dilutions		Х		Х	

Notes:

%R - percent recovery

RPD - relative percent difference

VALIDATION PERFORMED BY: Lyndi Mott, Arcadis

SIGNATURE:

DATE: February 24, 2022

PEER REVIEW: Dennis Capria, Arcadis

DATE: February 25, 2022

Stage 3 / 4 PFAS Calibration Standards

 SDG #:
 410-67825-1
 Date:
 2/23/2022

 Lab:
 Eurofins Lancaster
 Page:
 1

Project: Aberdeen Proving Ground Validated by: LWM

Method: EPA modified 537 per DoD QSM 5.3

PFOS 12/27/2021 Calibration

Page 981 - 1126 of SDG 410-67825-1

Instrument 29347

Cal Conc					Calculated		Calc		Calculated	Reported
ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	RF	Avg RF	Amount	Tvalue	% D	% D
0.185	128447	5858702	9.565	0.021924	1.1335373	1.0881	0.192725	0.185	4.176	4.1
0.463	321026	6253141	9.565	0.051338	1.0605862	1.0881	0.451293	0.463	-2.529	-2.5
1.85	1381266	6172606	9.565	0.223774	1.1569698	1.0881	1.967093	1.85	6.329	6.3
7.4	4970854	6025433	9.565	0.824979	1.0663407	1.0881	7.252019	7.4	-2.000	-2.1
18.5	11932407	5576512	9.565	2.139762	1.1063146	1.0881	18.80969	18.5	1.674	1.6
46.3	30748713	5876435	9.565	5.232545	1.0809783	1.0881	45.99696	46.3	-0.655	-0.6
92.6	50682533	5168573	9.565	9.805904	1.0128885	1.0881	86.19932	92.6	-6.912	-6.9

Match Match Match Match Match Match Match

Avg RF = 1.0882308 Match

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

Stage 3 / 4 PFAS ICV CCV Standards %D

SDG #:410-67825-1Date:2/23/2022Lab:Eurofins LancasterPage:2Project:Aberdeen Proving GroundValidated by:LWM

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-209082/9 12/27/2021 11:22

CCVIS 410-210527/1 12/30/2021 10:23

310191 7262331

PFOA

Page 1342 - 1354 of SDG 410-67825-1

	Analyte					Calc		Calculated	Reported
Analyte	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
PFBS	1277113	6368294	9.36	0.2005	1.0807	1.737	1.77	-1.87	-1.9
PFOS	1138980	5792427	9.57	0.1966	1.0881	1.729	1.85	-6.52	-6.6
PFOA	1191364	7306293	10	0.1631	0.8551	1.907	2.0	-4.65	-4.7

Page 1356 - 1373 of SDG 410-67825-1

0.500

0.50

-0.10

Match Match Match

Match Match

Match

-0.1

	Analyte					Calc		Calculated	Reported
Analyte	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Amount	Tvalue	% D	% D
PFBS	339036	6183082	9.36	0.0548	1.0807	0.475	0.443	7.20	7.3
PFOS	323533	5801981	9.57	0.0558	1.0881	0.490	0.463	5.93	5.9

0.8551

0.0427

Concentration ng/ml = (Peak area ratio/Avg RF) x EIS concentration

10

Stage 3 / 4 PFAS LCS

 SDG #:
 410-67825-1
 Date:
 2/23/2022

 Lab:
 Eurofins Lancaster
 Page:
 3

 Project:
 Aberdeen Proving Ground
 Validated by:
 LWM

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-209805/2-A

Page 662 and 1806 of SDG 410-67825-1 FV= 1ml Sample Volume 250 mls

						Calculated			Calculated	Reported	ĺ
	Analyte					Amount	Calculated	True Value	Percent	Percent	
Analyte	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	ng/L	ng/L	Recovery	Recovery	
PFBS	4139705	6614943	9.36	0.625811	1.0807	5.42	21.68	22.70	95.51	95	MATCH
PFOS	3903553	6092227	9.57	0.640743	1.0881	5.64	22.54	23.70	95.11	95	MATCH
PFOA	3826705	7390531	10	0.517785	0.8551	6.06	24.22	25.60	94.61	95	MATCH

Concentration $ng/ml = (Peak area ratio/Avg RF) \times DF \times EIS concentration$ Concentration ng/L = concentration ng/ml / (sample volume/1000)

LCS 410-210384/2-B

Page 664 and 1836 of SDG 410-67825-1 Final volume = 4ml; Weight = 1.00 gm; TS = 100%

Extract: 2 mls concentrated to 1 ml

						Calculated	Dry Weight		Calculated	Reported	
						Amount	Value	True Value	Percent	Percent	
Analyte	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	mg/kg	mg/kg	Recovery	Recovery	
PFBS	9224598	7245063	9.36	1.273225	1.0807	22.05	0.02205	0.022	99.80	99	MATCH
PFOS	9416121	6901143	9.57	1.364429	1.0881	24.00	0.02400	0.023	103.90	104	MATCH
PFOA	8651628	8282142	10	1.044612	0.8551	24.43	0.02443	0.025	97.73	98	MATCH

Calculated Amount ng/ml = (Peak area ratio/Avg RF) x DF x EIS concentration Calculated mg/kg = 4 x (Calc amt ng/ml x 0.5)/ sample weight g) / 1000 Dry Weight Amount = [Calculated mg/kg / (TS/100)]

Stage 3 / 4 PFAS MS/MSD

SDG #: 410-67825-1 Date: 2/23/2022

Lab: Eurofins Lancaster Page: 4

Project: Aberdeen Proving Ground Validated by: LWM

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID APG-ATC1-1-GW-121521 Page 668 and of SDG 410-67825-1

ANALYTE Perfluorohexanesulfonic acid

REPORTED MS %R 97
REPORTED MSD %R 99
REPORTED RPD 0

%R = 100 * (MS Conc - Sample Conc) RPD = 100 * | MS %R - MSD %R | Algorithm Alg

MS TV Average of MS MSD %R

Sample Concentration 0.96 97.17 MATCH MS Concentration 20.2 MS %R 20.2 98.16 MATCH MSD Concentration MSD %R MS TV 19.8 RPD 0.00 MATCH 19.6 MSD TV

Differences in %R may be due to rounded true values

Stage 3 / 4 PFAS Sample Concentration

 SDG #:
 410-67825-1
 Date:
 2/22/2022

 Lab:
 Eurofins Lancaster
 Page:
 5

Project: Aberdeen Proving Ground Validated by: LWM

Method: EPA modified 537 per DoD QSM 5.3

APG-S3-1-GW-121521 Lab ID: 410-67825-10

Page 895-911 of SDG 410-67825-1

Instrument 29347 12/30/2021 18:47 FV= 1ml

moti amene 2	5517	12,30,2021	10.17						
						Calculated			
	Analyte					Amount	Sample	Calculated	Reported
Analyte	Area	EIS Area	EIS Conc	Area Ratio	Avg RF	ng/ml	Volume mls	ng/L	Value ng/L
PFBS	457602	6596987	9.36	0.069365	1.0807	0.60	276	2.18	2.2
PFOS	39746187	5856476	9.57	6.786707	1.0881	59.69	276	216.27	220
PFOA	4688302	7115007	10	0.658931	0.8551	7.71	276	27.92	28

Match Match Match

Concentration $ng/ml = (Peak area ratio/Avg RF) \times DF \times EIS concentration$ Concentration ng/L = concentration ng/ml / (sample volume/1000)

Stage 3 / 4 PFAS EIS

SDG #:410-67825-1Date:2/22/2022Lab:Eurofins LancasterPage:6Project:Aberdeen Proving GroundValidated by:LWM

Method: EPA modified 537 per DoD QSM 5.3

APG-S3-1-GW-121521 Lab ID: 410-67825-10

EIS 13C8 PFOS

REPORTED EIS %R 100

%R = 100 * EIS ConcentrationEIS TV

EIS Concentration 9.58 ng/ml Page 898 of SDG 410-67825-1
EIS TV 9.57
%R 100.1 MATCH Reported %R on result page

%R = 100 * EIS Area CCV 100 EIS Area

EIS Area 5856476 Page 898 and 688 of SDG 410-67825-1 CCV 100 EIS Area 5801981 Page 688 of SDG 410-67825-1 %R 100.9

Sample EIS areas are compared to initial daily CCV on Form VIII.

CHAIN OF CUSTODY AND SAMPLE ANALYSIS DATA SHEETS

Chain of Custody Record

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Environment lesting

410-67825 Chain of Custody	Sampler	C: 00	0	Lab F	PM					-	Сап	ier Trackir	g No(s)		COC No		
410-67625 Chain of Custody	Phone:	12 Cott	(y, Dio	n Kal Gon		ephe	n J				Stat	e of Origin			410-39020-123 Page:		
Brian Keh			7		hen.Go	ordon	n@eu	rofins	et cor	n		n of Origin			Page 2 of 3	1 of 2	
Company ARCADIS U.S., Inc.			PWSID.						Ana	lysis F	Reque	sted			Job#		
Address 7550 Teague Road Suite 210	Due Date Request	ed: No ro	nod												Preservation C		
City	TAT Requested (d	ays):	, ,				51								A - HCL B - NaOH	M - Hexane N - None	
Hanover State, Zip		Stand					8 PF/							1	C - Zn Acetate D - Nitric Acid	O - AsNaO2 P - Na2O4S	
MD, 21076	Compliance Proje	ct: A Yes	Δ No				1-91-								E - NaHSO4 F - MeOH	Q - Na2SO3 R - Na2S2O3	
(703)-819-1240	D18-218 PFAS	PA/SI			9		Die B			11					G - Amchlor H - Ascorbic Acid		.hydrate
Email. Brian Keh@arcadis com	WO# 30001996 8AC	00 ANA			OF		17.		22				1 1	92	J - Ice J - DI Water	U - Acetone V - MCAA	
Project Name: Aberdeen Proving Ground	Project #: 41005401				o (Yos		OSM		515					containers	K - EDTA L - EDA	W - pH 4-5 Z - other (specif	y)
Site	SSOW#					fetho	(QO)	I	8					Con	Other:		
				88-A-I.:	e B	Moisture - Local Method	PFC_IDA_D5.3 - (MOD) QSM6.1 Table B-15- 18 PFAS	4	7					per of			
			Sample Type	Matrix (www.ter,	Field Filtered	re - L	A.D	000	Ø					Total Number			
Description of the second seco	Sample Date	Sample	(C=comp,	Sesolid, Oewas ta/oli,	Plei	loistu	5. H	0	3					otal	Special	Instructions/No	ato:
Sample Identification	Sample Date	Time		aterissus, A-Ab)	$\overline{\mathbb{X}}$ \times		N							X	Special	ilisti detions/ivo	te.
APG-ATC1-1-50-(0.5-2)-121621	121621	1255	G	Sell	MM	1	1	1	T					1			
APG-ATC1-1-GW-121821	1214521	1.	G	Water	NY	-	6								MS/	MSD	
APG-ATC2-1-50-(0.5-2)-121621		1230	G	Swale:	NN	1	4	1									
APG-ATC2-1-GW-121621	121521	1230	G	Water	1		2		+	11							
A76-A162-1-6W-121921			6		NN	Г	4	1		+	+	++	++-	532			
APG-514-1-50-6.5-2)12/621	121621	1200	6	Water Water	NN NIV	L	7	4	+	+		++	++	100	1		
APG-S1A-1-GW-121521	121521	1160	+	San I	MN		2		+	++	-	-	++-		F-0		
APG-FD-1-50-(0.5-2)-121621	1		G		11	1		\vdash	-	\dashv	-	-			FD		
APG-FD-1-GW-121521	121521	-	G	water	MM		2		_		_	\vdash			FD		
				Water	Ш					\perp				9 0			
				Water	Ш						\perp			1			
				Water													
Possible Hazard Identification	Z .				Sa					e may t	e asse	ssed if	samples a		ed longer than		
Non-Hazard Flammable Skin Irritant Pois Deliverable Requested: I, II, III, IV, Other (specify)	on B Unkr	iown I	Radiologica		Sp		Return			Require	Disponents:	osal By I	.ab	Arci	hive For	Months	
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Δ Yes Δ NO	Δ Yes Δ No										18-6,1				1. 1		

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2425 New Holland Pike Lancaster, PA 17601

Chain of Custody Record

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Environment Testing America

hone: 717-656-2300 Fax: 717-656-2681																			
Client Information	Sampler Jughin I	Coffey,	Bram	beh Gon	don, S	Steph	ien J						cking No		4	OC No 10-39020-12	246 3		
lient Contact Irian Keh	Phone:					Gorde	on@e	urofin	set.co	m	S	tate of On	N C	>	P	age: Page 3 of 3 - 1	20FZ	2	
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ddress:	Due Date Request	ed:				199	1		711	alysis	Requ	esteu		1	P	reservation C	odes:		
550 Teague Road Suite 210		Norm	Les!		日.											A - HCL	M - He	exane	
inty Hanover	TAT Requested (d.	Sterr	dud				PFAS									3 - NaOH C - Zn Acetate	N - No O - As	NaO2	
tate, Zip ND, 21076	Compliance Proje	ct: A Yes	Δ No				-									D - Nitric Acid E - NaHSO4		2503	
(703)-819-1240	PO# D18-218 PFAS						8-6	I	26		Ιİ					- MeOH 3 - Amchlor	S - H2		
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Brian Keh@arcadis.com	30001996 8AC0	O.ANA			10 80	욋	45.1		· (S)							l - DI Water C - EDTA	V - MC W - pł		
Aberdeen Proving Ground	41005401					1 5	0 081	S	4						ntain	- EDA	Z - oth	ner (specify)	
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			Sample	Matrix	pe	1 20	06.3	וין	7						1ber				
			Type	(Wowster, Sesolid,	Filte		Δ	K	0						Nun				
Sample Identification	Sample Date	Sample . Time	(C=comp, G=grab)	O=waste/oil. BT=Tissue, A=Air	Ë	Moleture	PFC	S						1	gal	Special	instruct	ions/Note	:
		><		ilion Code:	X	X N	N	ŅΕ	N		1				X				
APG-53-1-50-(0,5-2)-121621	121621	1125	C	S Water	NS	V	1	1	1										
APG-53-1-GW-121521	121521	0945	G	water	NI	V	2												
APG-E3-1-50-(0.5-2)-121621		6930	G	Soil	W	Y 3	3	1	1							M5/1	45[)	
APG-E3-1-GW-121621			G	water	N		2									•			
APG-E4-1-GW-121621			6	Water	יוע	V	2	П											
APG-E4-1-50-(0,5-2)-121621	121621		6	Soil	N		ı	u	(,			
APG-FB-1-12/621	121621		6	Water	П	Τ,	2									Field	Bla	nk	
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Possible Hazard Identification	8				15	Samp		-								l longer than			
Non-Hazard Flammable Skin Imtant Pois Deliverable Requested I, II, III, IV, Other (specify)	on B ጆ Unkn	own F	Radiologica	1	-	Speci		n To (Requir		posal B	ly Lab		Archiv	e For	Mo	onths	
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Relinquished by	Date/Time /	<u> </u>		ICompany /	1		ceived	bv:	_		_		- 1-	te/Time:			Comp	any	
OMA	Date/Time			Company			ceived				$\overline{}$			ite/Time:	_				
Brian Reh	12/16	12117	1:00	Arcad.	15												Comp		
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Custody Seals Intact: Custody Seal No.: Δ Yes Δ No						Co	ooler Te	mperat	ture(s) °	C and Ot	her Rem	arks:	18	.Y.	19.	9			
	-													1	<u> </u>	-	Ver	06/08/2021	

Login Sample Receipt Checklist

Client: ARCADIS U.S., Inc. Job Number: 410-67825-1

Login Number: 67825 List Source: Eurofins Lancaster Laboratories Env, LLC

List Number: 1

Creator: Lugardo, Tamara

Question	Answer	Comment
The cooler's custody seal is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	Water present in cooler; indicates evidence of melted ice
Cooler Temperature is acceptable (=6C, not frozen).</td <td>False</td> <td>Refer to Job Narrative for details.</td>	False	Refer to Job Narrative for details.
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (=6C, not frozen).</td <td>N/A</td> <td></td>	N/A	
NV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	False	Improper containers received.
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses.	True	
s the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	

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1.5

16

Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Date Collected: 12/16/21 12:55

Matrix: Solid

Date Received: 12/21/21 18:23

Percent Solids: 76.9

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	_ D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0021	UJ	0.0026	0.0021	0.0021	mg/Kg	-	01/04/22 02:21	1
8:2 Fluorotelomer sulfonic acid	<0.0021		0.0039	0.0021	0.0021	mg/Kg	₩	01/04/22 02:21	1
NEtFOSAA	< 0.00052		0.0026	0.00052	0.00052	mg/Kg	₩	01/04/22 02:21	1
NMeFOSAA	<0.00052		0.0026	0.00052	0.00052	mg/Kg	₩	01/04/22 02:21	1
Perfluorobutanesulfonic acid	<0.0021		0.0026	0.0021	0.0021	mg/Kg	₩	01/04/22 02:21	1
Perfluorobutanoic acid	<0.0021		0.0026	0.0021	0.0021	mg/Kg	₩	01/04/22 02:21	1
Perfluorodecanoic acid	<0.00052		0.00077	0.00052	0.00052	mg/Kg	₽	01/04/22 02:21	1
Perfluorododecanoic acid	< 0.00052		0.00077	0.00052	0.00052	mg/Kg	₩	01/04/22 02:21	1
Perfluoroheptanoic acid	< 0.00052		0.00077	0.00052	0.00052	mg/Kg	₩	01/04/22 02:21	1
Perfluorohexanesulfonic acid	<0.00052		0.00077	0.00052	0.00052	mg/Kg	₩	01/04/22 02:21	1
Perfluorohexanoic acid	< 0.00052		0.00077	0.00052	0.00052	mg/Kg	₩	01/04/22 02:21	1
Perfluorononanoic acid	< 0.00052		0.00077	0.00052	0.00052	mg/Kg	₩	01/04/22 02:21	1
Perfluorooctanesulfonic acid	<0.00052		0.00077	0.00052	0.00052	mg/Kg	₩	01/04/22 02:21	1
Perfluorooctanoic acid	< 0.00052		0.00077	0.00052	0.00052	mg/Kg	₩	01/04/22 02:21	1
Perfluoropentanoic acid	< 0.00052		0.00077	0.00052	0.00052	mg/Kg	₩	01/04/22 02:21	1
Perfluorotetradecanoic acid	<0.00052		0.00077	0.00052	0.00052	mg/Kg		01/04/22 02:21	1
Perfluorotridecanoic acid	< 0.00052		0.00077	0.00052	0.00052	mg/Kg	₩	01/04/22 02:21	1
Perfluoroundecanoic acid	<0.00052	$\mathbf{\Psi}$	0.00077	0.00052	0.00052	mg/Kg	≎	01/04/22 02:21	1
Isotope Dilution	%Recovery Qu	ıalifier	Limits			Prepai	red	Analyzed	Dil Fac
M2-6:2 FTS	70		50 - 150			12/30/21	06:52	01/04/22 02:21	1
M2-8:2 FTS	85		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C2 PFTeDA	77		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C3 PFBS	89		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C4 PFBA	86		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C4 PFHpA	88		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C5 PFPeA	83		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C8 PFOA	93		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C8 PFOS	101		50 - 150			12/30/21	06:52	01/04/22 02:21	1
d3-NMeFOSAA	35 *5-	•	50 - 150			12/30/21	06:52	01/04/22 02:21	1
d5-NEtFOSAA	46 *5-		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C2-PFDoDA	93		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C3 PFHxS	96		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C5 PFHxA	84		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C6 PFDA	92		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C7 PFUnA	97		50 - 150			12/30/21	06:52	01/04/22 02:21	1
13C9 PFNA	87		50 ₋ 150			10/20/01	06.50	01/04/22 02:21	1

Method: EPA 5	37(Mod)	- PFAS for QSM 5.3.	, Table B-15 - RE
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Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0021	0.0026	0.0021	0.0021	mg/Kg	*	01/06/22 05:32	1
8:2 Fluorotelomer sulfonic acid	<0.0021	0.0039	0.0021	0.0021	mg/Kg	₽	01/06/22 05:32	1
NEtFOSAA	<0.00052	0.0026	0.00052	0.00052	mg/Kg	₩	01/06/22 05:32	1
NMeFOSAA	<0.00052	0.0026	0.00052	0.00052	mg/Kg	₽	01/06/22 05:32	1
Perfluorobutanesulfonic acid	<0.0021	0.0026	0.0021	0.0021	mg/Kg	₩	01/06/22 05:32	1
Perfluorobutanoic acid	<0.0021	0.0026	0.0021	0.0021	mg/Kg	₩	01/06/22 05:32	1
Perfluorodecanoic acid	<0.00052	0.00078	0.00052	0.00052	mg/Kg	₽	01/06/22 05:32	1
Perfluorododecanoic acid	<0.00052	0.00078	0.00052	0.00052	mg/Kg	*	01/06/22 05:32	1
Perfluoroheptanoic acid	<0.00052	0.00078	0.00052	0.00052	mg/Kg	₩	01/06/22 05:32	1
Perfluorohexanesulfonic acid	<0.00052	0.00078	0.00052	0.00052	mg/Kg	₽	01/06/22 05:32	1

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1/20/2022

Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

1.18 mm

Client Sample ID: APG-ATC1-1-SO-(0.5-2)-121621 Lab Sample ID: 410-67825-1

Date Collected: 12/16/21 12:55

Matrix: Solid

Date Received: 12/21/21 18:23

Percent Solids: 76.9

Method: EPA 537(Mod) - PFA Analyte	Result	Qualifier	LOQ	LOD		Unit	_ <u>D</u>	Analyzed	Dil Fa
Perfluorohexanoic acid	< 0.00052		0.00078	0.00052	0.00052		₩	01/06/22 05:32	
Perfluorononanoic acid	<0.00052		0.00078	0.00052	0.00052			01/06/22 05:32	
Perfluorooctanesulfonic acid	< 0.00052		0.00078	0.00052	0.00052		₩	01/06/22 05:32	
Perfluorooctanoic acid	< 0.00052	M	0.00078	0.00052	0.00052		₩	01/06/22 05:32	
Perfluoropentanoic acid	<0.00052	M	0.00078	0.00052	0.00052	mg/Kg	☼	01/06/22 05:32	
Perfluorotetradecanoic acid	<0.00052		0.00078	0.00052	0.00052	mg/Kg	₩	01/06/22 05:32	
Perfluorotridecanoic acid	<0.00052		0.00078	0.00052	0.00052	mg/Kg	₩	01/06/22 05:32	
Perfluoroundecanoic acid	<0.00052		0.00078	0.00052	0.00052	mg/Kg	₩	01/06/22 05:32	
Isotope Dilution	%Recovery Qu	ialifier	Limits			Prepare	ed	Analyzed	Dil Fa
M2-6:2 FTS	79		50 - 150			01/04/22 1	8:53	01/06/22 05:32	
M2-8:2 FTS	79		50 - 150			01/04/22 1	8:53	01/06/22 05:32	
13C2 PFTeDA	72		50 - 150			01/04/22 1	8:53	01/06/22 05:32	
13C3 PFBS	86		50 - 150			01/04/22 1	8:53	01/06/22 05:32	
13C4 PFBA	88		50 - 150			01/04/22 1	8:53	01/06/22 05:32	
13C4 PFHpA	80		50 ₋ 150			01/04/22 1	8:53	01/06/22 05:32	
13C5 PFPeA	93		50 - 150			01/04/22 1	8:53	01/06/22 05:32	
13C8 PFOA	87		50 - 150			01/04/22 1	8:53	01/06/22 05:32	
13C8 PFOS	92		50 ₋ 150			01/04/22 1	8:53	01/06/22 05:32	
d3-NMeFOSAA	32 *5-		50 - 150			01/04/22 1	8:53	01/06/22 05:32	
d5-NEtFOSAA	43 *5		50 - 150					01/06/22 05:32	
13C2-PFDoDA	80		50 - 150					01/06/22 05:32	
13C3 PFHxS	92		50 ₋ 150					01/06/22 05:32	
13C5 PFHxA	82		50 ₋ 150					01/06/22 05:32	
13C6 PFDA	85		50 - 150					01/06/22 05:32	
13C7 PFUnA	86		50 ₋ 150					01/06/22 05:32	
13C9 PFNA	87		50 - 150					01/06/22 05:32	
General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
Percent Moisture	23.1		1.0		1.0		- -	12/23/21 12:59	
Percent Solids	76.9		1.0		1.0			12/23/21 12:59	
General Chemistry - Soluble	Decult	Ouglifier	1.00	LOD	DI	l lmi4	_	Amalumad	Dil Fa
Analyte		Qualifier	_ LOQ	0.01		Unit S.U.	_ <u>D</u>	Analyzed 12/28/21 15:40	
pH Temperature	5.1 20.6	J	0.01	0.01		Degrees C		12/28/21 15:40	
	20.0					9			
Method: D422 - Grain Size	Danielle.	Ouglifies	1.00	1.00	ъ.	l lm:4	-	A m a l	D:: E-
Analyte		Qualifier	LOQ -	LOD -		Unit	_ D	Analyzed	Dil Fa
Gravel	<1.0		1.0	1.0	1.0			12/30/21 11:30	
Sand	7.0		1.0	1.0	1.0			12/30/21 11:30	
Silt 	69.1		1.0	1.0	1.0			12/30/21 11:30	
Clay	23.0		1.0	1.0	1.0			12/30/21 11:30	
75 mm	100.0		1.0	1.0		% Passing		12/30/21 11:30	
37.5 mm	100.0		1.0	1.0		% Passing		12/30/21 11:30	
19 mm	100.0		1.0	1.0		% Passing		12/30/21 11:30	
4.75 mm	99.1		1.0	1.0		% Passing		12/30/21 11:30	
3.35 mm	97.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	
2.36 mm	93.1		1.0	1.0	1.0	% Passing		12/30/21 11:30	

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12/30/21 11:30

1.0 % Passing

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1.0

1.0

93.0

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1.0

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16

Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-ATC1-1-SO-(0.5-2)-121621

Lab Sample ID: 410-67825-1 Date Collected: 12/16/21 12:55 **Matrix: Solid** Date Received: 12/21/21 18:23 Percent Solids: 76.9

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
0.6 mm	93.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.3 mm	92.7		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.15 mm	92.4		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.075 mm	92.1		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.064 mm	89.5		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.05 mm	84.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.02 mm	56.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.005 mm	23.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.002 mm	15.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.001 mm	10.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1

Client Sample ID: APG-ATC1-1-GW-121521

Date Collected: 12/15/21 14:00 Date Received: 12/21/21 18:23

Lab Sample ID: 410-67825-2

Matrix: Water

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5	UJ	4.3	3.5	3.5	ng/L		12/30/21 17:33	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.6	1.7	1.7	ng/L		12/30/21 17:33	1
NEtFOSAA	<0.87		2.6	0.87	0.87	ng/L		12/30/21 17:33	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L		12/30/21 17:33	1
Perfluorobutanesulfonic acid	<0.87		1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluorobutanoic acid	<3.5		4.3	3.5	3.5	ng/L		12/30/21 17:33	1
Perfluorodecanoic acid	<0.87		1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluorododecanoic acid	<0.87		1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluoroheptanoic acid	<0.87	$lack \psi$	1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluorohexanesulfonic acid	0.96	JM	1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluorohexanoic acid	<0.87	UJ	1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluorononanoic acid	<0.87	1	1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluorooctanesulfonic acid	<0.87		1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluorooctanoic acid	<0.87	M	1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluoropentanoic acid	<0.87		1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluorotetradecanoic acid	<0.87		1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluorotridecanoic acid	<0.87		1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluoroundecanoic acid	<0.87	\downarrow	1.7	0.87	0.87	ng/L		12/30/21 17:33	1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	85	50 - 150	12/28/21 18:21	12/30/21 17:33	1
M2-8:2 FTS	91	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C2 PFTeDA	86	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C3 PFBS	96	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C4 PFBA	92	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C4 PFHpA	99	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C5 PFPeA	102	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C8 PFOA	105	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C8 PFOS	100	50 - 150	12/28/21 18:21	12/30/21 17:33	1
d3-NMeFOSAA	78	50 - 150	12/28/21 18:21	12/30/21 17:33	1
d5-NEtFOSAA	96	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C2-PFDoDA	91	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C3 PFHxS	102	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C5 PFHxA	99	50 - 150	12/28/21 18:21	12/30/21 17:33	1

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Date Received: 12/21/21 18:23

Client Sample ID: APG-ATC1-1-GW-121521

Date Collected: 12/15/21 14:00

Lab Sample ID: 410-67825-2

Matrix: Water

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C6 PFDA	93	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C7 PFUnA	98	50 - 150	12/28/21 18:21	12/30/21 17:33	1
13C9 PFNA	100	50 - 150	12/28/21 18:21	12/30/21 17:33	1

Client Sample ID: APG-ATC2-1-SO-(0.5-2)-121621

Lab Sample ID: 410-67825-3 Date Collected: 12/16/21 12:30 **Matrix: Solid** Percent Solids: 53.8 Date Received: 12/21/21 18:23

Method: EPA 537(Mod) - PF	AS for QSM 5.3,	Table B-	15						
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0028	UJ	0.0034	0.0028	0.0028	mg/Kg		01/04/22 02:32	1
8:2 Fluorotelomer sulfonic acid	<0.0028	1	0.0052	0.0028	0.0028	mg/Kg	₩	01/04/22 02:32	1
NEtFOSAA	< 0.00069		0.0034	0.00069	0.00069	mg/Kg	₩	01/04/22 02:32	1
NMeFOSAA	<0.00069		0.0034	0.00069	0.00069	mg/Kg	₽	01/04/22 02:32	1
Perfluorobutanesulfonic acid	<0.0028		0.0034	0.0028	0.0028	mg/Kg	₩	01/04/22 02:32	1
Perfluorobutanoic acid	<0.0028		0.0034	0.0028	0.0028	mg/Kg	₩	01/04/22 02:32	1
Perfluorodecanoic acid	<0.00069		0.0010	0.00069	0.00069	mg/Kg	₽	01/04/22 02:32	1
Perfluorododecanoic acid	< 0.00069		0.0010	0.00069	0.00069	mg/Kg	₩	01/04/22 02:32	1
Perfluoroheptanoic acid	<0.00069		0.0010	0.00069	0.00069	mg/Kg	₩	01/04/22 02:32	1
Perfluorohexanesulfonic acid	<0.00069		0.0010	0.00069	0.00069	mg/Kg	₩	01/04/22 02:32	1
Perfluorohexanoic acid	< 0.00069		0.0010	0.00069	0.00069	mg/Kg	₩	01/04/22 02:32	1
Perfluorononanoic acid	<0.00069		0.0010	0.00069	0.00069	mg/Kg	₩	01/04/22 02:32	1
Perfluorooctanesulfonic acid	<0.00069		0.0010	0.00069	0.00069	mg/Kg	₩	01/04/22 02:32	1
Perfluorooctanoic acid	< 0.00069	M	0.0010	0.00069	0.00069	mg/Kg	₩	01/04/22 02:32	1
Perfluoropentanoic acid	< 0.00069		0.0010	0.00069	0.00069	mg/Kg	₩	01/04/22 02:32	1
Perfluorotetradecanoic acid	<0.00069		0.0010	0.00069	0.00069	mg/Kg	₩	01/04/22 02:32	1
Perfluorotridecanoic acid	< 0.00069		0.0010	0.00069	0.00069	mg/Kg	₩	01/04/22 02:32	1
Perfluoroundecanoic acid	<0.00069	\mathbf{V}	0.0010	0.00069	0.00069	mg/Kg	≎	01/04/22 02:32	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prep	pared	Analyzed	Dil Fac
M2-6:2 FTS	85		50 - 150			12/30/2	21 06:52	01/04/22 02:32	1
M2-8:2 FTS	118		50 - 150			12/30/2	21 06:52	01/04/22 02:32	1
13C2 PFTeDA	102		50 - 150			12/30/2	21 06:52	01/04/22 02:32	1
13C3 PFBS	96		50 - 150			12/30/2	21 06:52	01/04/22 02:32	1
13C4 PFBA	98		50 - 150			12/30/2	21 06:52	01/04/22 02:32	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	85		50 - 150	12/30/21 06:52	01/04/22 02:32	1
M2-8:2 FTS	118		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C2 PFTeDA	102		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C3 PFBS	96		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C4 PFBA	98		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C4 PFHpA	103		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C5 PFPeA	100		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C8 PFOA	106		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C8 PFOS	106		50 - 150	12/30/21 06:52	01/04/22 02:32	1
d3-NMeFOSAA	90		50 - 150	12/30/21 06:52	01/04/22 02:32	1
d5-NEtFOSAA	107		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C2-PFDoDA	111		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C3 PFHxS	106		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C5 PFHxA	99		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C6 PFDA	109		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C7 PFUnA	108		50 - 150	12/30/21 06:52	01/04/22 02:32	1
13C9 PFNA	104		50 - 150	12/30/21 06:52	01/04/22 02:32	1

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Analyte	Result Qualifier	LOQ	LOD	DL Unit	D	Analyzed	Dil Fac	
Percent Moisture	46.2	1.0		1.0 %		12/23/21 12:59	1	

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-ATC2-1-SO-(0.5-2)-121621

52.5

33.5

9.5

4.5

2.0

Lab Sample ID: 410-67825-3 Date Collected: 12/16/21 12:30 **Matrix: Solid**

Date Received: 12/21/21 18:23 Percent Solids: 53.8

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Solids	53.8		1.0		1.0	%	_	12/23/21 12:59	
General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	5.2	J	0.01	0.01	0.01	S.U.	_	12/28/21 15:40	
Temperature	21.0		0.01	0.01	0.01	Degrees C		12/28/21 15:40	•
Method: D422 - Grain Size									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%		12/30/21 11:30	-
Sand	36.0		1.0	1.0	1.0	%		12/30/21 11:30	
Silt	53.6		1.0	1.0	1.0	%		12/30/21 11:30	
Clay	9.5		1.0	1.0	1.0	%		12/30/21 11:30	
75 mm	100.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	
37.5 mm	100.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	
19 mm	100.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	
4.75 mm	99.1		1.0	1.0	1.0	% Passing		12/30/21 11:30	
3.35 mm	98.7		1.0	1.0	1.0	% Passing		12/30/21 11:30	
2.36 mm	97.8		1.0	1.0	1.0	% Passing		12/30/21 11:30	
1.18 mm	97.8		1.0	1.0	1.0	% Passing		12/30/21 11:30	•
0.6 mm	96.3		1.0	1.0	1.0	% Passing		12/30/21 11:30	
0.3 mm	80.4		1.0	1.0	1.0	% Passing		12/30/21 11:30	
0.15 mm	66.7		1.0	1.0	1.0	% Passing		12/30/21 11:30	
0.075 mm	63.1		1.0	1.0	1.0	% Passing		12/30/21 11:30	
0.064 mm	60.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	

Client Sample ID: APG-ATC2-1-GW-121521

0.05 mm

0.02 mm

0.005 mm

0.002 mm

0.001 mm

Lab Sample ID: 410-67825-4 Date Collected: 12/15/21 12:30 **Matrix: Water** Date Received: 12/21/21 18:23

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

1.0

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5	UJ	4.4	3.5	3.5	ng/L		12/30/21 18:05	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.6	1.7	1.7	ng/L		12/30/21 18:05	1
NEtFOSAA	<0.87		2.6	0.87	0.87	ng/L		12/30/21 18:05	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L		12/30/21 18:05	1
Perfluorobutanesulfonic acid	<0.87	ŊÍ	1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluorobutanoic acid	<3.5	<i>'</i>	4.4	3.5	3.5	ng/L		12/30/21 18:05	1
Perfluorodecanoic acid	<0.87	M	1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluorododecanoic acid	<0.87		1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluoroheptanoic acid	<0.87	М	1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluorohexanesulfonic acid	<0.87	М	1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluorohexanoic acid	<0.87	M	1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluorononanoic acid	<0.87	M	1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluorooctanesulfonic acid	<0.87	M V	1.7	0.87	0.87	ng/L		12/30/21 18:05	1

1.0 % Passing

1.0 % Passing

1.0 % Passing

1.0 % Passing

1.0 % Passing

12/30/21 11:30

12/30/21 11:30

12/30/21 11:30

12/30/21 11:30

12/30/21 11:30

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-ATC2-1-GW-121521

Lab Sample ID: 410-67825-4 Date Collected: 12/15/21 12:30 **Matrix: Water**

Date Received: 12/21/21 18:23

Analyte	Result	Qualifier	LOC)	LOD	DL	Unit	D Analyzed	Dil Fac
Perfluorooctanoic acid	1.0	J M	1.7	7	0.87	0.87	ng/L	12/30/21 18:05	5 1
Perfluoropentanoic acid	<0.87	UJ	1.7	7	0.87	0.87	ng/L	12/30/21 18:05	5 1
Perfluorotetradecanoic acid	<0.87		1.7	7	0.87	0.87	ng/L	12/30/21 18:05	5 1
Perfluorotridecanoic acid	<0.87		1.7	7	0.87	0.87	ng/L	12/30/21 18:05	5 1
Perfluoroundecanoic acid	<0.87	\downarrow	1.7	7	0.87	0.87	ng/L	12/30/21 18:05	5 1
Isotope Dilution	%Recovery Qu	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	94		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
M2-8:2 FTS	102		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C2 PFTeDA	86		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C3 PFBS	104		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C4 PFBA	94		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C4 PFHpA	100		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C5 PFPeA	100		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C8 PFOA	111		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C8 PFOS	99		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
d3-NMeFOSAA	79		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
d5-NEtFOSAA	90		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C2-PFDoDA	95		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C3 PFHxS	104		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C5 PFHxA	101		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C6 PFDA	98		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C7 PFUnA	92		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1
13C9 PFNA	102		50 - 150				12/28/21 18:2	21 12/30/21 18:05	5 1

Client Sample ID: APG-S1A-1-SO-(0.5-2)-121621

Date Collected: 12/16/21 12:00

Date Received: 12/21/21 18:23

Matrix: Solid Percent Solids: 76.4

•								
Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
<0.0021	UJ	0.0026	0.0021	0.0021	mg/Kg	₩	01/04/22 02:42	1
<0.0021		0.0039	0.0021	0.0021	mg/Kg	₩	01/04/22 02:42	1
<0.00051		0.0026	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
<0.00051		0.0026	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
<0.0021		0.0026	0.0021	0.0021	mg/Kg	☼	01/04/22 02:42	1
<0.0021		0.0026	0.0021	0.0021	mg/Kg	₩	01/04/22 02:42	1
<0.00051		0.00077	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
< 0.00051		0.00077	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
<0.00051		0.00077	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
<0.00051		0.00077	0.00051	0.00051	mg/Kg	₽	01/04/22 02:42	1
<0.00051		0.00077	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
< 0.00051		0.00077	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
<0.00051		0.00077	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
<0.00051	M	0.00077	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
<0.00051	`	0.00077	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
<0.00051		0.00077	0.00051	0.00051	mg/Kg		01/04/22 02:42	1
<0.00051		0.00077	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
<0.00051	\downarrow	0.00077	0.00051	0.00051	mg/Kg	₩	01/04/22 02:42	1
	Result	Result Qualifier	<0.0021	Result Qualifier LOQ LOD <0.0021	Result Qualifier LOQ LOD DL <0.0021	Result Qualifier LOQ LOD DL Unit <0.0021	Result Qualifier LOQ LOD DL Unit D <0.0021	Result Qualifier LOQ LOD DL Unit D Analyzed

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-S1A-1-SO-(0.5-2)-121621 Lab Sample ID: 410-67825-5

Date Collected: 12/16/21 12:00 **Matrix: Solid** Date Received: 12/21/21 18:23 Percent Solids: 76.4

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	73		50 - 150	12/30/21 06:52	01/04/22 02:42	1
M2-8:2 FTS	86		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C2 PFTeDA	89		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C3 PFBS	98		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C4 PFBA	83		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C4 PFHpA	87		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C5 PFPeA	86		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C8 PFOA	95		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C8 PFOS	106		50 - 150	12/30/21 06:52	01/04/22 02:42	1
d3-NMeFOSAA	24	*5-	50 - 150	12/30/21 06:52	01/04/22 02:42	1
d5-NEtFOSAA	37	*5-	50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C2-PFDoDA	100		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C3 PFHxS	104		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C5 PFHxA	89		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C6 PFDA	96		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C7 PFUnA	99		50 - 150	12/30/21 06:52	01/04/22 02:42	1
13C9 PFNA	88		50 - 150	12/30/21 06:52	01/04/22 02:42	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0021		0.0026	0.0021	0.0021	mg/Kg	☼	01/06/22 05:43	1
8:2 Fluorotelomer sulfonic acid	<0.0021		0.0039	0.0021	0.0021	mg/Kg	☼	01/06/22 05:43	1
NEtFOSAA	< 0.00052		0.0026	0.00052	0.00052	mg/Kg	☼	01/06/22 05:43	1
NMeFOSAA	<0.00052		0.0026	0.00052	0.00052	mg/Kg	≎	01/06/22 05:43	1
Perfluorobutanesulfonic acid	<0.0021		0.0026	0.0021	0.0021	mg/Kg	≎	01/06/22 05:43	1
Perfluorobutanoic acid	<0.0021		0.0026	0.0021	0.0021	mg/Kg	☼	01/06/22 05:43	1
Perfluorodecanoic acid	<0.00052		0.00079	0.00052	0.00052	mg/Kg	≎	01/06/22 05:43	1
Perfluorododecanoic acid	<0.00052		0.00079	0.00052	0.00052	mg/Kg	≎	01/06/22 05:43	1
Perfluoroheptanoic acid	<0.00052		0.00079	0.00052	0.00052	mg/Kg	≎	01/06/22 05:43	1
Perfluorohexanesulfonic acid	< 0.00052		0.00079	0.00052	0.00052	mg/Kg	≎	01/06/22 05:43	1
Perfluorohexanoic acid	<0.00052		0.00079	0.00052	0.00052	mg/Kg	☼	01/06/22 05:43	1
Perfluorononanoic acid	< 0.00052		0.00079	0.00052	0.00052	mg/Kg	≎	01/06/22 05:43	1
Perfluorooctanesulfonic acid	<0.00052		0.00079	0.00052	0.00052	mg/Kg	≎	01/06/22 05:43	1
Perfluorooctanoic acid	< 0.00052	М	0.00079	0.00052	0.00052	mg/Kg	☼	01/06/22 05:43	1
Perfluoropentanoic acid	< 0.00052		0.00079	0.00052	0.00052	mg/Kg	≎	01/06/22 05:43	1
Perfluorotetradecanoic acid	<0.00052		0.00079	0.00052	0.00052	mg/Kg	≎	01/06/22 05:43	1
Perfluorotridecanoic acid	< 0.00052		0.00079	0.00052	0.00052	mg/Kg	≎	01/06/22 05:43	1
Perfluoroundecanoic acid	< 0.00052		0.00079	0.00052	0.00052	mg/Kg	₩	01/06/22 05:43	1

Isotope Dilution	%Recovery Qualifier	Limits	Prepared Analyzed	Dil Fac
M2-6:2 FTS	65	50 - 150	01/04/22 18:53 01/06/22 05:43	1
M2-8:2 FTS	69	50 - 150	01/04/22 18:53 01/06/22 05:43	1
13C2 PFTeDA	66	50 - 150	01/04/22 18:53 01/06/22 05:43	1
13C3 PFBS	85	50 - 150	01/04/22 18:53 01/06/22 05:43	1
13C4 PFBA	65	50 - 150	01/04/22 18:53 01/06/22 05:43	1
13C4 PFHpA	69	50 - 150	01/04/22 18:53 01/06/22 05:43	1
13C5 PFPeA	76	50 - 150	01/04/22 18:53 01/06/22 05:43	1
13C8 PFOA	74	50 - 150	01/04/22 18:53 01/06/22 05:43	1
13C8 PFOS	86	50 - 150	01/04/22 18:53 01/06/22 05:43	1
d3-NMeFOSAA	8 *5-	50 - 150	01/04/22 18:53 01/06/22 05:43	1
d5-NEtFOSAA	12 *5-	50 ₋ 150	01/04/22 18:53 01/06/22 05:43	X

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-S1A-1-SO-(0.5-2)-121621 Lab Sample ID: 410-67825-5

Date Collected: 12/16/21 12:00 Matrix: Solid
Date Received: 12/21/21 18:23 Percent Solids: 76.4

Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	d	Analyzed	Dil Fa
13C2-PFDoDA	71		50 - 150			01/04/22 18	3:53	01/06/22 05:43	
13C3 PFHxS	90		50 - 150			01/04/22 18	3:53	01/06/22 05:43	
13C5 PFHxA	67		50 - 150			01/04/22 18	3:53	01/06/22 05:43	
13C6 PFDA	71		50 - 150			01/04/22 18	3:53	01/06/22 05:43	
13C7 PFUnA	72		50 - 150			01/04/22 18	3:53	01/06/22 05:43	_
13C9 PFNA	77		50 - 150			01/04/22 18	3:53	01/06/22 05:43	
General Chemistry									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fa
Percent Moisture	23.6		1.0		1.0	%		12/23/21 12:59	
Percent Solids	76.4		1.0		1.0	%		12/23/21 12:59	
General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD		Unit	D	Analyzed	Dil Fa
рН	5.9	J	0.01	0.01	0.01	S.U.	_	12/28/21 15:40	
Temperature	20.7		0.01	0.01	0.01	Degrees C		12/28/21 15:40	
Method: D422 - Grain Size									
Analyte	Result	Qualifier	LOQ	LOD		Unit	D	Analyzed	Dil Fa
Gravel	<1.0		1.0	1.0	1.0	%		12/30/21 11:30	
Sand	21.7		1.0	1.0	1.0	%		12/30/21 11:30	
Silt	69.9		1.0	1.0	1.0	%		12/30/21 11:30	
Clay	8.0		1.0	1.0	1.0	%		12/30/21 11:30	
75 mm	100.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	
37.5 mm	100.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	
19 mm	100		1.0	1.0	1.0	% Passing		12/30/21 11:30	
4.75 mm	99.6		1.0	1.0	1.0	% Passing		12/30/21 11:30	
3.35 mm	98.4		1.0	1.0	1.0	% Passing		12/30/21 11:30	
2.36 mm	96.4		1.0	1.0	1.0	% Passing		12/30/21 11:30	
l.18 mm	96.3		1.0	1.0	1.0	% Passing		12/30/21 11:30	
).6 mm	95.9		1.0	1.0	1.0	% Passing		12/30/21 11:30	
).3 mm	88.9		1.0	1.0	1.0	% Passing		12/30/21 11:30	
).15 mm	82.8		1.0	1.0	1.0	% Passing		12/30/21 11:30	
0.075 mm	77.9		1.0	1.0	1.0	% Passing		12/30/21 11:30	
0.064 mm	72.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	
0.05 mm	54.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	
0.02 mm	30.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	
0.005 mm	8.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	
0.002 mm	4.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	
0.001 mm	2.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	

Client Sample ID: APG-S1A-1-GW-121521 Lab Sample ID: 410-67825-6

Date Collected: 12/15/21 11:00 Matrix: Water

Date Received: 12/21/21 18:23

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15										
Analyte	Result	Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac			
6:2 Fluorotelomer sulfonic acid	<3.4	UJ	4.2	3.4	3.4 ng/L	12/30/21 18:15	1			
8:2 Fluorotelomer sulfonic acid	<1.7		2.5	1.7	1.7 ng/L	12/30/21 18:15	1			
NEtFOSAA	<0.84		2.5	0.84	0.84 ng/L	12/30/21 18:15	1			
NMeFOSAA	<1.0	1	1.7	1.0	1.0 ng/L	12/30/21 18:15	1			

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ilos Liiv, LLO

Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client: ARCADIS U.S., Inc.

Client Sample ID: APG-S1A-1-GW-121521

Date Collected: 12/15/21 11:00 Date Received: 12/21/21 18:23

Lab Sample ID: 410-67825-6

Matrix: Water

Analyte	Result	Qualifier	l	_OQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorobutanesulfonic acid	<0.84	UJ		1.7	0.84	0.84	ng/L	_	12/30/21 18:15	1
Perfluorobutanoic acid	<3.4	M		4.2	3.4	3.4	ng/L		12/30/21 18:15	1
Perfluorodecanoic acid	<0.84			1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Perfluorododecanoic acid	<0.84			1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Perfluoroheptanoic acid	<0.84			1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Perfluorohexanesulfonic acid	<0.84			1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Perfluorohexanoic acid	<0.84			1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Perfluorononanoic acid	<0.84			1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Perfluorooctanesulfonic acid	<0.84	√		1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Perfluorooctanoic acid	1.1	J M		1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Perfluoropentanoic acid	<0.84	UJ		1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Perfluorotetradecanoic acid	<0.84			1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Perfluorotridecanoic acid	<0.84			1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Perfluoroundecanoic acid	<0.84	$\mathbf{\Psi}$		1.7	0.84	0.84	ng/L		12/30/21 18:15	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	1	Analyzed	Dil Fac

	0.0	· · · · · · · · · · · · · · · · · · ·	 0.0g/_	,	•
Isotope Dilution	%Recovery	Qualifier Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	99	50 - 150	12/28/21 18:21	12/30/21 18:15	1
M2-8:2 FTS	103	50 ₋ 150	12/28/21 18:21	12/30/21 18:15	1
13C2 PFTeDA	92	50 - 150	12/28/21 18:21	12/30/21 18:15	1
13C3 PFBS	102	50 - 150	12/28/21 18:21	12/30/21 18:15	1
13C4 PFBA	103	50 ₋ 150	12/28/21 18:21	12/30/21 18:15	1
13C4 PFHpA	107	50 - 150	12/28/21 18:21	12/30/21 18:15	1
13C5 PFPeA	101	50 - 150	12/28/21 18:21	12/30/21 18:15	1
13C8 PFOA	111	50 - 150	12/28/21 18:21	12/30/21 18:15	1
13C8 PFOS	102	50 - 150	12/28/21 18:21	12/30/21 18:15	1
d3-NMeFOSAA	88	50 - 150	12/28/21 18:21	12/30/21 18:15	1
d5-NEtFOSAA	104	50 ₋ 150	12/28/21 18:21	12/30/21 18:15	1
13C2-PFDoDA	105	50 - 150	12/28/21 18:21	12/30/21 18:15	1
13C3 PFHxS	107	50 - 150	12/28/21 18:21	12/30/21 18:15	1
13C5 PFHxA	102	50 - 150	12/28/21 18:21	12/30/21 18:15	1
13C6 PFDA	107	50 - 150	12/28/21 18:21	12/30/21 18:15	1
13C7 PFUnA	102	50 - 150	12/28/21 18:21	12/30/21 18:15	1
13C9 PFNA	106	50 - 150	12/28/21 18:21	12/30/21 18:15	1

Client Sample ID: APG-FD-1-SO-(0.5-2)-121621

Lab Sample ID: 410-67825-7 Date Collected: 12/16/21 00:00 **Matrix: Solid** Date Received: 12/21/21 18:23 Percent Solids: 65.8

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0024 UJ	0.0030	0.0024	0.0024	mg/Kg	☼	01/04/22 02:53	1
8:2 Fluorotelomer sulfonic acid	<0.0024	0.0044	0.0024	0.0024	mg/Kg	☼	01/04/22 02:53	1
NEtFOSAA	<0.00059	0.0030	0.00059	0.00059	mg/Kg	☼	01/04/22 02:53	1
NMeFOSAA	<0.00059	0.0030	0.00059	0.00059	mg/Kg	₽	01/04/22 02:53	1
Perfluorobutanesulfonic acid	<0.0024	0.0030	0.0024	0.0024	mg/Kg	☼	01/04/22 02:53	1
Perfluorobutanoic acid	<0.0024	0.0030	0.0024	0.0024	mg/Kg	☼	01/04/22 02:53	1
Perfluorodecanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	☼	01/04/22 02:53	1
Perfluorododecanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	☼	01/04/22 02:53	1
Perfluoroheptanoic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	☼	01/04/22 02:53	1
Perfluorohexanesulfonic acid	<0.00059	0.00089	0.00059	0.00059	mg/Kg	☼	01/04/22 02:53	1
Perfluorohexanoic acid	<0.00059 🗸	0.00089	0.00059	0.00059	mg/Kg	₩	01/04/22 02:53	1

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-FD-1-SO-(0.5-2)-121621 Lab Sample ID: 410-67825-7

Date Collected: 12/16/21 00:00 Matrix: Solid
Date Received: 12/21/21 18:23 Percent Solids: 65.8

Analyte	Result Qua	alifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorononanoic acid	<0.00059	JJ	0.00089	0.00059	0.00059	mg/Kg	⇔	01/04/22 02:53	1
Perfluorooctanesulfonic acid	<0.00059	T	0.00089	0.00059	0.00059	mg/Kg	⇔	01/04/22 02:53	1
Perfluorooctanoic acid	<0.00059 M		0.00089	0.00059	0.00059	mg/Kg	≎	01/04/22 02:53	1
Perfluoropentanoic acid	<0.00059		0.00089	0.00059	0.00059	mg/Kg	⇔	01/04/22 02:53	1
Perfluorotetradecanoic acid	<0.00059		0.00089	0.00059	0.00059	mg/Kg	₩	01/04/22 02:53	1
Perfluorotridecanoic acid	<0.00059		0.00089	0.00059	0.00059	mg/Kg	⇔	01/04/22 02:53	1
Perfluoroundecanoic acid	<0.00059	Ψ	0.00089	0.00059	0.00059	mg/Kg	≎	01/04/22 02:53	1
Isotope Dilution	%Recovery Qualific	er	Limits			Prepa	red	Analyzed	Dil Fac
M2-6:2 FTS	97		50 - 150			12/30/21	06:52	01/04/22 02:53	
M2-8:2 FTS	137		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C2 PFTeDA	127		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C3 PFBS	117		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C4 PFBA	108		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C4 PFHpA	116		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C5 PFPeA	107		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C8 PFOA	124		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C8 PFOS	128		50 - 150			12/30/21	06:52	01/04/22 02:53	1
d3-NMeFOSAA	48 *5-		50 - 150			12/30/21	06:52	01/04/22 02:53	1
d5-NEtFOSAA	63		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C2-PFDoDA	129		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C3 PFHxS	129		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C5 PFHxA	104		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C6 PFDA	118		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C7 PFUnA	133		50 - 150			12/30/21	06:52	01/04/22 02:53	1
13C9 PFNA	112		50 - 150			12/30/21	06:52	01/04/22 02:53	1

Analyte	Result (Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0023		0.0028	0.0023	0.0023	mg/Kg	*	01/06/22 05:54	1
8:2 Fluorotelomer sulfonic acid	<0.0023	(0.0043	0.0023	0.0023	mg/Kg	☼	01/06/22 05:54	1
NEtFOSAA	<0.00057	(0.0028	0.00057	0.00057	mg/Kg	☼	01/06/22 05:54	1
NMeFOSAA	<0.00057	(0.0028	0.00057	0.00057	mg/Kg	₩	01/06/22 05:54	1
Perfluorobutanesulfonic acid	<0.0023	(0.0028	0.0023	0.0023	mg/Kg	₩	01/06/22 05:54	1
Perfluorobutanoic acid	≥0.0023	(0.0028	0.0023	0.0023	mg/Kg	☼	01/06/22 05:54	1
Perfluorodecanoic acid	<0.00057	0.	00085	0.00057	0.00057	mg/Kg	₩	01/06/22 05:54	1
Perfluorododecanoic acid	< 0.00057	0.	00085	0.00057	0.00057	mg/Kg	☼	01/06/22 05:54	1
Perfluoroheptanoic acid	<0.00057	0.	00085	0.00057	0.00057	mg/Kg	☼	01/06/22 05:54	1
Perfluorohexanesulfonic acid	<0.00057	0.	00085	0.00057	0.00057	mg/Kg	₩	01/06/22 05:54	1
Perfluorohexanoic acid	<0.00057	0.	00085	0.00057	0.00057	mg/Kg	☼	01/06/22 05:54	1
Perfluorononanoic acid	<0.00057	0.	00085	0.00057	0.00057	mg/Kg	☼	01/06/22 05:54	1
Perfluorooctanesulfonic acid	<0.00057	0.	00085	0.00057	0.00057	mg/Kg	☼	01/06/22 05:54	1
Perfluorooctanoic acid	<0.00057	M 0.	00085	0.00057	0.00057	mg/Kg	☼	01/06/22 05:54	1
Perfluoropentanoic acid	<0.00057 N	M 0.	00085	0.00057	0.00057	mg/Kg	₩	01/06/22 05:54	1
Perfluorotetradecanoic acid	<0.00057	0.	00085	0.00057	0.00057	mg/Kg	⊅	01/06/22 05:54	1
Perfluorotridecanoic acid	< 0.00057	0.	00085	0.00057	0.00057	mg/Kg	₩.	01/06/22 05:54	1
Perfluoroundecanoic acid	<0.00057	0.	00085	0.00057	0.00057	mg/Kg	☼	01/06/22 05:54	1
Isotope Dilution	%Recovery Qua	alifier Limits	;			Prepa	red	Analyzed	Dil Fac
M2-6:2 FTS	81	50 - 15	50			01/04/22	18:53	01/06/22 05:54	1
M2-8:2 FTS	78	50 - 15	50			01/04/22	18:53	01/06/22 05:54	*

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

M2-6:2 FTS

M2-8:2 FTS

13C3 PFBS

13C2 PFTeDA

Client Sample ID: APG-FD-1-SO-(0.5-2)-121621 Lab Sample ID: 410-67825-7

Date Collected: 12/16/21 00:00 Matrix: Solid
Date Received: 12/21/21 18:23 Percent Solids: 65.8

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFTeDA	75		50 - 150	01/04/22 18:53	01/06/22 05:54	1
13C3 PFBS	85		50 - 150	01/04/22 18:53	01/06/22 05:54	1
13C4 PFBA	83		50 - 150	01/04/22 18:53	01/06/22 05:54	1
13C4 PFHpA	79		50 - 150	01/04/22 18:53	01/06/22 05:54	1
13C5 PFPeA	93		50 - 150	01/04/22 18:53	01/06/22 05:54	1
13C8 PFOA	85		50 - 150	01/04/22 18:53	01/06/22 05:54	1
13C8 PFOS	86		50 ₋ 1 5 0	01/04/22 18:53	01/06/22 05:54	1
d3-NMeFOSAA	19	*5-	50 - 150	01/04/22 18:53	01/06/22 05:54	1
d5-NEtFOSAA	25	*5-	50 - 150	01/04/22 18:53	01/06/22 05:54	1
13C2-PFDoDA	82		50 - 150	01/04/22 18:53	01/06/22 05:54	1
13C3 PFHxS	89		50 - 150	01/04/22 18:53	01/06/22 05:54	1
13C5 PFHxA	76		50 - 150	01/04/22 1 8:5 3	01/06/22 05:54	1
13C6 PFDA	83		50 - 150	01/04/22 18:53	01/06/22 05:54	1
13C7 PFUnA	85		50 - 150	01/04/22 18:53	01/06/22 05:54	1
13C9 PFNA	85		50 ₋ 150	01/04/22 18:53	01/06/22 05:54	4

General Chemistry								
Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	34.2	1.0		1.0	%		12/23/21 12:59	1
Percent Solids	65.8	1.0		1.0	%		12/23/21 12:59	1

Client Sample ID: APG-FD-1-GW-121521

Date Collected: 12/15/21 00:00

Lab Sample ID: 410-67825-8

Matrix: Water

Date Collected: 12/15/21 00:00

Date Received: 12/21/21 18:23

100

91

85

100

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5	UJ	4.3	3.5	3.5	ng/L	12/30/21 18:36	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.6	1.7	1.7	ng/L	12/30/21 18:36	1
NEtFOSAA	<0.86		2.6	0.86	0.86	ng/L	12/30/21 18:36	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L	12/30/21 18:36	1
Perfluorobutanesulfonic acid	<0.86	Ŋ	1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluorobutanoic acid	<3.5	N	4.3	3.5	3.5	ng/L	12/30/21 18:36	1
Perfluorodecanoic acid	<0.86	M	1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluorododecanoic acid	<0.86		1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluoroheptanoic acid	<0.86	M.	1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluorohexanesulfonic acid	<0.86		1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluorohexanoic acid	<0.86	M	1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluorononanoic acid	<0.86	M	1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluorooctanesulfonic acid	<0.86	M	1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluorooctanoic acid	1.0	JM	1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluoropentanoic acid	<0.86	M UJ	1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluorotetradecanoic acid	<0.86		1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluorotridecanoic acid	<0.86		1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Perfluoroundecanoic acid	<0.86	\downarrow	1.7	0.86	0.86	ng/L	12/30/21 18:36	1
Isotope Dilution	%Recovery Q	ualifier	Limits			Prepared	Analyzed	Dil Fac

50 - 150

50 - 150

50 - 150

50 - 150

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12/28/21 18:21 12/30/21 18:36

12/28/21 18:21 12/30/21 18:36

12/28/21 18:21 12/30/21 18:36

12/28/21 18:21 12/30/21 18:36

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Lab Sample ID: 410-67825-8 Client Sample ID: APG-FD-1-GW-121521

Date Collected: 12/15/21 00:00 **Matrix: Water** Date Received: 12/21/21 18:23

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFBA	98	50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C4 PFHpA	109	50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C5 PFPeA	107	50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C8 PFOA	106	50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C8 PFOS	100	50 - 150	12/28/21 18:21	12/30/21 18:36	1
d3-NMeFOSAA	74	50 - 150	12/28/21 18:21	12/30/21 18:36	1
d5-NEtFOSAA	92	50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C2-PFDoDA	91	50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C3 PFHxS	112	50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C5 PFHxA	104	50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C6 PFDA	95	50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C7 PFUnA	97	50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C9 PFNA	99	50 - 150	12/28/21 18:21	12/30/21 18:36	1

Client Sample ID: APG-S3-1-SO-(0.5-2)-121621 Lab Sample ID: 410-67825-9

Date Collected: 12/16/21 11:25 **Matrix: Solid** Date Received: 12/21/21 18:23 Percent Solids: 76.9

Analyte	Result Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0020	0.0025	0.0020	0.0020	mg/Kg	<u></u>	01/04/22 03:04	1
8:2 Fluorotelomer sulfonic acid	<0.0020	0.0038	0.0020	0.0020	mg/Kg	₩	01/04/22 03:04	1
NEtFOSAA	<0.00051	0.0025	0.00051	0.00051	mg/Kg	☼	01/04/22 03:04	1
NMeFOSAA	<0.00051	0.0025	0.00051	0.00051	mg/Kg	₩	01/04/22 03:04	1
Perfluorobutanesulfonic acid	<0.0020	0.0025	0.0020	0.0020	mg/Kg	₩	01/04/22 03:04	1
Perfluorobutanoic acid	<0.0020	0.0025	0.0020	0.0020	mg/Kg	☼	01/04/22 03:04	1
Perfluorodecanoic acid	<0.00051	0.00076	0.00051	0.00051	mg/Kg	₽	01/04/22 03:04	1
Perfluorododecanoic acid	<0.00051	0.00076	0.00051	0.00051	mg/Kg	₩	01/04/22 03:04	1
Perfluoroheptanoic acid	<0.00051	0.00076	0.00051	0.00051	mg/Kg	₩	01/04/22 03:04	1
Perfluorohexanesulfonic acid	<0.00051	0.00076	0.00051	0.00051	mg/Kg	₩	01/04/22 03:04	1
Perfluorohexanoic acid	<0.00051	0.00076	0.00051	0.00051	mg/Kg	₩	01/04/22 03:04	1
Perfluorononanoic acid	<0.00051	0.00076	0.00051	0.00051	mg/Kg	☼	01/04/22 03:04	1
Perfluorooctanesulfonic acid	<0.00051	0.00076	0.00051	0.00051	mg/Kg	₩	01/04/22 03:04	1
Perfluorooctanoic acid	<0.00051 M	0.00076	0.00051	0.00051	mg/Kg	₩	01/04/22 03:04	1
Perfluoropentanoic acid	<0.00051	0.00076	0.00051	0.00051	mg/Kg	₩	01/04/22 03:04	1
Perfluorotetradecanoic acid	<0.00051	0.00076	0.00051	0.00051	mg/Kg	₩	01/04/22 03:04	1
Perfluorotridecanoic acid	<0.00051	0.00076	0.00051	0.00051	mg/Kg	₩	01/04/22 03:04	1
Perfluoroundecanoic acid	<0.00051	0.00076	0.00051	0.00051	mg/Kg	₩	01/04/22 03:04	1

Isotope Dilution	%Recovery Quali	fier Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	66	50 - 150	12/30/21 06:52	01/04/22 03:04	1
M2-8:2 FTS	81	50 - 150	12/30/21 06:52	01/04/22 03:04	1
13C2 PFTeDA	83	50 ₋ 150	12/30/21 06:52	01/04/22 03:04	1
13C3 PFBS	95	50 - 150	12/30/21 06:52	01/04/22 03:04	1
13C4 PFBA	77	50 ₋ 150	12/30/21 06:52	01/04/22 03:04	1
13C4 PFHpA	80	50 ₋ 150	12/30/21 06:52	01/04/22 03:04	1
13C5 PFPeA	81	50 - 150	12/30/21 06:52	01/04/22 03:04	1
13C8 PFOA	91	50 ₋ 150	12/30/21 06:52	01/04/22 03:04	1
13C8 PFOS	102	50 ₋ 150	12/30/21 06:52	01/04/22 03:04	1
d3-NMeFOSAA	36 *5-	50 - 150	12/30/21 06:52	01/04/22 03:04	1
d5-NEtFOSAA	56	50 ₋ 150	12/30/21 06:52	01/04/22 03:04	1

Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-S3-1-SO-(0.5-2)-121621 Lab Sample ID: 410-67825-9

Date Collected: 12/16/21 11:25 **Matrix: Solid** Percent Solids: 76.9 Date Received: 12/21/21 18:23

Method: EPA 537(Mod)	- PFAS for QSM 5.3, Table B-15 (Continued)
Isotope Dilution	%Recovery Qualifier Limits

Isotope Dilution	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2-PFDoDA	90	50 - 150	12/30/21 06:52	01/04/22 03:04	1
13C3 PFHxS	98	50 - 150	12/30/21 06:52	01/04/22 03:04	1
13C5 PFHxA	76	50 - 150	12/30/21 06:52	01/04/22 03:04	1
13C6 PFDA	87	50 - 150	12/30/21 06:52	01/04/22 03:04	1
13C7 PFUnA	93	50 - 150	12/30/21 06:52	01/04/22 03:04	1
13C9 PFNA	80	50 - 150	12/30/21 06:52	01/04/22 03:04	1

Analyto	Popult	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Analyte		Qualifier	· -						Dil Fac
6:2 Fluoretelomer sulfonic acid	<0.0020		0.0025	0.0020	0.0020	0 0	₩	01/06/22 06:05	1
8:2 Fluorotelomer sulfonic acid	<0.0020		0.0037	0.0020	0.0020	mg/Kg	₩	01/06/22 06:05	1
NEtFOSAA	<0.00050		0.0025	0.00050	0.00050	mg/Kg	₩	01/06/22 06:05	1
NMeFOSAA	<0.00050		0.0025	0.00050	0.00050	mg/Kg	₩	01/06/22 06:05	1
Perfluorobutanesulfonic asid	<0.0020		0.0025	0.0020	0.0020	mg/Kg	☼	01/06/22 06:05	1
Perfluorobutanoic acid	<0.0020		0.0025	0.0020	0.0020	mg/Kg	☼	01/06/22 06:05	1
Perfluorodecanoic acid	<0.00050		0.00074	0.00050	0.00050	mg/Kg	₩	01/06/22 06:05	1
Perfluorododecanoic acid	<0.00050		0.00074	0.00050	0.00050	mg/Kg	☼	01/06/22 06:05	1
Perfluoroheptanoic acid	<0.00050		0.00074	0.00050	0.00050	mg/Kg	☼	01/06/22 06:05	1
Perfluorohexanesulfonic acid	<0.00050		0.00074	0.00050	0.00050	mg/Kg	₩	01/06/22 06:05	1
Perfluorohexanoic acid	<0:00050		0.00074	0.00050	0.00050	mg/Kg	☼	01/06/22 06:05	1
Perfluorononanoic acid	<0.00050		0.00074	0.00050	0.00050	mg/Kg	☼	01/06/22 06:05	1
Perfluorooctanesulfonic acid	<0.00050	· · · · · · · · · · · · · · · · · · ·	0.00074	0.00050	0.00050	mg/Kg	₽	01/06/22 06:05	1
Perfluorooctanoic acid	<0.00050	М	0.00074	0.00050	0.00050	mg/Kg	☼	01/06/22 06:05	1
Perfluoropentanoic acid	<0.00050		0.00074	0.00050	0.00050	mg/Kg	☼	01/06/22 06:05	1
Perfluorotetradecanoic acid	<0.00050		0.00074	0.00050	0.00050	mg/Kg	₩	01/06/22 06:05	1
Perfluorotridecanoic acid	<0.00050		0.00074	0.00050	0.00050	mg/Kg	₩	01/06/22 06:05	1
Perfluoroundecanoic acid	<0.00050		0.00074	0.00050	0.00050	mg/Kg	₩	01/06/22 06:05	1

Perfluoroundecanoic acid	<0.00050	0.00074	0.00050	0.00050	mg/Kg ⇔	01/06/22 06:05	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	68	50 - 150			01/04/22 18:53	01/06/22 06:05	1
M2-8:2 FTS	67	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C2 PFTeDA	66	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C3 PFBS	78	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C4 PFBA	70	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C4 PFHpA	66	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C5 PFPeA	79	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C8 PFOA	78	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C8 PFOS	80	50 - 150			01/04/22 18:53	01/06/22 06:05	1
d3-NMeFOSAA	29 *5-	50 - 150			01/04/22 18:53	01/06/22 06:05	1
d5-NEtFOSAA	40 *5-	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C2-PFDoDA	74	50 - 150			01/04/22 18:53	01/86/22 06:05	1
13C3 PFHxS	83	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C5 PFHxA	67	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C6 PFDA	74	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C7 PFUnA	74	50 - 150			01/04/22 18:53	01/06/22 06:05	1
13C9 PFNA	77	50 - 150			01/04/22 18:53	01/06/22 06:05	X

General Chemistry

Analyte	Result Qualifier	LOQ	LOD	DL Unit	D Analyzed	Dil Fac
Percent Moisture	23.1	1.0		1.0 %	12/23/21 12:59	1
Percent Solids	76.9	1.0		1.0 %	12/23/21 12:59	1

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-S3-1-SO-(0.5-2)-121621

Lab Sample ID: 410-67825-9 Date Collected: 12/16/21 11:25 **Matrix: Solid**

Date Received: 12/21/21 18:23 Percent Solids: 76.9

General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	5.6	J	0.01	0.01	0.01	S.U.	_	12/28/21 15:40	1
_Temperature	20.5		0.01	0.01	0.01	Degrees C		12/28/21 15:40	1

Method: D422 - Grain Size Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%		12/30/21 11:30	1
Sand	24.8		1.0	1.0	1.0	%		12/30/21 11:30	1
Silt	60.1		1.0	1.0	1.0	%		12/30/21 11:30	1
Clay	15.0		1.0	1.0	1.0	%		12/30/21 11:30	1
75 mm	100.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
37.5 mm	100.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
19 mm	100.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
4.75 mm	99.9		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
3.35 mm	99.6		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
2.36 mm	99.2		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
1.18 mm	99.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.6 mm	98.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.3 mm	85.6		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.15 mm	78.1		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.075 mm	75.1		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.064 mm	70.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.05 mm	56.5		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.02 mm	32.5		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.005 mm	15.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.002 mm	11.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.001 mm	8.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1

Client Sample ID: APG-S3-1-GW-121521

Lab Sample ID: 410-67825-10 Date Collected: 12/15/21 09:45 **Matrix: Water**

Date Received: 12/21/21 18:23

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.6	UJ	4.5	3.6	3.6	ng/L		12/30/21 18:47	1
8:2 Fluorotelomer sulfonic acid	<1.8	1	2.7	1.8	1.8	ng/L		12/30/21 18:47	1
NEtFOSAA	<0.91		2.7	0.91	0.91	ng/L		12/30/21 18:47	1
NMeFOSAA	<1.1	V	1.8	1.1	1.1	ng/L		12/30/21 18:47	1
Perfluorobutanesulfonic acid	2.2	J	1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluorobutanoic acid	<3.6	Ŋ UJ	4.5	3.6	3.6	ng/L		12/30/21 18:47	1
Perfluorodecanoic acid	<0.91	M	1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluorododecanoic acid	<0.91	\downarrow	1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluoroheptanoic acid	4.5	M J	1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluorohexanesulfonic acid	6.0		1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluorohexanoic acid	4.0	\downarrow	1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluorononanoic acid	<0.91	M UJ	1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluorooctanesulfonic acid	220	X J	1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluorooctanoic acid	28	ΜĴ	1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluoropentanoic acid	1.7	J	1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluorotetradecanoic acid	<0.91	UJ	1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluorotridecanoic acid	<0.91	$\mathbf{\Lambda}$	1.8	0.91	0.91	ng/L		12/30/21 18:47	1

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-S3-1-GW-121521 Lab Sample ID: 410-67825-10

Date Collected: 12/15/21 09:45

Date Received: 12/21/21 18:23

Matrix: Water

Analyte	Result Qualifie	r LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluoroundecanoic acid	<0.91 UJ	1.8	0.91	0.91	ng/L	12/30/21 18:47	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	88	50 - 150			12/28/21 18:21	12/30/21 18:47	1
M2-8:2 FTS	99	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C2 PFTeDA	87	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C3 PFBS	101	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C4 PFBA	103	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C4 PFHpA	103	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C5 PFPeA	106	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C8 PFOA	103	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C8 PFOS	100	50 - 150			12/28/21 18:21	12/30/21 18:47	1
d3-NMeFOSAA	81	50 - 150			12/28/21 18:21	12/30/21 18:47	1
d5-NEtFOSAA	95	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C2-PFDoDA	96	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C3 PFHxS	107	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C5 PFHxA	101	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C6 PFDA	100	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C7 PFUnA	99	50 - 150			12/28/21 18:21	12/30/21 18:47	1
13C9 PFNA	97	50 - 150			12/28/21 18:21	12/30/21 18:47	1

Client Sample ID: APG-E3-1-SO-(0.5-2)-121621 Lab Sample ID: 410-67825-11

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018	UJ	0.0022	0.0018	0.0018	mg/Kg	01/04/22 03:14	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0033	0.0018	0.0018	mg/Kg ♯	01/04/22 03:14	1
NEtFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg ⇔	01/04/22 03:14	1
NMeFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg ♯	01/04/22 03:14	1
Perfluorobutanesulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg ⇔	01/04/22 03:14	1
Perfluorobutanoic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg ♯	01/04/22 03:14	1
Perfluorodecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ☆	01/04/22 03:14	1
Perfluorododecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ♯	01/04/22 03:14	1
Perfluoroheptanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ☆	01/04/22 03:14	1
Perfluorohexanesulfonic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ♯	01/04/22 03:14	1
Perfluorohexanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ☆	01/04/22 03:14	1
Perfluorononanoic acid	<0.00044	Ψ	0.00066	0.00044	0.00044	mg/Kg ☆	01/04/22 03:14	1
Perfluorooctanesulfonic acid	0.0011	J	0.00066	0.00044	0.00044	mg/Kg ♯	01/04/22 03:14	1
Perfluorooctanoic acid	0.00047	J M	0.00066	0.00044	0.00044	mg/Kg ☆	01/04/22 03:14	1
Perfluoropentanoic acid	<0.00044	UJ	0.00066	0.00044	0.00044	mg/Kg ♯	01/04/22 03:14	1
Perfluorotetradecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ☆	01/04/22 03:14	1
Perfluorotridecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg ☆	01/04/22 03:14	1
Perfluoroundecanoic acid	<0.00044	\downarrow	0.00066	0.00044	0.00044	mg/Kg ⇔	01/04/22 03:14	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	84		50 - 150			12/30/21 06:52	01/04/22 03:14	1
M2-8:2 FTS	109		50 - 150			12/30/21 06:52	01/04/22 03:14	1
13C2 PFTeDA	101		50 - 150			12/30/21 06:52	01/04/22 03:14	1
13C3 PFBS	93		50 - 150			12/30/21 06:52	01/04/22 03:14	1

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Client Sample ID: APG-E3-1-SO-(0.5-2)-121621 Lab Sample ID: 410-67825-11

Date Collected: 12/16/21 09:30 **Matrix: Solid** Date Received: 12/21/21 18:23 Percent Solids: 83.8

Isotope Dilution	%Recovery Q	ualifier	Limits			Prepare	d	Analyzed	Dil Fac
13C4 PFBA	95		50 - 150			12/30/21 06	5:52	01/04/22 03:14	1
13C4 PFHpA	99		50 - 150			12/30/21 06	5:52	01/04/22 03:14	1
13C5 PFPeA	97		50 - 150			12/30/21 06	5:52	01/04/22 03:14	1
13C8 PFOA	104		50 - 150			12/30/21 06	5:52	01/04/22 03:14	1
13C8 PFOS	99		50 - 150			12/30/21 06	5:52	01/04/22 03:14	1
d3-NMeFOSAA	54		50 - 150			12/30/21 06	5:52	01/04/22 03:14	1
d5-NEtFOSAA	68		50 - 150			12/30/21 06	5:52	01/04/22 03:14	1
13C2-PFDoDA	120		50 - 150			12/30/21 06	5:52	01/04/22 03:14	1
13C3 PFHxS	99		50 - 150			12/30/21 00	5:52	01/04/22 03:14	1
13C5 PFHxA	92		50 - 150			12/30/21 06	5:52	01/04/22 03:14	1
13C6 PFDA	103		50 - 150			12/30/21 06	5:52	01/04/22 03:14	1
13C7 PFUnA	103		50 - 150			12/30/21 0	5:52	01/04/22 03:14	1
13C9 PFNA	98		50 - 150			12/30/21 06	5:52	01/04/22 03:14	1
=									
General Chemistry		.			-		_		5
Analyte		Qualifier	LOQ _	LOD		Unit	D	Analyzed	Dil Fac
Percent Moisture	16.2		1.0			%		12/23/21 12:59	1
Percent Solids	83.8		1.0		1.0	%		12/23/21 12:59	1
General Chemistry - Soluble									
Analyte	Result	Qualifier	LOQ	LOD	DI	Unit	D	Analyzed	Dil Fac
pH	6.3		0.01	0.01	0.01		- =	12/28/21 15:40	1
Temperature	21.6	J	0.01	0.01		Degrees C		12/28/21 15:40	1
	21.0		0.0.	0.0.	0.0.	209.0000		,,	•
Method: D422 - Grain Size									
Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	D11 E
Gravel						•		Allalyzeu	Dil Fac
Graver	<1.0		1.0	1.0	1.0		. –	12/30/21 11:30	1 DII Fac
Sand	<1.0 15.2					%	. =		
			1.0	1.0	1.0	% %	. <u>-</u>	12/30/21 11:30	1
Sand	15.2		1.0 1.0	1.0 1.0	1.0 1.0	% % %	. =	12/30/21 11:30 12/30/21 11:30	1 1
Sand Silt	15.2 70.9		1.0 1.0 1.0	1.0 1.0 1.0	1.0 1.0 1.0 1.0	% % %		12/30/21 11:30 12/30/21 11:30 12/30/21 11:30	1 1 1
Sand Silt Clay	15.2 70.9 13.0		1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0	% % %		12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30	1 1 1 1
Sand Silt Clay 75 mm	15.2 70.9 13.0 100.0		1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0	% % % % % Passing		12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30	1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm	15.2 70.9 13.0 100.0 100.0		1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0	% % % % Passing % Passing		12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm	15.2 70.9 13.0 100.0 100.0		1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % % % Passing % Passing % Passing	. <u>-</u>	12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm	15.2 70.9 13.0 100.0 100.0 99.1		1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing	. <u>-</u>	12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm 3.35 mm	15.2 70.9 13.0 100.0 100.0 100.0 99.1 97.3		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing % Passing % Passing % Passing % Passing % Passing % Passing		12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm 3.35 mm 2.36 mm	15.2 70.9 13.0 100.0 100.0 100.0 99.1 97.3		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing		12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm 3.35 mm 2.36 mm 1.18 mm	15.2 70.9 13.0 100.0 100.0 100.0 99.1 97.3 94.4		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing		12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm 3.35 mm 2.36 mm 1.18 mm 0.6 mm	15.2 70.9 13.0 100.0 100.0 99.1 97.3 94.4 94.4		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing		12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm 3.35 mm 2.36 mm 1.18 mm 0.6 mm 0.3 mm	15.2 70.9 13.0 100.0 100.0 99.1 97.3 94.4 94.4 93.9 91.3		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing		12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm 3.35 mm 2.36 mm 1.18 mm 0.6 mm 0.3 mm 0.15 mm	15.2 70.9 13.0 100.0 100.0 99.1 97.3 94.4 93.9 91.3 87.2		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing		12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm 3.35 mm 2.36 mm 1.18 mm 0.6 mm 0.3 mm 0.15 mm 0.075 mm	15.2 70.9 13.0 100.0 100.0 100.0 99.1 97.3 94.4 93.9 91.3 87.2 83.9		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing		12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm 3.35 mm 2.36 mm 1.18 mm 0.6 mm 0.3 mm 0.15 mm 0.075 mm	15.2 70.9 13.0 100.0 100.0 100.0 99.1 97.3 94.4 93.9 91.3 87.2 83.9 78.0		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing % Passing		12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm 3.35 mm 2.36 mm 1.18 mm 0.6 mm 0.3 mm 0.15 mm 0.075 mm 0.0064 mm 0.05 mm	15.2 70.9 13.0 100.0 100.0 100.0 99.1 97.3 94.4 93.9 91.3 87.2 83.9 78.0 64.5		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing		12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm 3.35 mm 2.36 mm 1.18 mm 0.6 mm 0.3 mm 0.15 mm 0.075 mm 0.0064 mm 0.05 mm 0.05 mm	15.2 70.9 13.0 100.0 100.0 99.1 97.3 94.4 93.9 91.3 87.2 83.9 78.0 64.5 33.0		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % % Passing		12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Sand Silt Clay 75 mm 37.5 mm 19 mm 4.75 mm 3.35 mm 2.36 mm 1.18 mm 0.6 mm 0.3 mm 0.15 mm 0.075 mm 0.005 mm 0.005 mm	15.2 70.9 13.0 100.0 100.0 100.0 99.1 97.3 94.4 93.9 91.3 87.2 83.9 78.0 64.5 33.0		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	% % % Passing		12/30/21 11:30 12/30/21 11:30	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

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Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-E3-1-GW-121621

Lab Sample ID: 410-67825-12 Date Collected: 12/16/21 09:45 **Matrix: Water**

Date Received: 12/21/21 18:23

Client: ARCADIS U.S., Inc.

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.5	UJ	4.4	3.5	3.5	ng/L		12/31/21 09:17	1
8:2 Fluorotelomer sulfonic acid	<1.8		2.7	1.8	1.8	ng/L		12/31/21 09:17	1
NEtFOSAA	<0.88		2.7	0.88	0.88	ng/L		12/31/21 09:17	1
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L		12/31/21 09:17	1
Perfluorobutanesulfonic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluorobutanoic acid	<3.5		4.4	3.5	3.5	ng/L		12/31/21 09:17	1
Perfluorodecanoic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluorododecanoic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluoroheptanoic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluorohexanesulfonic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluorohexanoic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluorononanoic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluorooctanesulfonic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluorooctanoic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluoropentanoic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluorotetradecanoic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluorotridecanoic acid	<0.88		1.8	0.88	0.88	ng/L		12/31/21 09:17	1
Perfluoroundecanoic acid	<0.88	\downarrow	1.8	0.88	0.88	ng/L		12/31/21 09:17	1

			3.		
Isotope Dilution	%Recovery (Qualifier Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	102	50 - 150	12/29/21 18:06	12/31/21 09:17	1
M2-8:2 FTS	101	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C2 PFTeDA	64	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C3 PFBS	104	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C4 PFBA	98	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C4 PFHpA	108	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C5 PFPeA	108	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C8 PFOA	113	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C8 PFOS	101	50 - 150	12/29/21 18:06	12/31/21 09:17	1
d3-NMeFOSAA	72	50 - 150	12/29/21 18:06	12/31/21 09:17	1
d5-NEtFOSAA	80	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C2-PFDoDA	92	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C3 PFHxS	110	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C5 PFHxA	108	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C6 PFDA	100	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C7 PFUnA	91	50 - 150	12/29/21 18:06	12/31/21 09:17	1
13C9 PFNA	104	50 - 150	12/29/21 18:06	12/31/21 09:17	1

Client Sample ID: APG-E4-1-GW-121621

Date Collected: 12/16/21 08:15 Date Received: 12/21/21 18:23 Lab Sample ID: 410-67825-13 **Matrix: Water**

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.6	UJ	4.5	3.6	3.6	ng/L		12/31/21 09:28	1
8:2 Fluorotelomer sulfonic acid	<1.8	1	2.7	1.8	1.8	ng/L		12/31/21 09:28	1
NEtFOSAA	<0.90		2.7	0.90	0.90	ng/L		12/31/21 09:28	1
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L		12/31/21 09:28	1
Perfluorobutanesulfonic acid	<0.90		1.8	0.90	0.90	ng/L		12/31/21 09:28	1
Perfluorobutanoic acid	<3.6		4.5	3.6	3.6	ng/L		12/31/21 09:28	1
Perfluorodecanoic acid	<0.90	1	1.8	0.90	0.90	ng/L		12/31/21 09:28	1

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-E4-1-GW-121621 Lab Sample ID: 410-67825-13

Date Collected: 12/16/21 08:15 **Matrix: Water** Date Received: 12/21/21 18:23

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15 (Continued) LOD Analyte Result Qualifier DL Unit **Analyzed** Dil Fac Perfluorododecanoic acid <0.90 1.8 0.90 0.90 ng/L 12/31/21 09:28 0.90 Perfluoroheptanoic acid <0.90 UJ 1.8 0.90 ng/L 12/31/21 09:28 Perfluorohexanesulfonic acid 0.95 J 1.8 0.90 0.90 ng/L 12/31/21 09:28 Perfluorohexanoic acid 0.90 0.90 ng/L 12/31/21 09:28 <0.90 UJ 1.8 Perfluorononanoic acid < 0.90 1.8 0.90 0.90 ng/L 12/31/21 09:28 Perfluorooctanesulfonic acid < 0.90 1.8 0.90 0.90 ng/L 12/31/21 09:28 Perfluorooctanoic acid <0.90 M 1.8 0.90 0.90 ng/L 12/31/21 09:28 Perfluoropentanoic acid < 0.90 1.8 0.90 12/31/21 09:28 0.90 ng/L Perfluorotetradecanoic acid < 0.90 1.8 0.90 0.90 ng/L 12/31/21 09:28 ng/L Perfluorotridecanoic acid < 0.90 1.8 0.90 0.90 12/31/21 09:28 Perfluoroundecanoic acid < 0.90 1.8 0.90 0.90 ng/L 12/31/21 09:28 Isotope Dilution %Recovery Qualifier Dil Fac Limits Prepared Analyzed M2-6:2 FTS 98 50 - 150 12/29/21 18:06 12/31/21 09:28 M2-8:2 FTS 97 50 - 150 12/29/21 18:06 12/31/21 09:28 67 13C2 PFTeDA 50 - 150 12/29/21 18:06 12/31/21 09:28 13C3 PFBS 109 50 - 150 12/29/21 18:06 12/31/21 09:28 13C4 PFBA 110 50 - 150 12/29/21 18:06 12/31/21 09:28 12/29/21 18:06 12/31/21 09:28 13C4 PFHpA 109 50 - 150 13C5 PFPeA 50 - 150 12/29/21 18:06 12/31/21 09:28 114 13C8 PFOA 50 - 150 12/29/21 18:06 12/31/21 09:28 118 13C8 PFOS 109 50 - 150 12/29/21 18:06 12/31/21 09:28 d3-NMeFOSAA 78 50 - 150 12/29/21 18:06 12/31/21 09:28 d5-NEtFOSAA 84 50 - 150 12/29/21 18:06 12/31/21 09:28

Client Sample ID: APG-E4-1-SO-(0.5-2)-121621

89

113

108

100

90

103

13C2-PFDoDA

13C3 PFHxS

13C5 PFHxA

13C6 PFDA

13C7 PFUnA

13C9 PFNA

Lab Sample ID: 410-67825-14 Date Collected: 12/16/21 08:00 **Matrix: Solid** Date Received: 12/21/21 18:23 Percent Solids: 86.3

50 - 150

50 - 150

50 - 150

50 - 150

50 - 150

50 - 150

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018	UJ	0.0023	0.0018	0.0018	mg/Kg	-	01/06/22 06:16	1
8:2 Fluorotelomer sulfonic acid	<0.0018	Ī	0.0034	0.0018	0.0018	mg/Kg	₩	01/06/22 06:16	1
NEtFOSAA	<0.00045		0.0023	0.00045	0.00045	mg/Kg	₩	01/06/22 06:16	1
NMeFOSAA	<0.00045		0.0023	0.00045	0.00045	mg/Kg	₩	01/06/22 06:16	1
Perfluorobutanesulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₩	01/06/22 06:16	1
Perfluorobutanoic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₩	01/06/22 06:16	1
Perfluorodecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/06/22 06:16	1
Perfluorododecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/06/22 06:16	1
Perfluoroheptanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/06/22 06:16	1
Perfluorohexanesulfonic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/06/22 06:16	1
Perfluorohexanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₽	01/06/22 06:16	1
Perfluorononanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/06/22 06:16	1
Perfluorooctanesulfonic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/06/22 06:16	1
Perfluorooctanoic acid	< 0.00045	M	0.00068	0.00045	0.00045	mg/Kg	☆	01/06/22 06:16	1

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12/29/21 18:06 12/31/21 09:28

12/29/21 18:06 12/31/21 09:28

12/29/21 18:06 12/31/21 09:28

12/29/21 18:06 12/31/21 09:28

12/29/21 18:06 12/31/21 09:28

12/29/21 18:06 12/31/21 09:28

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-E4-1-SO-(0.5-2)-121621 Lab Sample ID: 410-67825-14

Date Collected: 12/16/21 08:00 **Matrix: Solid** Date Received: 12/21/21 18:23 Percent Solids: 86.3

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit [) Analyzed	Dil Fac
Perfluoropentanoic acid	<0.00045	M UJ	0.00068	0.00045	0.00045	mg/Kg	01/06/22 06:16	1
Perfluorotetradecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg ⋠	01/06/22 06:16	1
Perfluorotridecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	01/06/22 06:16	1
Perfluoroundecanoic acid	<0.00045	\downarrow	0.00068	0.00045	0.00045	mg/Kg ⊰	01/06/22 06:16	1
Isotope Dilution	%Recovery Qua	alifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	69		50 - 150			01/04/22 18:53	01/06/22 06:16	1
M2-8:2 FTS	73		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C2 PFTeDA	72		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C3 PFBS	91		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C4 PFBA	83		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C4 PFHpA	77		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C5 PFPeA	89		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C8 PFOA	87		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C8 PFOS	92		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
d3-NMeFOSAA	24 *5-		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
d5-NEtFOSAA	29 *5-		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C2-PFDoDA	77		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C3 PFHxS	93		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C5 PFHxA	78		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C6 PFDA	79		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C7 PFUnA	80		50 - 150			01/04/22 18:53	3 01/06/22 06:16	1
13C9 PFNA	86		50 - 150			01/04/22 18:5	3 01/06/22 06:16	1

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	<u></u>	01/03/22 21:57	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0034	0.0018	0.0018	mg/Kg	₩	01/03/22 21:57	1
NEtFOSAA	<0.00045		0.0023	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
NMeFOSAA	<0.00045		0.0023	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluorobutanesulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₩	01/03/22 21:57	1
Perfluorobutanoic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	₩	01/03/22 21:57	1
Perfluorodecanoic acid	<0.90045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluorododecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluoroheptanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluorohexanesulfonic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluorohexanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluorononanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluorooctanesulfonic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluorooctanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluoropentanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluorotetradecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluorotridecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Perfluoroundecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	₩	01/03/22 21:57	1
Isotone Dilution	%Recovery Qu	ıalifier	l imits			Prena	rod	Analyzed	Dil Fac

ı	130tope Dilution	/ortecovery	Qualifiei	LIIIII	r repared Analyzeu	Diriac
	M2-6:2 FTS	43	*5-	50 - 150	12/30/21 00:11 01/03/22 21:57	1
ı	M2-8:2 FTS	55		50 - 150	12/30/21 00:11 01/03/22 21:57	1
	13C2 PFTeDA	69		50 - 150	12/30/21 00:11 01/03/22 21:57	1
١	13C3 PFBS	86		50 - 150	12/30/21 00:11 01/03/22 21:57	1
ı	13C4 PFBA	68		50 - 150	12/30/21 00:11 01/03/22 21:57	1

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Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-E4-1-SO-(0.5-2)-121621 Lab Sample ID: 410-67825-14

Date Collected: 12/16/21 08:00 Matrix: Solid
Date Received: 12/21/21 18:23 Percent Solids: 86.3

Isotope Dilution	S for QSM 5.3, %Recovery Qu		Limits	•		Prepared	Analyzed	Dil Fa
13C4 PFHpA	7011000101	-	50 - 150			12/30/21 00:11	·	
3C5 PFPeA	68		50 - 150				01/03/22 21:57	
3C8 PFOA	73		50 - 150				01/03/22 21:57	
3C8 PFOS	90		50 - 150				01/03/22 21:57	
I3-NMeFOSAA	13 *5		50 - 150				01/03/22 21:57	
IS-NMCF OSAA IS-NEtFOSAA	16 *5		50 - 150				01/03/22 21:57	
3C2-PFDoDA	76 3 75	-	50 - 150				01/03/22 21:57	
3C3 PFHxS	90		50 - 150				01/03/22 21:57	
3C5 PFHxA	66		50 - 150				01/03/22 21:57	
3C6 PFDA	73		50 - 150				01/03/22 21:57	
3C7 PFUnA							01/03/22 21.57	
	80 68		50 ₋ 150				01/03/22 21:57	
3C9 PFNA	00		50 - 150			12/30/21 00.11	01/03/22 21.57	
General Chemistry	Result	Qualifier	LOQ	LOD	DI	Unit D	Analyzed	Dil Fa
Percent Moisture	13.7	Qualifici	1.0		1.0		12/23/21 12:59	
ercent Moisture	86.3		1.0		1.0		12/23/21 12:59	
	00.3		1.0		1.0	70	12/20/21 12:00	
ieneral Chemistry - Soluble	Pocult	Qualifier	LOQ	LOD	DI	Unit D	Analyzod	Dil F
nalyte			0.01	0.01		S.U.	Analyzed 12/28/21 15:40	חוו ד
H emperature	7.6 20.7	J	0.01	0.01		Degrees C	12/28/21 15:40	
nalyte		Qualifier	LOQ	LOD _		Unit D	·	Dil F
Gravel	21.8		1.0	1.0	1.0	%	12/30/21 11:30	
and	45.2		1.0	1.0	1.0		12/30/21 11:30	
ilt	30.0		1.0	1.0	1.0	%	12/30/21 11:30	
lay	3.0		1.0	1.0	1.0	%	12/30/21 11:30	
5 mm	100.0		1.0	1.0	1.0	% Passing	12/30/21 11:30	
7.5 mm	100.0		1.0	1.0	1.0	% Passing	12/30/21 11:30	
9 mm	100.0		1.0	1.0	1.0	% Passing	12/30/21 11:30	
.75 mm	78.2		1.0	1.0	1.0	% Passing	12/30/21 11:30	
.35 mm	71.1		1.0	1.0	1.0	% Passing	12/30/21 11:30	
.36 mm	63.0		1.0	1.0	1.0	% Passing	12/30/21 11:30	
.18 mm	56.7		1.0	1.0	1.0	% Passing	12/30/21 11:30	
.6 mm	53.2		1.0	1.0	1.0	% Passing	12/30/21 11:30	
3 mm	46.5		1.0	1.0	1.0	% Passing	12/30/21 11:30	
15 mm	38.5		1.0	1.0	1.0	% Passing	12/30/21 11:30	
.075 mm	33.0		1.0	1.0	1.0	% Passing	12/30/21 11:30	
.064 mm	30.0		1.0	1.0	1.0	% Passing	12/30/21 11:30	
	23.0		1.0	1.0	1.0	% Passing	12/30/21 11:30	
.05 mm				1.0	1.0	% Passing	12/30/21 11:30	
	9.8		1.0	1.0	1.0	70 1 GCOII19	,,	
.02 mm			1.0			% Passing	12/30/21 11:30	
0.05 mm 0.02 mm 0.005 mm 0.002 mm	9.8 3.0 2.5			1.0	1.0			

Client: ARCADIS U.S., Inc. Job ID: 410-67825-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-FB-1-121621 Lab Sample ID: 410-67825-15

Date Collected: 12/16/21 15:30 **Matrix: Water**

Date Received: 12/21/21 18:23

Analyte	Result	Qualifier	LOQ	LOD		Unit D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.6	UJ	4.6	3.6	3.6	ng/L	12/31/21 09:38	1
8:2 Fluorotelomer sulfonic acid	<1.8		2.7	1.8	1.8	ng/L	12/31/21 09:38	1
NEtFOSAA	<0.91		2.7	0.91	0.91	ng/L	12/31/21 09:38	1
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L	12/31/21 09:38	1
Perfluorobutanesulfonic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluorobutanoic acid	<3.6		4.6	3.6	3.6	ng/L	12/31/21 09:38	1
Perfluorodecanoic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluorododecanoic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluoroheptanoic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluorohexanesulfonic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluorohexanoic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluorononanoic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluorooctanesulfonic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluorooctanoic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluoropentanoic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluorotetradecanoic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluorotridecanoic acid	<0.91		1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Perfluoroundecanoic acid	<0.91	\mathbf{V}	1.8	0.91	0.91	ng/L	12/31/21 09:38	1
Isotope Dilution	%Recovery Qu	ualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	104		50 - 150			12/29/21 18:06	12/31/21 09:38	1
M2-8:2 FTS	109		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C2 PFTeDA	65		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C3 PFBS	113		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C4 PFBA	127		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C4 PFHpA	113		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C5 PFPeA	116		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C8 PFOA	119		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C8 PFOS	114		50 - 150			12/29/21 18:06	12/31/21 09:38	1
d3-NMeFOSAA	92		50 - 150			12/29/21 18:06	12/31/21 09:38	1
d5-NEtFOSAA	96		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C2-PFDoDA	97		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C3 PFHxS	113		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C5 PFHxA	112		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C6 PFDA	116		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C7 PFUnA	103		50 - 150			12/29/21 18:06	12/31/21 09:38	1
13C9 PFNA	121		50 ₋ 150			12/20/21 18:06	12/31/21 09:38	1

Eurofins Lancaster Laboratories Env, LLC

2425 New Holland Pike

Chain of Custody Record



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Environment Testing America

Phone: 717-656-2300 Fax: 717-656-2681																			
Client Information (Sub Contract Lab)	Sampler:			Lab Pi Gorde		tephe	n J				ľ	Carrie	r Traci	ing No	(s):			COC No: 410-1167614.1	
Chent Contact: Shipping/Receiving	Phone:	•		E-Mail: Step!		Sordor	1@eu	rofinset	.com			State o Mary	of Orig land	in:				Page: Page 1 of 1	
Company: CT Laboratories								ired (See e ELAP		Δ								Jeb #: 410-67825-1	
Address:	Due Date Request	ed:		-	Бері	. 01 100	310113		_									Preservation Cod	os:
Environmental & Analytical Services, 1230 Lange Court,	1/14/2022		_	1					naly	/sis	Req	uesi	ted					A-HCL	M - Hexane
City: Baraboo	TAT Requested (d	ays):									***		* * * *	****	M M M M	(8 - NaOH C - Zn Acetate D - Nitric Acid	N - None O - AsNaO2 P - Na2O4S
State, Zip: WI, 53913						_ ≰	'	*****	***	****	: * * * * *	# # # ¹	K 9K 38 74				V.	E - NaHSO4 F - MeOH	Q - No2SO3 R - Na2S2O3
Phone:	PO#:					6 9060A		Folder	#	16	676) I	3 T A	NC.	AST.	ER I		G - Amchlor H - Ascorbic Acid	S - H2SO4 T - TSP Dodecahydrate
mail:	WO #:				Sample (Yes or No)	Carbon)/ SW846	ļ,	Comb	any:	EU	ROF	IN:	2 DV	(1807 (2821	NG	GR(1. Ira	U - Acetone V - MCAA
Project Name: Aberdeen Proving Ground	Project #: 41005401				iple (Yes or Yes or Ne)	हे		Proje	et: 4	ABE	RD	EEN	1 PK	(OV)		•••	OL D	K - EDTA L - EDA	W - pH 4-5 Z - other (specify)
Side:	SSOW#:				oldm Sy c			1.088	ed B	y :	erc		 ***	1: E	3M:	M # F	fcon	Other:	
				atrix	arod Sam Marksn	l g		***	****	***	***	M M M	******	****	***		2	Transferfol	a EDP.
			Type (v	eatifix Poweter, onoid,	F) bar	SUB (Total Organic				1 1	1 1	1	- 1	1	1		Total Number	14662013	12-29-2021
Sample !dentification - Client ID (Lab ID)	Sample Date	Sample Time		restafoë,	Field Filt	S B								-	ì		Total	Special In	structions/Note:
Was to the Second Secon			Preservation		X	(7 (6)		П	- 332		***	-			X		A CONTRACTOR
APG-ATC1-1-SO-(0.5-2)-121621 (410-67825-1)	12/16/21	12:55 Eastern		Solid	Ĭ	×											.1	10888	36
APG-ATC2-1-SO-(0.5-2)-121621 (410-67825-3)	12/16/21	12:30 Eastern	:	Solid	П	×											1		31
APG-S1A-1-SO-(0.5-2)-121621 (410-67825-5)	12/16/21	12:00 Eastern	;	Solid	П	×					П						1		38
NPG-S3-1-SO-(0.5-2)-121621 (410-67825-9)	12/16/21	11:25 Eastern	:	Solid	П	х											-1	ş	31
APG-E3-1-SO-(0.5-2)-121621 (410-67825-11)	12/16/21	09:30 Eastern		Solid		x											1		40
PG-E4-1-SO-(0.5-2)-121621 (410-67825-14)	12/16/21	08:00 Eastern		Solid		х											1		41
																	tuna		
					Ц										┸				
ote: Since laboratory accreditations are subject to change, Eurofins Lancaster bes not currently maintain accreditation in the State of Origin fisted above for a hould be brought to Eurofins Lancaster Laboratories Env attention immediately	nalysis/tests/matrix b	eing analyzed.	the samples must I	e shipped	back	to the E	Eurofin	s Lancas	er Lab	oratori	es Env	r labor	ratory	or othe	r instru	ctions	will be	e provided. Any chan	custody. If the laboratory ges to accreditation statu
ossible Hazard Identification					s	ample	e Dis	posal (A fee	may	be a	sses	sed	f sam		are r	etair	ned longer than	1 month)
nconfirmed								To Clie		[$\Box_{\mathcal{D}_i}$	ispos	al By	Lab			Arch	nive For	Months
eliverable Requested: I, II, III, IV, Other (specify)	Primary Deliver	able Rank:	2					uctions											
mpty Kit Relinquished by:	···	Date:			Time): 							Metho	d of Sh	ipmen	:			
plinquished by:	Date/Time:	y 1	S25 E	oany LE		Rec	eived i	by:						O	ate/Tin	10:			Company
altinquished by:	Date/Time: Company				Received by: Bu Date/Time: (7) Company CT L						Company Lass								
elinquished by:	Date/Time: Company				General Islands						Company 4								
Custody Seals Intact: Custody Seal No.: Δ Yes Δ No	166761 - Page																		

EUROFINS LANCASTER LAB ENV LLC

Project Name: ABERDEEN PROVING GROUND

Project Phase: Project #: 41005401 Contract #: 3462 Folder #: 166761 Page 2 of 5

Arrival Temperature: 3.3

Date Received: 12/30/2021

Reprint Date: 1/6/2022

Report Date: 1/6/2022

ANALYTICAL SAMPLE DATA

EUROFINS LANCASTER LAB ENV LLC STEPHEN GORDON 2425 NEW HOLLAND PIKE LANCASTER. PA 17601 Project Name: ABERDEEN PROVING GROUND

Project Phase:

Project #: 41005401 Folder #: 166761

Purchase Order #: JOB # 410-67825-1

Contract #: 3462

Copy: ELLE_Subcontracting@eurofinsUS

CT LAB#: 1088836 Sample Description: 410-67825-1 Client Sample #: APG-ATC1-1-SO-(0.5-2)-121621 Sampled: 12/16/2021 12:55 Analyte Result Units DL DOD DOD RL DF Qualifier Analysis Analyst Method Prep LOD LOQ Date/Time Date/Time **Inorganic Results** Solids, Percent 1.00 78.4 12/31/21 09:42 MRZ EPA 8000C 6970 J-**Total Organic Carbon** mg/kg 200 510 640 640 1.00 1/3/22 10:58 KMT L-Kahn/9060A CT LAB#: 1088837 Sample Description: 410-67825-3 Client Sample #: APG-ATC2-1-SO-(0.5-2)-121621 Sampled: 12/16/2021 12:30 Analyte Result Units DL DOD DOD RL DF Qualifier Prep Analysis Analyst Method LOD LOQ Date/Time Date/Time **Inorganic Results** Solids. Percent 66.0 % 1.00 12/31/21 09:42 MRZ EPA 8000C **Total Organic Carbon** 30700 J-1.00 mg/kg 240 610 760 760 1/3/22 11:04 KMT L-Kahn/9060A CT LAB#: 1088838 Sample Description: 410-67825-5 Client Sample #: APG-S1A-1-SO-(0.5-2)-121621 Sampled: 12/16/2021 12:00 Analyte Result Units DL DOD DOD RL DF Qualifier Analysis Analyst Method Prep LOD LOQ Date/Time Date/Time

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CT LABORATORIE

delivering more than data from your environmental analyses

EUROFINS LANCASTER LAB ENV LLC

Project Name: ABERDEEN PROVING GROUND

Project Phase: Project #: 41005401 Contract #: 3462 Folder #: 166761

Page 3 of 5

CT LAB#: 1088838	Sample Description: 410-678	25-5			Clie	nt Sample #: A	.PG-S1A-1-SC)-(0.5-2)-121621		Sampled: 12/16/2021 12	2:00
Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Analyst Date/Time	Method
Inorganic Results											
Solids, Percent	71.9	%					1.00			12/31/21 09:42 MRZ	EPA 8000C
Total Organic Carbon	ال 10200	mg/kg	220	560	700	700	1.00			1/3/22 11:09 KMT	L-Kahn/9060A
CT LAB#: 1088839	Sample Description: 410-678	25-9			Clie	nt Sample #: A	.PG-S3-1-SO-	(0.5-2)-121621		Sampled: 12/16/2021 11	1:25
Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Analyst Date/Time	Method
Inorganic Results											
Solids, Percent	74.7	%					1.00			12/31/21 09:42 MRZ	EPA 8000C
Total Organic Carbon	14200 J-	mg/kg	210	540	670	670	1.00			1/3/22 11:26 KMT	L-Kahn/9060A
CT LAB#: 1088840	Sample Description: 410-678	25-11			Clie	nt Sample #: A	.PG-E3-1-SO-	(0.5-2)-121621		Sampled: 12/16/2021 09	9:30
Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Analyst Date/Time	Method
Inorganic Results											
Solids, Percent	80.6	%					1.00			12/31/21 09:42 MRZ	EPA 8000C
Total Organic Carbon	ا 17000	mg/kg	200	500	620	620	1.00			1/3/22 11:32 KMT	L-Kahn/9060A
CT LAB#: 1088841	Sample Description: 410-678	25-14			Clie	nt Sample #: A	PG-E4-1-SO-	(0.5-2)-121621		Sampled: 12/16/2021 08	3:00
Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Analyst Date/Time	Method
Inorganic Results											
Solids, Percent	82.6	%					1.00			12/31/21 09:42 MRZ	EPA 8000C

Unless specifically stated to the contrary, soil/sediment/sludge sample results reported on a Dry Weight Basis

166761 - Page 3 of 11 Page 87 of 98

CT LABORATORI delivering more than data from your environmental analyses

EUROFINS LANCASTER LAB ENV LLC Project Name: ABERDEEN PROVING GROUND

Project Phase: Project #: 41005401 Contract #: 3462 Folder #: 166761

Page 4 of 5

CT LAB#: 1088841

Sample Description: 410-67825-14

Client Sample #: APG-E4-1-SO-(0.5-2)-121621

Sampled: 12/16/2021 08:00

Analyte	Result	Units DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Analyst Date/Time	Method
Total Organic Carbon	12800 J-	mg/kg 190	480	610	610	1.00			1/3/22 11:38 KMT L-Kah	n/9060A

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Lancaster Laboratories

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mple # ___

Environmental												ппри				=		-	
Client: Arcadis						Matrix					A	naly	ses	Requ	ıeste	ed .		For Lab Us	e Only
Project Name/#: Aberdeen Proving Ground PA/SI	Site ID #:										F	rese	rvat	ion C	Code	s		SF #:	
Project Manager: Ankit Cupia, John Roberts	P.O. #: 021	118216.3005	5.8AC0	10	=	ace												SCR #:	
Sampler: O. Ortolono, M. Blower British Kel	PWSID #:				Sediment	Ground		2	M 5.1			D422-63						Preservat	Ion Codes
Phone #: CO: 484.787.7796 /MB: 703.819.1240	Quote #:	219438			Sec	1		ine	ası	₹		D42						H = HCI	T = Thiosulfate
State where sample(s) were collected: Maryland						ble SES		onta	Go.	906	045C	(ASTM						N = HNO ₃	B = NaOH
	Colle	ection	٩	Composite		Potable ter NPDES	er:	Total # of Containers	S Group (DoD QSM	TOC (SW846 9060A)	pH (SW846 9045D)	Size						$S = H_2SO_4$ O = Other	P = H ₃ PO ₄
Sample Identification	Date	Time	Grab	ပိ	Soil	Water	Other:	Tot	PFAS	707) Hd	Grain						Rem	arks
APG-FF3-1-GW-013122	01/31/2	1015	×			×		2	X									250 ml	Plastic
APG-FF2-1-GW-013122	01/31/22	1050	×			×		2	×										Plustic
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			\sqcup				\sqcup												
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Turnaround Time Requested (TAT) (please che (Rush TAT is subject to laboratory approv		ndard larges.)	Rush	1	Relin	nquished	by: Dec	n k	Ceh	Ott	ate C1/22 31/22	07	ne 40	Rece	ived	by:		Date	Time
Date results are needed:					Reli	nquished	by:			Da	ate	Tir	me	Rece	ived	by:		Date	Time
Rush results requested by (please check): E-M		Phor					1												
E-mail Address: matthew blowerda	rcadis	· com	1		Reli	nquished	by:	_		Da	ate	Tir	me	Rece	ived	by:		Date	Time
Phone: (703)-819-1240																			
Data Package Options (please check if required)				Reli	nquished	by:			Di	ate	Tir	me	Rece	ived	by:		Date	Time
Type I (Validation/non-CLP) MA MCP										1									
Type III (Reduced non-CLP) CT RCP					Reli	nquished	by:			Da	ate	Tir	me	Rece	ived	by:		Date	Time
Type IV (CLP SOW) TX TRRF	'-13								1						1	1		21-22	1722
Type VI (Raw Data Only)					Reli	nquished	by Cc	mme	rcial	Carrie	er:					0		01	
EDD Required? Yes No If ye	es. format:				UPS		FedE:	x		Other				Tem	perati	ure ur	pon receip	ot_0-(_ °C

Eurofins Lancaster Laboratories Environmental, LLC • 2425 Nev

and Pike, Lancaster, PA 17601 • 717-656-2300

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Login Sample Receipt Checklist

Client: ARCADIS U.S., Inc. Job Number: 410-71439-1

Login Number: 71439 List Source: Eurofins Lancaster Laboratories Env, LLC

List Number: 1

Creator: Jeremiah, Cory T

Question	Answer	Comment
The cooler's custody seal is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable (=6C, not frozen).</td <td>True</td> <td></td>	True	
Cooler Temperature is recorded.	True	
MV: Container Temperature is acceptable (=6C, not frozen).</td <td>N/A</td> <td></td>	N/A	
NV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
here is sufficient vol. for all requested analyses.	True	
s the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	

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Client: ARCADIS U.S., Inc.

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-FF3-1-GW-013122

Date Collected: 01/31/22 10:15 Date Received: 02/01/22 17:22 Lab Sample ID: 410-71439-1

Matrix: Water

Analyte	Result	Qualifier	LOQ	LO	D	DL	Unit I	D Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<3.6		4.5	3	.6	3.6	ng/L	02/14/22 22:14	1
8:2 Fluorotelomer sulfonic acid	<1.8		2.7	1	.8	1.8	ng/L	02/14/22 22:14	1
NEtFOSAA	<0.89		2.7	3.0	39	0.89	ng/L	02/14/22 22:14	1
NMeFOSAA	<1.1		1.8	1	.1	1.1	ng/L	02/14/22 22:14	1
Perfluorobutanesulfonic acid	<0.89		1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluorobutanoic acid	<3.6		4.5	3	.6	3.6	ng/L	02/14/22 22:14	1
Perfluorodecanoic acid	<0.89		1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluorododecanoic acid	<0.89		1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluoroheptanoic acid	<0.89		1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluorohexanesulfonic acid	<0.89		1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluorohexanoic acid	<0.89	M	1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluorononanoic acid	<0.89	•	1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluorooctanesulfonic acid	<0.89		1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluorooctanoic acid	<0.89	M	1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluoropentanoic acid	<0.89	•	1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluorotetradecanoic acid	<0.89		1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluorotridecanoic acid	<0.89		1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Perfluoroundecanoic acid	<0.89		1.8	3.0	39	0.89	ng/L	02/14/22 22:14	1
Isotope Dilution	%Recovery Q	ualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	99		50 - 150				02/13/22 12:2	02/14/22 22:14	1
M2-8:2 FTS	94		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1
13C2 PFTeDA	67		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1
13C3 PFBS	88		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1
13C4 PFBA	62		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1
13C4 PFHpA	93		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1
13C5 PFPeA	82		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1
13C8 PFOA	97		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1
13C8 PFOS	90		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1
d3-NMeFOSAA	85		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1
d5-NEtFOSAA	90		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1
13C2-PFDoDA	85		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1
13C3 PFHxS	91		50 - 150				02/13/22 12:2	6 02/14/22 22:14	1

Client Sample ID: APG-FF2-1-GW-013122

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Date Collected: 01/31/22 10:50

Date Received: 02/01/22 17:22

13C5 PFHxA

13C6 PFDA

13C7 PFUnA

13C9 PFNA

Lab Sample ID: 410-71439-2

02/13/22 12:26 02/14/22 22:14

02/13/22 12:26 02/14/22 22:14

Matrix: Water

2/15/2022

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-15											
Analyte	Result C	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac		
6:2 Fluorotelomer sulfonic acid	<3.6		4.5	3.6	3.6	ng/L		02/14/22 22:25	1		
8:2 Fluorotelomer sulfonic acid	<1.8		2.7	1.8	1.8	ng/L		02/14/22 22:25	1		
NEtFOSAA	<0.91		2.7	0.91	0.91	ng/L		02/14/22 22:25	1		
NMeFOSAA	<1.1		1.8	1.1	1.1	ng/L		02/14/22 22:25	1		
Perfluorobutanesulfonic acid	<0.91		1.8	0.91	0.91	ng/L		02/14/22 22:25	1		
Perfluorobutanoic acid	<3.6		4.5	3.6	3.6	ng/L		02/14/22 22:25	1		
Perfluorodecanoic acid	<0.91		1.8	0.91	0.91	ng/L		02/14/22 22:25	1		

50 - 150

50 - 150

50 - 150

50 - 150

Eurofins Lancaster Laboratories Env, LLC

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Client: ARCADIS U.S., Inc.

Job ID: 410-71439-1

Project/Site: Aberdeen Proving Ground

Client Sample ID: APG-FF2-1-GW-013122

Date Collected: 01/31/22 10:50 Date Received: 02/01/22 17:22 Lab Sample ID: 410-71439-2

Matrix: Water

Analyte	Result Qualifier	LOQ	LOD	DL	Unit D	Analyzed	Dil Fac
Perfluorododecanoic acid	<0.91	1.8	0.91	0.91	ng/L	02/14/22 22:25	1
Perfluoroheptanoic acid	<0.91	1.8	0.91	0.91	ng/L	02/14/22 22:25	1
Perfluorohexanesulfonic acid	<0.91	1.8	0.91	0.91	ng/L	02/14/22 22:25	1
Perfluorohexanoic acid	<0.91	1.8	0.91	0.91	ng/L	02/14/22 22:25	1
Perfluorononanoic acid	<0.91	1.8	0.91	0.91	ng/L	02/14/22 22:25	1
Perfluorooctanesulfonic acid	<0.91	1.8	0.91	0.91	ng/L	02/14/22 22:25	1
Perfluorooctanoic acid	<0.91	1.8	0.91	0.91	ng/L	02/14/22 22:25	1
Perfluoropentanoic acid	<0.91	1.8	0.91	0.91	ng/L	02/14/22 22:25	1
Perfluorotetradecanoic acid	<0.91	1.8	0.91	0.91	ng/L	02/14/22 22:25	1
Perfluorotridecanoic acid	<0.91	1.8	0.91	0.91	ng/L	02/14/22 22:25	1
Perfluoroundecanoic acid	<0.91	1.8	0.91	0.91	ng/L	02/14/22 22:25	1
Isotope Dilution	%Recovery Qualifier	Limits			Prepared	Analyzed	Dil Fac
M2-6:2 FTS	86	50 - 150			02/13/22 12:26	02/14/22 22:25	1
M2-8:2 FTS	76	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C2 PFTeDA	58	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C3 PFBS	77	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C4 PFBA	56	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C4 PFHpA	78	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C5 PFPeA	71	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C8 PFOA	80	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C8 PFOS	71	50 - 150			02/13/22 12:26	02/14/22 22:25	1
d3-NMeFOSAA	69	50 - 150			02/13/22 12:26	02/14/22 22:25	1
d5-NEtFOSAA	75	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C2-PFDoDA	71	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C3 PFHxS	74	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C5 PFHxA	79	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C6 PFDA	80	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C7 PFUnA	71	50 - 150			02/13/22 12:26	02/14/22 22:25	1
13C9 PFNA	74	50 - 150			02/13/22 12:26	02/14/22 22:25	1

2/15/2022

