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

DATA USABILITY SUMMARY REPORT

2021 Sampling Event

Prepared for:

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

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ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

%D	percent difference
%R	percent recovery
APG	Aberdeen Proving Ground
Arcadis	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

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-ABR3-1-(0-2)-030821 APG-HELI-FIRE-1-SO-(0-2)-031221 APG-PI-12-2-SO-(0-2)-031521 APG-WEIDE-1-SO-(0-2)-031721 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)-030321	N-EtFOSAA	UJ	EIS %R less than 50%
	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
APG-MFR1-1-SO-(8-10)-030421	N-EtFOSAA	UJ	EIS %R less than 50%
	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 APG-BONEYARD-6-SO-(0-2)-031121	6:2 FTS 8:2 FTS	UJ	EIS %R less than 50%
	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%;
APG-AA5-1-GW-031621	6:2 FTS	DJ-	EIS %R greater than 150%; result reported from diluted analysis
	Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	EDJ	Result over calibration range of instrument; reported from 100-fold dilution
APG-AA5-1-SE-031621	Perfluorooctanesulfonic acid	J+	MS/MSD %R; high bias; Field duplicate RPD
	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%
	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%
APG-WES-M21-032021	Perfluorobutanoic acid	J+	EIS %R less than 50%
	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-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	TOC	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-E-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-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 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-BLDG-E4081-1-SO-(0-2)-031021 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 APG-PI-Minefield-1-SO-(0-2)-031521 APG-BAF-S6-1-SO-(0-2)-031621 APG-WEIDE-1-SO-(0-2)-031721 APG-BLDG-E5180-1-SO-(0-2)-031721 APG-BLDG-E4040-1-SO-(0-2)-031921 APG-G-STREET-1-SO-(0-2)-031921	pH	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.

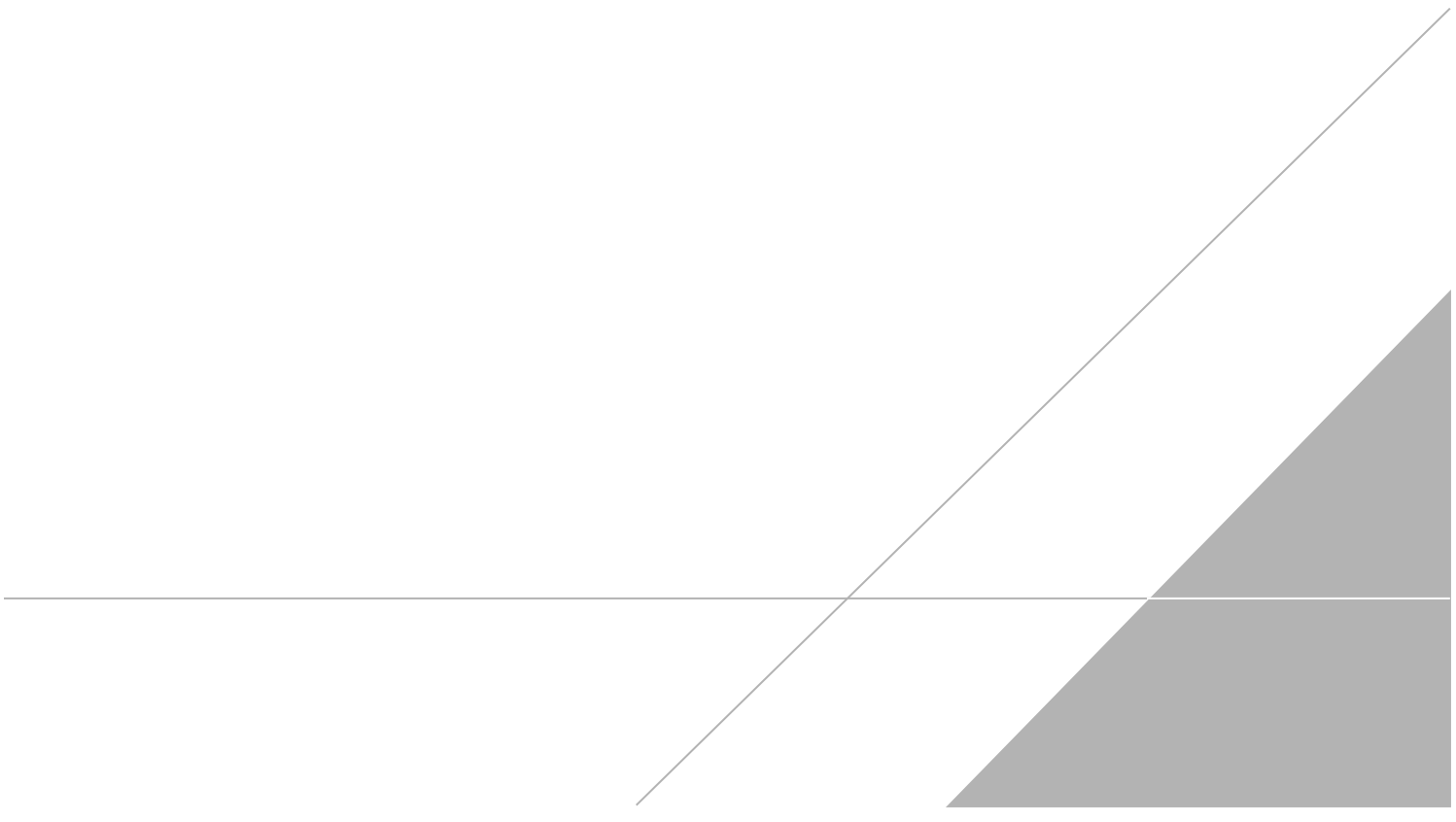
UB (Non-detect; contamination): Compound considered non-detect at the listed value due to associated blank contamination.

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.

DATA VALIDATION REPORTS



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:

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

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.

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

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
USEPA modified 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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-BAF-A1-1-SO-(0-2)-030221	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 50% but > 20%**	< 20%
APG-BAF-A1-2-SO-(0-2)-030221	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20%
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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 ± 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
APG-BAF-A1-2-GW-030221	Perfluorohexanesulfonic acid	--	1100	1100 D
	Perfluorooctanoic acid	--	700	700 D
	Perfluorooctanesulfonic acid	--	3900	3900 D
APG-FTA-M09-030221	6:2 Fluorotelomer sulfonic acid	--	340	340 D
	Perfluorohexanesulfonic acid	--	1700	1700 D
	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	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
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		X		X	
LCS/LCSD Precision (RPD)		X		X	
Matrix Spike (MS) %R	X				X
Matrix Spike Duplicate(MSD) %R	X				X
MS/MSD Precision (RPD)	X				X
Field Duplicate (RPD)	X				X
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X	X		
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 the laboratory
APG-BAF-B-1-SO-(0-2)-030221	6 days from collection; 5 days from receipt	

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

Criteria	Qualification
	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 ± 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
TOC	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 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 ± 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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X		X	
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)		X		X	
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
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 #: 410-31048-1 Date: 4/26/2021
Lab: Eurofins Lancaster Page: 1
Project: Aberdeen Proving Ground Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 29347

PFBA 3/05/2021 Calibration Page 702 - 715 of SDG 410-31048-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	76737	4041718	10	0.018986	0.9493117	0.8751	0.216961	0.2	8.480	8.5	Match
0.5	176646	4038069	10	0.043745	0.8749033	0.8751	0.499888	0.5	-0.022	0	Match
2	793768	4082481	10	0.194433	0.9721637	0.8751	2.221835	2	11.092	11.1	Match
8	2677850	3885912	10	0.689118	0.8613969	0.8751	7.874729	8	-1.566	-1.6	Match
20	6830316	3935411	10	1.735604	0.8678021	0.8751	19.83321	20	-0.834	-0.8	Match
50	16406435	3931630	10	4.172935	0.8345869	0.8751	47.68523	50	-4.630	-4.6	Match
100	28464329	3717120	10	7.65763	0.765763	0.8751	87.50577	100	-12.494	-12.5	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 #: 410-31048-1 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 Page 850 - 855 of SDG 410-31048-1

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

CCV 410-100974/80 3/10/2021 00:41 Page 1009 - 1014 of SDG 410-31048-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % 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

SDG #: 410-31048-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 4/26/2021
Page: 3
Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-100953/2-A

Page 1235 - 1240 of SDG 410-31048-1
Sample volume = 250 ml Final volume = 1ml

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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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

Compounds	LCS Calc Amount	LCSD Calc Amount	LCS/LCSD Calc RPD	Reported LCS/LCSD 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

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

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

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

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

eurofins | Lancaster Laboratories Environmental

For Eurofins Lancaster Laboratories Env

Acct. # _____ Group # _____ Sample

410-31048 Chain of Custody

COC #617017

Client Information		Matrix						Analysis Requested										For Lab Use Only
Client: ARCADIS	Acct. #:							Preservation and Filtration Codes										FSC:
Project Name/#: APG PFAS S1	PWSID #:																	SCR#: 265725
Project Manager: Keith Shepherd	P.O. #: 30001996.3BX50																	Preservation Codes: H=HCl, T=Thiosulfate, N=HNO_3, B=NaOH, S=H_2SO_4, $P=H_3PO_4$, F=Field Filtered, O=Other
Sampler: Dale Lynch	Quote #:																	
State where samples were collected: MD	For Compliance: Yes ☐ No ☐																	Remarks

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil	Water	Other:	Total # of Containers	PFAS	TOC	pH	GRAIN SIZE						
~~DL APG-BAF-AP-SO-(0-2)~~	3/2/21	1105		X	X			4	X	X	X	X						APG-BAF-A1-1-SO-(0-2)
~~DL APG-BAF-A1-GW~~	3/2/21	1300	X			X		2	X									APG-BAF-A1-1-GW
~~DL FB GW-030221~~	~~3/2/21~~	~~1115~~	~~X~~			~~X~~		~~2~~	~~X~~									~~APG-FB-01-030221~~
APG-BAF-A1-2-GW	3/2/21	1415	X			X		2	X									
APG-BAF-A1-2-SO-(0-2)	3/2/21	1315		X	X			2	X									
APG-FTA-MC9	3/2/21	1450	X			X		2	X									
APG-FTA-M10	3/2/21	1520	X			X		2	X									
APG-BAF-B-1-SO-(0-2)	3/2/21	1500		X	X			4	X	X	X	X						

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: Matthew.Blower@ARCADIS.com; Keith.Shepherd@ARCADIS.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) | Type VI (Raw Data Only)

Type III (Reduced non-CLP) | NJ DKQP | TX TRRP-13

NYSDEC Category A or B | MA MCP | CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	2/16/21	1213			
	3/3/21	0700		3/3/21	1300
	3/3/21	1531			
				3/3/21	1531

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:

UPS _____ FedEx _____ Other _____

Temperature upon receipt 1.3 °C

Definitions/Glossary

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

Job ID: 410-31048-1

Qualifiers

LCMS

Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
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.
M	Manual integrated compound.

General Chemistry

Qualifier	Qualifier Description
FL	MS and/or MSD recovery below control limits.

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
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

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

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	<0.0019		0.0024	0.0019	0.0019	mg/Kg	☼	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*	*Qualifier*	*Limits*	*Prepared*	*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*
13C7 PFUnA	*107*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:20*	*1*
13C9 PFNA	*99*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:20*	*1*

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	<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	1

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*55*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
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*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
13C4 PFHpA	*68*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
13C5 PFPeA	*64*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
13C8 PFOA	*69*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
13C8 PFOS	*86*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
d3-NMeFOSAA	*11*	**5-*	*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
d5-NEtFOSAA	*13*	**5-*	*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
13C2-PFDoDA	*71*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
13C3 PFHxS	*89*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
13C5 PFHxA	*65*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
13C6 PFDA	*67*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
13C7 PFUnA	*67*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*
13C9 PFNA	*68*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:36*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	**2860**	~~FL~~ 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	Result	Qualifier	LOQ	LOD	DL	Unit	D	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

Method: D422 - Grain Size

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%		03/06/21 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	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

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: D422 - Grain Size (Continued)

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

Lab Sample ID: 410-31048-2
Date Collected: 03/02/21 13:00
Matrix: Water
Date Received: 03/03/21 15:31

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	17		5.0	4.0	4.0	ng/L		03/10/21 01:45	1
8:2 Fluorotelomer sulfonic acid	<2.0		3.0	2.0	2.0	ng/L		03/10/21 01:45	1
NEtFOSAA	<1.0		3.0	1.0	1.0	ng/L		03/10/21 01:45	1
NMeFOSAA	<1.2		2.0	1.2	1.2	ng/L		03/10/21 01:45	1
Perfluorobutanesulfonic acid	14		2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluorobutanoic acid	6.2		5.0	4.0	4.0	ng/L		03/10/21 01:45	1
Perfluorodecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluorododecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluoroheptanoic acid	14		2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluorohexanesulfonic acid	71		2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluorohexanoic acid	16		2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluorononanoic acid	4.7		2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluorooctanesulfonic acid	330	J	2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluorooctanoic acid	120		2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluoropentanoic acid	8.4		2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluorotetradecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluorotridecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/10/21 01:45	1
Perfluoroundecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/10/21 01:45	1

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*

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

Lab Sample ID: 410-31048-2

Date Collected: 03/02/21 13:00

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

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	**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**	~~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

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

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

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

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

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	3900	D	200	100	100	ng/L		03/09/21 09:33	100

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

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

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	<0.0019		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
~~NEtFOSAA~~	~~<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~~	☼	~~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	M	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	☼	03/05/21 18:30	1

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

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

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	<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**	**M**	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*57*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
M2-8:2 FTS	*52*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C2 PFTeDA	*67*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C3 PFBS	*91*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C4 PFBA	*59*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C4 PFHpA	*64*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C5 PFPeA	*63*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C8 PFOA	*66*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C8 PFOS	*94*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
d3-NMeFOSAA	*8*	**5-*	*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
d5-NEtFOSAA	*11*	**5-*	*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C2-PFDoDA	*72*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C3 PFHxS	*94*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C5 PFHxA	*63*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C6 PFDA	*67*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C7 PFUnA	*67*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*
13C9 PFNA	*65*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:46*	*1*

General 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

Lab Sample ID: 410-31048-5

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

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

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 (Continued)

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*	*Qualifier*	*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) - PFAS for QSM 5.3, Table B-15 - DL

Analyte	Result	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
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*	*Qualifier*	*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*
13C5 PFHxA	*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*

Client Sample ID: APG-FTA-M10-030221

Lab Sample ID: 410-31048-6

Date Collected: 03/02/21 15:20

Matrix: Water

Date Received: 03/03/21 15:31

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	**10**		4.3	3.4	3.4	ng/L		03/05/21 21:51	1
8:2 Fluorotelomer sulfonic acid	<1.7		2.6	1.7	1.7	ng/L		03/05/21 21:51	1
NEtFOSAA	<0.86		2.6	0.86	0.86	ng/L		03/05/21 21:51	1
NMeFOSAA	<1.0		1.7	1.0	1.0	ng/L		03/05/21 21:51	1
Perfluorobutanesulfonic acid	**41**		1.7	0.86	0.86	ng/L		03/05/21 21:51	1
Perfluorobutanoic acid	**40**		4.3	3.4	3.4	ng/L		03/05/21 21:51	1
Perfluorodecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/05/21 21:51	1
Perfluorododecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/05/21 21:51	1
Perfluoroheptanoic acid	**95**		1.7	0.86	0.86	ng/L		03/05/21 21:51	1
Perfluorohexanoic acid	**140**		1.7	0.86	0.86	ng/L		03/05/21 21:51	1
Perfluorononanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/05/21 21:51	1
Perfluorooctanesulfonic acid	**14**	**M**	1.7	0.86	0.86	ng/L		03/05/21 21:51	1
Perfluorooctanoic acid	**49**		1.7	0.86	0.86	ng/L		03/05/21 21:51	1
Perfluoropentanoic acid	**130**		1.7	0.86	0.86	ng/L		03/05/21 21:51	1
Perfluorotetradecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/05/21 21:51	1
Perfluorotridecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/05/21 21:51	1
Perfluoroundecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/05/21 21:51	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*110*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
M2-8:2 FTS	*96*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C2 PFTeDA	*83*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C3 PFBS	*88*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C4 PFBA	*95*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C4 PFHpA	*77*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C5 PFPeA	*99*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C8 PFOA	*97*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C8 PFOS	*90*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
d3-NMeFOSAA	*104*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
d5-NEtFOSAA	*102*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C2-PFDoDA	*98*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C3 PFHxS	*77*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C5 PFHxA	*91*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C6 PFDA	*90*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C7 PFUnA	*90*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*1*
13C9 PFNA	*92*		*50 - 150*	*03/04/21 08:40*	*03/05/21 21:51*	*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
Perfluorohexanesulfonic acid	**2500**	**D**	17	8.6	8.6	ng/L		03/08/21 15:28	10

Isotope Dilution	*%Recovery*	*Qualifier*	*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

Date Collected: 03/02/21 15:00

Matrix: Solid

Date Received: 03/03/21 15:31

Percent Solids: 80.6

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	<0.0019		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

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

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

Lab Sample ID: 410-31048-7

Matrix: Solid
Percent Solids: 80.6

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
NEtFOSAA	<0.00046		0.0023	0.00046	0.00046	mg/Kg	☼	03/05/21 18:41	1
NMeFOSAA	<0.00046	UJ	0.0023	0.00046	0.00046	mg/Kg	☼	03/05/21 18:41	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	☼	03/05/21 18:41	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	☼	03/05/21 18:41	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*107*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
M2-8:2 FTS	*106*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C2 PFTeDA	*93*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C3 PFBS	*92*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C4 PFBA	*80*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C4 PFHpA	*90*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C5 PFPeA	*81*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C8 PFOA	*91*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C8 PFOS	*98*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
d3-NMeFOSAA	*43*	*5-	*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
d5-NEtFOSAA	*51*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C2-PFDoDA	*103*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C3 PFHxS	*102*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C5 PFHxA	*82*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C6 PFDA	*100*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C7 PFUnA	*97*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*
13C9 PFNA	*92*		*50 - 150*	*03/04/21 07:17*	*03/05/21 18:41*	*1*

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	<0.0019		0.0024	0.0019	0.0019	mg/Kg	☼	03/09/21 16:57	1
8:2 Fluorotelomer 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	1

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

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

Lab Sample ID: 410-31048-7

Matrix: Solid
Percent Solids: 80.6

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorooctanesulfonic acid	0.019		0.00071	0.00047	0.00047	mg/Kg	☼	03/09/21 16:57	1
Perfluorooctanoic acid	0.0017	M	0.00071	0.00047	0.00047	mg/Kg	☼	03/09/21 16:57	1
Perfluoropentanoic acid	0.0017		0.00071	0.00047	0.00047	mg/Kg	☼	03/09/21 16:57	1
Perfluorotetradecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/09/21 16:57	1
Perfluorotridecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/09/21 16:57	1
Perfluoroundecanoic acid	0.00048	J	0.00071	0.00047	0.00047	mg/Kg	☼	03/09/21 16:57	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*83*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
M2-8:2 FTS	*79*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C2 PFTeDA	*74*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C3 PFBS	*87*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C4 PFBA	*73*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C4 PFHpA	*78*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C5 PFPeA	*78*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C8 PFOA	*81*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C8 PFOS	*93*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
d3-NMeFOSAA	*19*	*5-	*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
d5-NEtFOSAA	*24*	*5-	*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C2-PFDoDA	*83*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C3 PFHxS	*92*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C5 PFHxA	*75*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C6 PFDA	*81*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C7 PFUnA	*78*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*
13C9 PFNA	*79*		*50 - 150*	*03/08/21 23:24*	*03/09/21 16:57*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	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

General Chemistry - Soluble

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	6.7	J	0.01	0.01	0.01	S.U.		03/08/21 15:05	1
Temperature	20.2		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	%		03/06/21 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
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	99.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1

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

Job ID: 410-31048-1

Client Sample ID: APG-BAF-B-1-SO-(0-2)-030221
Date Collected: 03/02/21 15:00
Date Received: 03/03/21 15:31

Lab Sample ID: 410-31048-7
Matrix: Solid
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 ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-BAF-D-1-SO-(0-2)-030321	410-31280-1	Soil	3/3/2021		X	X	X
APG-BAF-D-1-GW-030321	410-31280-2	Water	3/3/2021		X		
APG-BAF-E-1-SO-(0-2)-030321	410-31280-3	Soil	3/3/2021		X	X	X
APG-BAF-E-1-GW-030321	410-31280-4	Water	3/3/2021		X		
APG-BLDG-1059-1-SO-(0-2)-030321	410-31280-5	Soil	3/3/2021		X	X	X
APG-BLDG-1059-1-GW-030321	410-31280-6	Water	3/3/2021		X		
APG-BLDG-1065-1-SO-(0-2)-030321	410-31280-7	Soil	3/3/2021		X	X	X
APG-BLDG-1065-1-GW-030321	410-31280-8	Water	3/3/2021		X		
APG-FB-01-030321	410-31280-9	Water	3/3/2021		X		
APG-EB-01-030321	410-31280-10	Water	3/3/2021		X		
APG-SB-01-030321	410-31280-11	Water	3/3/2021		X		

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.

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

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 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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-BAF-D-1-SO-(0-2)-030321	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 20%**	< 20%
APG-BAF-E-1-SO-(0-2)-030321	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 50% but > 20%**	< 20%
APG-BLDG-1059-1-SO-(0-2)-030321	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 50% but > 20%
	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)-030321	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20%
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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 ± 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
APG-BLDG-1059-1-GW-030321	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
APG-BLDG-1065-1-GW-030321	6:2 Fluorotelomer sulfonic acid	--	3700	3700 D
	8:2 Fluorotelomer sulfonic acid	--	450	450 D
	Perfluorobutanesulfonic acid	--	410	410 D
	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	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
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		X		X	
LCS/LCSD Precision (RPD)		X		X	
Matrix Spike (MS) %R	X				X
Matrix Spike Duplicate(MSD) %R	X				X
MS/MSD Precision (RPD)	X				X
Field Duplicate (RPD)	X				X
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X	X		
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 the laboratory
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	

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

Criteria	Qualification
	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 ± 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 APG-BLDG-1065-1-SO-(0-2)-030321	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
TOC	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 ± 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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X		X	
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)	X				X
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
Transcription/calculations acceptable		X		X	

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
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 4/26/2021
Page: 1
Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 29347

PFBA 3/05/2021 Calibration

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Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	76737	4041718	10	0.018986	0.9493117	0.8751	0.216961	0.2	8.480	8.5	Match
0.5	176646	4038069	10	0.043745	0.8749033	0.8751	0.499888	0.5	-0.022	0	Match
2	793768	4082481	10	0.194433	0.9721637	0.8751	2.221835	2	11.092	11.1	Match
8	2677850	3885912	10	0.689118	0.8613969	0.8751	7.874729	8	-1.566	-1.6	Match
20	6830316	3935411	10	1.735604	0.8678021	0.8751	19.83321	20	-0.834	-0.8	Match
50	16406435	3931630	10	4.172935	0.8345869	0.8751	47.68523	50	-4.630	-4.6	Match
100	28464329	3717120	10	7.65763	0.765763	0.8751	87.50577	100	-12.494	-12.5	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 #: 410-31280-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 4/26/2021
Page: 2
Validated 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

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

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

Page 1190 - 1195 of SDG 410-31280-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % 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
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 4/26/2021
Page: 3
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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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

Compounds	LCS Calc Amount	LCSD Calc Amount	LCS/LCSD Calc RPD	Reported LCS/LCSD 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
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 4/26/2021
Page: 4
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

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

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 #: 410-31280-1 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-BLDG-1059-1-GW-030321 Lab ID: 410-31280-6
EIS 13C4 PFBA
REPORTED EIS %R 90

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

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

eurofins | Lancaster Laboratories Environmental

For Eurofins Lancaster Laboratories Environmental, Acct. # _____ Group # ___

410-31280 Chain of Custody

COC #616527 1 of 2

Client Information

Client: ARCADIS	Acct. #:
Project Name/#: Aberdeen Proving Ground	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996, 3BX50
Sampler: Dale Lynch	Quote #:
State where samples were collected:	For Compliance: Yes ☐ No ☐

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix: Soil/Sediment	Matrix: Water (Ground/Potable/NPDES/Surface)	Matrix: Other	Total # of Containers	Analysis Requested: PFAS (170)	Moisture (47)	Grain Size (73)	pH, TOC (34)	PFAS (173)	Remarks
APG-BAF-D-1-SO-(0-2)-030321	3/3/21	0915		X	SO			4	X	X	X	X		
APG-BAF-D-1-GW-030321		1000	X			GW		2					X	
APG-BAF-E-1-SO-(0-2)-030321		1030		X	SO			4	X	X	X	X		
APG-BAF-E-1-GW-030321		1115	X			GW		2					X	
APG-BLDG-1059-1-SO-(0-2)-030321		1200		X	SO			4	X	X	X	X		
APG-BLDG-1059-1-GW-030321		1230	X			GW		2					X	
APG-BLDG-1065-1-SO-(0-2)-030321		1320		X	SO			4	X	X	X	X		
APG-BLDG-1065-1-GW-030321		1400	X			GW		2					X	
APG-FB-01-030321		1500	X			GW		2					X	~~*not pumped~~
~~APG-FB-01-030321 DL~~														

Turnaround Time (TAT) Requested (please circle)
Standard Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: Keith.Shepherd@ARCADIS.com; Matthew.Blowe@ARCADIS.com

Data Package Options (circle if required)
Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	3/4/21	0700		3/4/21	11:50
	3/4/21	16:26			
				3/4/21	1647

EDD Required? Yes No
If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other x

Temperature upon receipt 0.6 °C

Environmental Analysis Request/Chain of Custody

eurofins | Lancaster Laboratories Environmental

For Eurofins Lancaster Laboratories Environmental use only

Acct. # _____ Group # _____ Sample # _____

COC # 616528

Client Information

Client: ARCADIS	Acct. #:
Project Name/#: Aberdeen Proving Ground	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.38X50
Sampler: Dan Lynch	Quote #:
State where samples were collected:	For Compliance: Yes ☐ No ☐

Matrix

Soil ☐ Sediment ☐ Tissue ☐ | Water: Potable ☐ Ground ☒ NPDES ☐ Surface ☐ | Other: _____

Analysis Requested

Preservation and Filtration Codes

PFAS (173)

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

For Lab Use Only
FSC: _____
SCR#: _____

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil	Sediment	Tissue	Water	Potable	Ground	NPDES	Surface	Other	Total # of Containers	PFAS (173)	Remarks
APG-EB-01-030321	3/3/21	1515	X					GW						2	X	~~Pump~~ DL
APG-SB-01-030321	3/3/21	1530	X					GW						2	X	

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: Keith.Shepherd@ARCADIS.com Matthew.Bigwood@ARCADIS.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
Dan Lynch	3/4/21	0700	Jall	3/4/21	11:50
Jall	3/4/21	16:26			
			Christopher R Barnes	3/4/21	1647

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other _____

Temperature upon receipt 0.6 °C

Definitions/Glossary

Client: ARCADIS U.S., Inc.
Job ID: 410-31280-1
Project/Site: Aberdeen Proving Ground

Qualifiers

LCMS

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.
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

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

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

Date Collected: 03/03/21 09:15
Date Received: 03/04/21 16:47

Lab Sample ID: 410-31280-1

Matrix: Solid
Percent Solids: 82.9

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		0.0023	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	mg/Kg	☼	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	mg/Kg	☼	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*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*67*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
M2-8:2 FTS	*67*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C2 PFTeDA	*72*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C3 PFBS	*85*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C4 PFBA	*66*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C4 PFHpA	*75*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C5 PFPeA	*72*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C8 PFOA	*77*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C8 PFOS	*86*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
d3-NMeFOSAA	*15*	**5-*	*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
d5-NEtFOSAA	*17*	**5-*	*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C2-PFDoDA	*83*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C3 PFHxS	*87*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C5 PFHxA	*73*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C6 PFDA	*77*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C7 PFUnA	*74*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*
13C9 PFNA	*75*		*50 - 150*	*03/05/21 20:35*	*03/06/21 14:59*	*1*

General Chemistry

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 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

Method: D422 - Grain Size

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%		03/06/21 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

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	<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*	*Qualifier*	*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*

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

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

Isotope Dilution	*%Recovery*	*Qualifier*	*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*		*50 - 150*	*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	LOQ	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 PFHxS	*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

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

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		0.0023	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
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 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(Mod) - PFAS for QSM 5.3, Table B-15 (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFHpA	86		50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C5 PFPeA	88		50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C8 PFOA	93		50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C8 PFOS	91		50 - 150	03/05/21 20:35	03/06/21 15:09	1
d3-NMeFOSAA	39	*5-	50 - 150	03/05/21 20:35	03/06/21 15:09	1
d5-NEtFOSAA	43	*5-	50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C2-PFDoDA	89		50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C3 PFHxS	89		50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C5 PFHxA	87		50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C6 PFDA	86		50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C7 PFUnA	84		50 - 150	03/05/21 20:35	03/06/21 15:09	1
13C9 PFNA	88		50 - 150	03/05/21 20:35	03/06/21 15:09	1

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	2170	J+	1330	887	887	mg/Kg	☼	03/13/21 15:20	3.84
Percent Moisture	13.4		1.0		1.0	%		03/05/21 11:44	1
Percent Solids	86.6		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	6.4	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

Method: D422 - Grain Size

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%		03/06/21 10:10	1
Sand	28.8		1.0	1.0	1.0	%		03/06/21 10:10	1
Silt	51.2		1.0	1.0	1.0	%		03/06/21 10:10	1
Clay	20.0		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	99.8		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
1.18 mm	99.5		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.6 mm	90.8		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.3 mm	78.7		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.15 mm	73.7		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.075 mm	71.2		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.064 mm	69.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.05 mm	63.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.02 mm	40.0		1.0	1.0	1.0	% Passing		03/06/21 10:10	1
0.005 mm	20.0		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-E-1-GW-030321

Lab Sample ID: 410-31280-4

Date Collected: 03/03/21 11:15
Matrix: Water
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	<3.8		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*	*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

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) - PFAS for QSM 5.3, Table B-15

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0019		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 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 for QSM 5.3, Table B-15 (Continued)

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorododecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/06/21 15:20	1
Perfluoroheptanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/06/21 15:20	1
Perfluorohexanesulfonic acid	**0.0037**		0.00071	0.00047	0.00047	mg/Kg	☼	03/06/21 15:20	1
Perfluorohexanoic acid	**0.00053**	**J**	0.00071	0.00047	0.00047	mg/Kg	☼	03/06/21 15:20	1
Perfluorononanoic acid	**0.0016**		0.00071	0.00047	0.00047	mg/Kg	☼	03/06/21 15:20	1
Perfluorooctanesulfonic acid	**0.14**		0.00071	0.00047	0.00047	mg/Kg	☼	03/06/21 15:20	1
Perfluorooctanoic acid	**0.0012**	**M**	0.00071	0.00047	0.00047	mg/Kg	☼	03/06/21 15:20	1
Perfluoropentanoic acid	**0.00065**	**J M**	0.00071	0.00047	0.00047	mg/Kg	☼	03/06/21 15:20	1
Perfluorotetradecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/06/21 15:20	1
Perfluorotridecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/06/21 15:20	1
Perfluoroundecanoic acid	**0.0017**	**M**	0.00071	0.00047	0.00047	mg/Kg	☼	03/06/21 15:20	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*95*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
M2-8:2 FTS	*88*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C2 PFTeDA	*85*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C3 PFBS	*88*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C4 PFBA	*85*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C4 PFHpA	*90*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C5 PFPeA	*91*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C8 PFOA	*94*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C8 PFOS	*93*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
d3-NMeFOSAA	*23*	**5-*	*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
d5-NEtFOSAA	*28*	**5-*	*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C2-PFDoDA	*99*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C3 PFHxS	*94*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C5 PFHxA	*89*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C6 PFDA	*92*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C7 PFUnA	*90*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*
13C9 PFNA	*89*		*50 - 150*	*03/05/21 20:35*	*03/06/21 15:20*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	**6090**	J+	2650	1770	1770	mg/Kg	☼	03/13/21 15:32	7.15
Percent Moisture	**19.1**		1.0		1.0	%		03/05/21 11:44	1
Percent Solids	**80.9**		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	**7.1**	J	0.01	0.01	0.01	S.U.		03/08/21 15:05	1
Temperature	**20.4**		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	%		03/06/21 10:10	1
Sand	**5.6**		1.0	1.0	1.0	%		03/06/21 10:10	1
Silt	**72.4**		1.0	1.0	1.0	%		03/06/21 10:10	1
Clay	**22.0**		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

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: D422 - Grain Size (Continued)

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
Lab Sample ID: 410-31280-6

Date Collected: 03/03/21 12:30
Matrix: Water
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	4100	~~D~~ 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 23:38*	*10*
M2-8:2 FTS	*108*		*50 - 150*	*03/08/21 08:30*	*03/09/21 23:38*	*10*
13C2 PFTeDA	*83*		*50 - 150*	*03/08/21 08:30*	*03/09/21 23:38*	*10*
13C3 PFBS	*94*		*50 - 150*	*03/08/21 08:30*	*03/09/21 23:38*	*10*
13C4 PFBA	*90*		*50 - 150*	*03/08/21 08:30*	*03/09/21 23:38*	*10*
13C4 PFHpA	*86*		*50 - 150*	*03/08/21 08:30*	*03/09/21 23:38*	*10*
13C5 PFPeA	*91*		*50 - 150*	*03/08/21 08:30*	*03/09/21 23:38*	*10*
13C8 PFOA	*91*		*50 - 150*	*03/08/21 08:30*	*03/09/21 23:38*	*10*
13C8 PFOS	*119*		*50 - 150*	*03/08/21 08:30*	*03/09/21 23:38*	*10*
d3-NMeFOSAA	*100*		*50 - 150*	*03/08/21 08:30*	*03/09/21 23:38*	*10*
d5-NEtFOSAA	*100*		*50 - 150*	*03/08/21 08:30*	*03/09/21 23:38*	*10*
13C2-PFDoDA	*97*		*50 - 150*	*03/08/21 08:30*	*03/09/21 23:38*	*10*

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

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

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

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

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	Qualifier	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

Lab Sample ID: 410-31280-7

Date Collected: 03/03/21 13:20
Matrix: Solid
Date Received: 03/04/21 16:47
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
~~NEtFOSAA~~	~~<0.00045~~		~~0.0022~~	~~0.00045~~	~~0.00045~~	~~mg/Kg~~	☼	~~03/06/21 15:30~~ R	1
~~NMeFOSAA~~	~~<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 15:30	1
M2-8:2 FTS	88		50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C2 PFTeDA	82		50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C3 PFBS	86		50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C4 PFBA	80		50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C4 PFHpA	83		50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C5 PFPeA	83		50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C8 PFOA	89		50 - 150	03/05/21 20:35	03/06/21 15:30	1
13C8 PFOS	90		50 - 150	03/05/21 20:35	03/06/21 15:30	1
d3-NMeFOSAA	11	*5-	50 - 150	03/05/21 20:35	03/06/21 15:30	1
d5-NEtFOSAA	14	*5-	50 - 150	03/05/21 20:35	03/06/21 15:30	1

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

Lab Sample ID: 410-31280-7

Date Collected: 03/03/21 13:20
Matrix: Solid
Date Received: 03/04/21 16:47
Percent Solids: 84.2

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

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

Lab Sample ID: 410-31280-8

Date Collected: 03/03/21 14:00
Matrix: Water
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	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

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

Lab Sample ID: 410-31280-8

Date Collected: 03/03/21 14:00

Matrix: Water

Date Received: 03/04/21 16:47

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

Analyte	Result	Qualifier	LOQ	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**	**J D M**	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

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) - PFAS 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**	~~**D**~~ 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

Matrix: Water

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

Client Sample ID: APG-FB-01-030321

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

Lab Sample ID: 410-31280-9
Matrix: Water

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

Analyte	Result	Qualifier	LOQ	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	M	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	M	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*	*Qualifier*	*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

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 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

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)

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorononanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/09/21 12:00	1
Perfluorooctanesulfonic acid	<0.86	M	1.7	0.86	0.86	ng/L		03/09/21 12:00	1
Perfluorooctanoic acid	<0.86	M	1.7	0.86	0.86	ng/L		03/09/21 12:00	1
Perfluoropentanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/09/21 12:00	1
Perfluorotetradecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/09/21 12:00	1
Perfluorotridecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/09/21 12:00	1
Perfluoroundecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/09/21 12:00	1

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

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		4.4	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

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

Job ID: 410-31280-1

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

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

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:

Sample ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-ABR6-1-GW-030521	410-31453-1	Water	3/5/2021		X		
APG-ABR6-1-SO-(0-2)-030521	410-31453-2	Soil	3/5/2021		X	X	X
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		X	X	X
APG-ABR7-1-GW-030521	410-31453-5	Water	3/5/2021		X		

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.

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

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

2. 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 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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-ABR6-1-SO-(0-2)-030521	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 50% but > 20%**	< 20%
APG-ABR6-2-SO-(0-2)-030521	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 50% but > 20%
	d5-NEtFOSAA	NEtFOSAA	**AC**	< 50% but > 20%
APG-ABR7-1-SO-(0-2)-030521	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 50% but > 20%
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX

Control Limit	Sample Result	Qualification
	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.

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	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
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		X		X	
LCS/LCSD Precision (RPD)		X		X	
Matrix Spike (MS) %R	X				X
Matrix Spike Duplicate(MSD) %R	X				X
MS/MSD Precision (RPD)	X				X
Field Duplicate (RPD)	X				X
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X		X	
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 APG-ABR7-1-SO-(0-2)-030521	3 days from collection; 3 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
	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 ± 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
TOC	75% to 89%	Non-detect	UJ
		Detect	J-
	111% to 125%	Non-detect	No Action
		Detect	J+
	Gross Exceedance >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 ± 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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X		X	
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)	X				X
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
Transcription/calculations acceptable		X		X	

Notes:
%R - percent recovery
RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE: 

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 Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 29347

PFBA 3/05/2021 Calibration Page 684 - 697 of SDG 410-31453-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	76737	4041718	10	0.018986	0.9493117	0.8751	0.216961	0.2	8.480	8.5	Match
0.5	176646	4038069	10	0.043745	0.8749033	0.8751	0.499888	0.5	-0.022	0	Match
2	793768	4082481	10	0.194433	0.9721637	0.8751	2.221835	2	11.092	11.1	Match
8	2677850	3885912	10	0.689118	0.8613969	0.8751	7.874729	8	-1.566	-1.6	Match
20	6830316	3935411	10	1.735604	0.8678021	0.8751	19.83321	20	-0.834	-0.8	Match
50	16406435	3931630	10	4.172935	0.8345869	0.8751	47.68523	50	-4.630	-4.6	Match
100	28464329	3717120	10	7.65763	0.765763	0.8751	87.50577	100	-12.494	-12.5	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 #: 410-31453-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 4/29/2021
Page: 2
Validated 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

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

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

Page 1003 - 1008 of SDG 410-31453-1

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

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

Stage 3 / 4
PFAS LCS

SDG #: 410-31453-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 4/29/2021
Page: 3
Validated by: SPR

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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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

Compounds	LCS Calc Amount	LCSD Calc Amount	LCS/LCSD Calc RPD	Reported LCS/LCSD 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 #: 410-31453-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 4/29/2021
Page: 4
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 Page 579 - 583 of SDG 410-31453-1

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

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

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

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[...]tody

eurofins | Lancaster Laboratories Environmental

Fo[...] [...]only Pg 1 of

Acct. # ______ 410-31453 Chain of Custody

COC #616529

Client Information

Client: ARCADIS	Acct. #:
Project Name/#: APG PFAS SI	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.3BX50
Sampler: Dale Lynch	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☐

For Lab Use Only
FSC: ______
SCR#: ______

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Analysis Requested — Preservation and Filtration Codes

Matrix: Soil ☒ Sediment ☐ Tissue ☐; Water: Potable ☐ Ground ☒ Surface ☐ NPDES ☐; Other:

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil / Sediment / Tissue	Water (Potable / Ground / Surface / NPDES)	Other	Total # of Containers	PFAS (170)	Moisture (77)	Grain Size (73)	pH, TOC (34)	PFAS (173)						Remarks
APG-ABR6-1-GW-030521	3/5/21	0930	X			GW		2					X						
APG-ABR6-1-SO-(0-2)-030521	↓	0915		X	SO			4	X	X	X	X							
APG-ABR6-2-SO-(0-2)-030521		1000		X	SO			2	X										
APG-ABR7-1-SO-(0-2)-030521		1030		X	SO			4	X	X	X	X							
APG-ABR7-1-GW-030521	↓		X			GW		2					X						

Turnaround Time (TAT) Requested (please circle)
(Standard) Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: ______

E-mail address: matthew.brown@arcadis.com, keith.shepherd@arcadis.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
[signature]	3/5/21	1500	S Duncan	3/5/21	1720
S Duncan	3/5/21	1900			
			[signature]	3-5-21	1928

EDD Required? Yes No
If yes, format: ______

Relinquished by Commercial Carrier:
UPS ______ FedEx ______ Other X

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Temperature upon receipt 2.7 °C

Definitions/Glossary

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

Job ID: 410-31453-1

Qualifiers

LCMS

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.
¤	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

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

Lab Sample ID: 410-31453-1

Date Collected: 03/05/21 09:30

Matrix: Water

Date Received: 03/05/21 19:28

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	**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		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*	*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*	*Qualifier*	*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 Collected: 03/05/21 09:15

Matrix: Solid

Date Received: 03/05/21 19:28

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

Client Sample ID: APG-ABR6-1-SO-(0-2)-030521
Date Collected: 03/05/21 09:15
Date Received: 03/05/21 19:28

Lab Sample ID: 410-31453-2
Matrix: Solid
Percent Solids: 74.7

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	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*	*Qualifier*	*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*	*03/08/21 21:28*	*1*
13C2 PFTeDA	*81*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C3 PFBS	*78*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C4 PFBA	*67*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C4 PFHpA	*75*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C5 PFPeA	*74*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C8 PFOA	*78*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C8 PFOS	*87*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
d3-NMeFOSAA	*20*	**5-*	*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
d5-NEtFOSAA	*26*	**5-*	*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C2-PFDoDA	*82*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C3 PFHxS	*86*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C5 PFHxA	*75*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C6 PFDA	*84*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C7 PFUnA	*89*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*
13C9 PFNA	*81*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:28*	*1*

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	<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	M	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	☼	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

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

Date Collected: 03/05/21 09:15
Date Received: 03/05/21 19:28

Lab Sample ID: 410-31453-2

Matrix: Solid
Percent Solids: 74.7

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorooctanesulfonic 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*	*Prepared*	*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	*15*	*5-	*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*	*1*

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	J	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

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

Method: D422 - Grain Size (Continued)

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

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	<0.0017		0.0022	0.0017	0.0017	mg/Kg	☼	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*

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

Date Collected: 03/05/21 10:00
Date Received: 03/05/21 19:28

Lab Sample ID: 410-31453-3

Matrix: Solid
Percent Solids: 85.0

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

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

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	<0.0018		0.0022	0.0018	0.0018	mg/Kg	☼	03/10/21 13:31	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0033	0.0018	0.0018	mg/Kg	☼	03/10/21 13:31	1
NEtFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
NMeFOSAA	<0.00044		0.0022	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluorobutanesulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	☼	03/10/21 13:31	1
Perfluorobutanoic acid	<0.0018	M	0.0022	0.0018	0.0018	mg/Kg	☼	03/10/21 13:31	1
Perfluorodecanoic acid	**0.0023**		0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluorododecanoic acid	**0.0014**		0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluoroheptanoic acid	**0.0010**		0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluorohexanesulfonic acid	**0.00054**	**J**	0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluorohexanoic acid	**0.00058**	**J**	0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluorononanoic acid	**0.0017**		0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluorooctanesulfonic acid	**0.0050**		0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluorooctanoic acid	**0.00090**	**M**	0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluoropentanoic acid	**0.0010**		0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluorotetradecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluorotridecanoic acid	**0.00044**	**J**	0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1
Perfluoroundecanoic acid	**0.0044**		0.00066	0.00044	0.00044	mg/Kg	☼	03/10/21 13:31	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	96		50 - 150	03/09/21 22:10	03/10/21 13:31	1
M2-8:2 FTS	88		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C2 PFTeDA	87		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C3 PFBS	96		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C4 PFBA	94		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C4 PFHpA	97		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C5 PFPeA	98		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C8 PFOA	99		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C8 PFOS	100		50 - 150	03/09/21 22:10	03/10/21 13:31	1
d3-NMeFOSAA	41	*5-	50 - 150	03/09/21 22:10	03/10/21 13:31	1
d5-NEtFOSAA	48	*5-	50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C2-PFDoDA	103		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C3 PFHxS	99		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C5 PFHxA	97		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C6 PFDA	96		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C7 PFUnA	93		50 - 150	03/09/21 22:10	03/10/21 13:31	1
13C9 PFNA	96		50 - 150	03/09/21 22:10	03/10/21 13:31	1

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	**15.0**		1.0		1.0	%		03/08/21 20:10	1
Percent Solids	**85.0**		1.0		1.0	%		03/08/21 20:10	1

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) - PFAS for QSM 5.3, Table B-15

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		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	M	0.00063	0.00042	0.00042	mg/Kg	☼	03/08/21 21:50	1
Perfluoropentanoic acid	<0.00042		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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*91*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
M2-8:2 FTS	*95*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C2 PFTeDA	*82*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C3 PFBS	*83*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C4 PFBA	*74*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C4 PFHpA	*78*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C5 PFPeA	*77*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C8 PFOA	*85*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C8 PFOS	*97*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
d3-NMeFOSAA	*33*	*5-	*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
d5-NEtFOSAA	*41*	*5-	*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C2-PFDoDA	*89*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C3 PFHxS	*92*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C5 PFHxA	*80*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C6 PFDA	*83*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C7 PFUnA	*87*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*
13C9 PFNA	*82*		*50 - 150*	*03/08/21 09:53*	*03/08/21 21:50*	*1*

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	<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

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) - PFAS for QSM 5.3, Table B-15 - RE (Continued)

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	☼	03/10/21 13:42	1
Perfluorononanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	☼	03/10/21 13:42	1
Perfluorooctanesulfonic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	☼	03/10/21 13:42	1
Perfluorooctanoic acid	<0.00043	M	0.00065	0.00043	0.00043	mg/Kg	☼	03/10/21 13:42	1
Perfluoropentanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	☼	03/10/21 13:42	1
Perfluorotetradecanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	☼	03/10/21 13:42	1
Perfluorotridecanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	☼	03/10/21 13:42	1
Perfluoroundecanoic acid	<0.00043		0.00065	0.00043	0.00043	mg/Kg	☼	03/10/21 13:42	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*69*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
M2-8:2 FTS	*68*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C2 PFTeDA	*74*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C3 PFBS	*86*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C4 PFBA	*85*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C4 PFHpA	*90*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C5 PFPeA	*89*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C8 PFOA	*87*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C8 PFOS	*91*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
d3-NMeFOSAA	*26*	*5-	*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
d5-NEtFOSAA	*29*	*5-	*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C2-PFDoDA	*87*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C3 PFHxS	*92*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C5 PFHxA	*87*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C6 PFDA	*81*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C7 PFUnA	*79*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*
13C9 PFNA	*85*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:42*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	**979**	J+	435	290	290	mg/Kg	☼	03/13/21 16:34	1.3
Percent Moisture	**10.3**		1.0		1.0	%		03/08/21 20:10	1
Percent Solids	**89.7**		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	**9.9**	J	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	**3.7**		1.0	1.0	1.0	%		03/10/21 19:00	1
Sand	**60.7**		1.0	1.0	1.0	%		03/10/21 19:00	1
Silt	**28.6**		1.0	1.0	1.0	%		03/10/21 19:00	1
Clay	**7.0**		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	**96.3**		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
3.35 mm	**94.2**		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
2.36 mm	**91.5**		1.0	1.0	1.0	% Passing		03/10/21 19:00	1

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: D422 - Grain 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

Lab Sample ID: 410-31453-5
Date Collected: 03/05/21 13:45
Matrix: Water
Date Received: 03/05/21 19:28

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	<4.4		5.5	4.4	4.4	ng/L		03/09/21 12:43	1
8:2 Fluorotelomer sulfonic acid	<2.2		3.3	2.2	2.2	ng/L		03/09/21 12:43	1
NEtFOSAA	<1.1		3.3	1.1	1.1	ng/L		03/09/21 12:43	1
NMeFOSAA	<1.3		2.2	1.3	1.3	ng/L		03/09/21 12:43	1
Perfluorobutanesulfonic acid	**4.2**		2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluorobutanoic acid	**21**		5.5	4.4	4.4	ng/L		03/09/21 12:43	1
Perfluorodecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluorododecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluoroheptanoic acid	**15**		2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluorohexanesulfonic acid	**92**		2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluorohexanoic acid	**35**		2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluorononanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluorooctanesulfonic acid	**24**		2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluorooctanoic acid	**60**		2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluoropentanoic acid	**23**	**M**	2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluorotetradecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluorotridecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/09/21 12:43	1
Perfluoroundecanoic acid	<1.1		2.2	1.1	1.1	ng/L		03/09/21 12:43	1

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*

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

Job ID: 410-31453-1

Client Sample ID: APG-ABR7-1-GW-030521
Date Collected: 03/05/21 13:45
Date Received: 03/05/21 19:28

Lab Sample ID: 410-31453-5
Matrix: Water

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

Isotope Dilution	%Recovery	Qualifier	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

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

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.

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

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 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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-(0-2)-030421	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 50% but > 20%
	d5-NEtFOSAA	NEtFOSAA	**< 50% but > 20%**	< 50% but > 20%
APG-HANGER-1060-1-SO-(0-2)-030421	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 20%**	< 20%
APG-MFR1-1-SO-(8-10)-030421	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20% (MS / MSD)
	d5-NEtFOSAA	NEtFOSAA	**< 50% but > 20%**	< 50% but > 20% (MS/MSD)
APG-DUP-01-030421	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 50% but > 20%**	< 20%
APG-MFR1-2-SO-(8-10)-030421	13C4 PFBA	Perfluorobutanoic acid	< 50% but > 20%	**AC**
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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.

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-030421	Perfluorohexanesulfonic acid	--	540	540 D
	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		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks		X		X	
C. Field blanks		X		X	
Laboratory Control Sample (LCS) %R		X		X	
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		X		X	
MS/MSD Precision (RPD)		X		X	
Field Duplicate (RPD)		X		X	
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X		X	
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 APG-MFR1-2-SO-(8-10)-030421	4 days from collection; 3 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
	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 ± 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
TOC	75% to 89%	Non-detect	UJ
		Detect	J-
	111% to 125%	Non-detect	No Action
		Detect	J+
	Gross Exceedance >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 ± 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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X		X	
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)	X				X
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
Transcription/calculations acceptable		X		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 07, 2021

Stage 3 / 4
PFAS Calibration Standards

SDG #: 410-31454-1 Date: 5/3/2021
Lab: Eurofins Lancaster Page: 1
Project: Aberdeen Proving Ground Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 29347

PFBA 3/05/2021 Calibration Page 788 - 801 of SDG 410-31454-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	76737	4041718	10	0.018986	0.9493117	0.8751	0.216961	0.2	8.480	8.5	Match
0.5	176646	4038069	10	0.043745	0.8749033	0.8751	0.499888	0.5	-0.022	0	Match
2	793768	4082481	10	0.194433	0.9721637	0.8751	2.221835	2	11.092	11.1	Match
8	2677850	3885912	10	0.689118	0.8613969	0.8751	7.874729	8	-1.566	-1.6	Match
20	6830316	3935411	10	1.735604	0.8678021	0.8751	19.83321	20	-0.834	-0.8	Match
50	16406435	3931630	10	4.172935	0.8345869	0.8751	47.68523	50	-4.630	-4.6	Match
100	28464329	3717120	10	7.65763	0.765763	0.8751	87.50577	100	-12.494	-12.5	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 #: 410-31454-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/3/2021
Page: 2
Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

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

Page 1077 - 1082 of SDG 410-31454-1

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

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

Page 1121 - 1126 of SDG 410-31454-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % 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

SDG #: 410-31454-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/3/2021
Page: 3
Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-100543/2-A

Page 1436 - 1441 of SDG 410-31454-1
Sample volume = 250 ml Final volume = 1ml

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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 1478 - 1483 of SDG 410-31454-1
Sample volume = 250 ml Final volume = 1ml

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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

Compounds	LCS Calc Amount	LCSD Calc Amount	LCS/LCSD Calc RPD	Reported LCS/LCSD 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 #:	410-31454-1	Date:	5/3/2021
Lab:	Eurofins Lancaster	Page:	4
Project:	Aberdeen Proving Ground	Validated 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

$$\%R = \frac{100 * (\text{MS Conc} - \text{Sample Conc})}{\text{MS TV}} \qquad RPD = \frac{100 * |\text{MS \%R} - \text{MSD \%R}}{\text{Average of MS MSD \%R}}$$

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

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

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 #:	410-31454-1	Date:	5/3/2021
Lab:	Eurofins Lancaster	Page:	6
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

EIS 13C5 PFPeA

REPORTED EIS %R 93

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

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[illegible]ain of Custody

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410-31454 Chain of Custody

Laboratories Environmental use only 1 of 2

Sample # _____

COC #617023

Client Information

Client: ARCADIS	Acct. #:
Project Name/#: APG PFAS SI	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.3Bx50
Sampler: Dale Lynch	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☐

Matrix: Soil ☒ Sediment ☐ Tissue ☐ Water ☒ Potable ☐ Ground ☐ NPDES ☐ Surface ☐ Other: ☐

Analysis Requested — Preservation and Filtration Codes

For Lab Use Only
FSC: _____
SCR#: _____

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Total # of Containers	PFAS (170)	Moisture (27)	Grain size (73)	pH, TOC (34)	PFAS (173)	Remarks
APG-Loading-PAD-1-SO-(0-2)-030421	3/4/21	0900		X	4	X	X	X	X		
APG-Loading-PAD-1-GW-030421		0950	X		2					X	
APG-Hanger-1060-1-SO-(0-2)-030421		1040		X	4	X	X	X	X		
APG-Hanger-1060-1-GW-030421		1130	X		2					X	
APG-FB-02-030421		1205	X		2					X	
APG-EB-02-030421		1210	X		2					X	
APG-MFR1-1-SO-(8-10)-030421/MS/MSD		1215		X	6	X					
APG-DUP-01-030421		1200		X	2	X					
APG-MFR1-1-GW-030421		1300	X		2					X	
APG-MFR1-2-SO-(8-10)-030421		1345		X	2	X					

Turnaround Time (TAT) Requested (please circle)
Standard Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: Keith.Shepherd@ARCADIS.com; Matthew.Blowe@ARCADIS.com

Data Package Options (circle if required)
Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
[signature]	3/5/21	1720	[signature]	3/5/21	1720
[signature]	3/5/21	1900			

EDD Required? Yes No
If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other X

Temperature upon receipt 3.1 °C

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only

Acct. # _____ Group # _____ Sample # _____

2 of 2

COC # 617018

Client Information

Client:	Acct. #:
Project Name/#:	PWSID #:
Project Manager: SEE Pg. 1	P.O. #:
Sampler:	Quote #:

State where samples were collected:

For Compliance: Yes ☐ No ☐

Matrix

Soil ☐ Sediment ☐ Tissue ☐ | Water Potable ☐ Ground ☒ Surface ☐ NPDES ☐ | Other: _____

Analysis Requested

Preservation and Filtration Codes

For Lab Use Only

FSC: _____

SCR#: _____

Preservation Codes

H=HCl	T=Thiosulfate
N=HNO_3	B=NaOH
S=H_2SO_4	P=H_3PO_4
F=Field Filtered	O=Other

Remarks

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix	Total # of Containers	PFAS (170)	Moisture (47)	Grain Size (73)	pH, TOC (34)	PFAS (173)
APG-MER1-2-GW-030421	3/4/21	1430	X		GW	2					X

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: SEE pg. 1

E-mail address: _____

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP)

Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
[signature]	3/5/21	1720	[signature]	3/5/21	1720
[signature]	3/5/21	1900			
			[signature]	3-5-21	1928

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other X

Temperature upon receipt 3.1 °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.

7044 0919

3/19/2021

Definitions/Glossary

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

Job ID: 410-31454-1

Qualifiers

LCMS

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.

General Chemistry

Qualifier	Qualifier Description
J	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 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

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

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	☼	03/08/21 22:01	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0033	0.0018	0.0018	mg/Kg	☼	03/08/21 22:01	1
NEtFOSAA	<0.00044	UJ	0.0022	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1
NMeFOSAA	<0.00044	UJ	0.0022	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1
Perfluorobutanesulfonic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	☼	03/08/21 22:01	1
Perfluorobutanoic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	☼	03/08/21 22:01	1
Perfluorodecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1
Perfluorododecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1
Perfluoroheptanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1
Perfluorohexanesulfonic acid	**0.0020**		0.00066	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1
Perfluorohexanoic acid	<0.00044	M	0.00066	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1
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	1
Perfluorooctanoic acid	**0.00062**	**J M**	0.00066	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1
Perfluoropentanoic acid	<0.00044	M	0.00066	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1
Perfluorotetradecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1
Perfluorotridecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1
Perfluoroundecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/08/21 22:01	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*123*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
M2-8:2 FTS	*126*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C2 PFTeDA	*103*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C3 PFBS	*98*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C4 PFBA	*89*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C4 PFHpA	*97*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C5 PFPeA	*95*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C8 PFOA	*100*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C8 PFOS	*113*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
d3-NMeFOSAA	*34*	*5-	*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
d5-NEtFOSAA	*42*	*5-	*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C2-PFDoDA	*106*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C3 PFHxS	*114*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C5 PFHxA	*98*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C6 PFDA	*98*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C7 PFUnA	*107*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*
13C9 PFNA	*103*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:01*	*1*

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	<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/Kg	☼	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

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

Date Collected: 03/04/21 09:00
Date Received: 03/05/21 19:28

Lab Sample ID: 410-31454-1

Matrix: Solid
Percent Solids: 86.9

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanoic acid	<0.00043	M	0.00064	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	1
Perfluorononanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	1
Perfluorooctanesulfonic acid	**0.0028**		0.00064	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	1
Perfluorooctanoic acid	**0.00059**	**J M**	0.00064	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	1
Perfluoropentanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	1
Perfluorotetradecanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	1
Perfluorotridecanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	1
Perfluoroundecanoic acid	<0.00043		0.00064	0.00043	0.00043	mg/Kg	☼	03/10/21 13:52	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*76*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
M2-8:2 FTS	*74*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C2 PFTeDA	*77*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C3 PFBS	*89*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C4 PFBA	*86*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C4 PFHpA	*90*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C5 PFPeA	*92*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C8 PFOA	*89*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C8 PFOS	*94*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
d3-NMeFOSAA	*27*	**5-*	*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
d5-NEtFOSAA	*29*	**5-*	*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C2-PFDoDA	*86*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C3 PFHxS	*94*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C5 PFHxA	*85*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C6 PFDA	*83*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C7 PFUnA	*81*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*
13C9 PFNA	*87*		*50 - 150*	*03/09/21 22:10*	*03/10/21 13:52*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	**6200**	J+	2130	1420	1420	mg/Kg	☼	03/13/21 16:47	6.17
Percent Moisture	**13.1**		1.0		1.0	%		03/08/21 15:30	1
Percent Solids	**86.9**		1.0		1.0	%		03/08/21 15:30	1

General Chemistry - Soluble

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	**7.5**	J	0.01	0.01	0.01	S.U.		03/08/21 15:05	1
Temperature	**20.0**		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	**10.5**		1.0	1.0	1.0	%		03/10/21 19:00	1
Sand	**38.7**		1.0	1.0	1.0	%		03/10/21 19:00	1
Silt	**34.9**		1.0	1.0	1.0	%		03/10/21 19:00	1
Clay	**16.0**		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	**96.5**		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
4.75 mm	**89.5**		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
3.35 mm	**88.1**		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
2.36 mm	**85.5**		1.0	1.0	1.0	% Passing		03/10/21 19:00	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

Method: D422 - Grain Size (Continued)

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

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

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	M	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*

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)

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 PFNA	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

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	<0.0017		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	mg/Kg	☼	03/08/21 22:12	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	86		50 - 150	03/08/21 09:53	03/08/21 22:12	1
M2-8:2 FTS	96		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C2 PFTeDA	87		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C3 PFBS	93		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C4 PFBA	71		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C4 PFHpA	77		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C5 PFPeA	74		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C8 PFOA	82		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C8 PFOS	104		50 - 150	03/08/21 09:53	03/08/21 22:12	1
d3-NMeFOSAA	13	*5-	50 - 150	03/08/21 09:53	03/08/21 22:12	1
d5-NEtFOSAA	16	*5-	50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C2-PFDoDA	89		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C3 PFHxS	103		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C5 PFHxA	81		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C6 PFDA	87		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C7 PFUnA	95		50 - 150	03/08/21 09:53	03/08/21 22:12	1
13C9 PFNA	86		50 - 150	03/08/21 09:53	03/08/21 22:12	1

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

Date Collected: 03/04/21 10:40
Date Received: 03/05/21 19:28

Lab Sample ID: 410-31454-3

Matrix: Solid
Percent Solids: 84.5

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	<0.0019		0.0024	0.0019	0.0019	mg/Kg	☼	03/10/21 14:03	1
8:2 Fluorotelomer sulfonic acid	<0.0019		0.0035	0.0019	0.0019	mg/Kg	☼	03/10/21 14:03	1
NEtFOSAA	<0.00047		0.0024	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
NMeFOSAA	<0.00047		0.0024	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluorobutanesulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	☼	03/10/21 14:03	1
Perfluorobutanoic acid	<0.0019	M	0.0024	0.0019	0.0019	mg/Kg	☼	03/10/21 14:03	1
Perfluorodecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluorododecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluoroheptanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluorohexanesulfonic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluorohexanoic acid	<0.00047	M	0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluorononanoic acid	**0.00059**	**J**	0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluorooctanesulfonic acid	**0.012**		0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluorooctanoic acid	**0.00053**	**J M**	0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluoropentanoic acid	**0.00051**	**J**	0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluorotetradecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluorotridecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1
Perfluoroundecanoic acid	<0.00047		0.00071	0.00047	0.00047	mg/Kg	☼	03/10/21 14:03	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*62*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
M2-8:2 FTS	*53*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C2 PFTeDA	*63*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C3 PFBS	*80*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C4 PFBA	*70*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C4 PFHpA	*72*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C5 PFPeA	*73*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C8 PFOA	*75*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C8 PFOS	*85*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
d3-NMeFOSAA	*9*	**5-*	*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
d5-NEtFOSAA	*11*	**5-*	*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C2-PFDoDA	*76*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C3 PFHxS	*85*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C5 PFHxA	*71*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C6 PFDA	*70*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C7 PFUnA	*67*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*
13C9 PFNA	*72*		*50 - 150*	*03/09/21 22:10*	*03/10/21 14:03*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
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	1
Percent Solids	**84.5**		1.0		1.0	%		03/08/21 15:30	1

General Chemistry - Soluble

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	**6.9**	J	0.01	0.01	0.01	S.U.		03/08/21 15:05	1
Temperature	**20.2**		0.01	0.01	0.01	Degrees C		03/08/21 15:05	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

Method: D422 - Grain Size

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%		03/10/21 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
Date Received: 03/05/21 19:28

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	**110**		6.0	4.8	4.8	ng/L		03/09/21 13:04	1
8:2 Fluorotelomer sulfonic acid	**99**		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	**27**		2.4	1.2	1.2	ng/L		03/09/21 13:04	1
Perfluorobutanoic acid	**56**		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	**100**		2.4	1.2	1.2	ng/L		03/09/21 13:04	1
Perfluorohexanoic acid	**140**		2.4	1.2	1.2	ng/L		03/09/21 13:04	1
Perfluorononanoic acid	**33**		2.4	1.2	1.2	ng/L		03/09/21 13:04	1
Perfluorooctanoic acid	**110**	**M**	2.4	1.2	1.2	ng/L		03/09/21 13:04	1
Perfluoropentanoic acid	**160**		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*
13C2 PFTeDA	*83*		*50 - 150*	*03/08/21 08:30*	*03/09/21 13:04*	*1*
13C3 PFBS	*101*		*50 - 150*	*03/08/21 08:30*	*03/09/21 13:04*	*1*
13C4 PFBA	*90*		*50 - 150*	*03/08/21 08:30*	*03/09/21 13:04*	*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
Date Received: 03/05/21 19:28

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

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 QSM 5.3, Table B-15 - DL

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	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	Qualifier	Limits	Prepared	Analyzed	Dil 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

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) - 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		4.4	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

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) - PFAS for QSM 5.3, Table B-15 (Continued)

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

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

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		4.2	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

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

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

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

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		0.0023	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	UJ	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	☼	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

Isotope Dilution	%Recovery	Qualifier	Limits	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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	**19.3**		1.0		1.0	%		03/08/21 15:30	1
Percent Solids	**80.7**		1.0		1.0	%		03/08/21 15:30	1

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

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	☼	03/08/21 22:56	1
8:2 Fluorotelomer sulfonic acid	<0.0019		0.0036	0.0019	0.0019	mg/Kg	☼	03/08/21 22:56	1
NEtFOSAA	<0.00048	UJ	0.0024	0.00048	0.00048	mg/Kg	☼	03/08/21 22:56	1
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	*88*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:56*	*1*
13C8 PFOA	*94*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:56*	*1*
13C8 PFOS	*116*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:56*	*1*
d3-NMeFOSAA	*34*	*5-	*50 - 150*	*03/08/21 09:53*	*03/08/21 22:56*	*1*
d5-NEtFOSAA	*49*	*5-	*50 - 150*	*03/08/21 09:53*	*03/08/21 22:56*	*1*
13C2-PFDoDA	*100*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:56*	*1*
13C3 PFHxS	*111*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:56*	*1*
13C5 PFHxA	*86*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:56*	*1*
13C6 PFDA	*92*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:56*	*1*
13C7 PFUnA	*100*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:56*	*1*
13C9 PFNA	*94*		*50 - 150*	*03/08/21 09:53*	*03/08/21 22:56*	*1*

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	<0.0019		0.0024	0.0019	0.0019	mg/Kg	☼	03/10/21 14:13	1
8:2 Fluorotelomer sulfonic acid	<0.0019		0.0036	0.0019	0.0019	mg/Kg	☼	03/10/21 14:13	1

Client Sample ID: APG-DUP-01-030421

Date Collected: 03/04/21 12:00
Date Received: 03/05/21 19:28

Lab Sample ID: 410-31454-8

Matrix: Solid
Percent Solids: 81.4

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
NEtFOSAA	<0.00048		0.0024	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
NMeFOSAA	<0.00048		0.0024	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluorobutanesulfonic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	☼	03/10/21 14:13	1
Perfluorobutanoic acid	<0.0019		0.0024	0.0019	0.0019	mg/Kg	☼	03/10/21 14:13	1
Perfluorodecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluorododecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluoroheptanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluorohexanesulfonic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluorohexanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluorononanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluorooctanesulfonic acid	**0.00093**		0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluorooctanoic acid	<0.00048	M	0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluoropentanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluorotetradecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluorotridecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1
Perfluoroundecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/10/21 14:13	1

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*	*03/10/21 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

Client Sample ID: APG-MFR1-1-GW-030421

Date Collected: 03/04/21 13:00
Date Received: 03/05/21 19:28

Lab Sample ID: 410-31454-9

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
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

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

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

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**	**J M**	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	M	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

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	<0.0019		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~~	☼	~~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

Client Sample ID: APG-MFR1-2-SO-(8-10)-030421

Date Collected: 03/04/21 13:45
Date Received: 03/05/21 19:28

Lab Sample ID: 410-31454-10

Matrix: Solid
Percent Solids: 82.1

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

Analyte	Result	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*	*Qualifier*	*Limits*	*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*

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	<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
Perfluorodecanoic 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	☼	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*41*	**5-*	*50 - 150*	*03/09/21 22:10*	*03/10/21 14:24*	*1*
M2-8:2 FTS	*38*	**5-*	*50 - 150*	*03/09/21 22:10*	*03/10/21 14:24*	*1*

Client Sample ID: APG-MFR1-2-SO-(8-10)-030421

Date Collected: 03/04/21 13:45
Date Received: 03/05/21 19:28

Lab Sample ID: 410-31454-10

Matrix: Solid
Percent Solids: 82.1

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

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFTeDA	53		50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C3 PFBS	73		50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C4 PFBA	50		50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C4 PFHpA	58		50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C5 PFPeA	53		50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C8 PFOA	57		50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C8 PFOS	78		50 - 150	03/09/21 22:10	03/10/21 14:24	1
d3-NMeFOSAA	8	*5-	50 - 150	03/09/21 22:10	03/10/21 14:24	1
d5-NEtFOSAA	11	*5-	50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C2-PFDoDA	58		50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C3 PFHxS	81		50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C5 PFHxA	54		50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C6 PFDA	55		50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C7 PFUnA	52		50 - 150	03/09/21 22:10	03/10/21 14:24	1
13C9 PFNA	56		50 - 150	03/09/21 22:10	03/10/21 14:24	1

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	979	~~J~~ J+	1200	801	801	mg/Kg	☼	03/13/21 17:12	3.29
Percent Moisture	17.9		1.0		1.0	%		03/08/21 15:30	1
Percent Solids	82.1		1.0		1.0	%		03/08/21 15:30	1

General Chemistry - Soluble

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	5.3	J	0.01	0.01	0.01	S.U.		03/08/21 15:05	1
Temperature	20.7		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	1.8		1.0	1.0	1.0	%		03/10/21 19:00	1
Sand	48.0		1.0	1.0	1.0	%		03/10/21 19:00	1
Silt	29.2		1.0	1.0	1.0	%		03/10/21 19:00	1
Clay	21.0		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	98.2		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
3.35 mm	96.6		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
2.36 mm	94.4		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
1.18 mm	90.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.6 mm	81.2		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.3 mm	58.7		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.15 mm	51.9		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.075 mm	50.2		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	44.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.02 mm	32.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.005 mm	21.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.002 mm	17.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
0.001 mm	15.0		1.0	1.0	1.0	% Passing		03/10/21 19:00	1

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

Job ID: 410-31454-1

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

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	<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*	*Qualifier*	*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*	*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*	*03/09/21 13:46*	*1*
13C5 PFHxA	*84*		*50 - 150*	*03/08/21 08:30*	*03/09/21 13:46*	*1*
13C6 PFDA	*88*		*50 - 150*	*03/08/21 08:30*	*03/09/21 13:46*	*1*
13C7 PFUnA	*88*		*50 - 150*	*03/08/21 08:30*	*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:

Sample ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-ABR3-1-(0-2)-030821	410-31764-1	Soil	3/8/2021		X	X	X
APG-ABR3-1-GW-030821	410-31764-2	Water	3/8/2021		X		
APG-BONEYARD-5-SO-(0-2)-030821	410-31764-3	Soil	3/8/2021		X		
APG-BONEYARD-5-GW-030821	410-31764-4	Water	3/8/2021		X		
APG-BONEYARD-2-SO-(0-2)-030821	410-31764-5	Soil	3/8/2021		X		
APG-BONEYARD-2-GW-030821	410-31764-6	Water	3/8/2021		X		
APG-BONEYARD-3-SO-(0-2)-030821	410-31764-7	Soil	3/8/2021		X		
APG-BONEYAD-3-GW-030821	410-31764-8	Water	3/8/2021		X		
APG-BONEYARD-4-SO-(0-2)-030821	410-31764-9	Soil	3/8/2021		X		
APG-BONEYARD-4-GW-030821	410-31764-10	Water	3/8/2021		X		

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.

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

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 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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-ABR3-1-(0-2)-030821	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 50% but > 20%
	d5-NEtFOSAA	NEtFOSAA	**< 50% but > 20%**	< 50% but > 20%
APG-BONEYARD-5-SO-(0-2)-030821	M2- 6:2 FTS	6:2 Fluorotelomer sulfonic acid	**< 50% but > 20%**	< 50% but > 20%
	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-(0-2)-030821	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 20%**	< 20%
APG-BONEYARD-3-SO-(0-2)-030821	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 20%**	< 20%
APG-BONEYARD-4-SO-(0-2)-030821	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20%
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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 ± 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
APG-ABR3-1-GW-030821	6:2 Fluorotelomer sulfonic acid	--	330	330 D
	8:2 Fluorotelomer sulfonic acid	--	1300	1300 D
	NMeFOSAA	--	15 J	15 DJ
	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		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
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		X		X	
LCS/LCSD Precision (RPD)		X		X	
Matrix Spike (MS) %R	X				X
Matrix Spike Duplicate(MSD) %R	X				X
MS/MSD Precision (RPD)	X				X
Field Duplicate (RPD)	X				X
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X	X		
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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.

Criteria	Qualification
	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 ± 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
TOC	75% to 89%	Non-detect	UJ
		Detect	J-
	111% to 125%	Non-detect	No Action
		Detect	J+
	Gross Exceedance >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 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 ± 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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X		X	
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)		X		X	
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
Transcription/calculations acceptable		X		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 #: 410-31764-1 Date: 3/5/2021
Lab: Eurofins Lancaster Page: 1
Project: Aberdeen Proving Ground Validated 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

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.1851	90922	3663647	9.565	0.024817	1.2824307	1.1097	0.213912	0.1851	15.566	15.6	Match
0.46275	208626	3767520	9.565	0.055375	1.1445939	1.1097	0.477301	0.46275	3.144	3.1	Match
1.851	894594	3877777	9.565	0.230698	1.1921248	1.1097	1.988486	1.851	7.428	7.4	Match
7.404	2982996	3775310	9.565	0.790133	1.0207482	1.1097	6.810507	7.404	-8.016	-8	Match
18.51	7615610	3769615	9.565	2.020262	1.0439658	1.1097	17.41354	18.51	-5.924	-5.9	Match
46.275	19117549	3694267	9.565	5.174923	1.0696519	1.1097	44.60498	46.275	-3.609	-3.6	Match
92.55	35924524	3661311	9.565	9.811929	1.0140584	1.1097	84.5734	92.55	-8.619	-8.6	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 #: 410-31764-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 3/5/2021
Page: 2
Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-101967/9 3/11/2021 19:27

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Analyte	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluoropentanoic acid	591092	3010428	10	0.1963	1.0300	1.906	2	-4.69	-4.6	Match
Perfluorohexanoic acid	656265	3578248	10	0.1834	0.9188	1.996	2	-0.19	-0.2	Match
Perfluoroheptanoic acid	751288	3524027	10	0.2132	1.1390	1.872	2	-6.41	-6.4	Match
Perfluorooctanoic acid	694697	3901880	10	0.1780	0.9747	1.827	2	-8.67	-8.7	Match
Perfluorooctanesulfonic acid	667233	3637749	9.57	0.1834	1.1100	1.581	2	-17.21	-17.3	Match
Perfluorononanoic acid	680797	3830388	10	0.1777	0.9315	1.908	2	-4.60	-4.6	Match

CCV 410-102949/1 3/13/2021 15:14

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Analyte	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluoropentanoic acid	171831	3319224	10	0.0518	1.0300	0.503	0.5	0.52	0.6	Match
Perfluorohexanoic acid	184667	4004788	10	0.0461	0.9188	0.502	0.5	0.37	0.4	Match
Perfluoroheptanoic acid	217995	3810197	10	0.0572	1.1390	0.502	0.5	0.46	0.5	Match
Perfluorooctanoic acid	220852	4296806	10	0.0514	0.9747	0.527	0.5	5.47	5.5	Match
Perfluorooctanesulfonic acid	218472	3897860	9.57	0.0560	1.1100	0.483	0.46	4.37	4.4	Match
Perfluorononanoic acid	198696	4189829	10	0.0474	0.9315	0.509	0.5	1.82	1.8	Match

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

Stage 3 / 4
PFAS LCS

SDG #: 410-31764-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 3/5/2021
Page: 3
Validated by: SPR

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

Analyte	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Dry Weight Value mg/kg	True Value mg/kg	Calculated Percent Recovery	Reported Percent 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 x (Calc amt ng/ml x 0.5)/ sample weight g) / 1000
Dry Weight Amount = [Calculated mg/kg / (TS/100)]

Stage 3 / 4
PFAS Sample Concentration

SDG #: 410-31764-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 3/5/2021
Page: 4
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

Analyte	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Calculated mg/kg	Calculated Amount Dry Weight mg/kg	Reported Value 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 x (Calc amt ng/ml x 0.5)/ sample weight g) / 1000
Dry Weight Amount = [Calculated mg/kg / (TS/100)]

Stage 3 / 4
PFAS EIS

SDG #: 410-31764-1 Date: 3/5/2021
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-ABR3-1-(0-2)-030821 Lab ID: 410-31764-1
EIS 13C8 PFOS
REPORTED EIS %R 100

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

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 Analysis Request/Chain of Custody

eurofins

Lancaster Laboratories Environmental

410-31764 Chain of Custody

Acct. # ___

For Eurofins Lancaster Laboratories Environmental use only

Sample # ___

pg 1 of

COC # 616530

Client Information

Client: ARCADIS	Acct. #:
Project Name/#: APG PFAS SI	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.38XSO
Sampler: Dale Lynch	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☐

Matrix: Tissue ☐ · Sediment ☐ · Soil ☒ · Ground ☒ · Potable ☐ · Surface ☐ · NPDES ☐ · Water · Other:

For Lab Use Only
FSC: ___
SCR#: ___

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Analysis Requested / Preservation and Filtration Codes

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil / Sediment	Water	Other	Total # of Containers	PFAS (170)	Moisture (77)	Grain Size (73)	pH, TOC (34)	PFAS (173)	Remarks
APG-ABR3-1-(0-2)-030821	3/8/21	0840		X	SO			4	X	X	X	X		
APG-ABR3-1-GW-030821		0930	X			GW		2					X	
APG-Boneyard-5-SO-(0-2)-030821		1000		X	SO			2	X					
APG-Boneyard-5-GW-030821		1035	X			GW		2					X	
APG-Boneyard-2-SO-(0-2)-030821		1110		X	SO			2	X					
APG-Boneyard-2-GW-030821		1140	X			GW		2					X	
APG-Boneyard-3-SO-(0-2)-030821		1210		X	SO			2	X					
APG-Boneyard-3-GW-030821		1250	X			GW		2					X	
APG-Boneyard-4-SO-(0-2)-030821		1330		X	SO			2	X					
APG-Boneyard-4-GW-030821		1415	X			GW		2					X	

Turnaround Time (TAT) Requested (please circle)
Standard (circled) Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: ___

E-mail address: Keith.Shepherd@ARCADIS.com; Matthew.Blow@ARCADIS.com

Relinquished by	Date	Time	Received by	Date	Time
[signature]	3/9/21	0700	[signature]	3/9/21	10:15
[signature]	3/9/21	16:31			
			[signature]	3-9-21	16:45

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

EDD Required? Yes No
If yes, format: ___

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS ___ FedEx ___ Other ___

Temperature upon 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.

7044 0919

3/19/2021

C3

Qualifiers

LCMS

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

Client Sample ID: APG-ABR3-1-(0-2)-030821

Date Collected: 03/08/21 08:40
Date Received: 03/09/21 16:45

Lab Sample ID: 410-31764-1

Matrix: Solid
Percent Solids: 81.8

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	<0.0019		0.0024	0.0019	0.0019	mg/Kg	☼	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*102*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
M2-8:2 FTS	*106*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C2 PFTeDA	*91*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C3 PFBS	*88*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C4 PFBA	*96*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C4 PFHpA	*102*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C5 PFPeA	*97*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C8 PFOA	*103*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C8 PFOS	*100*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
d3-NMeFOSAA	*29*	*5-	*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
d5-NEtFOSAA	*40*	*5-	*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C2-PFDoDA	*99*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C3 PFHxS	*101*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C5 PFHxA	*102*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C6 PFDA	*100*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C7 PFUnA	*104*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*
13C9 PFNA	*97*		*50 - 150*	*03/12/21 10:01*	*03/13/21 16:28*	*1*

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	<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

Client Sample ID: APG-ABR3-1-(0-2)-030821

Date Collected: 03/08/21 08:40
Date Received: 03/09/21 16:45

Lab Sample ID: 410-31764-1

Matrix: Solid
Percent Solids: 81.8

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanoic acid	**0.00061**	**J**	0.00072	0.00048	0.00048	mg/Kg	☼	03/11/21 06:48	1
Perfluorononanoic acid	**0.0014**		0.00072	0.00048	0.00048	mg/Kg	☼	03/11/21 06:48	1
Perfluorooctanesulfonic acid	**0.14**		0.00072	0.00048	0.00048	mg/Kg	☼	03/11/21 06:48	1
Perfluorooctanoic acid	**0.0017**	**M**	0.00072	0.00048	0.00048	mg/Kg	☼	03/11/21 06:48	1
Perfluoropentanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/11/21 06:48	1
Perfluorotetradecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/11/21 06:48	1
Perfluorotridecanoic acid	<0.00048		0.00072	0.00048	0.00048	mg/Kg	☼	03/11/21 06:48	1
Perfluoroundecanoic acid	**0.0010**		0.00072	0.00048	0.00048	mg/Kg	☼	03/11/21 06:48	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*105*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
M2-8:2 FTS	*97*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C2 PFTeDA	*96*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C3 PFBS	*110*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C4 PFBA	*91*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C4 PFHpA	*100*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C5 PFPeA	*95*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C8 PFOA	*106*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C8 PFOS	*112*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
d3-NMeFOSAA	*31*	**5-*	*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
d5-NEtFOSAA	*37*	**5-*	*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C2-PFDoDA	*111*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C3 PFHxS	*113*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C5 PFHxA	*98*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C6 PFDA	*107*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C7 PFUnA	*105*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*
13C9 PFNA	*99*		*50 - 150*	*03/10/21 11:30*	*03/11/21 06:48*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	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	1
Percent Solids	**81.8**		1.0		1.0	%		03/10/21 07:58	1

General Chemistry - Soluble

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	**6.7**	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	**3.8**		1.0	1.0	1.0	%		03/10/21 19:00	1
Sand	**26.8**		1.0	1.0	1.0	%		03/10/21 19:00	1
Silt	**60.4**		1.0	1.0	1.0	%		03/10/21 19:00	1
Clay	**9.0**		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	**96.4**		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
4.75 mm	**96.2**		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
3.35 mm	**96.2**		1.0	1.0	1.0	% Passing		03/10/21 19:00	1
2.36 mm	**96.2**		1.0	1.0	1.0	% Passing		03/10/21 19:00	1

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: D422 - Grain Size (Continued)

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

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	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	D M	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

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*

Client Sample ID: APG-ABR3-1-GW-030821

Lab Sample ID: 410-31764-2
Matrix: Water
Date Collected: 03/08/21 09:30
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) - PFAS for QSM 5.3, Table B-15 - DL

Analyte	Result	Qualifier	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	Qualifier	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
Matrix: Solid
Date Collected: 03/08/21 10:00
Date Received: 03/09/21 16:45
Percent Solids: 83.1

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	<0.0019	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~~	☼	~~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	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

Client Sample ID: APG-Boneyard-5-SO-(0-2)-030821
Date Collected: 03/08/21 10:00
Date Received: 03/09/21 16:45

Lab Sample ID: 410-31764-3
Matrix: Solid
Percent Solids: 83.1

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

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C6 PFDA	63		50 - 150	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
13C9 PFNA	63		50 - 150	03/12/21 10:01	03/13/21 16:38	1

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	<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**	**M**	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
Perfluoroundecanoic acid	<0.00047		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 Chemistry

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

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

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	**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*	*Qualifier*	*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*
13C8 PFOS	*82*		*50 - 150*	*03/10/21 08:44*	*03/11/21 02:34*	*1*
d3-NMeFOSAA	*75*		*50 - 150*	*03/10/21 08:44*	*03/11/21 02:34*	*1*
d5-NEtFOSAA	*70*		*50 - 150*	*03/10/21 08:44*	*03/11/21 02:34*	*1*
13C2-PFDoDA	*88*		*50 - 150*	*03/10/21 08:44*	*03/11/21 02:34*	*1*
13C3 PFHxS	*90*		*50 - 150*	*03/10/21 08:44*	*03/11/21 02:34*	*1*
13C5 PFHxA	*82*		*50 - 150*	*03/10/21 08:44*	*03/11/21 02:34*	*1*
13C6 PFDA	*77*		*50 - 150*	*03/10/21 08:44*	*03/11/21 02:34*	*1*
13C7 PFUnA	*78*		*50 - 150*	*03/10/21 08:44*	*03/11/21 02:34*	*1*
13C9 PFNA	*78*		*50 - 150*	*03/10/21 08:44*	*03/11/21 02:34*	*1*

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

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	<0.0019		0.0023	0.0019	0.0019	mg/Kg	☼	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
~~NEtFOSAA~~	~~<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

Client Sample ID: APG-Boneyard-2-SO-(0-2)-030821
Date Collected: 03/08/21 11:10
Date Received: 03/09/21 16:45

Lab Sample ID: 410-31764-5
Matrix: Solid
Percent Solids: 85.5

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

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**	**J M**	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	M	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*	*Qualifier*	*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: 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	<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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluoroundecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/11/21 07:09	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*68*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
M2-8:2 FTS	*62*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C2 PFTeDA	*75*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C3 PFBS	*92*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C4 PFBA	*62*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C4 PFHpA	*74*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C5 PFPeA	*67*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C8 PFOA	*80*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C8 PFOS	*97*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
d3-NMeFOSAA	*9*	*5-	*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
d5-NEtFOSAA	*12*	*5-	*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C2-PFDoDA	*84*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C3 PFHxS	*96*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C5 PFHxA	*70*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C6 PFDA	*81*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C7 PFUnA	*78*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*
13C9 PFNA	*77*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:09*	*1*

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

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	**3.9**	**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

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

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

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	☼	03/13/21 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

Client Sample ID: APG-Boneyard-3-SO-(0-2)-030821
Date Collected: 03/08/21 12:10
Date Received: 03/09/21 16:45

Lab Sample ID: 410-31764-7
Matrix: Solid
Percent Solids: 82.6

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

Isotope Dilution	%Recovery	Qualifier	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

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	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	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

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	1

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

Job ID: 410-31764-1

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

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

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	<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

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*

Client Sample ID: APG-Boneyard-4-SO-(0-2)-030821
Date Collected: 03/08/21 13:30
Date Received: 03/09/21 16:45

Lab Sample ID: 410-31764-9
Matrix: Solid
Percent Solids: 86.6

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	☼	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	M	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*	*Qualifier*	*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, Table B-15 - RE

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

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

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

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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*84*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
M2-8:2 FTS	*74*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C2 PFTeDA	*80*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C3 PFBS	*92*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C4 PFBA	*61*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C4 PFHpA	*77*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C5 PFPeA	*68*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C8 PFOA	*83*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C8 PFOS	*96*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
d3-NMeFOSAA	*11*	**5-*	*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
d5-NEtFOSAA	*15*	**5-*	*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C2-PFDoDA	*96*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C3 PFHxS	*96*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C5 PFHxA	*69*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C6 PFDA	*82*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C7 PFUnA	*83*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*
13C9 PFNA	*82*		*50 - 150*	*03/10/21 11:30*	*03/11/21 07:40*	*1*

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

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	**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	M	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

Client Sample ID: APG-Boneyard-4-GW-030821
Date Collected: 03/08/21 14:15
Date Received: 03/09/21 16:45

Lab Sample ID: 410-31764-10
Matrix: Water

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

Analyte	Result	Qualifier	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*
13C9 PFNA	*91*		*50 - 150*	*03/10/21 08:44*	*03/11/21 03:17*	*1*

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:

Sample ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-BLDG-250-PW-1-1-GW-030921	410-31990-1	Water	3/9/2021		X		
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		X		
APG-BLDG-250-PW-3-1-GW-030921	410-31990-4	Water	3/9/2021		X		
APG-BLDG-250-PW-4-1-GW-030921	410-31990-5	Water	3/9/2021		X		
APG-BLDG-250-PW-5-1-GW-030921	410-31990-6	Water	3/9/2021		X		
APG-AA-WWTP-1-EW-030921	410-31990-7	Water	3/9/2021		X		
APG-WB-MW-11A-030921	410-31990-8	Water	3/9/2021		X		
APG-WB-MW-14A-030921	410-31990-9	Water	3/9/2021		X		
APG-EB-03-030921	410-31990-10	Water	3/9/2021		X		

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.

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

Note:
QA - Quality Assurance

1. 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, $r^2 \geq 0.99$. 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 ± 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		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
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	X				X
LCS/LCSD Precision (RPD)	X				X
Matrix Spike (MS) %R		X		X	
Matrix Spike Duplicate(MSD) %R		X		X	
MS/MSD Precision (RPD)		X		X	
Field Duplicate (RPD)		X		X	
Extracted Internal Standard %R		X		X	
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content	X				X
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X	X		
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 #: 410-31990-1 Date: 5/3/2021
Lab: Eurofins Lancaster Page: 1
Project: Aberdeen Proving Ground Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

PFOA 3/17/2021 Calibration Page 685 - 698 of SDG 410-31990-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	141234	6771971	10	0.020856	1.0427836	0.9768	0.21351	0.2	6.755	6.8	Match
0.5	339917	6639170	10	0.051199	1.0239744	0.9768	0.524147	0.5	4.829	4.8	Match
2	1428396	6518513	10	0.219129	1.0956456	0.9768	2.243337	2	12.167	12.2	Match
8	4606305	6241486	10	0.738014	0.9225177	0.9768	7.555427	8	-5.557	-5.6	Match
20	11353940	6107162	10	1.859119	0.9295594	0.9768	19.03275	20	-4.836	-4.8	Match
50	26265377	5722106	10	4.590159	0.9180318	0.9768	46.9918	50	-6.016	-6	Match
100	43121158	4763137	10	9.053101	0.9053101	0.9768	92.68121	100	-7.319	-7.3	Match

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 #: 410-31990-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/3/2021
Page: 2
Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-103929/9 3/17/2021 01:41

Page 887 - 892 of SDG 410-31990-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	874409	4859351	10	0.1799	0.9055	1.987	2	-0.64	-0.6	Match
Perfluoropentanoic acid	931437	4634587	10	0.2010	1.0900	1.844	2	-7.81	-7.8	Match
Perfluorobutanesulfonic acid	772307	3826669	9.36	0.2018	1.1250	1.679	2	-5.13	-5	Match
Perfluorohexanoic acid	897494	5038802	10	0.1781	0.8906	2.000	2	0.00	0	Match
Perfluoroheptanoic acid	1138680	5302738	10	0.2147	1.1710	1.834	2	-8.31	-8.3	Match
Perfluorohexanesulfonic acid	721897	3684758	9.46	0.1959	1.0560	1.755	2	-7.14	-7.2	Match
Perfluorooctanesulfonic acid	783741	3880536	9.57	0.2020	1.1290	1.712	2	-10.37	-10.5	Match

CCV 410-104674/26 3/18/2021 22:16

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Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	3545496	5116461	10	0.6930	0.9055	7.653	8.0	-4.34	-4.3	Match
Perfluoropentanoic acid	3749862	4374335	10	0.8572	1.0900	7.865	8.0	-1.69	-1.7	Match
Perfluorobutanesulfonic acid	3045256	3918892	9.36	0.7771	1.1250	6.465	7.1	-8.68	-8.7	Match
Perfluorohexanoic acid	3577925	5062036	10	0.7068	0.8906	7.936	8.0	-0.80	-0.8	Match
Perfluoroheptanoic acid	4739651	5357598	10	0.8847	1.1710	7.555	8.0	-5.57	-5.5	Match
Perfluorohexanesulfonic acid	2734709	3552064	9.46	0.7699	1.0560	6.897	7.3	-5.52	-5.4	Match
Perfluorooctanesulfonic acid	3004073	3737618	9.57	0.8037	1.1290	6.813	7.4	-7.93	-8	Match

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

Stage 3 / 4
PFAS LCS

SDG #: 410-31990-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/3/2021
Page: 3
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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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 #:	410-31990-1	Date:	5/3/2021
Lab:	Eurofins Lancaster	Page:	4
Project:	Aberdeen Proving Ground	Validated by:	SPR

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID	APG-BLDG-250-PW-1-1-GW-030921
ANALYTE	Perfluorobutanoic acid
REPORTED MS %R	86
REPORTED MSD %R	89
REPORTED RPD	1

Page 392 - 393 SDG 410-31990-1

$$\%R = \frac{100 * (\text{MS Conc} - \text{Sample Conc})}{\text{MS TV}} \qquad RPD = \frac{100 * |\ \text{MS \%R} - \text{MSD \%R}}{\text{Average of MS MSD \%R}}$$

Sample Concentration	0			
MS Concentration	18.6	MS %R	86.51	MATCH
MSD Concentration	18.8	MSD %R	88.68	MATCH
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
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/3/2021
Page: 5
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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	Final Volume mls	Sample Volume mls	Final Calculated ng/L	Reported Value ng/L	
Perfluorobutanoic acid	1040582	4494060	10	0.231546	0.9055	2.56	1	310.4	8.2	8.2	Match
Perfluoropentanoic acid	5054077	4326834	10	1.168077	1.0900	10.72	1	310.4	34.5	35.0	Match
Perfluorobutanesulfonic acid	120925	3487754	9.36	0.034671	1.1250	0.29	1	310.4	0.9	0.93 J	Match
Perfluorohexanoic acid	2295479	4754627	10	0.482788	0.8906	5.42	1	310.4	17.5	17	Match
Perfluoroheptanoic acid	2201113	5365567	10	0.410229	1.1710	3.50	1	310.4	11.3	11	Match
Perfluorohexanesulfonic acid	283393	3498323	9.46	0.081008	1.0560	0.73	1	310.4	2.3	2	Match
Perfluorooctanesulfonic acid	571867	3522904	9.57	0.162328	1.1290	1.38	1	310.4	4.4	4.4	Match

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 #: 410-31990-1 Date: 5/3/2021
Lab: Eurofins Lancaster Page: 6
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
EIS 13C8 PFOS
REPORTED EIS %R 82

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

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. # _____

410-31990 Chain of Custody

tal use only

COC #616531

Client Information

Client: ARCADIS	Acct. #:
Project Name/#:	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.3Bx50
Sampler: Dale Lynch	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☐

Matrix

Soil ☐ Sediment ☐ Tissue ☐ | Water: Potable ☐ Ground ☒ NPDES ☐ Surface ☐ | Other: _____

Analysis Requested

Preservation and Filtration Codes

For Lab Use Only
FSC: _____
SCR#: _____

Preservation Codes

H=HCl	T=Thiosulfate
N=HNO_3	B=NaOH
S=H_2SO_4	P=H_3PO_4
F=Field Filtered	O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Total # of Containers	PFAS (170)	Moisture (33)	Grain Size (33)	pH, TOC (34)	PFAS (173)	Remarks
APG-BLDG-25D-PW-1-1-GW-030921 /ms/msd	3/9/21	0945	X		6					X	MS / MSD
APG-DUP-02-030921		1200	X		2					X	
APG-BLDG-25D-PW-2-1-GW-030921		0950	X		2					X	
APG-BLDG-25D-PW-3-1-GW-030921		0955	X		2					X	
APG-BLDG-25D-PW-4-1-GW-030921		1000	X		2					X	
APG-BLDG-25D-PW-5-1-GW-030921		1005	X		2					X	
APG-AA-WWTP-1-EW-030921		1045	X		2					X	
~~APG-WBA~~ APG-WB-MW-11A-030921		1410	X		2					X	
APG-WB-MW-14A-030921		1520	X		2					X	
APG-EB-03-030921		1430	X		2					X	

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: matthew.blow@arcadis.com Keith.Shepherd@arcadis.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP)	Type VI (Raw Data Only)	
Type III (Reduced non-CLP)	NJ DKQP	TX TRRP-13
NYSDEC Category A or B	MA MCP	CT RCP

Relinquished by	Date	Time	Received by	Date	Time
Dale Lynch	3/10/21	0700	[illegible]	3/10/21	11:45
[illegible]	3/10/21	17:29			
			[illegible]	3-10-2021	1813

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other X

Temperature upon receipt 2.1 °C

Definitions/Glossary

Client: ARCADIS U.S., Inc.
Job ID: 410-31990-1
Project/Site: Aberdeen Proving Ground

Qualifiers

LCMS

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

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

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

Job ID: 410-31990-1

Client Sample ID: APG-BLDG-250-PW-1-1-GW-030921

Lab Sample ID: 410-31990-1

Date Collected: 03/09/21 09:45
Date Received: 03/10/21 18:13

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
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*	*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

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
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

Client Sample ID: APG-DUP-02-030921

Date Collected: 03/09/21 12:00
Date Received: 03/10/21 18:13

Lab Sample ID: 410-31990-2
Matrix: Water

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	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 08:29*	*03/18/21 21:54*	*1*
M2-8:2 FTS	*93*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C2 PFTeDA	*73*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C3 PFBS	*82*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C4 PFBA	*98*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C4 PFHpA	*101*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C5 PFPeA	*94*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C8 PFOA	*98*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C8 PFOS	*85*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
d3-NMeFOSAA	*84*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
d5-NEtFOSAA	*91*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C2-PFDoDA	*80*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C3 PFHxS	*95*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C5 PFHxA	*100*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C6 PFDA	*92*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C7 PFUnA	*89*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*
13C9 PFNA	*92*		*50 - 150*	*03/17/21 08:29*	*03/18/21 21:54*	*1*

Client Sample ID: APG-BLDG-250-PW-2-1-GW-030921

Date Collected: 03/09/21 09:50
Date Received: 03/10/21 18:13

Lab Sample ID: 410-31990-3
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
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

Client Sample ID: APG-BLDG-250-PW-2-1-GW-030921

Lab Sample ID: 410-31990-3

Date Collected: 03/09/21 09:50
Date Received: 03/10/21 18:13

Matrix: Water

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

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

Lab Sample ID: 410-31990-4

Date Collected: 03/09/21 09:55
Date Received: 03/10/21 18:13

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
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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*106*		*50 - 150*	*03/17/21 08:29*	*03/18/21 22:05*	*1*

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

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

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		50 - 150	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

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	<3.3		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	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

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
Matrix: Water
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		4.2	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

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

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

Client Sample ID: APG-AA-WWTP-1-EW-030921

Lab Sample ID: 410-31990-7

Date Collected: 03/09/21 10:45
Matrix: Water
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	**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

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

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

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		4.2	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** 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*	*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

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		03/15/21 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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorododecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/15/21 20:07	1
Perfluoroheptanoic acid	**3.3**		1.7	0.86	0.86	ng/L		03/15/21 20:07	1
Perfluorohexanesulfonic acid	**39**		1.7	0.86	0.86	ng/L		03/15/21 20:07	1
Perfluorohexanoic acid	**14**		1.7	0.86	0.86	ng/L		03/15/21 20:07	1
Perfluorononanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/15/21 20:07	1
Perfluorooctanesulfonic acid	**1.4**	~~J H M~~ JM	1.7	0.86	0.86	ng/L		03/15/21 20:07	1
Perfluorooctanoic acid	**43**	**M**	1.7	0.86	0.86	ng/L		03/15/21 20:07	1
Perfluoropentanoic acid	**5.9**	**M**	1.7	0.86	0.86	ng/L		03/15/21 20:07	1
Perfluorotetradecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/15/21 20:07	1
Perfluorotridecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/15/21 20:07	1
Perfluoroundecanoic acid	<0.86		1.7	0.86	0.86	ng/L		03/15/21 20:07	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*145*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
M2-8:2 FTS	*150*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C2 PFTeDA	*115*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C3 PFBS	*98*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C4 PFBA	*99*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C4 PFHpA	*109*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C5 PFPeA	*107*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C8 PFOA	*117*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C8 PFOS	*115*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
d3-NMeFOSAA	*123*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
d5-NEtFOSAA	*148*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C2-PFDoDA	*131*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C3 PFHxS	*111*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C5 PFHxA	*112*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C6 PFDA	*124*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C7 PFUnA	*131*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*
13C9 PFNA	*123*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:07*	*1*

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

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		4.2	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

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

Job ID: 410-31990-1

Client Sample ID: APG-EB-03-030921
Date Collected: 03/09/21 14:30
Date Received: 03/10/21 18:13

Lab Sample ID: 410-31990-10
Matrix: Water

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

Analyte	Result	Qualifier	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*	*Qualifier*	*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 ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-EA-WWTP-1-EW-031021	410-32109-1	Water	3/10/2021		X		
APG-GWTP-1-GW-031021	410-32109-2	Water	3/10/2021		X		
APG-TANK-FIRE-1-SE-031021	410-32109-3	Sediment	3/10/2021		X		
APG-TANK-FIRE-1-SW-031021	410-32109-4	Water	3/10/2021		X		
APG-BLDG-E4081-1-SE-031021	410-32109-5	Sediment	3/10/2021		X		
APG-BLDG-E4081-1-SW-031021	410-32109-6	Water	3/10/2021		X		
APG-BLDG-E4081-2-SE-031021	410-32109-7	Sediment	3/10/2021		X		
APG-BLDG-E4081-2-SW-031021	410-32109-8	Water	3/10/2021		X		
APG-BLDG-E4081-2-SO-(0-2)-031021	410-32109-9	Soil	3/10/2021		X		
APG-DUP-03-031021	410-32109-10	Soil	3/10/2021	APG-BLDG-E4081-2-SO-(0-2)-031021	X		
APG-BLDG-E4081-1-SO-(0-2)-031021	410-32109-11	Soil	3/10/2021		X	X	X
APG-NOBLE-ROAD-1-SO-(0-2)-031021	410-32109-12	Soil	3/10/2021		X	X	X
APG-NOBLE-ROAD-2-SO-(0-2)-031021	410-32109-13	Soil	3/10/2021		X		
APG-FB-05-031021	410-32109-14	Water	3/10/2021		X		
APG-CASEY-YARD-1-SO-(0-2)-031021	410-32109-15	Soil	3/10/2021		X	X	X

Notes:

1. 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.

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

Note:
QA - Quality Assurance

1. 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 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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 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	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
C. Field blanks		X		X	
Laboratory Control Sample (LCS) %R		X		X	
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		X		X	
MS/MSD Precision (RPD)		X		X	
Field Duplicate (RPD)		X		X	
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X		X	
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 APG-CASEY-YARD-1-SO-(0-2)-031021	6 days from collection; 5 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
	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 ± 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 APG-CASEY-YARD-1-SO-(0-2)-031021	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
TOC	Gross Exceedance <75%	Non-detect	UX
		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.

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
MS percent recovery 30% to 74%	Non-detect	UJ
	Detect	J-
MS percent recovery <30%	Non-detect	UX
	Detect	J-
MS percent recovery >125%	Non-detect	No Action
	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	Total Organic Carbon	64%
APG-NOBLE-ROAD-1-SO-(0-2)-031021		
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
% Recovery < lower limit of 80%	Non-detect	UJ
	Detect	J-
% Recovery > upper limit of 120%	Non-detect	No Action
	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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X	X		
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)		X		X	
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
Transcription/calculations acceptable		X		X	

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 #: 410-32109-1 Date: 5/5/2021
Lab: Eurofins Lancaster Page: 1
Project: Aberdeen Proving Ground Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

PFOA 3/11/2021 Calibration Page 883 - 896 of SDG 410-32109-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	138150	6901684	10	0.020017	1.0008427	0.9699	0.206381	0.2	3.190	3.2	Match
0.5	318787	6286752	10	0.050708	1.0141548	0.9699	0.522814	0.5	4.563	4.6	Match
2	1312850	6304984	10	0.208224	1.0411208	0.9699	2.146862	2	7.343	7.3	Match
8	4676045	6203162	10	0.753816	0.9422705	0.9699	7.772104	8	-2.849	-2.8	Match
20	12198158	6501151	10	1.876307	0.9381537	0.9699	19.34537	20	-3.273	-3.3	Match
50	26668154	5766753	10	4.624466	0.9248932	0.9699	47.67982	50	-4.640	-4.6	Match
100	49469532	5333126	10	9.275898	0.9275898	0.9699	95.63767	100	-4.362	-4.4	Match

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 #: 410-32109-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/5/2021
Page: 2
Validated 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

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	1034968	5707650	10	0.1813	0.9173	1.977	2	-1.16	-1.2	Match
Perfluoropentanoic acid	1013552	4952024	10	0.2047	1.1070	1.849	2	-7.55	-7.6	Match
Perfluorobutanesulfonic acid	808453	3819560	9.36	0.2117	1.1340	1.747	2	-1.30	-1.2	Match
Perfluorohexanoic acid	976309	5696506	10	0.1714	0.8796	1.948	2	-2.58	-2.6	Match
Perfluoroheptanoic acid	1343450	5905046	10	0.2275	1.1690	1.946	2	-2.69	-2.7	Match
Perfluorohexanesulfonic acid	792080	4118268	9.46	0.1923	1.0280	1.770	2	-6.35	-6.4	Match
Perfluorooctanoic acid	1226755	6440445	10	0.1905	0.9699	1.964	2	-1.81	-1.8	Match

CCV 410-103254/15 3/15/2021 19:23 Page 1257 - 1262 of SDG 410-32109-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	1173360	5671291	10	0.2069	0.9173	2.255	2.0	12.77	12.8	Match
Perfluoropentanoic acid	1206313	5056294	10	0.2386	1.1070	2.155	2.0	7.76	7.7	Match
Perfluorobutanesulfonic acid	1005307	4413810	9.36	0.2278	1.1340	1.880	1.8	6.21	6.2	Match
Perfluorohexanoic acid	1134572	5979469	10	0.1897	0.8796	2.157	2.0	7.86	7.9	Match
Perfluoroheptanoic acid	1601160	6201495	10	0.2582	1.1690	2.209	2.0	10.43	10.5	Match
Perfluorohexanesulfonic acid	928995	4301387	9.46	0.2160	1.0280	1.987	1.8	9.20	9	Match
Perfluorooctanoic acid	1505842	6806383	10	0.2212	0.9699	2.281	2.0	14.05	14.1	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

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Sample volume = 250 ml Final volume = 1ml

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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 #:	410-32109-1	Date:	5/5/2021
Lab:	Eurofins Lancaster	Page:	4
Project:	Aberdeen Proving Ground	Validated by:	SPR

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID	APG-BLDG-E4081-2-SO-(0-2)-031021
ANALYTE	Perfluorobutanoic acid
REPORTED MS %R	97
REPORTED MSD %R	101
REPORTED RPD	2

Page 514 - 515 SDG 410-32109-1

$$\%R = \frac{100 * (\text{MS Conc} - \text{Sample Conc})}{\text{MS TV}} \qquad RPD = \frac{100 * |\ \text{MS \%R} - \text{MSD \%R}}{\text{Average of MS MSD \%R}}$$

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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Final Volume mls	Sample Volume mls	Final Calculated ng/L	Reported Value ng/L	
Perfluorobutanoic acid	1068338	4877017	10	0.219056	0.9173	2.39	1	292.3	8.2	8.2	Match
Perfluoropentanoic acid	2443867	4796492	10	0.509511	1.1070	4.60	1	292.3	15.7	16.0	Match
Perfluorobutanesulfonic acid	430410	4085435	9.36	0.105352	1.1340	0.87	1	292.3	3.0	3.0	Match
Perfluorohexanoic acid	2248876	5745354	10	0.391425	0.8796	4.45	1	292.3	15.2	15.0	Match
Perfluoroheptanoic acid	990076	6091631	10	0.162531	1.1690	1.39	1	292.3	4.8	4.8	Match
Perfluorohexanesulfonic acid	2064078	4472978	9.46	0.461455	1.0280	4.25	1	292.3	14.5	15.0	Match
Perfluorooctanoic acid	1847118	6835496	10	0.270224	0.9699	2.79	1	292.3	9.5	9.5	Match

Field Sample ID: APG-BLDG-E4081-2-SW-031021 Lab ID: 410-32109-8 Page 663 - 667 of SDG 410-32109-1

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Final Volume mls	Sample Volume mls	Final Calculated ng/L	Reported Value ng/L	
Perfluorobutanoic acid	568727	4484690	10	0.126815	0.9173	1.38	1	269.2	5.1	5.1	Match
Perfluoropentanoic acid	301454	4766134	10	0.063249	1.1070	0.57	1	269.2	2.1	2.1	Match
Perfluorobutanesulfonic acid	1749469	3911462	9.36	0.447267	1.1340	3.69	1	269.2	13.7	14.0	Match
Perfluorohexanoic acid	357070	5664399	10	0.063038	0.8796	0.72	1	269.2	2.7	2.7	Match
Perfluoroheptanoic acid	299826	5820414	10	0.051513	1.1690	0.44	1	269.2	1.6	1.6 J	Match
Perfluorooctanoic acid	222076	6896592	10	0.032201	0.9699	0.33	1	269.2	1.2	1.2 J	Match

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 #: 410-32109-1 Date: 5/5/2021
Lab: Eurofins Lancaster Page: 6
Project: Aberdeen Proving Ground Validated 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

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

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

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For Eurofins Lancaster Laboratories Environmental use only

Acct. # _____ Group # _____ Sample # _____ Pg 1 of 2

410-32109 Chain of Custody

SCR#: _____

Client Information

Client: ARCADIS	Acct. #:
Project Name/#: APG PFAS S1	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.7BX5D
Sampler: Dale Lynch	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☐

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix: Soil/Sediment	Matrix: Water	Matrix: Other	Total # of Containers	PFAS (120)	Moisture (27)	Grain Size (73)	pH, TDL (34)	PFAS (133)	Remarks
APG-AA-WWTP-1-EW-031021	3/10/21	0945	X			GW		2					X	
APG-GWTP-1-GW-031021		1000				GW		2					X	
APG-TANK-FIRE-1-SE-031021		1030			SE			2	X					
APG-TANK-FIRE-1-SW-031021		1040				SW		2					X	
APG-BLDG-E4081-1-SE-031021		1120			SE			2	X					
APG-BLDG-E4081-1-SW-031021		1130				SW		2					X	
APG-BLDG-E4081-2-SE-031021		1140			SE			2	X					
APG-BLDG-E4081-2-SW-031021		1145				SW		2					X	
APG-BLDG-E4081-2-SO-(0-2)-031021		1200			SO			6	X					MS/MSD
DL ~~APG-BLDG~~ APG-DUP-03-031021		1200			SO			2	X					

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: Keith.Shepherd@ARCADIS.com, Matthew.Blowe@ARCADIS.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
Dale Lynch	3/11/21	0700	Bill DeLong	3-11-21	11:00
Bill DeLong	3-11-21	1657			
			Received by	3-11-21	17:15

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other X

Temperature upon receipt 1.1 °C

Environmental Analysis Request/Chain of Custody

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Acct. # _____ Group # _____ Sample # _____ pg 2 of 2

COC #616533

Client Information

Client:	Acct. #:
Project Name/#:	PWSID #:
Project Manager: see pg 1	P.O. #:
Sampler:	Quote #:
State where samples were collected:	For Compliance: Yes ☐ No ☐

Matrix

Soil ☒ Sediment ☐ Tissue ☐ Water ☐ Potable ☒ Ground ☐ NPDES ☐ Surface ☐ Other: ___

Analysis Requested

Preservation and Filtration Codes

For Lab Use Only
FSC:_____
SCR#:_____

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Remarks

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil	Water	Other	Total # of Containers	PFAS (170)	Moisture (27)	Grain Size (73)	pH, TOC (34)	PFAS (173)
APG-BLDG-E4081-1-SO-(0-2)-031021	3/10/21	1215		X	SO			4	X	X	X	X	
APG-NOBLE-ROAD-1-SO-(0-2)-031021		1245		X	SO			4	X	X	X	X	
APG-NOBLE-ROAD-2-SO-(0-2)-031021		1300		X	SO			2	X				
APG-FB-05-031021		1315	X			GW		2					X
APG-CASEY-YARD-1-SO-(0-2)-031021		1330		X	SO			4	X	X	X	X	

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: see pg 1

E-mail address: _____

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
Dat Le	3/11/21	0700	Bill DeLong	3-11-21	1400
Bill DeLong	3-11-21	1657			
				3-11-20	17:15

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other X

Temperature upon receipt 1.4 °C

Definitions/Glossary

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

Job ID: 410-32109-1

Qualifiers

LCMS

Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
^c	CCV Recovery is outside acceptance limits.
B	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)
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

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

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	**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		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		1.7	0.86	0.86	ng/L		03/15/21 20:29	1
Perfluoroheptanoic acid	**4.8**		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**		1.7	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		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*	*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

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	<3.2		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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	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	0.81	0.81	ng/L		03/15/21 20:40	1
Perfluorohexanesulfonic acid	<0.81		1.6	0.81	0.81	ng/L		03/15/21 20:40	1
Perfluorohexanoic acid	**1.0**	**J**	1.6	0.81	0.81	ng/L		03/15/21 20:40	1
Perfluorononanoic acid	<0.81		1.6	0.81	0.81	ng/L		03/15/21 20:40	1
Perfluorooctanesulfonic acid	<0.81		1.6	0.81	0.81	ng/L		03/15/21 20:40	1
Perfluorooctanoic acid	<0.81	M	1.6	0.81	0.81	ng/L		03/15/21 20:40	1
Perfluoropentanoic acid	**1.5**	**J M**	1.6	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	0.81	0.81	ng/L		03/15/21 20:40	1
Perfluoroundecanoic acid	<0.81		1.6	0.81	0.81	ng/L		03/15/21 20:40	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*137*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
M2-8:2 FTS	*143*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C2 PFTeDA	*110*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C3 PFBS	*97*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C4 PFBA	*105*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C4 PFHpA	*114*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C5 PFPeA	*107*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C8 PFOA	*118*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C8 PFOS	*111*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
d3-NMeFOSAA	*135*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
d5-NEtFOSAA	*147*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C2-PFDoDA	*125*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C3 PFHxS	*111*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C5 PFHxA	*112*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C6 PFDA	*122*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C7 PFUnA	*127*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*
13C9 PFNA	*120*		*50 - 150*	*03/12/21 20:41*	*03/15/21 20:40*	*1*

Client Sample ID: APG-TANK-FIRE-1-SE-031021

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

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	M	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

Client Sample ID: APG-TANK-FIRE-1-SE-031021

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)

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluoropentanoic acid	<0.0023		0.0034	0.0023	0.0023	mg/Kg	☼	03/13/21 17:20	1
Perfluorotetradecanoic acid	<0.0023		0.0034	0.0023	0.0023	mg/Kg	☼	03/13/21 17:20	1
Perfluorotridecanoic acid	<0.0023		0.0034	0.0023	0.0023	mg/Kg	☼	03/13/21 17:20	1
Perfluoroundecanoic acid	<0.0023		0.0034	0.0023	0.0023	mg/Kg	☼	03/13/21 17:20	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*92*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
M2-8:2 FTS	*99*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C2 PFTeDA	*79*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C3 PFBS	*80*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C4 PFBA	*90*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C4 PFHpA	*95*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C5 PFPeA	*90*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C8 PFOA	*93*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C8 PFOS	*89*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
d3-NMeFOSAA	*84*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
d5-NEtFOSAA	*92*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C2-PFDoDA	*92*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C3 PFHxS	*90*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C5 PFHxA	*91*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C6 PFDA	*93*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C7 PFUnA	*96*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*
13C9 PFNA	*91*		*50 - 150*	*03/12/21 10:01*	*03/13/21 17:20*	*1*

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

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

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		4.2	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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorotridecanoic acid	<0.84		1.7	0.84	0.84	ng/L		03/15/21 20:52	1
Perfluoroundecanoic acid	<0.84		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

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	<0.0021		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*	*Qualifier*	*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*
13C2 PFTeDA	*91*		*50 - 150*	*03/16/21 11:32*	*03/17/21 19:08*	*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

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

Lab Sample ID: 410-32109-6
Date Collected: 03/10/21 11:30
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	<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

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

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

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

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

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

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	107		50 - 150	03/12/21 10:01	03/13/21 17:52	1
M2-8:2 FTS	101		50 - 150	03/12/21 10:01	03/13/21 17:52	1
13C2 PFTeDA	96		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	1
13C4 PFBA	86		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	1
13C5 PFPeA	87		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
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	1
d5-NEtFOSAA	75		50 - 150	03/12/21 10:01	03/13/21 17:52	1
13C2-PFDoDA	104		50 - 150	03/12/21 10:01	03/13/21 17:52	1

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

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

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	Qualifier	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	M	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

Client Sample ID: APG-BLDG-E4081-2-SW-031021

Lab Sample ID: 410-32109-8
Matrix: Water
Date Collected: 03/10/21 11:45
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

Lab Sample ID: 410-32109-9
Matrix: Solid
Date Collected: 03/10/21 12:00
Date Received: 03/11/21 17:15
Percent Solids: 86.4

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	<0.0019		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

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

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

Client Sample ID: APG-BLDG-E4081-2-SO-(0-2)-031021

Lab Sample ID: 410-32109-9
Date Collected: 03/10/21 12:00
Matrix: Solid
Date Received: 03/11/21 17:15
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
Date Collected: 03/10/21 12:00
Matrix: Solid
Date Received: 03/11/21 17:15
Percent Solids: 85.6

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	<0.0017		0.0021	0.0017	0.0017	mg/Kg	☼	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	mg/Kg	☼	03/13/21 18:34	1

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*

General Chemistry

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

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

Job ID: 410-32109-1

Client Sample ID: APG-BLDG-E4081-1-SO-(0-2)-031021

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

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	<0.0021		0.0026	0.0021	0.0021	mg/Kg	☼	03/13/21 18:45	1
8:2 Fluorotelomer sulfonic acid	<0.0021		0.0039	0.0021	0.0021	mg/Kg	☼	03/13/21 18:45	1
NEtFOSAA	<0.00053		0.0026	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
NMeFOSAA	<0.00053		0.0026	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluorobutanesulfonic acid	<0.0021		0.0026	0.0021	0.0021	mg/Kg	☼	03/13/21 18:45	1
Perfluorobutanoic acid	<0.0021		0.0026	0.0021	0.0021	mg/Kg	☼	03/13/21 18:45	1
Perfluorodecanoic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluorododecanoic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluoroheptanoic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluorohexanesulfonic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluorohexanoic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluorononanoic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluorooctanesulfonic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluorooctanoic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluoropentanoic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluorotetradecanoic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluorotridecanoic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1
Perfluoroundecanoic acid	<0.00053		0.00079	0.00053	0.00053	mg/Kg	☼	03/13/21 18:45	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*105*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
M2-8:2 FTS	*106*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C2 PFTeDA	*96*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C3 PFBS	*86*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C4 PFBA	*94*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C4 PFHpA	*101*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C5 PFPeA	*95*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C8 PFOA	*100*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C8 PFOS	*96*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
d3-NMeFOSAA	*75*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
d5-NEtFOSAA	*82*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C2-PFDoDA	*101*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C3 PFHxS	*98*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C5 PFHxA	*99*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C6 PFDA	*99*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C7 PFUnA	*98*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*
13C9 PFNA	*97*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:45*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	**6500**	J-	2510	1680	1680	mg/Kg	☼	03/18/21 15:11	6.19
Percent Moisture	**26.1**		1.0		1.0	%		03/12/21 09:52	1
Percent Solids	**73.9**		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	**6.1**	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

Client Sample ID: APG-BLDG-E4081-1-SO-(0-2)-031021

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

Method: D422 - Grain Size

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

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		0.0023	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	M	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*104*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:55*	*1*
M2-8:2 FTS	*97*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:55*	*1*
13C2 PFTeDA	*97*		*50 - 150*	*03/12/21 10:01*	*03/13/21 18:55*	*1*

Client Sample ID: APG-NOBLE-ROAD-1-SO-(0-2)-031021
Date Collected: 03/10/21 12:45
Date Received: 03/11/21 17:15

Lab Sample ID: 410-32109-12
Matrix: Solid
Percent Solids: 84.0

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	03/12/21 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

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	<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	M	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	M	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	Qualifier	Limits	Prepared	Analyzed	Dil 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	03/15/21 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	03/16/21 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

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

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

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		50 - 150	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

General Chemistry

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

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.		03/16/21 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
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

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	☼	03/16/21 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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorobutanoic acid	<0.0018		0.0022	0.0018	0.0018	mg/Kg	☼	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*	*Qualifier*	*Limits*	*Prepared*	*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 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 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 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 20:40*	*03/16/21 15:30*	*1*
13C5 PFHxA	*103*		*50 - 150*	*03/15/21 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 20:40*	*03/16/21 15:30*	*1*
13C9 PFNA	*116*		*50 - 150*	*03/15/21 20:40*	*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

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 (Continued)

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	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		1.7	0.86	0.86	ng/L		03/17/21 17:18	1
Perfluorooctanesulfonic acid	<0.86	B	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	M	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*120*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
M2-8:2 FTS	*108*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C2 PFTeDA	*75*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C3 PFBS	*82*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C4 PFBA	*94*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C4 PFHpA	*100*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C5 PFPeA	*94*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C8 PFOA	*104*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C8 PFOS	*91*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
d3-NMeFOSAA	*89*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
d5-NEtFOSAA	*95*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C2-PFDoDA	*84*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C3 PFHxS	*94*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C5 PFHxA	*99*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C6 PFDA	*98*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C7 PFUnA	*92*		*50 - 150*	*03/14/21 17:11*	*03/17/21 17:18*	*1*
13C9 PFNA	*95*		*50 - 150*	*03/14/21 17:11*	*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

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		0.0023	0.0018	0.0018	mg/Kg	☼	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

Client Sample ID: APG-CASEY-YARD-1-SO-(0-2)-031021
Date Collected: 03/10/21 13:30
Date Received: 03/11/21 17:15

Lab Sample ID: 410-32109-15
Matrix: Solid
Percent Solids: 82.0

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

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**	J-	2440	1630	1630	mg/Kg	☼	03/18/21 16:02	6.68
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
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
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

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

Job ID: 410-32109-1

Client Sample ID: APG-CASEY-YARD-1-SO-(0-2)-031021
Date Collected: 03/10/21 13:30
Date Received: 03/11/21 17:15

Lab Sample ID: 410-32109-15
Matrix: Solid
Percent Solids: 82.0

Method: 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

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 ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-BLDG-300-1-SO-(0-2)-031521	410-32605-1	Soil	3/15/2021		X	X	X
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		X		
APG-BLDG-300-2-GW-031521	410-32605-4	Water	3/15/2021		X		
APG-PI-12-1-SO-(0-2)-031521	410-32605-5	Soil	3/15/2021		X	X	X
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	X	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		X		

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.

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

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 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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)-031521	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 20%
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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.

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 Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
C. Field blanks		X		X	
Laboratory Control Sample (LCS) %R		X		X	
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	X				X
MS/MSD Precision (RPD)	X				X
Field Duplicate (RPD)	X				X
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X		X	
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 APG-PI-Minefield-1-SO-(0-2)-031521	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.

Criteria	Qualification
	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 ± 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 APG-PI-Minefield-1-SO-(0-2)-031521	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
TOC	75% to 89%	Non-detect	UJ
		Detect	J-
	Gross Exceedance <75%	Non-detect	X
		Detect	J-
	111% to 125%	Non-detect	No Action
		Detect	J+
	Gross Exceedance >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 ± 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	TOC	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
> 120%	Non-detect	No Action
	Detect	J+
< 80%	Non-detect	X
	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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X	X		
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)	X				X
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
Transcription/calculations acceptable		X		X	

Notes:
%R - percent recovery
RPD - relative percent difference

VALIDATION PERFORMED BY: Andrew Korycinski

SIGNATURE: 

DATE: May 4, 2021

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 Page 695 of SDG 410-32605-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.185	112847	4530652	9.57	0.024907	1.2884558	1.129805	0.210978	0.185	14.042	14	Match
0.463	237658	4291416	9.57	0.05538	1.1446765	1.129805	0.469095	0.463	1.316	1.4	Match
1.85	1023084	4474362	9.57	0.228655	1.1828247	1.129805	1.936818	1.85	4.693	4.6	Match
7.4	3457565	4321506	9.57	0.800083	1.0347024	1.129805	6.777099	7.4	-8.418	-8.5	Match
18.5	8789708	4278558	9.57	2.054362	1.062716	1.129805	17.40146	18.5	-5.938	-6	Match
46.3	22390022	4345279	9.57	5.152724	1.0650446	1.129805	43.6461	46.3	-5.732	-5.7	Match
92.6	40632444	3715471	9.57	10.93601	1.1302123	1.129805	92.63341	92.6	0.036	0.1	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 #: 410-32605-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/4/2021
Page: 2
Validated 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

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorooctanesulfonic acid	783741	3880536	9.57	0.2020	1.1290	1.712	1.91	-10.37	-10.5	Match
Perfluoropentanoic acid	931437	4634587	10	0.2010	1.0900	1.844	2	-7.81	-7.8	Match
Perfluoroundecanoic acid	958252	5675208	10	0.1688	0.9594	1.760	2	-12.00	-12	Match

CCV 410-104674/80 3/19/2021 08:35

Page 1109 of SDG 410-32605-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorooctanesulfonic acid	225429	3759767	9.57	0.0600	1.1290	0.508	0.463	9.77	9.8	Match
Perfluoropentanoic acid	245899	4280286	10	0.0574	1.0900	0.527	0.5	5.41	5.4	Match
Perfluoroundecanoic acid	264468	5091940	10	0.0519	0.9594	0.541	0.5	8.27	8.3	Match

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

Stage 3 / 4
PFAS LCS

SDG #: 410-32605-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/4/2021
Page: 3
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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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) x EIS concentration)/Sample volume)*1000

Stage 3 / 4
PFAS Sample Concentration

SDG #: 410-32065-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/4/2021
Page: 4
Validated 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

TS=84.1%, FV= 4ml Sample Weight=1.00 g
Extract: 2 mls concentrated to 1 ml

Analyte	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Calculated mg/kg	Calculated Amount Dry Weight mg/kg	Reported Value 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 x (Calc amt ng/ml x 0.5)/ sample weight g) / 1000
Dry Weight Amount = [Calculated mg/kg / (TS/100)]

Stage 3 / 4
PFAS EIS

SDG #:	410-32065-1	Date:	5/4/2021
Lab:	Eurofins Lancaster	Page:	5
Project:	Aberdeen Proving Ground	Validated 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

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

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

eurofins Environmental Analysis Request/Chain of Custody

Lancaster Laboratories Environmental

Acct. # ___ 410-32605 Chain of Custody

For Eurofins Lancaster Laboratories Environmental use only — Pg 1 of 2

Sample # ___

COC # 616537

Client Information	
Client: ARCADIS	Acct. #:
Project Name/#: APG PFAS SI	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.3BX50
Sampler: Dale Lynch	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☐

Matrix: Tissue ☐ / Sediment ☐ / Soil ☒ ; Water: Ground ☒ Surface ☐ / Potable ☐ NPDES ☐ ; Other:

Analysis Requested — Preservation and Filtration Codes

For Lab Use Only — FSC: ___ SCR#: ___

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil	Water	Other	Total # of Containers	PFAS (170)	Moisture (77)	Grain Size (33)	pH, TOC (34)	PFAS (173)	Remarks
APG-BLDG-300-1-SO-(0-2)-031521	3/15/21	1045		X	SO			4	X	X	X	X		
APG-BLDG-300-2-SO-(0-2)-031521		1100		X	SO			2	X					
APG-BLDG-300-1-GW-031521		0930	X			GW		2					X	
APG-BLDG-300-2-GW-031521		1040	X			GW		2					X	
APG-P1-12-1-SO-(0-2)-031521		1300		X	SO			4	X	X	X	X		
APG-P1-12-1-GW-031521		1340	X			GW		2					X	
APG-P1-12-2-SO-(0-2)-031521		1400		X	SO			2	X					
DL ~~APG-P1-12-2-GW-031521~~			~~X~~			~~GW~~		~~2~~					~~X~~	DL
APG-FB-04-031521		1500	X			GW		2					X	
DL ~~APG-P1-Minefield-1-GW-031521~~		1505		X	SO			4	X	X	X	X		APG-P1-Minefield-1-SO-(0-2)-031521

Turnaround Time (TAT) Requested (please circle)
Standard (circled) Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: ___

E-mail address: Matthew.Brown@ARCADIS.com, Keith.Shepherd@ARCADIS.com

Relinquished by	Date	Time	Received by	Date	Time
[signature]	3/16/21	0700	[signature]	3/16/21	11:25
[signature]	3/16/21	1755			
			[signature]	3-16-2021	1816

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) — Type VI (Raw Data Only)
Type III (Reduced non-CLP) — NJ DKQP — TX TRRP-13
NYSDEC Category A or B — MA MCP — CT RCP

EDD Required? Yes No
If yes, format: ___

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS ___ FedEx ___ Other ___

Temperature upon receipt 1.1 °C

Environmental Analysis Request/Chain of Custody

eurofins | Lancaster Laboratories Environmental

For Eurofins Lancaster Laboratories Environmental use only

Acct. # _____ Group # _____ Sample # _____

pg 2 of 2

COC #616571

Client Information

Client:	Acct. #:
Project Name/#:	PWSID #:
Project Manager: SEE pg 1	P.O. #:
Sampler:	Quote #:
State where samples were collected:	For Compliance: Yes ☐ No ☐

Matrix

Soil ☒ Sediment ☐ Tissue ☐ Water ☑ Ground ☐ Potable ☐ Surface ☐ NPDES ☐ Other: _____

Analysis Requested

Preservation and Filtration Codes

For Lab Use Only

FSC: _____

SCR#: _____

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Remarks

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil/Sediment	Water	Other	Total # of Containers	PFAS (170)	Moisture (77)	Grain Size (73)	pH, TOC (34)	PFAS (173)
APG-P1-mineField-2-SO-(0-2)-031521	3/15/21	1515		X	SO			2	X				
APG-P1-mineField-1-GW-031521	3/15/21	1515	X			GW		2	**				X

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: SEE pg 1

E-mail address: _____

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
[signature]	3/16/21	0700	[signature]	3/16/21	11:25
[signature]	3/16/21	1715			
			[signature]	3-16-21	1826

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other _____

Temperature upon receipt 1.1 °C

Client Sample ID: APG-BLDG-300-1-SO-(0-2)-031521
Date Collected: 03/15/21 10:45
Date Received: 03/16/21 18:26

Lab Sample ID: 410-32605-1
Matrix: Solid
Percent Solids: 84.1

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	<0.0019		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	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*	*Qualifier*	*Limits*	*Prepared*	*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*	*03/17/21 11:39*	*03/19/21 10:03*	*1*

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	<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

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**

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanoic acid	0.00069		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 13:49	1
Perfluorononanoic acid	0.00075		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 13:49	1
Perfluorooctanesulfonic acid	0.013		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 13:49	1
Perfluorooctanoic acid	0.00065	J M	0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 13:49	1
Perfluoropentanoic acid	0.0012	M	0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 13:49	1
Perfluorotetradecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 13:49	1
Perfluorotridecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 13:49	1
Perfluoroundecanoic acid	0.0014		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 13:49	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*90*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
M2-8:2 FTS	*74*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C2 PFTeDA	*66*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C3 PFBS	*77*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C4 PFBA	*82*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C4 PFHpA	*83*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C5 PFPeA	*79*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C8 PFOA	*82*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C8 PFOS	*84*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
d3-NMeFOSAA	*25*	**5-*	*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
d5-NEtFOSAA	*32*	**5-*	*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C2-PFDoDA	*74*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C3 PFHxS	*83*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C5 PFHxA	*80*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C6 PFDA	*80*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C7 PFUnA	*81*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*
13C9 PFNA	*76*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:49*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	6370	J-	1690	1130	1130	mg/Kg	☼	03/18/21 17:31	4.74
Percent Moisture	15.9		1.0		1.0	%		03/17/21 09:28	1
Percent Solids	84.1		1.0		1.0	%		03/17/21 09:28	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.		03/23/21 19:22	1
Temperature	20.1		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
Gravel	8.1		1.0	1.0	1.0	%		03/23/21 01:00	1
Sand	26.2		1.0	1.0	1.0	%		03/23/21 01:00	1
Silt	50.7		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	91.9		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
3.35 mm	91.2		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
2.36 mm	90.2		1.0	1.0	1.0	% Passing		03/23/21 01:00	1

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

Method: D422 - Grain Size (Continued)

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

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		0.0023	0.0018	0.0018	mg/Kg	☼	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	1

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*

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

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

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

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

Analyte	Result	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

Isotope Dilution	%Recovery	Qualifier	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

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 Collected: 03/15/21 10:40
Matrix: Water
Date Received: 03/16/21 18:26

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	**11**		5.9	4.8	4.8	ng/L		03/19/21 01:24	1
8:2 Fluorotelomer sulfonic acid	<2.4		3.6	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	1
NMeFOSAA	<1.4		2.4	1.4	1.4	ng/L		03/19/21 01:24	1
Perfluorobutanesulfonic acid	**54**		2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluorobutanoic acid	**31**		5.9	4.8	4.8	ng/L		03/19/21 01:24	1
Perfluorodecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluorododecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluoroheptanoic acid	**36**		2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluorohexanesulfonic acid	**350**		2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluorohexanoic acid	**110**		2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluorononanoic acid	**5.5**		2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluorooctanesulfonic acid	**220**		2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluorooctanoic acid	**83**	**M**	2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluoropentanoic acid	**69**		2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluorotetradecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluorotridecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/19/21 01:24	1
Perfluoroundecanoic acid	<1.2		2.4	1.2	1.2	ng/L		03/19/21 01:24	1

Isotope Dilution	%Recovery	Qualifier	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

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

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	<0.0017		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*	*Qualifier*	*Limits*	*Prepared*	*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*	*03/17/21 11:39*	*03/19/21 10:25*	*1*

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	<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		0.0021	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	☼	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	1

Client Sample ID: APG-PI-12-1-SO-(0-2)-031521

Date Collected: 03/15/21 13:00
Date Received: 03/16/21 18:26

Lab Sample ID: 410-32605-5

Matrix: Solid
Percent Solids: 86.6

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanoic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 14:00	1
Perfluorononanoic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 14:00	1
Perfluorooctanesulfonic acid	**0.0020**		0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 14:00	1
Perfluorooctanoic acid	<0.00042	M	0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 14:00	1
Perfluoropentanoic acid	**0.00044**	**J M**	0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 14:00	1
Perfluorotetradecanoic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 14:00	1
Perfluorotridecanoic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 14:00	1
Perfluoroundecanoic acid	<0.00042		0.00064	0.00042	0.00042	mg/Kg	☼	03/24/21 14:00	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*111*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
M2-8:2 FTS	*85*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C2 PFTeDA	*78*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C3 PFBS	*96*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C4 PFBA	*81*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C4 PFHpA	*90*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C5 PFPeA	*82*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C8 PFOA	*95*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C8 PFOS	*102*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
d3-NMeFOSAA	*23*	**5-*	*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
d5-NEtFOSAA	*31*	**5-*	*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C2-PFDoDA	*88*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C3 PFHxS	*107*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C5 PFHxA	*85*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C6 PFDA	*91*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C7 PFUnA	*89*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*
13C9 PFNA	*88*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:00*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	**2670**	J-	1750	1170	1170	mg/Kg	☼	03/18/21 17:43	5.05
Percent Moisture	**13.4**		1.0		1.0	%		03/17/21 09:28	1
Percent Solids	**86.6**		1.0		1.0	%		03/17/21 09:28	1

General Chemistry - Soluble

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	**7.0**	J	0.01	0.01	0.01	S.U.		03/23/21 19:22	1
Temperature	**20.5**		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
Gravel	**12.6**		1.0	1.0	1.0	%		03/23/21 01:00	1
Sand	**45.8**		1.0	1.0	1.0	%		03/23/21 01:00	1
Silt	**29.7**		1.0	1.0	1.0	%		03/23/21 01:00	1
Clay	**12.0**		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	**95.8**		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
4.75 mm	**87.5**		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
3.35 mm	**87.3**		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
2.36 mm	**87.2**		1.0	1.0	1.0	% Passing		03/23/21 01:00	1

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

Method: D422 - Grain Size (Continued)

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

Matrix: Water

Date Received: 03/16/21 18:26

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

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

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*

Client Sample ID: APG-PI-12-1-GW-031521

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) - PFAS for QSM 5.3, Table B-15 - DL

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	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*	*Qualifier*	*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*	*03/25/21 08:15*	*10*
13C4 PFHpA	*91*		*50 - 150*	*03/24/21 07:53*	*03/25/21 08:15*	*10*
13C5 PFPeA	*83*		*50 - 150*	*03/24/21 07:53*	*03/25/21 08:15*	*10*
13C8 PFOS	*85*		*50 - 150*	*03/24/21 07:53*	*03/25/21 08:15*	*10*
13C3 PFHxS	*87*		*50 - 150*	*03/24/21 07:53*	*03/25/21 08:15*	*10*
13C5 PFHxA	*86*		*50 - 150*	*03/24/21 07:53*	*03/25/21 08:15*	*10*

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

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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil 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*

Client Sample ID: APG-PI-12-2-SO-(0-2)-031521

Date Collected: 03/15/21 14:00
Date Received: 03/16/21 18:26

Lab Sample ID: 410-32605-7

Matrix: Solid
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

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	<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	**0.0012**		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 - 150	03/23/21 20:31	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

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

Client Sample ID: APG-FB-04-031521

Lab Sample ID: 410-32605-8
Date Collected: 03/15/21 15:00
Matrix: Water
Date Received: 03/16/21 18:26

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		4.4	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
Perfluoroundecanoic acid	<0.88		1.8	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*

Client Sample ID: APG-PI-Minefield-1-SO-(0-2)-031521
Date Collected: 03/15/21 15:05
Date Received: 03/16/21 18:26

Lab Sample ID: 410-32605-9
Matrix: Solid
Percent Solids: 89.1

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	0.0021		0.0021	0.0016	0.0016	mg/Kg	☼	03/19/21 10:47	1
8:2 Fluorotelomer sulfonic acid	0.018		0.0031	0.0016	0.0016	mg/Kg	☼	03/19/21 10:47	1
NEtFOSAA	<0.00041		0.0021	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
NMeFOSAA	<0.00041		0.0021	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluorobutanesulfonic acid	<0.0016		0.0021	0.0016	0.0016	mg/Kg	☼	03/19/21 10:47	1
Perfluorobutanoic acid	<0.0016		0.0021	0.0016	0.0016	mg/Kg	☼	03/19/21 10:47	1
Perfluorodecanoic acid	0.0059		0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluorododecanoic acid	0.0063		0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluoroheptanoic acid	0.00050	J	0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluorohexanesulfonic acid	<0.00041		0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluorohexanoic acid	0.00091		0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluorononanoic acid	0.00077		0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluorooctanesulfonic acid	0.00093		0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluorooctanoic acid	0.0011		0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluoropentanoic acid	0.00059	J M	0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluorotetradecanoic acid	0.0025		0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluorotridecanoic acid	0.0014		0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1
Perfluoroundecanoic acid	0.0048		0.00062	0.00041	0.00041	mg/Kg	☼	03/19/21 10:47	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*113*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
M2-8:2 FTS	*112*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C2 PFTeDA	*87*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C3 PFBS	*92*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C4 PFBA	*98*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C4 PFHpA	*106*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C5 PFPeA	*90*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C8 PFOA	*108*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C8 PFOS	*103*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
d3-NMeFOSAA	*74*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
d5-NEtFOSAA	*88*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C2-PFDoDA	*95*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C3 PFHxS	*106*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C5 PFHxA	*105*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C6 PFDA	*108*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C7 PFUnA	*100*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*
13C9 PFNA	*102*		*50 - 150*	*03/17/21 11:39*	*03/19/21 10:47*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	4000	J-	2590	1730	1730	mg/Kg	☼	03/18/21 17:56	7.69
Percent Moisture	10.9		1.0		1.0	%		03/17/21 09:28	1
Percent Solids	89.1		1.0		1.0	%		03/17/21 09:28	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.		03/23/21 19:22	1
Temperature	21.1		0.01	0.01	0.01	Degrees C		03/23/21 19:22	1

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
Date Received: 03/16/21 18:26
Percent Solids: 89.1

Method: D422 - Grain Size

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

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	<0.0017		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	M	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*	*Qualifier*	*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*

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	%		03/17/21 09:28	1
Percent Solids	92.7		1.0		1.0	%		03/17/21 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

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	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

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

Job ID: 410-32605-1

Client Sample ID: APG-PI-Minefield-1-GW-031521
Date Collected: 03/15/21 15:15
Date Received: 03/16/21 18:26

Lab Sample ID: 410-32605-11
Matrix: Water

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

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 ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-AA5-1-GW-031621	410-32720-1	Water	3/16/2021		X		
APG-AA5-1-SE-031621	410-32720-2	Sediment	3/16/2021		X		
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		X		
APG-FUZE-1-SW-031621	410-32720-5	Water	3/16/2021		X		
APG-FUZE-1-SE-031621	410-32720-6	Sediment	3/16/2021		X		
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		X	X	X
APG-BAF-S6-1-GW-031621	410-32720-9	Water	3/16/2021		X		
APG-EF15-1-GW-031621	410-32720-10	Water	3/16/2021		X		

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.

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

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 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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%
APG-BAF-S6-1-SO-(0-2)-031621	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%
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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.

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
APG-AA5-1-SE-031621	8:2 Fluorotelomer sulfonic acid	SR>4X	SR>4X
	Perfluorooctanesulfonic acid	>UL	>UL
	6:2 Fluorotelomer sulfonic acid	AC	<LL but >10%

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
> the upper control limit (UL)	Non-detect	No Action
	Detect	J+
< the lower control limit (LL) but > 10%	Non-detect	UJ
	Detect	J-
< 10%	Non-detect	X
	Detect	J-
SR>4X: Parent sample concentration > four times the MS/MSD spiking solution concentration.	Detect	No Action
	Non-detect	

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-AA5-1-SE-031621/ APG-DUP-05-031621	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
	Perfluorohexanoic acid (PFHxA)	0.016	0.024	40.0 %
	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 %
APG-FUZE-1-SW-031621/ APG-DUP-06-031621	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 %
	Perfluorohexane sulfonic acid (PFHxS)	530	530	0.0 %
	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
APG-AA5-1-GW-031621 DL	6:2 Fluorotelomer sulfonic acid	--	5200	5200 D
	Perfluorobutanesulfonic acid	--	5000	5000 D
	Perfluorohexanesulfonic acid	--	42000 E	42000 EDJ
	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
APG-FUZE-1-GW-031621 DL	6:2 Fluorotelomer sulfonic acid	--	8500	8500 D
	Perfluoroheptanoic acid	--	8000	8000 D
	Perfluorohexanesulfonic acid	--	4400	4400 D
	Perfluorohexanoic acid	--	14000	14000 D
	Perfluorooctanesulfonic acid	--	4300	4300 D
	Perfluorooctanoic acid	--	7800	7800 D
	Perfluoropentanoic acid	--	8300	8300 D
APG-FUZE-1-SW-031621	6:2 Fluorotelomer sulfonic acid	--	930	930 D
	Perfluoroheptanoic acid	--	860	860 D
	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	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
C. Field blanks	X				X
Laboratory Control Sample (LCS) %R		X		X	
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		X	X		
MS/MSD Precision (RPD)		X		X	
Field Duplicate (RPD)		X	X		
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X		X	
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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.

Criteria	Qualification
	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 ± 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
TOC	75% to 89%	Non-detect	UJ
		Detect	J-
	Gross Exceedance <75%	Non-detect	X
		Detect	J-
	111% to 125%	Non-detect	No Action
		Detect	J+
	Gross Exceedance >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.

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
TOC	30% to 74%	Non-detect	UJ
		Detect	J-
	<30%	Non-detect	X
		Detect	J-
	> 125%	Non-detect	No Action
		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 ± 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
> 120%	Non-detect	No Action
	Detect	J+
< 80%	Non-detect	X
	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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X	X		
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)		X		X	
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
Transcription/calculations acceptable		X		X	

Notes:
%R - percent recovery
RPD - relative percent difference

VALIDATION PERFORMED BY: Andrew Korycinski

SIGNATURE: 

DATE: May 5, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 10, 2021

Stage 3 / 4
PFAS Calibration Standards

SDG #: 410-32720-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/5/2021
Page: 1
Validated by: AJK

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

Perfluoroheptanoic acid 3/17/2021 Calibration Page 741 of SDG 410-32720-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	145909	5669610	10	0.025735	1.286764	1.1706	0.219845	0.2	9.922	9.9	Match
0.5	347651	5830141	10	0.05963	1.1925989	1.1706	0.509392	0.5	1.878	1.9	Match
2	1439885	5586600	10	0.257739	1.2886953	1.1706	2.201749	2	10.087	10.1	Match
8	5069911	5633282	10	0.899992	1.1249905	1.1706	7.68823	8	-3.897	-3.9	Match
20	12200655	5325160	10	2.291134	1.145567	1.1706	19.57213	20	-2.139	-2.1	Match
50	28356865	5202098	10	5.451044	1.0902088	1.1706	46.56582	50	-6.868	-6.9	Match
100	47689610	4476006	10	10.6545	1.0654501	1.1706	91.01661	100	-8.983	-9.0	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
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/5/2021
Page: 1
Validated by: AJK

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-103929/9 3/17/2021 01:41 Page 1031 of SDG 410-32720-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluoroheptanoic acid	1138680	5302738	10	0.2147	1.1710	1.834	2	-8.31	-8.3	Match
Perfluorononanoic acid	821719	4533612	10	0.1813	0.9430	1.922	2	-3.90	-3.9	Match
Perfluorooctanoic acid	1050583	5961164	10	0.1762	0.9768	1.804	2	-9.79	-9.8	Match

CCVIS 410-107908/1 3/27/2021 09:26 Page 1317 of SDG 410-32720-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluoroheptanoic acid	335131	5906008	10	0.0567	1.1340	0.500	0.5	0.08	0	Match
Perfluorononanoic acid	239446	4727817	10	0.0506	0.9723	0.521	0.5	4.18	4.2	Match
Perfluorooctanoic acid	359053	5932397	10	0.0605	1.0130	0.597	0.5	19.49	19.5	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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent Recovery	
Perfluoroheptanoic acid	4360015	5466824	10	0.797541	1.1710	27.24	25.600	106.42	106	Match
Perfluorononanoic acid	3227508	4677965	10	0.689938	0.9430	29.27	25.600	114.32	114	Match
Perfluorooctanoic acid	4141599	5976832	10	0.692942	0.9768	28.38	25.600	110.84	111	Match

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

Stage 3 / 4
PFAS MS/MSD

SDG #: 410-32720-1 Date: 5/5/2021
Lab: Eurofins Lancaster Page: 4
Project: Aberdeen Proving Ground Validated 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

$$\%R = \frac{100 * (\text{MS Conc} - \text{Sample Conc})}{\text{MS TV}} \qquad RPD = \frac{100 * |\text{MS \%R} - \text{MSD \%R}}{\text{Average of MS MSD \%R}}$$

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: 5
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 Page 537 of SDG 410-32720-1
Dilution = 10

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Final Volume mls	Sample Volume mls	Final Calculated ng/L	Reported Value ng/L	
Perfluoroheptanoic acid	30794937	350321	1	87.90491	1.1340	775.18	1	219.9	3525.1	3500	Match
Perfluorononanoic acid	3891205	280935	1	13.85091	0.9723	142.46	1	219.9	647.8	650	Match
Perfluorooctanoic acid	51289555	553401	1	92.68063	1.0130	914.91	1	219.9	4160.6	4200	Match

Calculated amount ng/L = (Peak area ratio/Avg RF) x DF x EIS conc ng/L
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 #:	410-32720-1	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

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

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

eurofins | Lancaster Laboratories Environmental

For Eurofins Lancaster Laboratories Enviroi

Acct. # _____ Group # _____ Sample # _____

410-32720 Chain of Custody

COC # 616538

Client Information		Matrix						Analysis Requested										For Lab Use Only
Client: ARCADIS	Acct. #:	Tissue ☐	Ground ☒	Surface ☐				Preservation and Filtration Codes										FSC:
Project Name/#: APG PFAS S1	PWSID #:	Sediment ☒	Potable ☐	NPDES ☐														SCR#:
Project Manager: Keith Shepherd	P.O. #: 30001996.3BX50	Soil ☐	Water		Other:	Total # of Containers	PFAS (170)	Moisture (73)	Grain Size (73)	pH, TOC (34)	PFAS (173)							Preservation Codes
Sampler: Dale Lynch	Quote #:																	H=HCl T=Thiosulfate
State where samples were collected: MD	For Compliance: Yes ☐ No ☐																	N=HNO_3 B=NaOH
																		S=H_2SO_4 P=H_3PO_4
																		F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite														Remarks
APG-AAS-1-GW-031621	3/16/21	0920	X			GW		2					X					
APG-AAS-1-SE-031621 MS/MSD		0900	X		SE			6	X									MS/MSD
APG-Dup-05-031621		1200	X		SE			2	X									
APG-FUZE-1-GW-031621		1050	X			GW		2					X					
APG-FUZE-1-SW-031621 MS/MSD		1040	X			SW		6					X					MS/MSD
APG-FUZE-1-SE-031621		1030	X		SE			2	X									
APG-Dup-06-031621		1200	X			GW		2					X					
APG-BAF-S6-1-SO-(0-2)-031621		1120		X	SO			4	X	X	X	X						
APG-BAF-S6-1-GW-031621		1150	X			GW		2					X					
APG-EF15-1-GW-031621		1240	X			GW		2					X					

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: Matthew.Blowe@ARCADIS.com Keith.Shepherd@ARCADIS.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) | Type VI (Raw Data Only)

Type III (Reduced non-CLP) | NJ DKQP | TX TRRP-13

NYSDEC Category A or B | MA MCP | CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	3/17/21	0700		3/17/21	11:55
	3/17/21	1540			
				3/17/21	1650

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other _____

Temperature upon receipt 1.2 °C

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-32720-1
Project/Site: Aberdeen Proving Ground PFAS S1

Qualifiers

LCMS

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.

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

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

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

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	**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*	*Qualifier*	*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) - PFAS for QSM 5.3, Table B-15 - DL

Analyte	Result	Qualifier	LOQ	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**	230	110	110	ng/L		03/27/21 10:21	100
Perfluorohexanesulfonic acid	**42000**	**E D J**	230	110	110	ng/L		03/27/21 10:21	100
Perfluorohexanoic acid	**16000**	**D**	230	110	110	ng/L		03/27/21 10:21	100
Perfluorooctanesulfonic acid	**64000**	**E D J**	230	110	110	ng/L		03/27/21 10:21	100
Perfluoropentanoic acid	**11000**	**D**	230	110	110	ng/L		03/27/21 10:21	100

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
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*

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) - PFAS for QSM 5.3, Table B-15

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	**0.053**	~~FL~~ J-	0.0025	0.0020	0.0020	mg/Kg	☼	03/24/21 14:22	1
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	mg/Kg	☼	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**	~~FH~~ 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	mg/Kg	☼	03/24/21 14:22	1
Perfluorotridecanoic acid	**0.0049**		0.00074	0.00049	0.00049	mg/Kg	☼	03/24/21 14:22	1
Perfluoroundecanoic acid	**0.0046**		0.00074	0.00049	0.00049	mg/Kg	☼	03/24/21 14:22	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*109*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
M2-8:2 FTS	*83*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C2 PFTeDA	*51*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C3 PFBS	*72*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C4 PFBA	*83*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C4 PFHpA	*87*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C5 PFPeA	*80*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C8 PFOA	*81*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C8 PFOS	*74*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
d3-NMeFOSAA	*69*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
d5-NEtFOSAA	*73*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C2-PFDoDA	*54*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C3 PFHxS	*81*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C5 PFHxA	*81*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C6 PFDA	*66*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C7 PFUnA	*62*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*1*
13C9 PFNA	*73*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:22*	*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
8:2 Fluorotelomer sulfonic acid	**0.15**	**D**	0.037	0.020	0.020	mg/Kg	☼	03/24/21 21:23	10

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-8:2 FTS	*91*		*50 - 150*	*03/23/21 20:31*	*03/24/21 21:23*	*10*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	**23.4**		1.0		1.0	%		03/18/21 08:33	1
Percent Solids	**76.6**		1.0		1.0	%		03/18/21 08:33	1

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

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	**0.091**		0.0027	0.0022	0.0022	mg/Kg	☼	03/24/21 14:56	1
NEtFOSAA	<0.00055		0.0027	0.00055	0.00055	mg/Kg	☼	03/24/21 14:56	1
NMeFOSAA	<0.00055		0.0027	0.00055	0.00055	mg/Kg	☼	03/24/21 14:56	1
Perfluorobutanesulfonic acid	<0.0022		0.0027	0.0022	0.0022	mg/Kg	☼	03/24/21 14:56	1
Perfluorobutanoic acid	**0.0054**		0.0027	0.0022	0.0022	mg/Kg	☼	03/24/21 14:56	1
Perfluorodecanoic acid	**0.010**		0.00082	0.00055	0.00055	mg/Kg	☼	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*95*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
M2-8:2 FTS	*78*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C2 PFTeDA	*59*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C3 PFBS	*71*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C4 PFBA	*81*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C4 PFHpA	*84*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C5 PFPeA	*80*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C8 PFOA	*75*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C8 PFOS	*72*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
d3-NMeFOSAA	*71*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
d5-NEtFOSAA	*81*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C2-PFDoDA	*60*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C3 PFHxS	*79*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C5 PFHxA	*77*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C6 PFDA	*69*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C7 PFUnA	*76*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*1*
13C9 PFNA	*73*		*50 - 150*	*03/23/21 20:31*	*03/24/21 14:56*	*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
8:2 Fluorotelomer sulfonic acid	**0.16**	**D**	0.041	0.022	0.022	mg/Kg	☼	03/24/21 21:45	10

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-8:2 FTS	*81*		*50 - 150*	*03/23/21 20:31*	*03/24/21 21:45*	*10*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	**28.1**		1.0		1.0	%		03/18/21 08:33	1
Percent Solids	**71.9**		1.0		1.0	%		03/18/21 08:33	1

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

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	690	D	38	25	25	ng/L		03/23/21 18:57	10
NEtFOSAA	<13		38	13	13	ng/L		03/23/21 18:57	10
NMeFOSAA	<15		25	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	13	13	ng/L		03/23/21 18:57	10

Isotope Dilution	*%Recovery*	*Qualifier*	*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 for 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 for QSM 5.3, Table B-15 - RE

Analyte	Result	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

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

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

Analyte	Result	Qualifier	LOQ	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	E D	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*209*	*5+	*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*	*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*
13C9 PFNA	*85*		*50 - 150*	*03/25/21 16:55*	*03/27/21 10:33*	*10*

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

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	270		2.6	1.8	1.8	ng/L		03/22/21 14:54	1
NEtFOSAA	<0.88	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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorotridecanoic acid	1.8		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*

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

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
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

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	0.0089		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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
NMeFOSAA	<0.0012		0.0060	0.0012	0.0012	mg/Kg	☼	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*	*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
Lab Sample ID: 410-32720-7

Date Collected: 03/16/21 12:00
Matrix: Water
Date Received: 03/17/21 16:00

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	**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

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

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

Analyte	Result	Qualifier	LOQ	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		03/23/21 19:30	10

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*111*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
M2-8:2 FTS	*86*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C2 PFTeDA	*36*	*5-	*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C3 PFBS	*90*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C4 PFBA	*100*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C4 PFHpA	*101*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C5 PFPeA	*104*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C8 PFOA	*95*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C8 PFOS	*93*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
d3-NMeFOSAA	*80*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
d5-NEtFOSAA	*82*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C2-PFDoDA	*55*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C3 PFHxS	*99*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C5 PFHxA	*97*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C6 PFDA	*90*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C7 PFUnA	*78*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*10*
13C9 PFNA	*96*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:30*	*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	**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

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

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

Analyte	Result	Qualifier	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	*33*	**5-*	*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

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	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	UJ	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*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*45*	**5-*	*50 - 150*	*03/25/21 15:04*	*03/26/21 12:48*	*1*
M2-8:2 FTS	*41*	**5-*	*50 - 150*	*03/25/21 15:04*	*03/26/21 12:48*	*1*

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

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

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

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	<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	0.00049	0.00049	mg/Kg	☼	03/24/21 15:18	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil 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
13C2 PFTeDA	47	*5-	50 - 150	03/23/21 20:31	03/24/21 15:18	1
13C3 PFBS	72		50 - 150	03/23/21 20:31	03/24/21 15:18	1
13C4 PFBA	43	*5-	50 - 150	03/23/21 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
13C5 PFPeA	43	*5-	50 - 150	03/23/21 20:31	03/24/21 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
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	1

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**

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

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 - 150	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

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	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

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	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

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

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

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**	**J M**	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

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
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) - PFAS for QSM 5.3, Table B-15

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

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) - PFAS for QSM 5.3, Table B-15 (Continued)

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorononanoic acid	**48**		2.8	1.4	1.4	ng/L		03/22/21 16:00	1
Perfluorooctanoic acid	**170**		2.8	1.4	1.4	ng/L		03/22/21 16:00	1
Perfluoropentanoic acid	**43**	**M**	2.8	1.4	1.4	ng/L		03/22/21 16:00	1
Perfluorotetradecanoic acid	<1.4		2.8	1.4	1.4	ng/L		03/22/21 16:00	1
Perfluorotridecanoic acid	<1.4		2.8	1.4	1.4	ng/L		03/22/21 16:00	1
Perfluoroundecanoic acid	**1.5**	**J M**	2.8	1.4	1.4	ng/L		03/22/21 16:00	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*140*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
M2-8:2 FTS	*109*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C2 PFTeDA	*62*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C3 PFBS	*81*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C4 PFBA	*81*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C4 PFHpA	*97*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C5 PFPeA	*90*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C8 PFOA	*103*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C8 PFOS	*80*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
d3-NMeFOSAA	*102*	*^c*	*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
d5-NEtFOSAA	*113*	*^c*	*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C2-PFDoDA	*87*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C3 PFHxS	*96*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C5 PFHxA	*92*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C6 PFDA	*103*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C7 PFUnA	*96*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*1*
13C9 PFNA	*82*		*50 - 150*	*03/19/21 09:11*	*03/22/21 16:00*	*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	**1300**	**D**	28	14	14	ng/L		03/23/21 19:41	10

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C8 PFOS	*92*		*50 - 150*	*03/19/21 09:11*	*03/23/21 19:41*	*10*

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:

Sample ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-FB-03-031221	410-32347-1	Water	3/12/2021		X		
APG-BLDG-2308-1-GW-031221	410-32347-2	Water	3/12/2021		X		
APG-BLDG-2200-2-SO-(0-2)-031221	410-32347-3	Soil	3/12/2021		X		
APG-BLDG-2200-1-SO-(0-2)-031221	410-32347-4	Soil	3/12/2021		X	X	X
APG-HELI-FIRE-1-SO-(0-2)-031221	410-32347-5	Soil	3/12/2021		X	X	X
APG-HELI-FIRE-1-GW-031221	410-32347-6	Water	3/12/2021		X		
APG-FB-07-031221	410-32347-7	Water	3/12/2021		X		

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.

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

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 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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)-031221	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 50% but > 20%
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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.

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	6:2 Fluorotelomer sulfonic acid	--	220	220 D
	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	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
C. Field blanks		X		X	
Laboratory Control Sample (LCS) %R		X		X	
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	X				X
MS/MSD Precision (RPD)	X				X
Field Duplicate (RPD)	X				X
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X		X	
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 APG-HELI-FIRE-1-SO-(0-2)-031221	4 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
	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 ± 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
TOC	Gross Exceedance < 75%	Non-detect	UX
		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 ± 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 APG-HELI-FIRE-1-SO-(0-2)-031221	Total Organic Carbon	64%

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
	Detect	J-
% Recovery > upper limit of 120%	Non-detect	No Action
	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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X	X		
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)	X				X
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
Transcription/calculations acceptable		X		X	

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 #: 410-32347-1 Date: 5/7/2021
Lab: Eurofins Lancaster Page: 1
Project: Aberdeen Proving Ground Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

PFOA 3/17/2021 Calibration Page 634 - 647 of SDG 410-32347-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	141234	6771971	10	0.020856	1.0427836	0.9768	0.21351	0.2	6.755	6.8	Match
0.5	339917	6639170	10	0.051199	1.0239744	0.9768	0.524147	0.5	4.829	4.8	Match
2	1428396	6518513	10	0.219129	1.0956456	0.9768	2.243337	2	12.167	12.2	Match
8	4606305	6241486	10	0.738014	0.9225177	0.9768	7.555427	8	-5.557	-5.6	Match
20	11353940	6107162	10	1.859119	0.9295594	0.9768	19.03275	20	-4.836	-4.8	Match
50	26265377	5722106	10	4.590159	0.9180318	0.9768	46.9918	50	-6.016	-6	Match
100	43121158	4763137	10	9.053101	0.9053101	0.9768	92.68121	100	-7.319	-7.3	Match

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 #: 410-32347-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/7/2021
Page: 2
Validated 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

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	874409	4859351	10	0.1799	0.9055	1.987	2	-0.64	-0.6	Match
Perfluoropentanoic acid	931437	4634587	10	0.2010	1.0900	1.844	2	-7.81	-7.8	Match
Perfluorobutanesulfonic acid	772307	3826669	9.36	0.2018	1.1250	1.679	2	-5.13	-5	Match
Perfluorohexanoic acid	897494	5038802	10	0.1781	0.8906	2.000	2	0.00	0	Match
Perfluoroheptanoic acid	1138680	5302738	10	0.2147	1.1710	1.834	2	-8.31	-8.3	Match
Perfluorohexanesulfonic acid	721897	3684758	9.46	0.1959	1.0560	1.755	2	-7.14	-7.2	Match
Perfluorooctanesulfonic acid	783741	3880536	9.57	0.2020	1.1290	1.712	2	-10.37	-10.5	Match

CCV 410-104674/26 3/17/2021 13:03 Page 956 - 961 of SDG 410-32347-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	1026168	4959129	10	0.2069	0.9055	2.285	2.0	14.26	14.3	Match
Perfluoropentanoic acid	1120771	4551362	10	0.2462	1.0900	2.259	2.0	12.96	12.9	Match
Perfluorobutanesulfonic acid	968137	4236967	9.36	0.2285	1.1250	1.901	1.8	7.41	7.4	Match
Perfluorohexanoic acid	1057799	5262676	10	0.2010	0.8906	2.257	2.0	12.85	12.9	Match
Perfluoroheptanoic acid	1332276	5385910	10	0.2474	1.1710	2.112	2.0	5.62	5.7	Match
Perfluorohexanesulfonic acid	831776	3812500	9.46	0.2182	1.0560	1.954	1.8	7.39	7.2	Match
Perfluorooctanesulfonic acid	1001900	4163874	9.57	0.2406	1.1291	2.039	1.9	10.24	10.1	Match

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

Stage 3 / 4
PFAS LCS

SDG #: 410-32347-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/7/2021
Page: 3
Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-103137/2-A

Page 1385 - 1390 of SDG 410-32347-1
Sample volume = 250 ml Final volume = 1ml

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/7/2021
Page: 4
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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Final Volume mls	Sample Volume mls	Final Calculated ng/L	Reported Value ng/L	
Perfluorobutanoic acid	12401977	4797460	10	2.585113	0.9055	28.55	1	235.4	121.3	120	Match
Perfluoropentanoic acid	42841422	4109267	10	10.42556	1.0900	95.65	1	235.4	406.3	410	Match
Perfluorobutanesulfonic acid	4453799	3651886	9.36	1.219589	1.1250	10.15	1	235.4	43.1	43	Match
Perfluorohexanoic acid	39372402	4981202	10	7.904197	0.8906	88.75	1	235.4	377.0	380	Match
Perfluoroheptanoic acid	25938975	4427253	10	5.858932	1.1710	50.03	1	235.4	212.5	210	Match
Perfluorohexanesulfonic acid	8738570	337650	9.46	25.88056	1.0560	231.85	1	235.4	984.9	990	Match
Perfluorooctanesulfonic acid	22282883	3863000	9.57	5.768284	1.1290	48.90	1	235.4	207.7	210	Match

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 #:	410-32347-1	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-BLDG-2308-1-GW-031221 Lab ID: 410-32347-2

EIS 13C8 PFOS

REPORTED EIS %R 90

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

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 Analysis Chain of Custody

eurofins | Lancaster Laboratories Environmental

Acct. #

410-32347 Chain of Custody

For Environmental use only

Table #

COC # 616536

Client Information

Client: ARCADIS	Acct. #:
Project Name/#: APG PFAS SI	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.3BX50
Sampler:	Quote #:
State where samples were collected:	For Compliance: Yes ☐ No ☐

Matrix: ☐ Tissue ☐ Sediment ☒ Soil ☒ Water ☐ Ground ☐ Potable ☐ Surface ☐ NPDES ☐ Other:

Analysis Requested — Preservation and Filtration Codes

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Total # of Containers	PFAS (170)	Moisture (77)	Grain Size (73)	pH, TOC (34)	PFAS (173)	Remarks
~~APG-FB-031221~~ APG-FB-03-031221	3/12/21	0810	X		2					X	
APG-BLDG-2308-1-GW-031221		1000	X		2					X	
APG-BLDG-2200-2-SO-(0-2)-031221		0930		X	2	X					
APG-BLDG-2200-1-SO-(0-2)-031221		1040		X	4	X	X	X	X		
APG-HELI-FIRE-1-SO-(0-2)-031221		1330		X	4	X	X	X	X		
APG-HELI-FIRE-1-GW-031221		1400	X		2					X	
APG-FB-07-031221		1340	X		2					X	

Turnaround Time (TAT) Requested (please circle)
Standard Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days:

E-mail address: Matthew.Bloom@ARCADIS.com; Keith.Shepherd@ARCADIS.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP)	Type VI (Raw Data Only)	
Type III (Reduced non-CLP)	NJ DKQP	TX TRRP-13
NYSDEC Category A or B	MA MCP	CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	3/12/21	1500		3/12/21	15:45
	3/12/21	17:11			
				3-12-21	1730

EDD Required? Yes No
If yes, format:

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS FedEx Other

Temperature upon receipt 1.3 °C

Qualifiers

LCMS

Qualifier	Qualifier Description
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
*5+	Isotope dilution analyte is outside acceptance limits, high biased.
B	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.
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)
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

Client Sample ID: APG-FB-03-031221

Lab Sample ID: 410-32347-1

Date Collected: 03/12/21 08:10
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	<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		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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*130*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
M2-8:2 FTS	*115*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C2 PFTeDA	*92*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C3 PFBS	*86*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C4 PFBA	*108*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C4 PFHpA	*115*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C5 PFPeA	*108*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C8 PFOA	*114*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C8 PFOS	*97*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
d3-NMeFOSAA	*92*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
d5-NEtFOSAA	*104*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C2-PFDoDA	*102*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C3 PFHxS	*102*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C5 PFHxA	*113*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C6 PFDA	*106*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C7 PFUnA	*110*		*50 - 150*	*03/15/21 08:34*	*03/17/21 12:52*	*1*
13C9 PFNA	*112*		*50 - 150*	*03/15/21 08:34*	*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

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	<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

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

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

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*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*104*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
M2-8:2 FTS	*101*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C2 PFTeDA	*68*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C3 PFBS	*84*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C4 PFBA	*91*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C4 PFHpA	*82*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C5 PFPeA	*84*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C8 PFOA	*97*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C8 PFOS	*90*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
d3-NMeFOSAA	*81*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
d5-NEtFOSAA	*88*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C2-PFDoDA	*91*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C3 PFHxS	*76*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C5 PFHxA	*91*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C6 PFDA	*98*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C7 PFUnA	*101*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*1*
13C9 PFNA	*99*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:14*	*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
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*	*Qualifier*	*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*

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

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		0.0023	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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluoroheptanoic acid	**0.00075**		0.00069	0.00046	0.00046	mg/Kg	☼	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*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*121*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:03*	*1*
M2-8:2 FTS	*103*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:03*	*1*
13C2 PFTeDA	*105*		*50 - 150*	*03/15/21 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 13:55*	*03/17/21 20:03*	*1*
13C4 PFHpA	*117*		*50 - 150*	*03/15/21 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 13:55*	*03/17/21 20:03*	*1*
13C8 PFOS	*104*		*50 - 150*	*03/15/21 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 13:55*	*03/17/21 20:03*	*1*
13C2-PFDoDA	*110*		*50 - 150*	*03/15/21 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 13:55*	*03/17/21 20:03*	*1*
13C6 PFDA	*111*		*50 - 150*	*03/15/21 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 13:55*	*03/17/21 20:03*	*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

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		0.0023	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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanoic acid	0.00080		0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:14	1
Perfluorononanoic acid	0.0012		0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:14	1
Perfluorooctanesulfonic acid	0.0012		0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:14	1
Perfluorooctanoic acid	0.00078		0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:14	1
Perfluoropentanoic acid	0.0015	M	0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:14	1
Perfluorotetradecanoic acid	0.00053	J	0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:14	1
Perfluorotridecanoic acid	0.00059	J	0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:14	1
Perfluoroundecanoic acid	0.0043		0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:14	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*124*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
M2-8:2 FTS	*103*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C2 PFTeDA	*107*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C3 PFBS	*100*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C4 PFBA	*109*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C4 PFHpA	*112*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C5 PFPeA	*108*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C8 PFOA	*115*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C8 PFOS	*114*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
d3-NMeFOSAA	*98*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
d5-NEtFOSAA	*102*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C2-PFDoDA	*108*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C3 PFHxS	*113*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C5 PFHxA	*114*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C6 PFDA	*110*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C7 PFUnA	*107*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*
13C9 PFNA	*117*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:14*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	5690	J-	3000	2000	2000	mg/Kg	☼	03/18/21 16:15	8.54
Percent Moisture	14.6		1.0		1.0	%		03/13/21 08:14	1
Percent Solids	85.4		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	20.5		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
Gravel	28.8		1.0	1.0	1.0	%		03/15/21 13:20	1
Sand	33.3		1.0	1.0	1.0	%		03/15/21 13:20	1
Silt	33.0		1.0	1.0	1.0	%		03/15/21 13:20	1
Clay	5.0		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	71.3		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
3.35 mm	70.3		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
2.36 mm	69.8		1.0	1.0	1.0	% Passing		03/15/21 13:20	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

Method: D422 - Grain Size (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

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	<0.0017		0.0021	0.0017	0.0017	mg/Kg	☼	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

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*97*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
M2-8:2 FTS	*72*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
13C2 PFTeDA	*67*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
13C3 PFBS	*81*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
13C4 PFBA	*62*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
13C4 PFHpA	*80*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
13C5 PFPeA	*64*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
13C8 PFOA	*85*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
13C8 PFOS	*85*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
d3-NMeFOSAA	*24*	*5-	*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
d5-NEtFOSAA	*30*	*5-	*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
13C2-PFDoDA	*78*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*
13C3 PFHxS	*91*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:05*	*1*

Client Sample ID: APG-HELI-FIRE-1-SO-(0-2)-031221

Date Collected: 03/12/21 13:30
Date Received: 03/12/21 17:30

Lab Sample ID: 410-32347-5

Matrix: Solid
Percent Solids: 89.9

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

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		50 - 150	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

Client Sample ID: APG-HELI-FIRE-1-SO-(0-2)-031221

Lab Sample ID: 410-32347-5

Date Collected: 03/12/21 13:30
Date Received: 03/12/21 17:30

Matrix: Solid
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
Date Received: 03/12/21 17:30

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
6:2 Fluorotelomer sulfonic acid	3.8	~~J~~ 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

Client Sample ID: APG-HELI-FIRE-1-GW-031221

Date Collected: 03/12/21 14:00
Date Received: 03/12/21 17:30

Lab Sample ID: 410-32347-6

Matrix: Water

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

Analyte	Result	Qualifier	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*

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	**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	**2.1**	**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	B	1.9	0.95	0.95	ng/L		03/22/21 11:57	1
Perfluorotridecanoic acid	<0.95	B	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*	*Qualifier*	*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 11:57*	*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*	*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

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

Isotope Dilution	%Recovery	Qualifier	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		50 - 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		50 - 150	03/20/21 10:25	03/22/21 11:57	1
13C6 PFDA	121		50 - 150	03/20/21 10:25	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

Date Collected: 03/12/21 13:40
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	<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

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

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

Job ID: 410-32347-1

Client Sample ID: APG-FB-07-031221
Date Collected: 03/12/21 13:40
Date Received: 03/12/21 17:30

Lab Sample ID: 410-32347-7
Matrix: Water

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

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

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:

Sample ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-BONEYARD-1-SO-(0-2)-031121	410-32349-1	Soil	3/11/2021		X	X	X
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		X		
APG-BONEYARD-6-GW-031121	410-32349-4	Water	3/11/2021		X		
APG-BONEYARD-7-SO-(0-2)-031121	410-32349-5	Soil	3/11/2021		X		
APG-BONEYARD-7-GW-031121	410-32349-6	Water	3/11/2021		X		
APG-OLD-FTA-1-SO-(0-2)-031121	410-32349-7	Soil	3/11/2021		X	X	X
APG-OLD-FTA-1-GW-031121	410-32349-8	Water	3/11/2021		X		
APG-OLD-FTA-2-SO-(0-2)-031121	410-32349-9	Soil	3/11/2021		X		
APG-OLD-FTA-2-GW-031121	410-32349-10	Water	3/11/2021		X		
APG-FTA-M08-031121	410-32349-11	Water	3/11/2021		X		
APG-DUP-04-031121	410-32349-12	Water	3/11/2021	APG-FTA-M08-031121	X		

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.

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

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 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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-(0-2)-031121	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 20%**	≤ 20%
APG-BONEYARD-6-SO-(0-2)-031121	M2-6:2 FTS	6:2 Fluorotelomer sulfonic acid	**< 50% but > 20%**	< 50% but > 20%
	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-(0-2)-031121	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 20%**	< 20%
APG-OLD-FTA-1-SO-(0-2)-031121	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 20%**	< 20%
APG-OLD-FTA-2-SO-(0-2)-031121	d3-NMeFOSAA	NMeFOSAA	**< 20%**	< 20%
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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.

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-FTA-M08-031121	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
	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	MS Recovery	MSD 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
> the upper control limit (UL)	Non-detect	No Action
	Detect	J+
< the lower control limit (LL) but > 10%	Non-detect	UJ
	Detect	J-
< 10%	Non-detect	UX
	Detect	J-
SR>4X: Parent sample concentration > four times the MS/MSD spiking solution concentration.	Detect	No Action
D: MS/MSD added spike diluted below calibration range	Non-detect	No Action
	Detect	

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
APG-FTA-M08-031121 / APG-DUP-04-031121	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 %
	Perfluorohexanesulfonic acid	2900	3100	6.6 %
	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
APG-BLDG-2308-1-GW-031221 (continued)	Perfluorobutanoic acid	--	72	72 D
	Perfluorodecanoic acid	--	64	64 D
	Perfluoroheptanoic acid	--	62	62 D
	Perfluorohexanesulfonic acid	--	1200	1200 D
	Perfluorohexanoic acid	--	250	250 D
	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
APG-OLD-FTA-2-GW-031121	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
	Perfluoroheptanoic acid	--	860	860 D
	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
APG-FTA-M08-031121	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
	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
APG-DUP-04-031121	8:2 Fluorotelomer sulfonic acid	--	37	37 D
	6:2 Fluorotelomer sulfonic acid	--	660	660 D
	Perfluorobutanesulfonic acid	--	150	150 D
	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	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
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		X		X	
LCS/LCSD Precision (RPD)		X		X	
Matrix Spike (MS) %R		X		X	
Matrix Spike Duplicate(MSD) %R		X		X	
MS/MSD Precision (RPD)		X		X	
Field Duplicate (RPD)		X		X	
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X	X		
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 APG-OLD-FTA-1-SO-(0-2)-031121	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
	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 ± 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	Gross Exceedance < 75%	Non-detect	UX
		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 ± 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
% Recovery < lower limit of 80%	Non-detect	UJ
	Detect	J-
% Recovery > upper limit of 120%	Non-detect	No Action
	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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X	X		
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)	X				X
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
Transcription/calculations acceptable		X		X	

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 #: 410-32349-1 Date: 5/7/2021
Lab: Eurofins Lancaster Page: 1
Project: Aberdeen Proving Ground Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

PFOA 3/17/2021 Calibration Page 947 - 960 of SDG 410-32349-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	141234	6771971	10	0.020856	1.0427836	0.9768	0.21351	0.2	6.755	6.8	Match
0.5	339917	6639170	10	0.051199	1.0239744	0.9768	0.524147	0.5	4.829	4.8	Match
2	1428396	6518513	10	0.219129	1.0956456	0.9768	2.243337	2	12.167	12.2	Match
8	4606305	6241486	10	0.738014	0.9225177	0.9768	7.555427	8	-5.557	-5.6	Match
20	11353940	6107162	10	1.859119	0.9295594	0.9768	19.03275	20	-4.836	-4.8	Match
50	26265377	5722106	10	4.590159	0.9180318	0.9768	46.9918	50	-6.016	-6	Match
100	43121158	4763137	10	9.053101	0.9053101	0.9768	92.68121	100	-7.319	-7.3	Match

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 #: 410-32349-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/7/2021
Page: 2
Validated 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

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	874409	4859351	10	0.1799	0.9055	1.987	2	-0.64	-0.6	Match
Perfluoropentanoic acid	931437	4634587	10	0.2010	1.0900	1.844	2	-7.81	-7.8	Match
Perfluorobutanesulfonic acid	772307	3826669	9.36	0.2018	1.1250	1.679	2	-5.13	-5	Match
Perfluorohexanoic acid	897494	5038802	10	0.1781	0.8906	2.000	2	0.00	0	Match
Perfluoroheptanoic acid	1138680	5302738	10	0.2147	1.1710	1.834	2	-8.31	-8.3	Match
Perfluorohexanesulfonic acid	721897	3684758	9.46	0.1959	1.0560	1.755	2	-7.14	-7.2	Match
Perfluorooctanesulfonic acid	783741	3880536	9.57	0.2020	1.1290	1.712	2	-10.37	-10.5	Match

CCV 410-104674/53 3/19/2021 03:37

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Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	1009628	4955298	10	0.2037	0.9055	2.250	2.0	12.51	12.5	Match
Perfluoropentanoic acid	1073805	4357270	10	0.2464	1.0900	2.261	2.0	13.05	13	Match
Perfluorobutanesulfonic acid	880987	3932902	9.36	0.2240	1.1250	1.864	1.8	5.29	5.3	Match
Perfluorohexanoic acid	1021509	5165110	10	0.1978	0.8906	2.221	2.0	11.03	11	Match
Perfluoroheptanoic acid	1390524	5311875	10	0.2618	1.1710	2.235	2.0	11.77	11.8	Match
Perfluorohexanesulfonic acid	794749	3611340	9.46	0.2201	1.0560	1.971	1.8	8.32	8.1	Match
Perfluorooctanesulfonic acid	915554	3838793	9.57	0.2385	1.1291	2.021	1.9	9.27	9.2	Match

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

Stage 3 / 4
PFAS LCS

SDG #: 410-32349-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/7/2021
Page: 3
Validated by: SPR

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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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 #:	410-32349-1	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

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

$$\%R = \frac{100 * (\text{MS Conc} - \text{Sample Conc})}{\text{MS TV}} \qquad RPD = \frac{100 * |\ \text{MS \%R} - \text{MSD \%R}}{\text{Average of MS MSD \%R}}$$

Sample Concentration	0			
MS Concentration	19.8	MS %R	88.00	MATCH
MSD Concentration	20.4	MSD %R	96.68	MATCH
MS TV	22.5	RPD	2.99	MATCH
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
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/7/2021
Page: 5
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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Final Volume mls	Sample Volume mls	Final Calculated ng/L	Reported Value ng/L	
Perfluorobutanoic acid	2854020	549347	10	5.195296	0.9055	57.37	1	305.3	187.9	190	Match
Perfluoropentanoic acid	8623350	459069	10	18.78443	1.0900	172.33	1	305.3	564.5	560	Match
Perfluorobutanesulfonic acid	2283337	398068	9.36	5.736048	1.1250	47.72	1	305.3	156.3	160	Match
Perfluorohexanoic acid	16738461	555645	10	30.12438	0.8906	338.25	1	305.3	1107.9	1100	Match
Perfluoroheptanoic acid	4985957	524770	10	9.501223	1.1710	81.14	1	305.3	265.8	270	Match
Perfluorohexanesulfonic acid	40631793	408277	9.46	99.52016	1.0560	891.53	1	305.3	2920.2	2900	Match
Perfluorootanoic acid	14242712	73078	10	194.8974	0.9768	1995.26	1	305.3	6535.4	6500	Match
Perfluorooctanesulfonic acid	16516195	51106	9.57	323.1753	1.1290	2739.40	1	305.3	8972.8	9000	Match

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 #:	410-32349-1	Date:	5/7/2021
Lab:	Eurofins Lancaster	Page:	6
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

EIS 13C4 PFBA

REPORTED EIS %R 104

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

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 Custody

eurofins | Lancaster Laboratories Environmental

Acct. # _____

410-32349 Chain of Custody

...mental use only

Pg 1 of 2

COC # 616534

Client Information

Client: ARCADIS	Acct. #:
Project Name/#: APG PFAS S1	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.3BX50
Sampler: Dale Lynch	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☐

Matrix

Soil ☒ Sediment ☐ Tissue ☐ Water ☐ Potable ☒ Ground ☐ NPDES ☐ Surface ☐ Other: ____

Analysis Requested

Preservation and Filtration Codes

For Lab Use Only

FSC: _____

SCR#: _____

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil/Sediment	Water	Other	Total # of Containers	PFAS (170)	Moisture (73)	Grain Size (73)	pH, TOC (34)	PFAS (173)	Remarks
APG-Boneyard-1-SO-(0-2)-031121	3/11/21	0830		X	SO			4	X	X	X	X		
APG-Boneyard-1-GW-031121		0910	X			GW		2					X	
APG-Boneyard-6-SO-(0-2)-031121		~~0930~~		X	SO			2	X					@1045
APG-Boneyard-6-GW-031121		~~1010~~	X			GW		2					X	@1120
APG-Boneyard-7-SO-(0-2)-031121		0930		X	SO			2	X					
APG-Boneyard-7-GW-031121		1010	X			GW		2					X	
APG-OLD-FTA-1-SO-(0-2)-031121		1230		X	SO			4	X	X	X	X		
APG-OLD-FTA-1-GW-031121		1310	X			GW		2					X	
APG-OLD-FTA-2-SO-(0-2)-031121		1325		X	SO			2	X					
APG-OLD-FTA-2-GW ~~(0-2)~~ 031121		1410	X			GW		2					X	

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: Matthew.Brown@ARCADIS.com; Keith.Shepherd@ARCADIS.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	3/12/21	0700		3/12/21	15:45
	3/12/21	17:11			
				3-12-21	1730

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:

UPS _____ FedEx _____ Other _____

Temperature upon receipt 1.4 °C

Environmental Analysis Request/Chain of Custody

eurofins | Lancaster Laboratories Environmental

For Eurofins Lancaster Laboratories Environmental use only

Acct. # _____ Group # _____ Sample # _____ pg 2 of 2

COC # 616572

Client Information

Client: | Acct. #:

Project Name/#: | PWSID #:

Project Manager: see pg 1 | P.O. #:

Sampler: | Quote #:

State where samples were collected: | For Compliance: Yes ☐ No ☐

Matrix

Soil ☐ Sediment ☐ Tissue ☐ | Water: Potable ☐ Ground ☒ Surface ☐ NPDES ☐ | Other: ____

Analysis Requested

Preservation and Filtration Codes

For Lab Use Only

FSC: _____

SCR#: _____

Preservation Codes

H=HCl | T=Thiosulfate

N=HNO_3 | B=NaOH

S=H_2SO_4 | P=H_3PO_4

F=Field Filtered | O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil	Sediment	Tissue	Potable	Ground	Surface	NPDES	Other	Water	Total # of Containers	PFAS (123)	Remarks
APG-FTA-MW08-031121	3/11/21	1345	X						GW					6	X	MS / MSD
APG-DUP-04-031121	3/11/21	1200	X						GW					2	X	

Turnaround Time (TAT) Requested (please circle)

Standard | Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: see pg 1

E-mail address: _____

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) | Type VI (Raw Data Only)

Type III (Reduced non-CLP) | NJ DKQP | TX TRRP-13

NYSDEC Category A or B | MA MCP | CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	3/12/21	0700		3/12/21	15:45
	3/12/21	17:11			
				3-12-21	1730

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? (Yes) No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:

UPS _____ FedEx _____ Other _____

Temperature upon receipt 1.4 °C

Definitions/Glossary

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

Job ID: 410-32349-1

Qualifiers

LCMS

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.
B	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.
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

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

Client Sample ID: APG-Boneyard-1-SO-(0-2)-031121

Date Collected: 03/11/21 08:30
Date Received: 03/12/21 17:30

Lab Sample ID: 410-32349-1

Matrix: Solid
Percent Solids: 83.9

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	☼	03/24/21 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
~~NMeFOSAA~~	~~<0.00044~~		~~0.0022~~	~~0.00044~~	~~0.00044~~	~~mg/Kg~~	☼	~~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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*73*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
M2-8:2 FTS	*59*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C2 PFTeDA	*61*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C3 PFBS	*81*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C4 PFBA	*58*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C4 PFHpA	*64*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C5 PFPeA	*57*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C8 PFOA	*66*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C8 PFOS	*86*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
d3-NMeFOSAA	*8*	**5-*	*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
d5-NEtFOSAA	*12*	**5-*	*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C2-PFDoDA	*67*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C3 PFHxS	*91*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C5 PFHxA	*60*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C6 PFDA	*64*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C7 PFUnA	*72*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*
13C9 PFNA	*61*		*50 - 150*	*03/23/21 20:31*	*03/24/21 13:16*	*1*

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	<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

Client Sample ID: APG-Boneyard-1-SO-(0-2)-031121

Date Collected: 03/11/21 08:30
Date Received: 03/12/21 17:30

Lab Sample ID: 410-32349-1

Matrix: Solid
Percent Solids: 83.9

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:36	1
Perfluorononanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:36	1
Perfluorooctanesulfonic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:36	1
Perfluorooctanoic acid	<0.00046	M	0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:36	1
Perfluoropentanoic acid	<0.00046	M	0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:36	1
Perfluorotetradecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:36	1
Perfluorotridecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:36	1
Perfluoroundecanoic acid	<0.00046		0.00069	0.00046	0.00046	mg/Kg	☼	03/17/21 20:36	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*97*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
M2-8:2 FTS	*89*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C2 PFTeDA	*94*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C3 PFBS	*98*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C4 PFBA	*97*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C4 PFHpA	*106*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C5 PFPeA	*94*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C8 PFOA	*104*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C8 PFOS	*108*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
d3-NMeFOSAA	*14*	**5-*	*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
d5-NEtFOSAA	*20*	**5-*	*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C2-PFDoDA	*97*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C3 PFHxS	*112*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C5 PFHxA	*100*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C6 PFDA	*103*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C7 PFUnA	*104*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*
13C9 PFNA	*101*		*50 - 150*	*03/15/21 13:55*	*03/17/21 20:36*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	**3290**	J-	2170	1450	1450	mg/Kg	☼	03/18/21 16:40	6.08
Percent Moisture	**16.1**		1.0		1.0	%		03/15/21 05:25	1
Percent Solids	**83.9**		1.0		1.0	%		03/15/21 05:25	1

General Chemistry - Soluble

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	**6.3**	J	0.01	0.01	0.01	S.U.		03/16/21 18:12	1
Temperature	**20.3**		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	**7.0**		1.0	1.0	1.0	%		03/15/21 13:20	1
Sand	**22.3**		1.0	1.0	1.0	%		03/15/21 13:20	1
Silt	**56.7**		1.0	1.0	1.0	%		03/15/21 13:20	1
Clay	**14.0**		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	**93.0**		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
3.35 mm	**91.1**		1.0	1.0	1.0	% Passing		03/15/21 13:20	1
2.36 mm	**89.6**		1.0	1.0	1.0	% Passing		03/15/21 13:20	1

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: D422 - Grain Size (Continued)

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

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	**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*	*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*

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

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

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) - 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	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	M	0.00073	0.00049	0.00049	mg/Kg	☼	03/30/21 16:09	1
Perfluorohexanoic acid	<0.00049	M	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	M	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	mg/Kg	☼	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

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) - 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	<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	M	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	M	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*	*Qualifier*	*Limits*	*Prepared*	*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	*76*		*50 - 150*	*03/31/21 10:07*	*03/31/21 18:36*	*1*
13C5 PFHxA	*52*		*50 - 150*	*03/31/21 10:07*	*03/31/21 18:36*	*1*
13C6 PFDA	*53*		*50 - 150*	*03/31/21 10:07*	*03/31/21 18:36*	*1*
13C7 PFUnA	*54*		*50 - 150*	*03/31/21 10:07*	*03/31/21 18:36*	*1*
13C9 PFNA	*54*		*50 - 150*	*03/31/21 10:07*	*03/31/21 18:36*	*1*

General Chemistry

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

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

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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
NEtFOSAA	<0.99		3.0	0.99	0.99	ng/L		03/17/21 13:59	1
NMeFOSAA	<1.2		2.0	1.2	1.2	ng/L		03/17/21 13:59	1
Perfluorobutanesulfonic acid	**1.6**	**J M**	2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluorobutanoic acid	<4.0		5.0	4.0	4.0	ng/L		03/17/21 13:59	1
Perfluorodecanoic acid	<0.99		2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluorododecanoic acid	<0.99		2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluoroheptanoic acid	**1.5**	**J**	2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluorohexanesulfonic acid	**26**		2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluorohexanoic acid	**7.5**		2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluorononanoic acid	**1.5**	**J**	2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluorooctanesulfonic acid	**17**		2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluorooctanoic acid	**13**	**M**	2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluoropentanoic acid	**1.8**	**J M**	2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluorotetradecanoic acid	<0.99		2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluorotridecanoic acid	<0.99		2.0	0.99	0.99	ng/L		03/17/21 13:59	1
Perfluoroundecanoic acid	<0.99		2.0	0.99	0.99	ng/L		03/17/21 13:59	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*132*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
M2-8:2 FTS	*109*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C2 PFTeDA	*74*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C3 PFBS	*88*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C4 PFBA	*99*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C4 PFHpA	*108*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C5 PFPeA	*97*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C8 PFOA	*108*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C8 PFOS	*95*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
d3-NMeFOSAA	*80*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
d5-NEtFOSAA	*96*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C2-PFDoDA	*87*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C3 PFHxS	*99*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C5 PFHxA	*108*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C6 PFDA	*100*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C7 PFUnA	*107*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*
13C9 PFNA	*108*		*50 - 150*	*03/15/21 08:34*	*03/17/21 13:59*	*1*

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

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	<0.0019		0.0023	0.0019	0.0019	mg/Kg	☼	03/30/21 16:20	1
8:2 Fluorotelomer sulfonic acid	<0.0019		0.0035	0.0019	0.0019	mg/Kg	☼	03/30/21 16:20	1
~~NEtFOSAA~~	~~<0.00047~~		~~0.0023~~	~~0.00047~~	~~0.00047~~	~~mg/Kg~~	☼	~~03/30/21 16:20~~	R 1
~~NMeFOSAA~~	~~<0.00047~~		~~0.0023~~	~~0.00047~~	~~0.00047~~	~~mg/Kg~~	☼	~~03/30/21 16:20~~	R 1
Perfluorobutanesulfonic acid	<0.0019		0.0023	0.0019	0.0019	mg/Kg	☼	03/30/21 16:20	1
Perfluorobutanoic acid	<0.0019		0.0023	0.0019	0.0019	mg/Kg	☼	03/30/21 16:20	1
Perfluorodecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/30/21 16:20	1
Perfluorododecanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/30/21 16:20	1
Perfluoroheptanoic acid	<0.00047		0.00070	0.00047	0.00047	mg/Kg	☼	03/30/21 16:20	1

Client Sample ID: APG-Boneyard-7-SO-(0-2)-031121
Date Collected: 03/11/21 09:30
Date Received: 03/12/21 17:30

Lab Sample ID: 410-32349-5
Matrix: Solid
Percent Solids: 84.4

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

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	M	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*	*Qualifier*	*Limits*	*Prepared*	*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*

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	<0.0019		0.0023	0.0019	0.0019	mg/Kg	☼	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		0.00070	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

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	03/31/21 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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<4.0		5.1	4.0	4.0	ng/L		03/17/21 14:10	1
8:2 Fluorotelomer sulfonic acid	<2.0		3.0	2.0	2.0	ng/L		03/17/21 14:10	1
NEtFOSAA	<1.0		3.0	1.0	1.0	ng/L		03/17/21 14:10	1
NMeFOSAA	<1.2		2.0	1.2	1.2	ng/L		03/17/21 14:10	1
Perfluorobutanesulfonic acid	<1.0	M	2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluorobutanoic acid	<4.0	M	5.1	4.0	4.0	ng/L		03/17/21 14:10	1
Perfluorodecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluorododecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluoroheptanoic acid	<1.0	M	2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluorohexanesulfonic acid	**25**		2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluorohexanoic acid	**3.6**		2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluorononanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluorooctanesulfonic acid	**1.7**	**J**	2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluorooctanoic acid	**6.9**		2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluoropentanoic acid	<1.0	M	2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluorotetradecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluorotridecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/17/21 14:10	1
Perfluoroundecanoic acid	<1.0		2.0	1.0	1.0	ng/L		03/17/21 14:10	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	135		50 - 150	03/15/21 08:34	03/17/21 14:10	1
M2-8:2 FTS	125		50 - 150	03/15/21 08:34	03/17/21 14:10	1
13C2 PFTeDA	94		50 - 150	03/15/21 08:34	03/17/21 14:10	1

Client Sample ID: APG-Boneyard-7-GW-031121

Lab Sample ID: 410-32349-6
Matrix: Water
Date Collected: 03/11/21 10:10
Date Received: 03/12/21 17:30

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

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
Matrix: Solid
Date Collected: 03/11/21 12:30
Percent Solids: 81.8
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	<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~~	☼	~~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**	J	0.00072	0.00048	0.00048	mg/Kg	☼	03/17/21 20:47	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	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

Client Sample ID: APG-OLD-FTA-1-SO-(0-2)-031121

Date Collected: 03/11/21 12:30
Date Received: 03/12/21 17:30

Lab Sample ID: 410-32349-7

Matrix: Solid
Percent Solids: 81.8

Method: EPA 537(Mod) - PFAS 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

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	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	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 acid	<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	M	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**	**I**	0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 13:27	1

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	1

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	**1170**	J-	928	619	619	mg/Kg	☼	03/20/21 16:02	2.53

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

Method: D422 - Grain Size

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Gravel	<1.0		1.0	1.0	1.0	%		03/15/21 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

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	<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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorooctanoic acid	**720**	**D M**	22	11	11	ng/L		03/19/21 03:15	10
Perfluoropentanoic acid	**130**	**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 I D M~~ 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 08:34*	*03/19/21 03:15*	*10*
M2-8:2 FTS	*113*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C2 PFTeDA	*81*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C3 PFBS	*89*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C4 PFBA	*109*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C4 PFHpA	*117*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C5 PFPeA	*101*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C8 PFOA	*110*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C8 PFOS	*88*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
d3-NMeFOSAA	*95*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
d5-NEtFOSAA	*105*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C2-PFDoDA	*104*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C3 PFHxS	*104*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C5 PFHxA	*111*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C6 PFDA	*106*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C7 PFUnA	*105*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*
13C9 PFNA	*84*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:15*	*10*

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	**7000**	**D**	220	110	110	ng/L		03/19/21 03:48	100

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C8 PFOS	*98*		*50 - 150*	*03/15/21 08:34*	*03/19/21 03:48*	*100*

Client Sample ID: APG-OLD-FTA-2-SO-(0-2)-031121

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

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	☼	03/30/21 16:31	1
8:2 Fluorotelomer sulfonic acid	<0.0018		0.0033	0.0018	0.0018	mg/Kg	☼	03/30/21 16:31	1
~~NEtFOSAA~~	~~<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**	**J M**	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	M	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

Client Sample ID: APG-OLD-FTA-2-SO-(0-2)-031121
Date Collected: 03/11/21 13:25
Date Received: 03/12/21 17:30

Lab Sample ID: 410-32349-9
Matrix: Solid
Percent Solids: 87.4

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

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*	*Qualifier*	*Limits*	*Prepared*	*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*

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	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	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	M	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	0.00046	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*76*		*50 - 150*	*03/31/21 10:07*	*03/31/21 18:58*	*1*
M2-8:2 FTS	*62*		*50 - 150*	*03/31/21 10:07*	*03/31/21 18:58*	*1*
13C2 PFTeDA	*73*		*50 - 150*	*03/31/21 10:07*	*03/31/21 18:58*	*1*
13C3 PFBS	*77*		*50 - 150*	*03/31/21 10:07*	*03/31/21 18:58*	*1*
13C4 PFBA	*83*		*50 - 150*	*03/31/21 10:07*	*03/31/21 18:58*	*1*

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-15 - RE (Continued)

Isotope Dilution	%Recovery	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	*5-	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	03/31/21 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
Date Received: 03/12/21 17:30

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	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	B	21	10	10	ng/L		03/22/21 11:35	10
Perfluorotridecanoic acid	<10	B	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	Qualifier	Limits	Prepared	Analyzed	Dil 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

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

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

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
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) - PFAS for QSM 5.3, 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	D 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	Qualifier	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

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	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	D	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	E D	23	11	11	ng/L		03/19/21 03:59	10
Perfluorooctanesulfonic acid	19000	E D	23	11	11	ng/L		03/19/21 03:59	10
Perfluorooctanoic acid	26000	E D	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	11	ng/L		03/19/21 03:59	10

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil 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

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

Method: EPA 537(Mod) - PFAS for QSM 5.3, Table B-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
13C5 PFHxA	59		50 - 150	03/15/21 08:34	03/19/21 03:59	10
13C6 PFDA	64		50 - 150	03/15/21 08:34	03/19/21 03:59	10
13C7 PFUnA	62		50 - 150	03/15/21 08:34	03/19/21 03:59	10
13C9 PFNA	46	*5-	50 - 150	03/15/21 08:34	03/19/21 03:59	10

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

Analyte	Result	Qualifier	LOQ	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~~ 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

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

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)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C9 PFNA	78		50 - 150	03/15/21 08:34	03/19/21 04:21	10

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	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

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	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

Client Sample ID: APG-DUP-04-031121
Date Collected: 03/11/21 12:00
Date Received: 03/12/21 17:30

Lab Sample ID: 410-32349-12
Matrix: Water

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

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	8500	D	180	89	89	ng/L		03/19/21 05:16	100
Perfluorooctanoic acid	6600	D	180	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:

Sample ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-DUP-07-031721	410-32859-1	Water	3/17/2021	APG-NOBLE-ROAD-1-GW-031721	X		
APG-NOBLE-ROAD-1-GW-031721	410-32859-2	Water	3/17/2021		X		
APG-WEIDE-1-SO-(0-2)-031721	410-32859-3	Soil	3/17/2021		X	X	X
APG-WEIDE-1-GW-031721	410-32859-4	Water	3/17/2021		X		
APG-BLDG-E4081-1-GW-031721	410-32859-5	Water	3/17/2021		X		
APG-BLDG-E5180-1-SO-(0-2)-031721	410-32859-6	Soil	3/17/2021		X	X	X
APG-BLDG-E5180-1-GW-031721	410-32859-7	Water	3/17/2021		X		
APG-BLDG-E5180-2-GW-031721	410-32859-8	Water	3/17/2021		X		
APG-FB-06-031721	410-32859-9	Water	3/17/2021		X		

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.

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

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 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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)-031721	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 50% but > 20%
	d5-NEtFOSAA	NEtFOSAA	**< 50% but > 20%**	< 50% but > 20%
APG-WEIDE-1-GW-031721	13C2 PFTeDA	Perfluorotetradecanoic acid	**< 50% but > 20%**	NA
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ

Control Limit	Sample Result	Qualification
	Detect	J+
< 20%	Non-detect	UX
	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.

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-031721	Perfluorohexanesulfonic acid	SR>4X	SR>4X
	Perfluorooctanesulfonic acid		
	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
> the upper control limit (UL)	Non-detect	No Action
	Detect	J+
< the lower control limit (LL) but > 10%	Non-detect	UJ
	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	Compounds	Sample Result	Duplicate Result	RPD
APG-NOBLE-ROAD-1-GW-031721 / APG-DUP-07-031721	Perfluorobutanesulfonic acid	30	29	3.4 %
	Perfluorobutanoic acid	36	35	2.8 %
	Perfluoroheptanoic acid	22	22	0.0 %
	Perfluorohexanesulfonic acid	580	540	7.1 %
	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
APG-DUP-07-031721	Perfluorohexanesulfonic acid	--	540	540 D
	Perfluorooctanesulfonic acid	--	700	700 D
APG-NOBLE-ROAD-1-GW-031721	Perfluorohexanesulfonic acid	--	580	580 D
	Perfluorooctanesulfonic acid	--	740	740 D
APG-BLDG-E5180-1-GW-031721	6:2 Fluorotelomer sulfonic acid	--	790	790 D
	Perfluorobutanesulfonic acid	--	830	830 D
	Perfluorobutanoic acid	--	700	700 D
	Perfluoroheptanoic acid	--	970	970 D
	Perfluorohexanoic acid	--	2900	2900 D
	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
APG-BLDG-E5180-2-GW-031721	6:2 Fluorotelomer sulfonic acid	--	380	380 D
	Perfluorobutanesulfonic acid	--	220	220 D
	Perfluorobutanoic acid	--	820	820 D
	Perfluoroheptanoic acid	--	3000	3000 D
	Perfluorohexanoic acid	--	3300	3300 D
	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	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
C. Field blanks		X		X	
Laboratory Control Sample (LCS) %R		X		X	
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		X		X	
MS/MSD Precision (RPD)		X		X	
Field Duplicate (RPD)		X		X	
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X		X	
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 APG-BLDG-E5180-1-SO-(0-2)-031721	6 days from collection; 5 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
	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 ± 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 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
TOC	Gross Exceedance < 75%	Non-detect	UX
		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 ± 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 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
% Recovery < lower limit of 80%	Non-detect	UJ
	Detect	J-
% Recovery > upper limit of 120%	Non-detect	No Action
	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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X	X		
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)	X				X
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
Transcription/calculations acceptable		X		X	

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

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	115624	6026889	10	0.019185	0.9592345	0.8912	0.215268	0.2	7.634	7.6	Match
0.5	259283	5341810	10	0.048538	0.9707683	0.8912	0.544641	0.5	8.928	8.9	Match
2	1053537	5346282	10	0.19706	0.9852988	0.8912	2.211173	2	10.559	10.6	Match
8	3635346	5465297	10	0.665169	0.8314612	0.8912	7.463745	8	-6.703	-6.7	Match
20	10343596	6051931	10	1.70914	0.8545699	0.8912	19.17796	20	-4.110	-4.1	Match
50	24124585	5884392	10	4.099758	0.8199517	0.8912	46.00267	50	-7.995	-8.0	Match
100	40646397	4974602	10	8.170784	0.8170784	0.8912	91.68294	100	-8.317	-8.3	Match
				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 #: 410-32859-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/14/2021
Page: 2
Validated 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

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	913589	5148581	10	0.1774	0.9165	1.936	2	-3.19	-3.2	Match
Perfluoropentanoic acid	980836	4464334	10	0.2197	1.1370	1.932	2	-3.38	-3.4	Match
Perfluorobutanesulfonic acid	841695	3966701	9.36	0.2122	1.1058	1.796	2	1.47	1.5	Match
Perfluorohexanoic acid	966270	5539738	10	0.1744	0.8912	1.957	2	-2.14	-2.1	Match
Perfluoroheptanoic acid	1251604	5694521	10	0.2198	1.1340	1.938	2	-3.09	-3.1	Match
Perfluorohexanesulfonic acid	779632	4070289	9.46	0.1915	1.0470	1.731	2	-8.43	-8.5	Match
Perfluorooctanesulfonic acid	832886	4243385	9.57	0.1963	1.1450	1.641	2	-14.11	-14.2	Match

CCV 410-106599/19 3/24/2021 15:40

Page 890 - 895 of SDG 410-32859-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	3628514	5202022	10	0.6975	0.9165	7.611	8.0	-4.87	-4.9	Match
Perfluoropentanoic acid	3734763	4351629	10	0.8582	1.1370	7.548	8.0	-5.65	-5.6	Match
Perfluorobutanesulfonic acid	3252444	4121321	9.36	0.7892	1.1058	6.680	7.1	-5.65	-5.7	Match
Perfluorohexanoic acid	3507130	5397840	10	0.6497	0.8912	7.290	8.0	-8.87	-8.9	Match
Perfluoroheptanoic acid	5122953	5539034	10	0.9249	1.1340	8.156	8.0	1.95	1.9	Match
Perfluorohexanesulfonic acid	2866760	3743321	9.46	0.7658	1.0470	6.920	7.3	-5.21	-5.2	Match
Perfluorooctanesulfonic acid	3135905	3742734	9.57	0.8379	1.1450	7.003	7.4	-5.37	-5.4	Match

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

Stage 3 / 4
PFAS LCS

SDG #: 410-32859-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/14/2021
Page: 3
Validated by: SPR

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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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 #:	410-32859-1	Date:	5/14/2021
Lab:	Eurofins Lancaster	Page:	4
Project:	Aberdeen Proving Ground	Validated by:	SPR

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID	APG-NOBLE-ROAD-1-GW-031721
ANALYTE	Perfluorohexanoic acid
REPORTED MS %R	107
REPORTED MSD %R	93
REPORTED RPD	4

Page 453 - 454 SDG 410-32859-1

$$\%R = \frac{100 * (\text{MS Conc} - \text{Sample Conc})}{\text{MS TV}} \qquad RPD = \frac{100 * |\ \text{MS \%R} - \text{MSD \%R}}{\text{Average of MS MSD \%R}}$$

Sample Concentration	55			
MS Concentration	84.8	MS %R	106.05	MATCH
MSD Concentration	81.6	MSD %R	92.36	MATCH
MS TV	28.1	RPD	3.85	MATCH
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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Final Volume mls	Sample Volume mls	Final Calculated ng/L	Reported Value ng/L	
Perfluorobutanoic acid	2457370	3244951	10	0.75729	0.9165	8.26	1	228.6	36.1	36	Match
Perfluoropentanoic acid	3426314	3642902	10	0.940545	1.1370	8.27	1	228.6	36.2	36	Match
Perfluorobutanesulfonic acid	2676402	3271662	9.36	0.818056	1.1058	6.92	1	228.6	30.3	30	Match
Perfluorohexanoic acid	4550838	4080916	10	1.115151	0.8912	12.51	1	228.6	54.7	55	Match
Perfluoroheptanoic acid	2395815	4136705	10	0.57916	1.1340	5.11	1	228.6	22.3	22	Match
Perfluorohexanesulfonic acid	4455298	305080	9.46	14.6037	1.0470	131.95	1	228.6	577.2	580	Match
Perfluorooctanesulfonic acid	6442493	318955	9.57	20.19875	1.1450	168.82	1	228.6	738.5	740	Match

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 #: 410-32859-1 Date: 5/14/2021
Lab: Eurofins Lancaster Page: 6
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
EIS 13C5 PFHxA
REPORTED EIS %R 73

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

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

eurofins | Lancaster Laboratories Environmental

For Eurofins Lancaster Laboratories Enviro

Acct. # _____ Group # _____ Sample # _____

410-32859 Chain of Custody

COC # 616539

Client Information

Client: ARCADIS	Acct. #:
Project Name/#: APG PFAS SI	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.3BX50
Sampler: Dale Lynch	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☐

Matrix

Soil ☒ Sediment ☐ Tissue ☐ Water ☒ Ground ☐ Potable ☐ NPDES ☐ Surface ☐ Other: ____

Analysis Requested

Preservation and Filtration Codes

Sample Identification	Collected Date	Collected Time	Grab	Composite	Total # of Containers	PFAS (170)	Moisture (73)	Grain Size (73)	pH, TOC (34)	PFAS (173)	Remarks
APG-DUP-07-031721	3/17/21	1200	X		2					X	
APG-NOBLE-ROAD-1-GW-031721 MS/MSD		1030	X		6					X	MS / MSD
APG-WEIDE-1-SO-(0-2)-031721		1100		X	4	X	X	X	X		
APG-WEIDE-1-GW-031721		1130	X		2					X	
APG-BLDG-E4081-1-GW-031721		1210	X		2					X	
APG-BLDG-E5180-1-SO-(0-2)-031721		1230		X	4	X	X	X	X		
APG-BLDG-E5180-1-GW-031721		1315	X		2					X	
APG-BLDG-E5180-2-GW-031721		1400	X		2					X	
APG-FB-06-031721		1250	X		2					X	

For Lab Use Only

FSC: _____

SCR#: _____

Preservation Codes

H=HCl	T=Thiosulfate
N=HNO_3	B=NaOH
S=H_2SO_4	P=H_3PO_4
F=Field Filtered	O=Other

Remarks

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: Matthew.Bloom@ARCADIS.com Keith.Shepherd@ARCADIS.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) | Type VI (Raw Data Only)

Type III (Reduced non-CLP) | NJ DKQP | TX TRRP-13

NYSDEC Category A or B | MA MCP | CT RCP

Relinquished by	Date	Time	Received by	Date	Time
[signature]	3/18/21	0700	[signature]	3/18/21	11:55
[signature]	3/18/21	1510	Received by	Date	Time
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	[signature]	3-18-21	15:10

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other X

Temperature upon receipt 0.5 °C

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-32859-1
Project/Site: Aberdeen Proving Ground PFAS S1

Qualifiers

LCMS

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

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
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

Client Sample ID: APG-DUP-07-031721
Lab Sample ID: 410-32859-1
Date Collected: 03/17/21 12:00
Matrix: Water
Date Received: 03/18/21 15:00

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	<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	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) - PFAS for QSM 5.3, Table B-15 - DL

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	**540**	**D**	22	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*	*Qualifier*	*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
Matrix: Water
Date Received: 03/18/21 15:00

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	<4.4		5.5	4.4	4.4	ng/L		03/24/21 17:08	1

Client Sample ID: APG-NOBLE-ROAD-1-GW-031721 Lab Sample ID: 410-32859-2

Date Collected: 03/17/21 10:30 **Matrix: Water**
Date Received: 03/18/21 15:00

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

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

Isotope Dilution	*%Recovery*	*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*	**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) - PFAS for QSM 5.3, Table B-15 - DL

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	**580**	**D**	22	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*	*Qualifier*	*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	☼	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

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 (Continued)

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		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*	*Qualifier*	*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*
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*

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	<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

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 - RE (Continued)

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorooctanesulfonic acid	<0.00045		0.00067	0.00045	0.00045	mg/Kg	☼	03/24/21 15:29	1
Perfluorooctanoic acid	<0.00045	M	0.00067	0.00045	0.00045	mg/Kg	☼	03/24/21 15:29	1
Perfluoropentanoic acid	<0.00045		0.00067	0.00045	0.00045	mg/Kg	☼	03/24/21 15:29	1
Perfluorotetradecanoic acid	<0.00045		0.00067	0.00045	0.00045	mg/Kg	☼	03/24/21 15:29	1
Perfluorotridecanoic acid	<0.00045		0.00067	0.00045	0.00045	mg/Kg	☼	03/24/21 15:29	1
Perfluoroundecanoic acid	<0.00045		0.00067	0.00045	0.00045	mg/Kg	☼	03/24/21 15:29	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*107*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
M2-8:2 FTS	*78*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C2 PFTeDA	*70*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C3 PFBS	*78*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C4 PFBA	*72*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C4 PFHpA	*81*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C5 PFPeA	*74*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C8 PFOA	*90*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C8 PFOS	*83*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
d3-NMeFOSAA	*22*	**5-*	*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
d5-NEtFOSAA	*27*	**5-*	*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C2-PFDoDA	*82*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C3 PFHxS	*87*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C5 PFHxA	*72*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C6 PFDA	*79*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C7 PFUnA	*85*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*
13C9 PFNA	*78*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:29*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	**2330**	J-	1770	1180	1180	mg/Kg	☼	03/20/21 16:15	4.98
Percent Moisture	**15.4**		1.0		1.0	%		03/19/21 10:01	1
Percent Solids	**84.6**		1.0		1.0	%		03/19/21 10:01	1

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.		03/23/21 19:22	1
Temperature	**20.3**		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
Gravel	**2.0**		1.0	1.0	1.0	%		04/01/21 12:49	1
Sand	**25.1**		1.0	1.0	1.0	%		04/01/21 12:49	1
Silt	**46.0**		1.0	1.0	1.0	%		04/01/21 12:49	1
Clay	**27.0**		1.0	1.0	1.0	%		04/01/21 12:49	1
75 mm	**100.0**		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
37.5 mm	**100.0**		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
19 mm	**100**		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
4.75 mm	**98.0**		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
3.35 mm	**97.9**		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
2.36 mm	**97.9**		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
1.18 mm	**97.9**		1.0	1.0	1.0	% Passing		04/01/21 12:49	1
0.6 mm	**97.0**		1.0	1.0	1.0	% Passing		04/01/21 12:49	1

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 (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

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	**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**	**M** MJ+	2.8	1.4	1.4	ng/L		03/28/21 13:08	1
Perfluorotetradecanoic acid	<1.4	UJ	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	*111*		*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*

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
13C9 PFNA	73		50 - 150	03/26/21 16:45	03/28/21 13:08	1

Client Sample ID: APG-BLDG-E4081-1-GW-031721
Lab Sample ID: 410-32859-5
Date Collected: 03/17/21 12:10
Matrix: Water
Date Received: 03/18/21 15:00

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	**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	M	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

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	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

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: 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	**0.0030**		0.0023	0.0018	0.0018	mg/Kg	☼	03/24/21 15:51	1
8:2 Fluorotelomer sulfonic acid	**0.0028**	**J**	0.0034	0.0018	0.0018	mg/Kg	☼	03/24/21 15:51	1
NEtFOSAA	<0.00045		0.0023	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
NMeFOSAA	<0.00045		0.0023	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluorobutanesulfonic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	03/24/21 15:51	1
Perfluorobutanoic acid	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	03/24/21 15:51	1
Perfluorodecanoic acid	**0.0080**		0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluorododecanoic acid	**0.00081**		0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluoroheptanoic acid	**0.0018**		0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluorohexanesulfonic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluorohexanoic acid	**0.0011**		0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluorononanoic acid	**0.0046**		0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluorooctanesulfonic acid	**0.019**		0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluorooctanoic acid	**0.0016**	**M**	0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluoropentanoic acid	**0.0027**	**M**	0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluorotetradecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluorotridecanoic acid	<0.00045		0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1
Perfluoroundecanoic acid	**0.0021**		0.00068	0.00045	0.00045	mg/Kg	☼	03/24/21 15:51	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*98*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
M2-8:2 FTS	*80*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C2 PFTeDA	*70*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C3 PFBS	*80*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C4 PFBA	*94*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C4 PFHpA	*94*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C5 PFPeA	*93*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C8 PFOA	*88*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C8 PFOS	*85*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
d3-NMeFOSAA	*53*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
d5-NEtFOSAA	*67*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C2-PFDoDA	*80*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C3 PFHxS	*89*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C5 PFHxA	*91*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C6 PFDA	*85*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C7 PFUnA	*84*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*
13C9 PFNA	*84*		*50 - 150*	*03/23/21 20:31*	*03/24/21 15:51*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	**10000**	J-	2450	1630	1630	mg/Kg	☼	03/20/21 16:27	6.84
Percent Moisture	**16.2**		1.0		1.0	%		03/19/21 10:01	1
Percent Solids	**83.8**		1.0		1.0	%		03/19/21 10:01	1

General Chemistry - Soluble

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	**6.5**	J	0.01	0.01	0.01	S.U.		03/23/21 19:22	1
Temperature	**21.4**		0.01	0.01	0.01	Degrees C		03/23/21 19:22	1

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

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	**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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*117*		*50 - 150*	*03/26/21 16:45*	*03/28/21 13:30*	*10*
M2-8:2 FTS	*111*		*50 - 150*	*03/26/21 16:45*	*03/28/21 13:30*	*10*
13C2 PFTeDA	*66*		*50 - 150*	*03/26/21 16:45*	*03/28/21 13:30*	*10*
13C3 PFBS	*84*		*50 - 150*	*03/26/21 16:45*	*03/28/21 13:30*	*10*

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

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

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) - PFAS 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
Lab Sample ID: 410-32859-8
Date Collected: 03/17/21 14:00
Matrix: Water
Date Received: 03/18/21 15:00

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	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	M	23	12	12	ng/L		03/28/21 13:52	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 13:52	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

Client Sample ID: APG-BLDG-E5180-2-GW-031721 Lab Sample ID: 410-32859-8

Date Collected: 03/17/21 14:00 **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
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	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

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 Lab Sample ID: 410-32859-9

Date Collected: 03/17/21 12:50 **Matrix: Water**
Date Received: 03/18/21 15:00

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	<3.6	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	M	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	M	1.8	0.90	0.90	ng/L		03/28/21 14:25	1
Perfluorotetradecanoic acid	<0.90	M	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

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

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

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

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

ARCADIS

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:

SDGs	Sample ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
						PFAS	TOC	pH
410-33044-1	APG-P1-12-2-GW-031821	410-33044-1	Water	3/18/2021		X		
	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		X		
410-33045-1	APG-BLDG-E4040-1-SO-(0-2)-031921	410-33045-1	Soil	3/19/2021		X	X	X
	APG-BLDG-E4040-1-GW-031921	410-33045-2	Water	3/19/2021		X		
	APG-G-STREET-1-SO-(0-2)-031921	410-33045-3	Soil	3/19/2021		X	X	X
	APG-G-STREET-1-GW-031921	410-33045-4	Water	3/19/2021		X		
	APG-CASEY-YARD-1-GW-031921	410-33045-5	Water	3/19/2021		X		

Notes:

1. Stage 4 validation was performed on sample APG-P1-12-2-GW-031821.
2. 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.

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

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
410-33045-1	410-33045-2	APG-BLDG-E4040-1-GW-031921
	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 537	Soil	28 days to extraction; 28 days from extraction to analysis	Cool to <6 °C
	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, $r^2 \geq 0.99$. 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-(0-2)-031921	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 50% but > 20%
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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.

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
APG-P1-12-2-GW-031821	6:2 Fluorotelomer sulfonic acid	SR>4X	SR>4X
	Perfluorohexanesulfonic acid		
	Perfluorohexanoic acid		
	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
> the upper control limit (UL)	Non-detect	No Action
	Detect	J+
< the lower control limit (LL) but > 10%	Non-detect	UJ
	Detect	J-
< 10%	Non-detect	UX
	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
APG-P1-12-2-GW-031821 / APG-DUP-08-031821	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
	Perfluoroheptanoic acid	1200	1100	8.6 %
	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
APG-P1-12-2-GW-031821	6:2 Fluorotelomer sulfonic acid	--	7900	7900 D
	Perfluorohexanoic acid	--	4800	4800 D
	Perfluorooctanesulfonic acid	--	4800	4800 D
	Perfluoropentanoic acid	--	6400	6400 D
APG-DUP-08-031821	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
	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	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
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	X				X
LCS/LCSD Precision (RPD)	X				X
Matrix Spike (MS) %R		X		X	
Matrix Spike Duplicate (MSD) %R		X		X	
MS/MSD Precision (RPD)		X		X	
Field Duplicate (RPD)		X	X		
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X		X	
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 APG-G-STREET-1-SO-(0-2)-031921	4 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
	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 ± 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 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
TOC	Gross Exceedance < 75%	Non-detect	UX
		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.

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
MS percent recovery 30% to 74%	Non-detect	UJ
	Detect	J-
MS percent recovery <30%	Non-detect	UX
	Detect	J-
MS percent recovery >125%	Non-detect	No Action
	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 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-
% Recovery > upper limit of 120%	Non-detect	No Action
	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 Required
	No	Yes	No	Yes	
Miscellaneous Instrumentation					
Stage 2 Validation					
Holding times		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
Laboratory Control Sample (LCS) %R		X	X		
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	X				X
MS/MSD Precision (RPD)	X				X
Lab Duplicate (RPD)		X		X	
Field Duplicate (RPD)	X				X
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Initial calibration correlation coefficient (TOC)		X		X	
Continuing calibration %R		X	X		
Raw Data		X		X	
Transcription/calculations acceptable		X		X	

Notes:
%R - percent recovery
RPD - relative percent difference

VALIDATION PERFORMED BY: Suresh PR, Arcadis

SIGNATURE: 

DATE: May 17, 2021

PEER REVIEW: Dennis Capria, Arcadis

DATE: May 26, 2021

Stage 3 / 4
PFAS Calibration Standards

SDG #: 410-33044-1 Date: 5/17/2021
Lab: Eurofins Lancaster Page: 1
Project: Aberdeen Proving Ground Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

Perfluoropentanoic acid 3/30/2021 Calibration Page 710 - 723 of SDG 410-33044-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	161692	6144800	10	0.026314	1.3156816	1.087	0.242076	0.2	21.038	21	Match
0.5	285606	5038151	10	0.056689	1.1337731	1.087	0.521515	0.5	4.303	4.3	Match
2	1305889	5619070	10	0.232403	1.1620152	1.087	2.138023	2	6.901	6.9	Match
8	4785784	5687564	10	0.841447	1.0518088	1.087	7.741003	8	-3.237	-3.2	Match
20	13053657	6579917	10	1.983863	0.9919317	1.087	18.25081	20	-8.746	-8.7	Match
50	31852513	6422817	10	4.959275	0.9918549	1.087	45.6235	50	-8.753	-8.7	Match
100	47712199	4961671	10	9.616155	0.9616155	1.087	88.46509	100	-11.535	-11.5	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 #: 410-33044-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/17/2021
Page: 2
Validated 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

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	1178996	6528415	10	0.1806	0.9387	1.924	2	-3.81	-3.8	Match
Perfluoropentanoic acid	1317911	6070621	10	0.2171	1.0870	1.997	2	-0.14	-0.1	Match
Perfluorobutanesulfonic acid	1107148	5188592	9.36	0.2134	1.1300	1.767	2	-0.14	0	Match
Perfluorohexanoic acid	1160334	6250885	10	0.1856	0.9490	1.956	2	-2.20	-2.2	Match
Perfluoroheptanoic acid	1497399	7343740	10	0.2039	1.1220	1.817	2	-9.13	-9.2	Match
Perfluorohexanesulfonic acid	947593	5078847	9.46	0.1866	1.0680	1.653	2	-12.56	-12.6	Match
Perfluorooctanesulfonic acid	1037374	5236571	9.57	0.1981	1.1590	1.636	2	-14.36	-14.5	Match

CCV 410-108879/1 3/30/2021 13:21

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Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	281207	5628499	10	0.0500	0.9387	0.532	0.5	6.45	6.5	Match
Perfluoropentanoic acid	313041	5570474	10	0.0562	1.0870	0.517	0.5	3.40	3.4	Match
Perfluorobutanesulfonic acid	271815	4687471	9.36	0.0580	1.1300	0.480	0.4	8.42	8.6	Match
Perfluorohexanoic acid	266289	5310674	10	0.0501	0.9490	0.528	0.5	5.67	5.7	Match
Perfluoroheptanoic acid	351732	6090054	10	0.0578	1.1220	0.515	0.5	2.95	2.9	Match
Perfluorohexanesulfonic acid	221083	4326822	9.46	0.0511	1.0680	0.453	0.5	-0.75	-0.8	Match
Perfluorooctanesulfonic acid	260398	4509932	9.57	0.0577	1.1590	0.477	0.5	2.97	2.9	Match

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

Stage 3 / 4
PFAS LCS

SDG #: 410-33044-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/17/2021
Page: 3
Validated by: SPR

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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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 #:	410-33044-1	Date:	5/17/2021
Lab:	Eurofins Lancaster	Page:	4
Project:	Aberdeen Proving Ground	Validated by:	SPR

Method: EPA modified 537 per DoD QSM 5.3

MS/MSD Sample ID	APG-P1-12-2-GW-031821
ANALYTE	Perfluorotetradecanoic acid
REPORTED MS %R	92
REPORTED MSD %R	92
REPORTED RPD	2

Page 453 - 454 SDG 410-32859-1

$$\%R = \frac{100 * (\text{MS Conc} - \text{Sample Conc})}{\text{MS TV}} \qquad RPD = \frac{100 * |\ \text{MS \%R} - \text{MSD \%R}}{\text{Average of MS MSD \%R}}$$

Sample Concentration	0			
MS Concentration	229	MS %R	91.60	MATCH
MSD Concentration	233	MSD %R	91.37	MATCH
MS TV	250	RPD	1.73	MATCH
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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Final Volume mls	Sample Volume mls	Final Calculated ng/L	Reported Value ng/L	
Perfluorobutanoic acid	15509554	4901908	10	3.163983	0.9387	33.71	1	25.4	1327.0	1300	Match
Perfluoropentanoic acid	9388058	531415	10	17.66615	1.0870	162.52	1	25.4	6398.5	6400	Match
Perfluorobutanesulfonic acid	6273939	4249057	9.36	1.476549	1.1300	12.23	1	25.4	481.5	480	Match
Perfluorohexanoic acid	6533922	564657	10	11.57149	0.9490	121.93	1	25.4	4800.5	4800	Match
Perfluoroheptanoic acid	20427652	5836504	10	3.499981	1.1220	31.19	1	25.4	1228.1	1200	Match
Perfluorohexanesulfonic acid	34729173	3899150	9.46	8.906857	1.0680	78.89	1	25.4	3106.1	3100	Match
Perfluorooctanesulfonic acid	6846366	461792	9.57	14.82565	1.1590	122.42	1	25.4	4819.6	4800	Match

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 #:	410-33044-1	Date:	5/17/2021
Lab:	Eurofins Lancaster	Page:	6
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: 410-32859-2

EIS 13C4 PFBA

REPORTED EIS %R 80

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

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

[redacted]

eurofins | Lancaster Laboratories Environmental

For Eurofins Lancaster Laboratories Envir

Acct. # ______ Group # ______ Sample # ______

410-33044 Chain of Custody

COC # 616540

Client Information		Matrix	Analysis Requested	For Lab Use Only
Client: ARCADIS	Acct. #:	☐ Tissue ☒ Ground ☐ Surface	Preservation and Filtration Codes	FSC: ______ SCR#: ______
Project Name/#: APG PFAS SI	PWSID #:	☐ Sediment ☐ Potable ☐ NPDES		
Project Manager: Keith Shepherd	P.O. #: 30001996.3BX50	☐ Soil / Water / Other:		
Sampler: Dale Lynch	Quote #:			
State where samples were collected: MD	For Compliance: Yes ☐ No ☐			

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil	Water	Other	Total # of Containers	PFAS (1?3)	Remarks
APG-P1-12-2-GW-031821 MS/MSD	3/18/21	1030	X			GW		6	X	MS/MSD
APG-DUP-08-031821		1200	X			GW		2	X	
~~APG-CASEY YARD-1-GW-031821~~						~~GW~~		~~2~~	~~X~~	
APG-BLDG-2200-1-GW-031821		1250	X			GW		2	X	

Turnaround Time (TAT) Requested (please circle)

(Standard) Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: ______

E-mail address: Matthew.Blow@ARCADIS.com Keith.Shepherd@ARCADIS.com

Relinquished by	Date	Time	Received by	Date	Time
[signature]	3/19/21	0700	[signature]	3/19/21	15:20
[signature]	3/19/21	16:43			
			[signature]	3/19/21	17:17

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

EDD Required? Yes No
If yes, format: ______

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS ____ FedEx ____ Other X

Temperature upon receipt 1.1 °C

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.
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.

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
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

Client: ARCADIS U.S., Inc.
Project/Site: Aberdeen Proving Ground PFAS S1

Job ID: 410-33044-1

Client Sample ID: APG-P1-12-2-GW-031821
Date Collected: 03/18/21 10:30
Date Received: 03/19/21 17:17

Lab Sample ID: 410-33044-1
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	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

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*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*

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	7900	~~D~~ DJ	490	390	390	ng/L		03/30/21 14:18	10
Perfluorohexanoic acid	4800	D	200	98	98	ng/L		03/30/21 14:18	10
Perfluorooctanesulfonic acid	4800	D	200	98	98	ng/L		03/30/21 14:18	10
Perfluoropentanoic acid	6400	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*

Client Sample ID: APG-DUP-08-031821
Lab Sample ID: 410-33044-2
Date Collected: 03/18/21 12:00
Matrix: Water
Date Received: 03/19/21 17:17

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	4200	~~D~~ DJ	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 D~~ 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*	*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) - PFAS 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*	*Qualifier*	*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*

Client Sample ID: APG-BLDG-2200-1-GW-031821
Lab Sample ID: 410-33044-3
Date Collected: 03/18/21 12:50
Matrix: Water
Date Received: 03/19/21 17:17

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	19		5.2	4.1	4.1	ng/L		03/25/21 09:21	1

Client: ARCADIS U.S., Inc.
Project/Site: Aberdeen Proving Ground PFAS S1

Job ID: 410-33044-1

Client Sample ID: APG-BLDG-2200-1-GW-031821
Date Collected: 03/18/21 12:50
Date Received: 03/19/21 17:17

Lab Sample ID: 410-33044-3
Matrix: Water

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

Analyte	Result	Qualifier	LOQ	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*	*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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For Eurofins Lancaster Laboratories Environmental use only

Acct. # _____ Group # _____ Sample # _____

410-33045 Chain of Custody

6541

Client Information

Client: ARCADIS	Acct. #:
Project Name/#: APG PFAS SI	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.38x50
Sampler: Dale Lynch	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☐

Matrix

Soil ☒ Sediment ☐ Tissue ☐ | Water ☑ Potable ☐ Ground ☐ NPDES ☐ Surface ☐ | Other: ____

Analysis Requested

Preservation and Filtration Codes

Sample Identification	Collected Date	Collected Time	Grab	Composite	Total # of Containers	PFAS (170)	moisture (27)	Grain Size (33)	pH, TOC (34)	PFAS (173)
APG-BLDG-E4040-1-SO-(0-2)-031921	3/19/21	0900		X	4	X	X	X	X	
APG-BLDG-E4040-1-GW-031921		0940	X		2					X
APG-G-Street-1-SO-(0-2)-031921		1030		X	4	X	X	X	X	
APG-G-Street-1-GW-031921		1110	X		2					X
APG-CASEY-YARD-1-GW-031921		1200	X		2					X

For Lab Use Only

FSC: _____

SCR#: _____

Preservation Codes

H=HCl	T=Thiosulfate
N=HNO_3	B=NaOH
S=H_2SO_4	P=H_3PO_4
F=Field Filtered	O=Other

Remarks

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: Matthew.Blower@ARCADIS.com Keith.Shepherd@ARCADIS.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) | Type VI (Raw Data Only)

Type III (Reduced non-CLP) | NJ DKQP | TX TRRP-13

NYSDEC Category A or B | MA MCP | CT RCP

	Date	Time		Date	Time
Relinquished by	3/19/21	1500	Received by	3/19/21	15:20
Relinquished by	3/19/21	16:43	Received by		
Relinquished by			Received by		
Relinquished by			Received by		
Relinquished by			Received by	31921	17:17

EDD Required? Yes No

If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other X

Temperature upon receipt 1.1 °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.

7044 0919

CS CB

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-33045-1
Project/Site: Aberdeen Proving Ground PFAS S1

Qualifiers

LCMS

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.

General Chemistry

Qualifier	Qualifier Description
FL	MS and/or MSD recovery below control limits.

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
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

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

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	<0.0017		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		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*	*Qualifier*	*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*

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	<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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 16:02	1
Perfluorononanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 16:02	1
Perfluorooctanesulfonic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 16:02	1
Perfluorooctanoic acid	<0.00044	M	0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 16:02	1
Perfluoropentanoic acid	<0.00044	M	0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 16:02	1
Perfluorotetradecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 16:02	1
Perfluorotridecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 16:02	1
Perfluoroundecanoic acid	<0.00044		0.00066	0.00044	0.00044	mg/Kg	☼	03/24/21 16:02	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*87*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
M2-8:2 FTS	*77*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C2 PFTeDA	*69*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C3 PFBS	*82*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C4 PFBA	*78*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C4 PFHpA	*88*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C5 PFPeA	*79*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C8 PFOA	*87*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C8 PFOS	*89*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
d3-NMeFOSAA	*21*	*5-	*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
d5-NEtFOSAA	*25*	*5-	*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C2-PFDoDA	*79*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C3 PFHxS	*92*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C5 PFHxA	*80*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C6 PFDA	*85*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C7 PFUnA	*80*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*
13C9 PFNA	*82*		*50 - 150*	*03/23/21 20:31*	*03/24/21 16:02*	*1*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	**4320**	J-	2450	1640	1640	mg/Kg	☼	03/24/21 18:25	7.37
Percent Moisture	**9.9**		1.0		1.0	%		03/20/21 09:30	1
Percent Solids	**90.1**		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	**7.0**	J	0.01	0.01	0.01	S.U.		03/23/21 19:22	1
Temperature	**19.6**		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
Gravel	**6.1**		1.0	1.0	1.0	%		03/23/21 01:00	1
Sand	**45.0**		1.0	1.0	1.0	%		03/23/21 01:00	1
Silt	**34.0**		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**		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
4.75 mm	**93.9**		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
3.35 mm	**93.7**		1.0	1.0	1.0	% Passing		03/23/21 01:00	1
2.36 mm	**93.6**		1.0	1.0	1.0	% Passing		03/23/21 01:00	1

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**

Method: D422 - Grain Size (Continued)

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

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	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

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*

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	Analyzed	Dil Fac
13C5 PFHxA	85		50 - 150	03/24/21 07:53	03/25/21 09:32	1
13C6 PFDA	79		50 - 150	03/24/21 07:53	03/25/21 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) - PFAS for QSM 5.3, Table B-15

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0017		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	M	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	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

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

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Total Organic Carbon	1580	~~FL~~ 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
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
Lab Sample ID: 410-33045-4
Date Collected: 03/19/21 11:10
Matrix: Water
Date Received: 03/19/21 17:17

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	<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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	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**	**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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*118*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
M2-8:2 FTS	*87*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C2 PFTeDA	*63*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C3 PFBS	*74*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C4 PFBA	*52*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C4 PFHpA	*81*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C5 PFPeA	*69*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C8 PFOA	*88*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C8 PFOS	*84*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
d3-NMeFOSAA	*85*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
d5-NEtFOSAA	*88*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C2-PFDoDA	*75*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C3 PFHxS	*81*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C5 PFHxA	*72*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C6 PFDA	*82*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C7 PFUnA	*80*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*
13C9 PFNA	*87*		*50 - 150*	*03/25/21 17:17*	*03/27/21 15:09*	*1*

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

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	<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

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	Qualifier	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 Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-WES-M09-032021	410-33396-1	Water	3/20/2021		X		
APG-WES-M14-032021	410-33396-2	Water	3/20/2021		X		
APG-WES-M17-032021	410-33396-3	Water	3/20/2021		X		
APG-WES-M18-032021	410-33396-4	Water	3/20/2021		X		
APG-WES-M21-032021	410-33396-5	Water	3/20/2021		X		

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.

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

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, $r^2 \geq 0.99$. 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
APG-WES-M21-032021	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%**
	d5-NEtFOSAA	NEtFOSAA	< 20%	**< 50% but > 20%**
	13C2 PFDoDA	Perfluorododecanoic acid	< 20%	**< 50% but > 20%**
		Perfluorotridecanoic acid		
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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.

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	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
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		X		X	
LCS/LCSD Precision (RPD)		X		X	
Matrix Spike (MS) %R	X				X
Matrix Spike Duplicate (MSD) %R	X				X
MS/MSD Precision (RPD)	X				X
Field Duplicate (RPD)	X				X
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content	X				X
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X		X	
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 30728

Perfluoropentanoic acid 3/30/2021 Calibration Page 899 - 912 of SDG 410-33396-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.2	161692	6144800	10	0.026314	1.3156816	1.087	0.242076	0.2	21.038	21	Match
0.5	285606	5038151	10	0.056689	1.1337731	1.087	0.521515	0.5	4.303	4.3	Match
2	1305889	5619070	10	0.232403	1.1620152	1.087	2.138023	2	6.901	6.9	Match
8	4785784	5687564	10	0.841447	1.0518088	1.087	7.741003	8	-3.237	-3.2	Match
20	13053657	6579917	10	1.983863	0.9919317	1.087	18.25081	20	-8.746	-8.7	Match
50	31852513	6422817	10	4.959275	0.9918549	1.087	45.6235	50	-8.753	-8.7	Match
100	47712199	4961671	10	9.616155	0.9616155	1.087	88.46509	100	-11.535	-11.5	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 #: 410-33396-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/17/2021
Page: 2
Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-108787/9 3/30/2021 12:06 Page 1137 - 1142 of SDG 410-33396-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	1178996	6528415	10	0.1806	0.9387	1.924	2	-3.81	-3.8	Match
Perfluoropentanoic acid	1317911	6070621	10	0.2171	1.0870	1.997	2	-0.14	-0.1	Match
Perfluorobutanesulfonic acid	1107148	5188592	9.36	0.2134	1.1300	1.767	2	-0.14	0	Match
Perfluorohexanoic acid	1160334	6250885	10	0.1856	0.9490	1.956	2	-2.20	-2.2	Match
Perfluoroheptanoic acid	1497399	7343740	10	0.2039	1.1220	1.817	2	-9.13	-9.2	Match
Perfluorohexanesulfonic acid	947593	5078847	9.46	0.1866	1.0680	1.653	2	-12.56	-12.6	Match
Perfluorooctanesulfonic acid	1037374	5236571	9.57	0.1981	1.1590	1.636	2	-14.36	-14.5	Match

CCV 410-109847/19 4/01/2021 14:33 Page 1213 - 1218 of SDG 410-33396-1

Compounds	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluorobutanoic acid	4412153	6141623	10	0.7184	0.9387	7.653	8.0	-4.34	-4.3	Match
Perfluoropentanoic acid	4704340	5739454	10	0.8196	1.0870	7.540	8.0	-5.74	-5.7	Match
Perfluorobutanesulfonic acid	4037836	5286268	9.36	0.7638	1.1300	6.327	7.1	-10.64	-10.6	Match
Perfluorohexanoic acid	4089632	5725133	10	0.7143	0.9490	7.527	8.0	-5.91	-5.9	Match
Perfluoroheptanoic acid	5791697	6849129	10	0.8456	1.1220	7.537	8.0	-5.79	-5.8	Match
Perfluorohexanesulfonic acid	3580570	4570733	9.46	0.7834	1.0680	6.939	7.3	-4.95	-4.9	Match
Perfluorooctanesulfonic acid	4008014	4805724	9.57	0.8340	1.1590	6.887	7.4	-7.06	-7.1	Match

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

Stage 3 / 4
PFAS LCS

SDG #: 410-33396-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/17/2021
Page: 3
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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent Recovery	
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

Compounds	LCS Calc Amount	LCSD Calc Amount	LCS/LCSD Calc RPD	Reported LCS/LCSD 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

SDG #: 410-33396-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/17/2021
Page: 4
Validated by: SPR

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

Compounds	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Final Volume mls	Sample Volume mls	Final Calculated ng/L	Reported Value ng/L	
Perfluorobutanoic acid	3239713	2177508	10	1.487808	0.9387	15.85	1	297.1	53.3	53	Match
Perfluoropentanoic acid	2092464	3081671	10	0.679003	1.0870	6.25	1	297.1	21.0	21	Match
Perfluorobutanesulfonic acid	1009973	3171031	9.36	0.3185	1.1300	2.64	1	297.1	8.9	8.9	Match
Perfluorohexanoic acid	3809882	3678569	10	1.035697	0.9490	10.91	1	297.1	36.7	37	Match
Perfluoroheptanoic acid	2485680	4813654	10	0.516381	1.1220	4.60	1	297.1	15.5	15	Match
Perfluorohexanesulfonic acid	1810839	3482132	9.46	0.520037	1.0680	4.61	1	297.1	15.5	16	Match
Perfluorooctanesulfonic acid	4628748	3807558	9.57	1.215674	1.1590	10.04	1	297.1	33.8	34	Match

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 #: 410-33396-1 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

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

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

Environmental Analysis Request/Chain of

eurofins | Lancaster Laboratories Environmental

For Eurofins Lancaster Laboratories Environ

Acct. # _____ Group # _____ Sample # _____

410-33396 Chain of Custody

COC # 616570

Client Information

Client: ARCADIS	Acct. #:
Project Name/#: APG PFAS S1	PWSID #:
Project Manager: Keith Shepherd	P.O. #: 30001996.38X50
Sampler: Dale Lynch	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☐

For Lab Use Only
FSC: _____
SCR#: _____

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Remarks

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix: Soil	Sediment	Tissue	Water: Potable	Ground	Surface	NPDES	Other:	Total # of Containers	Preservation and Filtration Codes: PFAS (123)	Remarks
APG-WES-MW09-032021	3/20/21	0820	X					GW					2	X	0820
APG-WES-MW14-032021		1100	X					GW					2	X	
APG-WES-MW17-032021		1030	X					GW					2	X	
APG-WES-MW18-032021		1005	X					GW					2	X	
APG-WES-MW21-032021		0945	X					GW					2	X	

Turnaround Time (TAT) Requested (please circle)
Standard Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: Matthew.Blower@ARCADIS.com
Keith.Shepherd@ARCADIS.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP)	Type VI (Raw Data Only)	
Type III (Reduced non-CLP)	NJ DKQP	TX TRRP-13
NYSDEC Category A or B	MA MCP	CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	3/22/21	0700		3/23/21	12:46
	3/23/21	1815			

EDD Required? Yes No
If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS _____ FedEx _____ Other X

Temperature upon receipt -0.2 °C

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 410-33396-1
Project/Site: Aberdeen Proving Ground PFAS S1

Qualifiers

LCMS

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.

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
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

Client Sample ID: APG-WES-M09-032021
Lab Sample ID: 410-33396-1

Date Collected: 03/20/21 08:20
Matrix: Water

Date Received: 03/23/21 18:20

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		4.2	3.4	3.4	ng/L		04/01/21 21:02	1
8:2 Fluorotelomer sulfonic acid	<1.7		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	M	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*	*Qualifier*	*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-	*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*

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	<3.5		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		1.7	0.87	0.87	ng/L		03/27/21 12:01	1
Perfluoroheptanoic acid	**18**		1.7	0.87	0.87	ng/L		03/27/21 12:01	1
Perfluorohexanesulfonic acid	**17**		1.7	0.87	0.87	ng/L		03/27/21 12:01	1

Client Sample ID: APG-WES-M09-032021
Lab Sample ID: 410-33396-1
Date Collected: 03/20/21 08:20
Matrix: Water
Date Received: 03/23/21 18:20

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanoic acid	**44**		1.7	0.87	0.87	ng/L		03/27/21 12:01	1
Perfluorononanoic acid	**3.9**		1.7	0.87	0.87	ng/L		03/27/21 12:01	1
Perfluorooctanesulfonic acid	**38**		1.7	0.87	0.87	ng/L		03/27/21 12:01	1
Perfluorooctanoic acid	**57**	**M**	1.7	0.87	0.87	ng/L		03/27/21 12:01	1
Perfluoropentanoic acid	**22**	**M**	1.7	0.87	0.87	ng/L		03/27/21 12:01	1
Perfluorotetradecanoic acid	<0.87		1.7	0.87	0.87	ng/L		03/27/21 12:01	1
Perfluorotridecanoic acid	<0.87		1.7	0.87	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*	*Qualifier*	*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*	*1*

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

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		03/27/21 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

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

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

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*

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	<3.4		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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
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*

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

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

Isotope Dilution	%Recovery	Qualifier	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 08:23	04/01/21 21:13	1
13C7 PFUnA	80		50 - 150	04/01/21 08:23	04/01/21 21:13	1
13C9 PFNA	84		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
Date Collected: 03/20/21 10:30
Matrix: Water
Date Received: 03/23/21 18:20

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		4.4	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	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

Client Sample ID: APG-WES-M17-032021
Lab Sample ID: 410-33396-3

Date Collected: 03/20/21 10:30
Matrix: Water
Date Received: 03/23/21 18:20

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

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C9 PFNA	85		50 - 150	04/01/21 08:23	04/01/21 21:24	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
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**	**M**	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

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

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	<3.8		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		1.9	0.94	0.94	ng/L		04/01/21 21:35	1
Perfluorooctanesulfonic acid	**1.0**	**J M**	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*	*Qualifier*	*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*	*04/01/21 21:35*	*1*
13C2 PFTeDA	*77*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C3 PFBS	*68*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C4 PFBA	*66*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C4 PFHpA	*79*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C5 PFPeA	*73*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C8 PFOA	*85*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C8 PFOS	*77*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
d3-NMeFOSAA	*77*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
d5-NEtFOSAA	*83*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C2-PFDoDA	*82*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C3 PFHxS	*77*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C5 PFHxA	*74*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C6 PFDA	*82*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C7 PFUnA	*86*		*50 - 150*	*04/01/21 08:23*	*04/01/21 21:35*	*1*
13C9 PFNA	*82*		*50 - 150*	*04/01/21 08:23*	*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

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	<3.6		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	1
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	1
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

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorododecanoic 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
Perfluorotridecanoic 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*	*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 for QSM 5.3, Table B-15 - RE

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

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

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

Analyte	Result	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*

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	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-BLDG-E5005-1-GW-042221	410-37146-1	Water	4/22/2021		X		
APG-BLDG-E5005-1-SO-042221	410-37146-2	Soil	4/22/2021		X		
APG-BLDG-E5005-2-SO-042221	410-37146-3	Soil	4/22/2021		X		
APG-BLDG-E5005-3-SO-042221	410-37146-4	Soil	4/22/2021		X		
APG-SB-2-042221	410-37146-5	Water	4/22/2021		X		

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.

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

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, $r^2 \geq 0.99$. 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-SO-042221	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 50% but > 20%
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	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	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
C. Source blanks		X		X	
Laboratory Control Sample (LCS) %R		X		X	
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	X				X
MS/MSD Precision (RPD)	X				X
Field Duplicate (RPD)	X				X
Extracted Internal Standard %R		X	X		
Injection Internal Standard %R		X		X	
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	

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		X		X	
E. Transcription/calculations acceptable		X		X	
F. Reporting limits adjusted to reflect sample dilutions		X		X	

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 #: 410-37146-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/18/2021
Page: 1
Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Instrument ID: 29347

PFOS 4/27/2021 Calibration

Page 750 - 765 of SDG 410-37146-1

Cal Conc ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.1851	105782	4567586	9.565	0.023159	1.1967504	1.0568	0.209613	0.1851	13.243	13.2	Match
0.46275	247647	4572168	9.565	0.054164	1.1195653	1.0568	0.490234	0.46275	5.939	5.9	Match
1.851	961549	4422834	9.565	0.217406	1.1234386	1.0568	1.967718	1.851	6.306	6.3	Match
7.404	3131270	3888004	9.565	0.805367	1.0404288	1.0568	7.289303	7.404	-1.549	-1.5	Match
18.51	8781415	4240475	9.565	2.070856	1.0701103	1.0568	18.74313	18.51	1.259	1.3	Match
46.275	18512854	4223575	9.565	4.383219	0.9060073	1.0568	39.67211	46.275	-14.269	-14.3	Match
92.55	36279476	3984169	9.565	9.105908	0.9410914	1.0568	82.41674	92.55	-10.949	-10.9	Match

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
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/18/2021
Page: 2
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	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluoropentanoic acid	644572	3165916	10	0.2036	1.0270	1.982	2	-0.88	-0.9	Match
Perfluorohexanoic acid	615425	3951467	10	0.1557	0.8612	1.808	2	-9.58	-9.6	Match
Perfluoroheptanoic acid	776228	3475935	10	0.2233	1.1200	1.994	2	-0.31	-0.3	Match
Perfluorooctanoic acid	730753	4181822	10	0.1747	0.9046	1.932	2	-3.41	-3.4	Match
Perfluorooctanesulfonic acid	749384	4201064	9.57	0.1784	1.0570	1.615	2	-15.44	-15.6	Match
Perfluorononanoic acid	657053	3808288	10	0.1725	0.9553	1.806	2	-9.70	-9.7	Match

CCVIS 410-120060/1 4/28/2021 13:07

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Analyte	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
Perfluoropentanoic acid	168494	3557133	10	0.0474	1.0270	0.461	0.5	-7.75	-7.8	Match
Perfluorohexanoic acid	208106	4576635	10	0.0455	0.8612	0.528	0.5	5.60	5.6	Match
Perfluoroheptanoic acid	229663	3938266	10	0.0583	1.1200	0.521	0.5	4.14	4.2	Match
Perfluorooctanoic acid	218565	4639391	10	0.0471	0.9046	0.521	0.5	4.16	4.2	Match
Perfluorooctanesulfonic acid	239845	4457704	9.57	0.0538	1.0570	0.487	0.46	5.21	5.2	Match
Perfluorononanoic acid	213442	4113826	10	0.0519	0.9553	0.543	0.5	8.62	8.6	Match

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

Stage 3 / 4
PFAS LCS

SDG #: 410-37146-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/18/2021
Page: 3
Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

LCS 410-119816/2-B

Page 1477 - 1482 of SDG 410-37146-1
Final volume = 4ml; Weight = 1.00 gm; TS = 100%
Extract: 2 mls concentrated to 1 ml

Analyte	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Dry Weight Value mg/kg	True Value mg/kg	Calculated Percent Recovery	Reported Percent 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

Analyte	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Dry Weight Value mg/kg	True Value mg/kg	Calculated Percent Recovery	Reported Percent 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	LCS Calc Amount	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 x (Calc amt ng/ml x 0.5)/ sample weight g) / 1000
Dry Weight Amount = [Calculated mg/kg / (TS/100)]

Stage 3 / 4
PFAS Sample Concentration

SDG #: 410-37146-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 5/18/2021
Page: 4
Validated by: SPR

Method: EPA modified 537 per DoD QSM 5.3

Page 715 - 719 of SDG 410-37146-1

Field Sample ID: APG-BLDG-E5005-2-SO-042221 Lab ID: 410-37146-3

TS=75.6%, FV= 4ml Sample Weight=1.02 g
Extract: 2 mls concentrated to 1 ml

Analyte	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Calculated mg/kg	Calculated Amount Dry Weight mg/kg	Reported Value mg/kg	
Perfluoropentanoic acid	122381	2594559	10	0.047168	1.0270	0.46	0.0009	0.00119	0.0012	Match
Perfluorohexanoic acid	85078	3601363	10	0.023624	0.8612	0.27	0.0005	0.00071	0.00071 J	Match
Perfluoroheptanoic acid	259692	3290915	10	0.078912	1.1200	0.70	0.0014	0.00183	0.0018	Match
Perfluorooctanoic acid	289698	3874428	10	0.074772	0.9046	0.83	0.0016	0.00214	0.0021	Match
Perfluorooctanesulfonic acid	1631503	3644522	9.57	0.447659	1.0570	4.05	0.0079	0.01051	0.01	Match
Perfluorononanoic acid	359050	3343212	10	0.107397	0.9553	1.12	0.0022	0.00292	0.0029	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 EIS

SDG #: 410-37146-1 Date: 5/18/2021
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-BLDG-E5005-2-SO-042221 Lab ID: 410-37146-3
EIS 13C8 PFOS
REPORTED EIS %R 85

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

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

410-37146 Chain of Custody

eurofins

Client Information	Sampler: Matthew Blower	Lab PM: Gordon, Stephen	COC No: 410-19163-6763 1
Client Contact: Mr. Dale Lynch / Matthew Blower	Phone: (703)-819-1240	E-Mail: Stephen.Gordon@eurofinset.com	MD
Company: ARCADIS U.S. Inc	PWSID:	Analysis Requested	Page: Page 1 of 2
Address: 7550 Teague Road Suite 210	Due Date Requested: 4/30/21		Job #:
City: Hanover	TAT Requested (days):		Preservation Codes:
State, Zip: MD, 21076	Compliance Project: Δ Yes Δ No		A - HCL; B - NaOH; C - Zn Acetate; D - Nitric Acid; E - NaHSO4; F - MeOH; G - Amchlor; H - Ascorbic Acid; I - Ice; J - DI Water; K - EDTA; L - EDA; M - Hexane; N - None; O - AsNaO2; P - Na2O4S; Q - Na2SO3; R - Na2S2O3; S - H2SO4; T - TSP Dodecahydrate; U - Acetone; V - MCAA; W - pH 4-5; Z - other (specify)
Phone:	PO #: D18-218 PFAS PA/SI		Other:
Email: dale.lynch@arcadis.com	WO #: 30001993.3CH20		
Project Name: Aberdeen Proving Ground	Project #: 41005401		
Site:	SSOW#:		

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	PFC_IDA_D5.3 - QSM5.1 Table B-15- 24 PFAS	PFC_IDA_D5.3 - (MOD) QSM5.1 Table B-15- 24 PFAS	Total Number of containers	Special Instructions/Note:
			Preservation Code:			N	N		
~~APG-IDW-WW-1~~ APG-IDW-SO-1	4/22/21	11:05	C	Solid		X		1	
~~Solid~~									
APG-IDW-WW-1	4/22/21	11:05	C	Water		X		2	
~~Water~~									
APG-BLDG-E5005-1-GW-042221	4/22/21	10:05	G	Water		X		2	Run as separate job
APG-BLDG-E5005-1-SO-042221	4/22/21	09:45	G	Soil		X		2	
APG-BLDG-E5005-2-SO-042221	4/22/21	09:00	G	Soil		X		2	
APG-BLDG-E5005-3-SO-042221	4/22/21	08:45	G	Soil		X		2	
APG-SB-2-042221	4/22/21	10:15	G	Water		X		2	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by	Date	Time	Method of Shipment

	Relinquished by	Date/Time	Company	Received by	Date/Time	Company
1	[signature]	4/21/21 12:35	EUROFINS	[signature] ~~17:25~~	4/21/21 17:25	Arcadis
2	[signature]	4/22/21 18:15	Arcadis	[signature]	4/23/21 15:00	ELLE
3	[signature]	4/23/21 17:30	ELLE	[signature]	4-23-21 1753	ELLE

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks: 1.9-2.5°C

KAM

Ver. 11/01/2020

Definitions/Glossary

Client: ARCADIS U.S., Inc.
Job ID: 410-37146-1
Project/Site: Aberdeen Proving Ground

Qualifiers

LCMS

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 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

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

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	<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*	*Qualifier*	*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

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	☼	04/28/21 14:10	1
8:2 Fluorotelomer sulfonic acid	<0.0016		0.0031	0.0016	0.0016	mg/Kg	☼	04/28/21 14:10	1
NEtFOSAA	<0.00041	UJ	0.0020	0.00041	0.00041	mg/Kg	☼	04/28/21 14:10	1
NMeFOSAA	<0.00041	UJ	0.0020	0.00041	0.00041	mg/Kg	☼	04/28/21 14:10	1
Perfluorobutanesulfonic acid	<0.0016		0.0020	0.0016	0.0016	mg/Kg	☼	04/28/21 14:10	1
Perfluorobutanoic acid	<0.0016		0.0020	0.0016	0.0016	mg/Kg	☼	04/28/21 14:10	1
Perfluorodecanoic acid	<0.00041		0.00061	0.00041	0.00041	mg/Kg	☼	04/28/21 14:10	1

Client Sample ID: APG-BLDG-E5005-1-SO-042221
Date Collected: 04/22/21 09:45
Date Received: 04/23/21 17:53

Lab Sample ID: 410-37146-2
Matrix: Solid
Percent Solids: 92.3

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	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	M	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*93*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
M2-8:2 FTS	*88*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C2 PFTeDA	*89*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C3 PFBS	*95*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C4 PFBA	*82*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C4 PFHpA	*84*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C5 PFPeA	*82*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C8 PFOA	*91*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C8 PFOS	*87*	*M*	*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
d3-NMeFOSAA	*29*	**5-*	*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
d5-NEtFOSAA	*35*	**5-*	*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C2-PFDoDA	*80*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C3 PFHxS	*87*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C5 PFHxA	*84*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C6 PFDA	*88*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C7 PFUnA	*93*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*
13C9 PFNA	*83*		*50 - 150*	*04/27/21 23:09*	*04/28/21 14:10*	*1*

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	<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	M	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	☼	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	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 - RE (Continued)

Analyte	Result	Qualifier	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	D	Analyzed	Dil Fac
Percent Moisture	**7.7**		1.0		1.0	%		04/24/21 14:43	1
Percent Solids	**92.3**		1.0		1.0	%		04/24/21 14:43	1

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

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	<0.0021		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

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

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

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

Lab Sample ID: 410-37146-4

Date Collected: 04/22/21 08:45
Matrix: Solid
Date Received: 04/23/21 17:53
Percent Solids: 82.3

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	☼	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**	**J M**	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	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	93		50 - 150	04/27/21 23:09	04/28/21 14:31	1
M2-8:2 FTS	93		50 - 150	04/27/21 23:09	04/28/21 14:31	1
13C2 PFTeDA	95		50 - 150	04/27/21 23:09	04/28/21 14:31	1

Client Sample ID: APG-BLDG-E5005-3-SO-042221

Lab Sample ID: 410-37146-4

Date Collected: 04/22/21 08:45
Matrix: Solid
Date Received: 04/23/21 17:53
Percent Solids: 82.3

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

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
13C5 PFHxA	85		50 - 150	04/27/21 23:09	04/28/21 14:31	1
13C6 PFDA	88		50 - 150	04/27/21 23:09	04/28/21 14:31	1
13C7 PFUnA	97		50 - 150	04/27/21 23:09	04/28/21 14:31	1
13C9 PFNA	86		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

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

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	<3.6		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	Qualifier	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

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

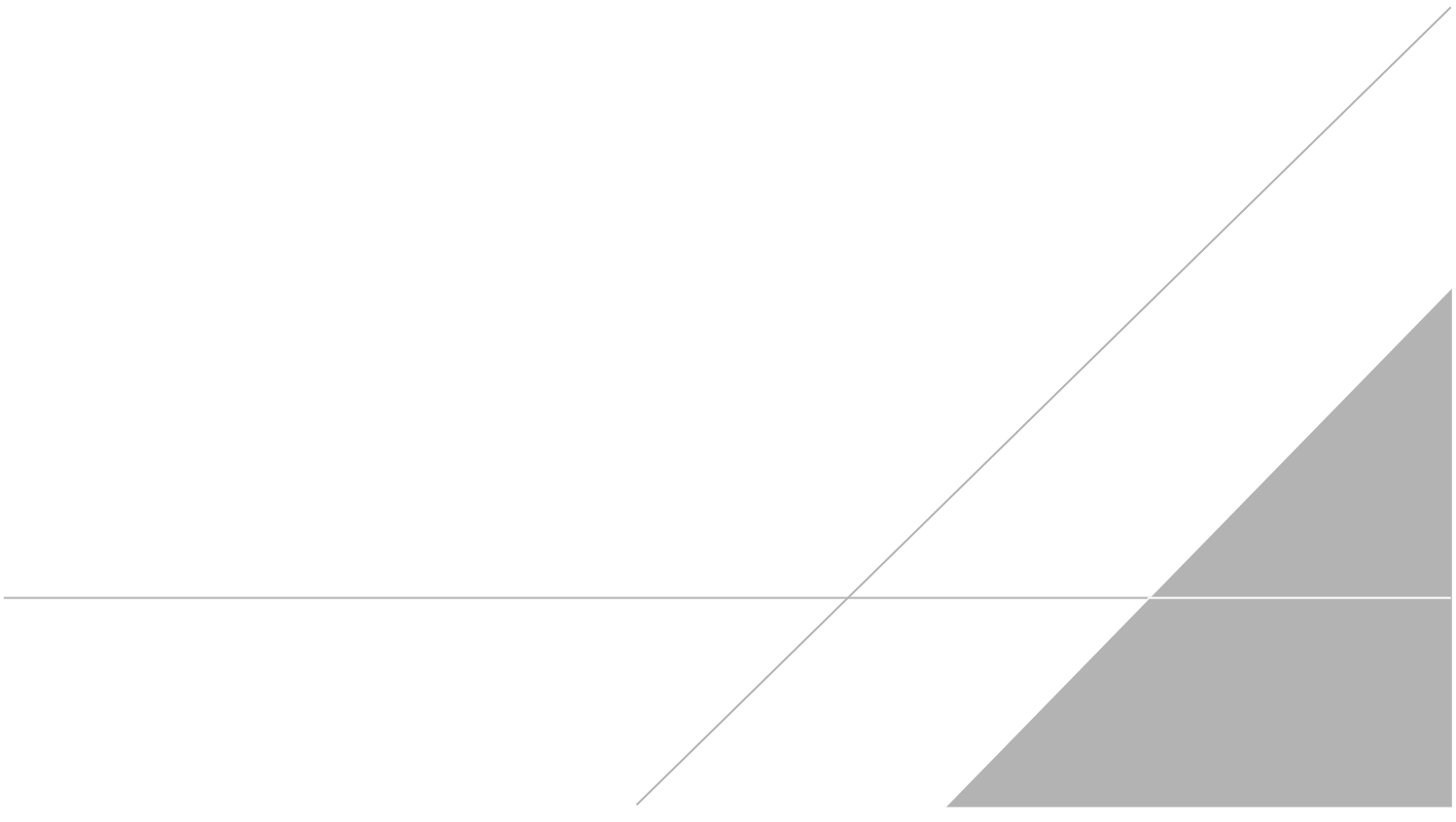
Job ID: 410-37146-1

Client Sample ID: APG-SB-2-042221
Date Collected: 04/22/21 10:15
Date Received: 04/23/21 17:53

Lab Sample ID: 410-37146-5
Matrix: Water

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

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

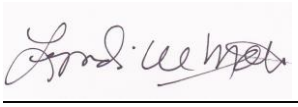
March 22, 2022

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



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Our Ref.:

Contract W912DR-13-D-0019
Arcadis Project: 30001975

Date: March 22, 2022

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CONTENTS

TABLES

ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

%D	percent difference
%R	percent recovery
APG	Aberdeen Proving Ground
Arcadis	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 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

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.

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.

DATA USABILITY SUMMARY TABLE

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 APG-E4-1-SO-(0.5-2)-121621	All target PFAS compounds	UJ non-detects J detects	Temperature Exceedance.
	N-MeFOSAA N-EtFOSAA	UJ	Extracted Internal Standard (EIS) %R less than 50%
APG-FD-1-SO-(0.5-2)-121621 APG-S3-1-SO-(0.5-2)-121621	All target PFAS compounds	UJ non-detects J detects	Temperature Exceedance.
	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 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	TOC	J-	Temperature Exceedance.
	pH	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.

DATA VALIDATION REPORTS

Aberdeen Proving Ground – Edgewood PFAS PA/SI

DATA REVIEW

Aberdeen Proving Ground, Maryland

Perfluoroalkyl 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:

Sample ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis		
					PFAS	TOC	pH
APG-ATC1-1-SO-(0.5-2)-121621	410-67825-1	Soil	12/16/2021		X	X	X
APG-ATC1-1-GW-121521	410-67825-2	Water	12/15/2021		X		
APG-ATC2-1-SO-(0.5-2)-121621	410-67825-3	Soil	12/16/2021		X	X	X
APG-ATC2-1-GW-121521	410-67825-4	Water	12/15/2021		X		
APG-S1A-1-SO-(0.5-2)-121621	410-67825-5	Soil	12/16/2021		X	X	X
APG-S1A-1-GW-121521	410-67825-6	Water	12/15/2021		X		
APG-FD-1-SO-(0.5-2)-121621	410-67825-7	Soil	12/16/2021	APG-S1A-1-SO-(0.5-2)-121621	X		
APG-FD-1-GW-121521	410-67825-8	Water	12/15/2021	APG-ATC2-1-GW-121521	X		
APG-S3-1-SO-(0.5-2)-121621	410-67825-9	Soil	12/16/2021		X	X	X
APG-S3-1-GW-121521	410-67825-10	Water	12/15/2021		X		
APG-E3-1-SO-(0.5-2)-121621	410-67825-11	Soil	12/16/2021		X	X	X
APG-E3-1-GW-121621	410-67825-12	Water	12/16/2021		X		
APG-E4-1-GW-121621	410-67825-13	Water	12/16/2021		X		
APG-E4-1-SO-(0.5-2)-121621	410-67825-14	Soil	12/16/2021		X	X	X
APG-FB-1-121621	410-67825-15	Water	12/16/2021		X		
APG-FF3-1-GW-013122	410-71439-1	Water	1/31/2022		X		
APG-FF2-1-GW-013122	410-71439-2	Water	1/31/2022		X		

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.

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

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.

Criteria	Qualification	
	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, $r^2 \geq 0.99$. 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)-121621	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 50% but > 20%
	d5-NEtFOSAA	NEtFOSAA	**< 50% but > 20%**	< 50% but > 20%
APG-S1A-1-SO-(0.5-2)-121621	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 20%
	d5-NEtFOSAA	NEtFOSAA	**< 50% but > 20%**	< 20%
APG-E4-1-SO-(0.5-2)-121621	d3-NMeFOSAA	NMeFOSAA	**< 50% but > 20%**	< 20%
	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
> 150%	Non-detect	No Action
	Detect	J-
< 50% but > 20%	Non-detect	UJ
	Detect	J+
< 20%	Non-detect	UX
	Detect	X

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	Perfluorooctanoic 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	Perfluorooctanesulfonic 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	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS/MS)					
Stage 2 Validation					
Holding times/Temperature		X	X		
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
C. Field blanks		X		X	
Laboratory Control Sample (LCS) %R		X		X	
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		X		X	
MS/MSD Precision (RPD)		X		X	
Field Duplicate (RPD)		X		X	
Extracted Internal Standard %R		X	X		
Dilution Factor		X		X	
Moisture Content		X		X	
Stage 3/4 Validation					
Instrument tune and performance check		X		X	
Initial calibration %RSDs		X		X	
Continuing calibration %Ds		X		X	
Instrument sensitivity check		X		X	
Ion transitions used		X		X	
Compound identification and quantitation					
A. Reconstructed ion chromatograms		X		X	
B. Quantitation Reports		X		X	
C. RT of sample compounds within the established RT windows		X		X	
D. Ion Ratio %R		X	X		

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

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.

Criteria	Qualification
	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.

Criteria	Qualification	
	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 ± 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 APG-E3-1-SO-(0.5-2)-121621 APG-E4-1-SO-(0.5-2)-121621	CCV	Soil pH	7.12 SU	7.0 SU

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
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

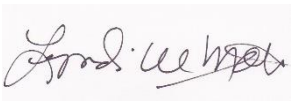
Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

DATA VALIDATION CHECKLIST FOR GENERAL CHEMISTRY

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

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 ng/ml	Std Area	EIS Area	EIS Conc	Area Ratio	Calculated RF	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
0.185	128447	5858702	9.565	0.021924	1.1335373	1.0881	0.192725	0.185	4.176	4.1	Match
0.463	321026	6253141	9.565	0.051338	1.0605862	1.0881	0.451293	0.463	-2.529	-2.5	Match
1.85	1381266	6172606	9.565	0.223774	1.1569698	1.0881	1.967093	1.85	6.329	6.3	Match
7.4	4970854	6025433	9.565	0.824979	1.0663407	1.0881	7.252019	7.4	-2.000	-2.1	Match
18.5	11932407	5576512	9.565	2.139762	1.1063146	1.0881	18.80969	18.5	1.674	1.6	Match
46.3	30748713	5876435	9.565	5.232545	1.0809783	1.0881	45.99696	46.3	-0.655	-0.6	Match
92.6	50682533	5168573	9.565	9.805904	1.0128885	1.0881	86.19932	92.6	-6.912	-6.9	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 #: 410-67825-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 2/23/2022
Page: 2
Validated by: LWM

Method: EPA modified 537 per DoD QSM 5.3

ICV 410-209082/9 12/27/2021 11:22 Page 1342 - 1354 of SDG 410-67825-1

Analyte	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
PFBS	1277113	6368294	9.36	0.2005	1.0807	1.737	1.77	-1.87	-1.9	Match
PFOS	1138980	5792427	9.57	0.1966	1.0881	1.729	1.85	-6.52	-6.6	Match
PFOA	1191364	7306293	10	0.1631	0.8551	1.907	2.0	-4.65	-4.7	Match

CCVIS 410-210527/1 12/30/2021 10:23 Page 1356 - 1373 of SDG 410-67825-1

Analyte	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calc Amount	Tvalue	Calculated % D	Reported % D	
PFBS	339036	6183082	9.36	0.0548	1.0807	0.475	0.443	7.20	7.3	Match
PFOS	323533	5801981	9.57	0.0558	1.0881	0.490	0.463	5.93	5.9	Match
PFOA	310191	7262331	10	0.0427	0.8551	0.500	0.50	-0.10	-0.1	Match

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

Stage 3 / 4
PFAS LCS

SDG #: 410-67825-1
Lab: Eurofins Lancaster
Project: Aberdeen Proving Ground

Date: 2/23/2022
Page: 3
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

Analyte	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Calculated ng/L	True Value ng/L	Calculated Percent Recovery	Reported Percent 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) x DF x 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

Analyte	Std Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Dry Weight Value mg/kg	True Value mg/kg	Calculated Percent Recovery	Reported Percent 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

$$\%R = \frac{100 * (\text{MS Conc} - \text{Sample Conc})}{\text{MS TV}} \qquad RPD = \frac{100 * |\text{MS \%R} - \text{MSD \%R}|}{\text{Average of MS MSD \%R}}$$

Sample Concentration	0.96			
MS Concentration	20.2	MS %R	97.17	MATCH
MSD Concentration	20.2	MSD %R	98.16	MATCH
MS TV	19.8	RPD	0.00	MATCH
MSD TV	19.6			

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

Analyte	Analyte Area	EIS Area	EIS Conc	Area Ratio	Avg RF	Calculated Amount ng/ml	Sample Volume mls	Calculated ng/L	Reported Value ng/L	
PFBS	457602	6596987	9.36	0.069365	1.0807	0.60	276	2.18	2.2	Match
PFOS	39746187	5856476	9.57	6.786707	1.0881	59.69	276	216.27	220	Match
PFOA	4688302	7115007	10	0.658931	0.8551	7.71	276	27.92	28	Match

Concentration ng/ml = (Peak area ratio/Avg RF) x DF x EIS concentration
Concentration ng/L = concentration ng/ml / (sample volume/1000)

Stage 3 / 4
PFAS EIS

SDG #: 410-67825-1 Date: 2/22/2022
Lab: Eurofins Lancaster Page: 6
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
EIS 13C8 PFOS
REPORTED EIS %R 100

%R = 100 * EIS Concentration / EIS 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

410-67825 Chain of Custody

LLC

Chain of Custody Record

eurofins Environment Testing America

Client Information: Brian Keh	Sampler: Justin Coffey, Brian Keh	Lab PM: Gordon, Stephen J	Carrier Tracking No(s):	COC No: 410-39020-12246.2
	Phone:	E-Mail: Stephen.Gordon@eurofinset.com	State of Origin: MD	Page: ~~Page 2 of 3~~ 1 of 2
Company: ARCADIS U.S., Inc.	PWSID:			Job #:

Address: 7550 Teague Road Suite 210	Due Date Requested: Normal
City: Hanover	TAT Requested (days): Standard
State, Zip: MD, 21076	Compliance Project: Δ Yes Δ No
Phone: (703)-819-1240	PO #: D18-218 PFAS PA/SI
Email: Brian.Keh@arcadis.com	WO #: 30001996.8AC00 ANA
Project Name: Aberdeen Proving Ground	Project #: 41005401
Site:	SSOW#:

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	Moisture - Local Method	PFC_IDA_D5.3 - (MOD) QSM5.1 Table B-15 - 18 PFAS	TOC, pH	Grain size	Total Number of containers	Special Instructions/Note:
			Preservation Code:		X	X	N	N			X	
APG-ATC1-1-SO-(0.5-2)-121621	121621	1255	G	~~Water~~ Soil	N	N	1	1	1	1		
APG-ATC1-1-GW-121~~6~~521	12~~16~~1521	1400	G	Water	N	Y		6				MS/MSD
APG-ATC2-1-SO-(0.5-2)-121621	121621	1230	G	~~Water~~ Soil	N	N	1	1	1	1		
APG-ATC2-1-GW-121521	121521	1230	G	Water				2				
APG-S1A-1-SO-(0.5-2)121621	121621	1200	G	~~Water~~ Soil	N	N	1	1	1	1		
APG-S1A-1-GW-121521	121521	1100	G	Water	N	N		2				
APG-FD-1-SO-(0.5-2)-121621	121621	—	G	~~Water~~ Soil	N	N	1	1				FD
APG-FD-1-GW-121521	121521	—	G	~~Water~~ Water	N	N		2				FD
				Water								
				Water								
				Water								

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)
Other:

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month): ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by	Date/Time	Company	Received by	Date/Time	Company
[signature]	12/13/21 12:45	EZLE			
Brian Keh	12/16/21 17:00	Arcadis			
			[signature]	12-21-21 1823	ELLE

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks: 18.8, 19.9

Ver: 06/08/2021

1/20/2022

Eurofins Lancaster Laboratories Env, LLC
2425 New Holland Pike
Lancaster, PA 17601
Phone: 717-656-2300 Fax: 717-656-2681

Chain of Custody Record

eurofins Environment Testing America

Client Information	Sampler: Justin Coffey, Brian Keh	Lab PM: Gordon, Stephen J	Carrier Tracking No(s):	COC No: 410-39020-12246.3
Client Contact: Brian Keh	Phone:	E-Mail: Stephen.Gordon@eurofinset.com	State of Origin: MD	Page: Page ~~3 of 3~~ 2of2
Company: ARCADIS U.S., Inc.	PWSID:	Analysis Requested		Job #:
Address: 7550 Teague Road Suite 210	Due Date Requested: Normal			Preservation Codes: A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)
City: Hanover	TAT Requested (days): Standard			
State, Zip: MD, 21076	Compliance Project: Δ Yes Δ No			
Phone: (703)-819-1240	PO #: D18-218 PFAS PA/SI			
Email: Brian.Keh@arcadis.com	WO #: 30001996.8AC00.ANA			
Project Name: Aberdeen Proving Ground	Project #: 41005401			
Site:	SSOW#:			Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	Moisture - Local Method	PFC_IDA_D5.3 - (MOD) QSM5.1 Table B-15-18 PFAS	Grain TOCs, pH	Grain Size	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N	N	N		
APG-S3-1-SO-(0.5-2)-121621	121621	1125	G	~~Water~~ Soil	N	N	1	1	1	1		
APG-S3-1-GW-121521	121521	0945	G	water	N	N		2				
APG-E3-1-SO-(0.5-2)-121621	121621	0930	G	Soil	N	Y	3	3	1	1		MS/MSD
APG-E3-1-GW-121621	121621	0945	G	water	N	N		2				
APG-E4-1-GW-121621	121621	0815	G	Water	N	N		2				
APG-E4-1-SO-(0.5-2)-121621	121621	0800	G	Soil	N	N	1	1	1	1		
APG-FB-1-121621	121621	1530	G	water				2				Field Blank

Possible Hazard Identification	Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown ☐ Radiological	☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months
Deliverable Requested: I, II, III, IV, Other (specify)	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

	Relinquished by	Date/Time	Company	Received by	Date/Time	Company
1	[signature]	12/3/21 12:45	ECLE	[signature]		
2	Brian Keh	12/16/21 17:00	Arcadis	[signature]		
3				[signature]	12-21-21 1823	ECLE

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: 18.4, 19.9

Ver: 06/08/2021

Login Sample Receipt Checklist

Client: ARCADIS U.S., Inc.

Job Number: 410-67825-1

Login Number: 67825
List Number: 1
Creator: Lugardo, Tamara

List Source: Eurofins Lancaster Laboratories Env, LLC

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).	False	Refer to Job Narrative for details.
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: 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	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	

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) - PFAS for QSM 5.3, Table B-15

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
6:2 Fluorotelomer sulfonic acid	<0.0021	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		0.00077	0.00052	0.00052	mg/Kg	☼	01/04/22 02:21	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*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*	*12/30/21 06:52*	*01/04/22 02:21*	*1*

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	<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

Client Sample ID: APG-ATC1-1-SO-(0.5-2)-121621

Date Collected: 12/16/21 12:55
Date Received: 12/21/21 18:23

Lab Sample ID: 410-67825-1

Matrix: Solid
Percent Solids: 76.9

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorohexanoic acid	<0.00052		0.00078	0.00052	0.00052	mg/Kg	☼	01/06/22 05:32	1
Perfluorononanoic acid	<0.00052		0.00078	0.00052	0.00052	mg/Kg	☼	01/06/22 05:32	1
Perfluorooctanesulfonic acid	<0.00052		0.00078	0.00052	0.00052	mg/Kg	☼	01/06/22 05:32	1
Perfluorooctanoic acid	<0.00052	M	0.00078	0.00052	0.00052	mg/Kg	☼	01/06/22 05:32	1
Perfluoropentanoic acid	<0.00052	M	0.00078	0.00052	0.00052	mg/Kg	☼	01/06/22 05:32	1
Perfluorotetradecanoic acid	<0.00052		0.00078	0.00052	0.00052	mg/Kg	☼	01/06/22 05:32	1
Perfluorotridecanoic acid	<0.00052		0.00078	0.00052	0.00052	mg/Kg	☼	01/06/22 05:32	1
Perfluoroundecanoic acid	<0.00052		0.00078	0.00052	0.00052	mg/Kg	☼	01/06/22 05:32	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*79*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
M2-8:2 FTS	*79*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C2 PFTeDA	*72*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C3 PFBS	*86*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C4 PFBA	*88*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C4 PFHpA	*80*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C5 PFPeA	*93*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C8 PFOA	*87*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C8 PFOS	*92*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
d3-NMeFOSAA	*32*	**5-*	*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
d5-NEtFOSAA	*43*	**5-*	*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C2-PFDoDA	*80*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C3 PFHxS	*92*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C5 PFHxA	*82*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C6 PFDA	*85*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C7 PFUnA	*86*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*
13C9 PFNA	*87*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:32*	*1*

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

General Chemistry - Soluble

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	**5.1**	J	0.01	0.01	0.01	S.U.		12/28/21 15:40	1
Temperature	**20.6**		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	**7.0**		1.0	1.0	1.0	%		12/30/21 11:30	1
Silt	**69.1**		1.0	1.0	1.0	%		12/30/21 11:30	1
Clay	**23.0**		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	**99.1**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
3.35 mm	**97.0**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
2.36 mm	**93.1**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
1.18 mm	**93.0**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1

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: D422 - Grain Size (Continued)

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
Lab Sample ID: 410-67825-2
Date Collected: 12/15/21 14:00
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	<3.5	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		1.7	0.87	0.87	ng/L		12/30/21 17:33	1
Perfluorohexanesulfonic acid	0.96	J M	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		1.7	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		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*

Client Sample ID: APG-ATC1-1-GW-121521

Lab Sample ID: 410-67825-2
Matrix: Water
Date Collected: 12/15/21 14:00
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
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
Matrix: Solid
Date Collected: 12/16/21 12:30
Date Received: 12/21/21 18:23
Percent Solids: 53.8

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	<0.0028	UJ	0.0034	0.0028	0.0028	mg/Kg	☼	01/04/22 02:32	1
8:2 Fluorotelomer sulfonic acid	<0.0028		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		0.0010	0.00069	0.00069	mg/Kg	☼	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

General Chemistry

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

Client Sample ID: APG-ATC2-1-SO-(0.5-2)-121621

Date Collected: 12/16/21 12:30
Date Received: 12/21/21 18:23

Lab Sample ID: 410-67825-3

Matrix: Solid
Percent Solids: 53.8

General Chemistry (Continued)

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Solids	53.8		1.0		1.0	%		12/23/21 12:59	1

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	1
Temperature	21.0		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	36.0		1.0	1.0	1.0	%		12/30/21 11:30	1
Silt	53.6		1.0	1.0	1.0	%		12/30/21 11:30	1
Clay	9.5		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	99.1		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
3.35 mm	98.7		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
2.36 mm	97.8		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
1.18 mm	97.8		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.6 mm	96.3		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.3 mm	80.4		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.15 mm	66.7		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.075 mm	63.1		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.064 mm	60.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.05 mm	52.5		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.02 mm	33.5		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.005 mm	9.5		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.002 mm	4.5		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.001 mm	2.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1

Client Sample ID: APG-ATC2-1-GW-121521

Date Collected: 12/15/21 12:30
Date Received: 12/21/21 18:23

Lab Sample ID: 410-67825-4

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
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	M	1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluorobutanoic acid	<3.5		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	M	1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluorohexanesulfonic acid	<0.87	M	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	1.7	0.87	0.87	ng/L		12/30/21 18:05	1

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

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorooctanoic acid	**1.0**	**J M**	1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluoropentanoic acid	<0.87	UJ	1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluorotetradecanoic acid	<0.87		1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluorotridecanoic acid	<0.87		1.7	0.87	0.87	ng/L		12/30/21 18:05	1
Perfluoroundecanoic acid	<0.87		1.7	0.87	0.87	ng/L		12/30/21 18:05	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*94*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
M2-8:2 FTS	*102*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C2 PFTeDA	*86*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C3 PFBS	*104*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C4 PFBA	*94*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C4 PFHpA	*100*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C5 PFPeA	*100*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C8 PFOA	*111*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C8 PFOS	*99*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
d3-NMeFOSAA	*79*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
d5-NEtFOSAA	*90*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C2-PFDoDA	*95*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C3 PFHxS	*104*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C5 PFHxA	*101*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C6 PFDA	*98*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C7 PFUnA	*92*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*
13C9 PFNA	*102*		*50 - 150*	*12/28/21 18:21*	*12/30/21 18:05*	*1*

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

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	<0.0021	UJ	0.0026	0.0021	0.0021	mg/Kg	☼	01/04/22 02:42	1
8:2 Fluorotelomer sulfonic acid	<0.0021		0.0039	0.0021	0.0021	mg/Kg	☼	01/04/22 02:42	1
NEtFOSAA	<0.00051		0.0026	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
NMeFOSAA	<0.00051		0.0026	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluorobutanesulfonic acid	<0.0021		0.0026	0.0021	0.0021	mg/Kg	☼	01/04/22 02:42	1
Perfluorobutanoic acid	<0.0021		0.0026	0.0021	0.0021	mg/Kg	☼	01/04/22 02:42	1
Perfluorodecanoic acid	<0.00051		0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluorododecanoic acid	<0.00051		0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluoroheptanoic acid	<0.00051		0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluorohexanesulfonic acid	<0.00051		0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluorohexanoic acid	<0.00051		0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluorononanoic acid	<0.00051		0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluorooctanesulfonic acid	<0.00051		0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluorooctanoic acid	<0.00051	M	0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluoropentanoic acid	<0.00051		0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluorotetradecanoic acid	<0.00051		0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluorotridecanoic acid	<0.00051		0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	1
Perfluoroundecanoic acid	<0.00051		0.00077	0.00051	0.00051	mg/Kg	☼	01/04/22 02:42	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

Lab Sample ID: 410-67825-5

Matrix: Solid
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

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	<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	M	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	1

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

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

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2-PFDoDA	71		50 - 150	01/04/22 18:53	01/06/22 05:43	1
13C3 PFHxS	90		50 - 150	01/04/22 18:53	01/06/22 05:43	1
13C5 PFHxA	67		50 - 150	01/04/22 18:53	01/06/22 05:43	1
13C6 PFDA	71		50 - 150	01/04/22 18:53	01/06/22 05:43	1
13C7 PFUnA	72		50 - 150	01/04/22 18:53	01/06/22 05:43	1
13C9 PFNA	77		50 - 150	01/04/22 18:53	01/06/22 05:43	1

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	23.6		1.0		1.0	%		12/23/21 12:59	1
Percent Solids	76.4		1.0		1.0	%		12/23/21 12:59	1

General Chemistry - Soluble

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
pH	5.9	J	0.01	0.01	0.01	S.U.		12/28/21 15:40	1
Temperature	20.7		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	21.7		1.0	1.0	1.0	%		12/30/21 11:30	1
Silt	69.9		1.0	1.0	1.0	%		12/30/21 11:30	1
Clay	8.0		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		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
4.75 mm	99.6		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
3.35 mm	98.4		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
2.36 mm	96.4		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
1.18 mm	96.3		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.6 mm	95.9		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.3 mm	88.9		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.15 mm	82.8		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.075 mm	77.9		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.064 mm	72.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.05 mm	54.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.02 mm	30.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.005 mm	8.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.002 mm	4.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.001 mm	2.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1

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		1.7	1.0	1.0	ng/L		12/30/21 18:15	1

Client Sample ID: APG-S1A-1-GW-121521

Lab Sample ID: 410-67825-6
Matrix: Water
Date Collected: 12/15/21 11:00
Date Received: 12/21/21 18:23

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

Analyte	Result	Qualifier	LOQ	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		1.7	0.84	0.84	ng/L		12/30/21 18:15	1

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
Matrix: Solid
Date Collected: 12/16/21 00:00
Date Received: 12/21/21 18:23
Percent Solids: 65.8

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	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

Client Sample ID: APG-FD-1-SO-(0.5-2)-121621

Date Collected: 12/16/21 00:00
Date Received: 12/21/21 18:23

Lab Sample ID: 410-67825-7

Matrix: Solid
Percent Solids: 65.8

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorononanoic acid	<0.00059	UJ	0.00089	0.00059	0.00059	mg/Kg	☼	01/04/22 02:53	1
Perfluorooctanesulfonic acid	<0.00059		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		0.00089	0.00059	0.00059	mg/Kg	☼	01/04/22 02:53	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*97*		*50 - 150*	*12/30/21 06:52*	*01/04/22 02:53*	*1*
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*

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	<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	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*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*81*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:54*	*1*
M2-8:2 FTS	*78*		*50 - 150*	*01/04/22 18:53*	*01/06/22 05:54*	*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

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

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 - 150	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 18:53	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	1

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

Lab Sample ID: 410-67825-8
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

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	M	1.7	0.86	0.86	ng/L		12/30/21 18:36	1
Perfluorobutanoic acid	<3.5	M	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**	**J M**	1.7	0.86	0.86	ng/L		12/30/21 18:36	1
Perfluoropentanoic acid	<0.86	M	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		1.7	0.86	0.86	ng/L		12/30/21 18:36	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	100		50 - 150	12/28/21 18:21	12/30/21 18:36	1
M2-8:2 FTS	91		50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C2 PFTeDA	85		50 - 150	12/28/21 18:21	12/30/21 18:36	1
13C3 PFBS	100		50 - 150	12/28/21 18:21	12/30/21 18:36	1

Client Sample ID: APG-FD-1-GW-121521
Lab Sample ID: 410-67825-8
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

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	UJ	0.0025	0.0020	0.0020	mg/Kg	☼	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	Qualifier	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 Sample ID: APG-S3-1-SO-(0.5-2)-121621

Date Collected: 12/16/21 11:25
Date Received: 12/21/21 18:23

Lab Sample ID: 410-67825-9

Matrix: Solid
Percent Solids: 76.9

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

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

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	<0.0020		0.0025	0.0020	0.0020	mg/Kg	☼	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 acid	<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	M	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

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	01/06/22 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	1

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

Client Sample ID: APG-S3-1-SO-(0.5-2)-121621

Lab Sample ID: 410-67825-9

Date Collected: 12/16/21 11:25
Date Received: 12/21/21 18:23

Matrix: Solid
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
Date Received: 12/21/21 18:23

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
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		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		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	M 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		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**		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**	J	1.8	0.91	0.91	ng/L		12/30/21 18:47	1
Perfluorooctanoic acid	**28**	M J	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		1.8	0.91	0.91	ng/L		12/30/21 18:47	1

Client Sample ID: APG-S3-1-GW-121521

Lab Sample ID: 410-67825-10
Matrix: Water
Date Collected: 12/15/21 09:45
Date Received: 12/21/21 18:23

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

Analyte	Result	Qualifier	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
Matrix: Solid
Date Collected: 12/16/21 09:30
Percent Solids: 83.8
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	<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		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		0.00066	0.00044	0.00044	mg/Kg	☼	01/04/22 03:14	1

Isotope Dilution	*%Recovery*	*Qualifier*	*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*

Client Sample ID: APG-E3-1-SO-(0.5-2)-121621

Date Collected: 12/16/21 09:30
Date Received: 12/21/21 18:23

Lab Sample ID: 410-67825-11

Matrix: Solid
Percent Solids: 83.8

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

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFBA	95		50 - 150	12/30/21 06:52	01/04/22 03:14	1
13C4 PFHpA	99		50 - 150	12/30/21 06:52	01/04/22 03:14	1
13C5 PFPeA	97		50 - 150	12/30/21 06:52	01/04/22 03:14	1
13C8 PFOA	104		50 - 150	12/30/21 06:52	01/04/22 03:14	1
13C8 PFOS	99		50 - 150	12/30/21 06:52	01/04/22 03:14	1
d3-NMeFOSAA	54		50 - 150	12/30/21 06:52	01/04/22 03:14	1
d5-NEtFOSAA	68		50 - 150	12/30/21 06:52	01/04/22 03:14	1
13C2-PFDoDA	120		50 - 150	12/30/21 06:52	01/04/22 03:14	1
13C3 PFHxS	99		50 - 150	12/30/21 06:52	01/04/22 03:14	1
13C5 PFHxA	92		50 - 150	12/30/21 06:52	01/04/22 03:14	1
13C6 PFDA	103		50 - 150	12/30/21 06:52	01/04/22 03:14	1
13C7 PFUnA	103		50 - 150	12/30/21 06:52	01/04/22 03:14	1
13C9 PFNA	98		50 - 150	12/30/21 06:52	01/04/22 03:14	1

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	**16.2**		1.0		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	DL	Unit	D	Analyzed	Dil Fac
pH	**6.3**	J	0.01	0.01	0.01	S.U.		12/28/21 15:40	1
Temperature	**21.6**		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	**15.2**		1.0	1.0	1.0	%		12/30/21 11:30	1
Silt	**70.9**		1.0	1.0	1.0	%		12/30/21 11:30	1
Clay	**13.0**		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	**99.1**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
3.35 mm	**97.3**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
2.36 mm	**94.4**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
1.18 mm	**94.4**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.6 mm	**93.9**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.3 mm	**91.3**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.15 mm	**87.2**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.075 mm	**83.9**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.064 mm	**78.0**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.05 mm	**64.5**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.02 mm	**33.0**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.005 mm	**13.0**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.002 mm	**7.0**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.001 mm	**4.8**		1.0	1.0	1.0	% Passing		12/30/21 11:30	1

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

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	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		1.8	0.88	0.88	ng/L		12/31/21 09:17	1

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

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

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		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		1.8	0.90	0.90	ng/L		12/31/21 09:28	1

Client Sample ID: APG-E4-1-GW-121621

Lab Sample ID: 410-67825-13
Matrix: Water
Date Collected: 12/16/21 08:15
Date Received: 12/21/21 18:23

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Perfluorododecanoic acid	<0.90	UJ	1.8	0.90	0.90	ng/L		12/31/21 09:28	1
Perfluoroheptanoic acid	<0.90	UJ	1.8	0.90	0.90	ng/L		12/31/21 09:28	1
Perfluorohexanesulfonic acid	**0.95**	**J**	1.8	0.90	0.90	ng/L		12/31/21 09:28	1
Perfluorohexanoic acid	<0.90	UJ	1.8	0.90	0.90	ng/L		12/31/21 09:28	1
Perfluorononanoic acid	<0.90		1.8	0.90	0.90	ng/L		12/31/21 09:28	1
Perfluorooctanesulfonic acid	<0.90		1.8	0.90	0.90	ng/L		12/31/21 09:28	1
Perfluorooctanoic acid	<0.90	M	1.8	0.90	0.90	ng/L		12/31/21 09:28	1
Perfluoropentanoic acid	<0.90		1.8	0.90	0.90	ng/L		12/31/21 09:28	1
Perfluorotetradecanoic acid	<0.90		1.8	0.90	0.90	ng/L		12/31/21 09:28	1
Perfluorotridecanoic acid	<0.90		1.8	0.90	0.90	ng/L		12/31/21 09:28	1
Perfluoroundecanoic acid	<0.90		1.8	0.90	0.90	ng/L		12/31/21 09:28	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*98*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
M2-8:2 FTS	*97*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C2 PFTeDA	*67*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C3 PFBS	*109*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C4 PFBA	*110*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C4 PFHpA	*109*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C5 PFPeA	*114*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C8 PFOA	*118*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C8 PFOS	*109*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
d3-NMeFOSAA	*78*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
d5-NEtFOSAA	*84*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C2-PFDoDA	*89*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C3 PFHxS	*113*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C5 PFHxA	*108*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C6 PFDA	*100*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C7 PFUnA	*90*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*
13C9 PFNA	*103*		*50 - 150*	*12/29/21 18:06*	*12/31/21 09:28*	*1*

Client Sample ID: APG-E4-1-SO-(0.5-2)-121621

Lab Sample ID: 410-67825-14
Matrix: Solid
Date Collected: 12/16/21 08:00
Percent Solids: 86.3
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	<0.0018	UJ	0.0023	0.0018	0.0018	mg/Kg	☼	01/06/22 06:16	1
8:2 Fluorotelomer sulfonic acid	<0.0018		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

Client Sample ID: APG-E4-1-SO-(0.5-2)-121621

Date Collected: 12/16/21 08:00
Date Received: 12/21/21 18:23

Lab Sample ID: 410-67825-14

Matrix: Solid
Percent Solids: 86.3

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

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	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		0.00068	0.00045	0.00045	mg/Kg	☼	01/06/22 06:16	1

Isotope Dilution	*%Recovery*	*Qualifier*	*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*	*01/06/22 06:16*	*1*
13C2 PFTeDA	*72*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C3 PFBS	*91*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C4 PFBA	*83*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C4 PFHpA	*77*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C5 PFPeA	*89*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C8 PFOA	*87*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C8 PFOS	*92*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
d3-NMeFOSAA	*24*	**5-*	*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
d5-NEtFOSAA	*29*	**5-*	*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C2-PFDoDA	*77*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C3 PFHxS	*93*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C5 PFHxA	*78*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C6 PFDA	*79*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C7 PFUnA	*80*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*
13C9 PFNA	*86*		*50 - 150*	*01/04/22 18:53*	*01/06/22 06:16*	*1*

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	<0.0018		0.0023	0.0018	0.0018	mg/Kg	☼	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	<0.00045		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

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*43*	**5-*	*50 - 150*	*12/30/21 00:11*	*01/03/22 21:57*	*1*
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*
13C3 PFBS	*86*		*50 - 150*	*12/30/21 00:11*	*01/03/22 21:57*	*1*
13C4 PFBA	*68*		*50 - 150*	*12/30/21 00:11*	*01/03/22 21:57*	*1*

Client Sample ID: APG-E4-1-SO-(0.5-2)-121621

Date Collected: 12/16/21 08:00
Date Received: 12/21/21 18:23

Lab Sample ID: 410-67825-14

Matrix: Solid
Percent Solids: 86.3

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

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFHpA	71		50 - 150	12/30/21 00:11	01/03/22 21:57	1
13C5 PFPeA	68		50 - 150	12/30/21 00:11	01/03/22 21:57	1
13C8 PFOA	73		50 - 150	12/30/21 00:11	01/03/22 21:57	1
13C8 PFOS	90		50 - 150	12/30/21 00:11	01/03/22 21:57	1
d3-NMeFOSAA	13	*5-	50 - 150	12/30/21 00:11	01/03/22 21:57	1
d5-NEtFOSAA	16	*5-	50 - 150	12/30/21 00:11	01/03/22 21:57	1
13C2-PFDoDA	75		50 - 150	12/30/21 00:11	01/03/22 21:57	1
13C3 PFHxS	90		50 - 150	12/30/21 00:11	01/03/22 21:57	1
13C5 PFHxA	66		50 - 150	12/30/21 00:11	01/03/22 21:57	1
13C6 PFDA	73		50 - 150	12/30/21 00:11	01/03/22 21:57	1
13C7 PFUnA	80		50 - 150	12/30/21 00:11	01/03/22 21:57	1
13C9 PFNA	68		50 - 150	12/30/21 00:11	01/03/22 21:57	1

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	DL	Unit	D	Analyzed	Dil Fac
Percent Moisture	13.7		1.0		1.0	%		12/23/21 12:59	1
Percent Solids	86.3		1.0		1.0	%		12/23/21 12:59	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.		12/28/21 15:40	1
Temperature	20.7		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	21.8		1.0	1.0	1.0	%		12/30/21 11:30	1
Sand	45.2		1.0	1.0	1.0	%		12/30/21 11:30	1
Silt	30.0		1.0	1.0	1.0	%		12/30/21 11:30	1
Clay	3.0		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	78.2		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
3.35 mm	71.1		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
2.36 mm	63.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
1.18 mm	56.7		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.6 mm	53.2		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.3 mm	46.5		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.15 mm	38.5		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.075 mm	33.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.064 mm	30.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.05 mm	23.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.02 mm	9.8		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.005 mm	3.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.002 mm	2.5		1.0	1.0	1.0	% Passing		12/30/21 11:30	1
0.001 mm	3.0		1.0	1.0	1.0	% Passing		12/30/21 11:30	1

Client Sample Results

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

Job ID: 410-67825-1

Client Sample ID: APG-FB-1-121621

Date Collected: 12/16/21 15:30
Date Received: 12/21/21 18:23

Lab Sample ID: 410-67825-15

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
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		1.8	0.91	0.91	ng/L		12/31/21 09:38	1

Isotope Dilution	*%Recovery*	*Qualifier*	*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*	*12/29/21 18:06*	*12/31/21 09:38*	*1*

Eurofins Lancaster Laboratories Env, LLC
2425 New Holland Pike
Lancaster, PA 17601
Phone: 717-656-2300 Fax: 717-656-2681

Chain of Custody Record

eurofins | Environment Testing America

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Gordon, Stephen J	Carrier Tracking No(s):	COC No: 410-1167614.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: Stephen.Gordon@eurofinset.com	State of Origin: Maryland	Page: Page 1 of 1
Company: CT Laboratories		Accreditations Required (See note): Dept. of Defense ELAP - A2LA		Job #: 410-67825-1
Address: Environmental & Analytical Services, 1230 Lange Court,	Due Date Requested: 1/14/2022			
City: Baraboo	TAT Requested (days):			
State, Zip: WI, 53913				
Phone:	PO #:			
Email:	WO #:			
Project Name: Aberdeen Proving Ground	Project #: 41005401			
Site:	SSOW#:			

Analysis Requested

Folder # 166761
Company: EUROFINS LANCASTER L
Project: ABERDEEN PROVING GRO
Logged By: erc PM: BMS

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)

Other:

Transfer to a EDD. HLC 2913 12-29-2021

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUB (Total Organic Carbon)/ SW846 9060A	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
APG-ATC1-1-SO-(0.5-2)-121621 (410-67825-1)	12/16/21	12:55 Eastern		Solid			X	1	10858836
APG-ATC2-1-SO-(0.5-2)-121621 (410-67825-3)	12/16/21	12:30 Eastern		Solid			X	1	37
APG-S1A-1-SO-(0.5-2)-121621 (410-67825-5)	12/16/21	12:00 Eastern		Solid			X	1	38
APG-S3-1-SO-(0.5-2)-121621 (410-67825-9)	12/16/21	11:25 Eastern		Solid			X	1	39
APG-E3-1-SO-(0.5-2)-121621 (410-67825-11)	12/16/21	09:30 Eastern		Solid			X	1	40
APG-E4-1-SO-(0.5-2)-121621 (410-67825-14)	12/16/21	08:00 Eastern		Solid			X	1	41

Note: Since laboratory accreditations are subject to change, Eurofins Lancaster Laboratories Env places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins Lancaster Laboratories Env laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins Lancaster Laboratories Env attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to Eurofins Lancaster Laboratories Env.

Possible Hazard Identification	Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
Unconfirmed	☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months
Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time: 12/30/21 1730	Company CT Labs
Relinquished by:	Date/Time:	Company	Received by:	Date/Time: 12/30/21 1324	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.: N/A	166761 - Page 10 of 1	Cooler Temperature(s) °C and Other Remarks: 3.3 IR28

Ver: 06/08/2021

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

Arrival Temperature: 3.3
Report Date: 1/6/2022
Date Received: 12/30/2021
Reprint Date: 1/6/2022

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 LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results												
Solids, Percent	***78.4***	%					1.00			12/31/21 09:42	MRZ	EPA 8000C
Total Organic Carbon	***6970*** J-	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 LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results												
Solids, Percent	***66.0***	%					1.00			12/31/21 09:42	MRZ	EPA 8000C
Total Organic Carbon	***30700*** J-	mg/kg	240	610	760	760	1.00			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 LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method

Unless specifically stated to the contrary, soil/sediment/sludge sample results reported on a Dry Weight Basis

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 LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results												
Solids, Percent	***71.9***	%					1.00			12/31/21 09:42	MRZ	EPA 8000C
Total Organic Carbon	***10200*** J-	mg/kg	220	560	700	700	1.00			1/3/22 11:09	KMT	L-Kahn/9060A

CT LAB#: 1088839 Sample Description: 410-67825-9 Client Sample #: APG-S3-1-SO-(0.5-2)-121621 Sampled: 12/16/2021 11:25

Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	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: 410-67825-11 Client Sample #: APG-E3-1-SO-(0.5-2)-121621 Sampled: 12/16/2021 09:30

Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results												
Solids, Percent	***80.6***	%					1.00			12/31/21 09:42	MRZ	EPA 8000C
Total Organic Carbon	***17000*** J-	mg/kg	200	500	620	620	1.00			1/3/22 11:32	KMT	L-Kahn/9060A

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 Date/Time	Analyst	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

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 Date/Time	Analyst	Method
Total Organic Carbon	***12800***	J-	mg/kg	190	480	610	610	1.00			1/3/22 11:38	KMT	L-Kahn/9060A

Unless specifically stated to the contrary, soil/sediment/sludge sample results reported on a Dry Weight Basis

eurofins

Lancaster Laboratories Environmental

Environm[barcode]quest/Chain of Custody

410-71439 Chain of Custody

Acct. .　　　　mple # ______

Client:	Arcadis		
Project Name/#:	Aberdeen Proving Ground PA/SI	Site ID #:	
Project Manager:	~~Ankit Gupta, Josh Roberts~~ Matt Blower	P.O. #:	02118216.3005.8AC00
Sampler:	~~C. Ortolano, M. Blower~~ Brian Keh	PWSID #:	
Phone #:	CO: 484.787.7796 /MB: 703.819.1240	Quote #:	219438
State where sample(s) were collected:	Maryland		

Matrix: Sediment / Soil; Ground / Potable Water; Surface / NPDES; Other:

Analyses Requested / Preservation Codes

Sample Identification	Date	Time	Grab	Composite	Sediment / Soil	Water	Other:	Total # of Containers	PFAS Group (DoD QSM 5.1)	TOC (SW846 9060A)	pH (SW846 9045D)	Grain Size (ASTM D422-63)						Remarks
APG-FF3-1-GW-013122	01/31/22	1015	x			x		2	X									250 mL Plastic
APG-FF2-1-GW-013122	01/31/22	1050	x			x		2	X									250 mL Plastic

For Lab Use Only

SF #: ______

SCR #: ______

Preservation Codes

H = HCl　T = Thiosulfate

N = HNO_3　B = NaOH

S = H_2SO_4　P = H_3PO_4

O = Other

Turnaround Time Requested (TAT) (please check): Standard (circled)　Rush

(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed:

Rush results requested by (please check): E-Mail　Phone

E-mail Address: matthew.blower@arcadis.com

Phone: (703)-819-1240

Data Package Options (please check if required)

Type I (Validation/non-CLP)　MA MCP

Type III (Reduced non-CLP)　CT RCP

Type IV (CLP SOW)　TX TRRP-13

Type VI (Raw Data Only)

EDD Required? Yes　No　If yes, format: ______

Relinquished by:	Date	Time	Received by:	Date	Time
Brian Dean Keh	02/01/22 ~~01/31/22~~	0740			
			[signature]	2-1-22	1722

Relinquished by Commercial Carrier:

UPS ______ FedEx ______ Other ______

Temperature upon receipt 0.1 °C

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300

7045 0713

Login Sample Receipt Checklist

Client: ARCADIS U.S., Inc.

Job Number: 410-71439-1

Login Number: 71439
List Number: 1
Creator: Jeremiah, Cory T

List Source: Eurofins Lancaster Laboratories Env, LLC

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).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: 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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	

Client Sample ID: APG-FF3-1-GW-013122

Lab Sample ID: 410-71439-1

Date Collected: 01/31/22 10:15

Matrix: Water

Date Received: 02/01/22 17:22

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	<3.6		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	0.89	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	0.89	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	0.89	0.89	ng/L		02/14/22 22:14	1
Perfluorododecanoic acid	<0.89		1.8	0.89	0.89	ng/L		02/14/22 22:14	1
Perfluoroheptanoic acid	<0.89		1.8	0.89	0.89	ng/L		02/14/22 22:14	1
Perfluorohexanesulfonic acid	<0.89		1.8	0.89	0.89	ng/L		02/14/22 22:14	1
Perfluorohexanoic acid	<0.89	M	1.8	0.89	0.89	ng/L		02/14/22 22:14	1
Perfluorononanoic acid	<0.89		1.8	0.89	0.89	ng/L		02/14/22 22:14	1
Perfluorooctanesulfonic acid	<0.89		1.8	0.89	0.89	ng/L		02/14/22 22:14	1
Perfluorooctanoic acid	<0.89	M	1.8	0.89	0.89	ng/L		02/14/22 22:14	1
Perfluoropentanoic acid	<0.89		1.8	0.89	0.89	ng/L		02/14/22 22:14	1
Perfluorotetradecanoic acid	<0.89		1.8	0.89	0.89	ng/L		02/14/22 22:14	1
Perfluorotridecanoic acid	<0.89		1.8	0.89	0.89	ng/L		02/14/22 22:14	1
Perfluoroundecanoic acid	<0.89		1.8	0.89	0.89	ng/L		02/14/22 22:14	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
M2-6:2 FTS	*99*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
M2-8:2 FTS	*94*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C2 PFTeDA	*67*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C3 PFBS	*88*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C4 PFBA	*62*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C4 PFHpA	*93*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C5 PFPeA	*82*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C8 PFOA	*97*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C8 PFOS	*90*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
d3-NMeFOSAA	*85*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
d5-NEtFOSAA	*90*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C2-PFDoDA	*85*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C3 PFHxS	*91*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C5 PFHxA	*88*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C6 PFDA	*95*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C7 PFUnA	*92*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*
13C9 PFNA	*90*		*50 - 150*	*02/13/22 12:26*	*02/14/22 22:14*	*1*

Client Sample ID: APG-FF2-1-GW-013122

Lab Sample ID: 410-71439-2

Date Collected: 01/31/22 10:50

Matrix: Water

Date Received: 02/01/22 17:22

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	<3.6		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

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

Job ID: 410-71439-1

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

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

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*