NAVFAC
Naval Facilities Engineering Command

Off-Base Drinking Water Sample Results, Electronic Data Deliverable, Data Validation Report, and the Sample Location Figure, SDG 320-45868-1

Naval Air Warfare Center Warminster
Warminster, Pennsylvania

August 2019

"NAWC-120418-RW-098","537","RES","320-45868-1","TALSAC","1763-23-1","Perfluorooctanesulfonic acid (PFOS)","10.0","ng/L","","0.862","DL","","TRG","","","4.54","LOQ","YES","-99","","275.5","10.00","1.81",""
"NAWC-120418-RW-098","537","RES","320-45868-1","TALSAC","335-67-1","Perfluorooctanoic acid (PFOA)","11.7","ng/L","M","2.45","DL","","TRG","","","6.35","LOQ","YES","-99","","275.5","10.00","5.44",""
"NAWC-120418-RW-098","537","RES","320-45868-1","TALSAC","355-46-4","Perfluorohexanesulfonic acid (PFHxS)","4.28","ng/L","J","0.581","DL","","TRG","","","4.54","LOQ","YES","-99","","275.5","10.00","1.81",""
"NAWC-120418-RW-098","537","RES","320-45868-1","TALSAC","375-73-5","Perfluorobutanesulfonic acid (PFBS)","4.68","ng/L","","0.726","DL","","TRG","","","4.54","LOQ","YES","-99","","275.5","10.00","1.81",""
"NAWC-120418-RW-098","537","RES","320-45868-1","TALSAC","375-85-9","Perfluoroheptanoic acid (PFHpA)","3.48","ng/L","J","1.18","DL","","TRG","","","4.54","LOQ","YES","-99","","275.5","10.00","2.72",""
"NAWC-120418-RW-098","537","RES","320-45868-1","TALSAC","375-95-1","Perfluorononanoic acid (PFNA)","1.28","ng/L","J","0.426","DL","","TRG","","","4.54","LOQ","YES","-99","","275.5","10.00","0.907",""
"NAWC-120418-RW-098","537","RES","320-45868-1","TALSAC","STL00993","13C2 PFHxA","90.6","ng/L","","-99","DL","","SURR","100","","-99","LOQ","YES","90.7","","275.5","10.00","0",""
"NAWC-120418-RW-098","537","RES","320-45868-1","TALSAC","STL00996","13C2 PFDA","87.2","ng/L","","-99","DL","","SURR","96","","-99","LOQ","YES","90.7","","275.5","10.00","0",""
"NAWC-120418-FRB-098","537","RES","320-45868-2","TALSAC","1763-23-1","Perfluorooctanesulfonic acid (PFOS)","1.73","ng/L","U","0.821","DL","","TRG","","","4.32","LOQ","YES","-99","","289.3","10.00","1.73",""
"NAWC-120418-FRB-098","537","RES","320-45868-2","TALSAC","335-67-1","Perfluorooctanoic acid (PFOA)","5.18","ng/L","U M","2.33","DL","","TRG","","","6.05","LOQ","YES","-99","","289.3","10.00","5.18",""
"NAWC-120418-FRB-098","537","RES","320-45868-2","TALSAC","355-46-4","Perfluorohexanesulfonic acid (PFHxS)","1.73","ng/L","U","0.553","DL","","TRG","","","4.32","LOQ","YES","-99","","289.3","10.00","1.73",""
"NAWC-120418-FRB-098","537","RES","320-45868-2","TALSAC","375-73-5","Perfluorobutanesulfonic acid (PFBS)","1.73","ng/L","U","0.691","DL","","TRG","","","4.32","LOQ","YES","-99","","289.3","10.00","1.73",""
"NAWC-120418-FRB-098","537","RES","320-45868-2","TALSAC","375-85-9","Perfluoroheptanoic acid (PFHpA)","2.59","ng/L","U","1.12","DL","","TRG","","","4.32","LOQ","YES","-99","","289.3","10.00","2.59",""
"NAWC-120418-FRB-098","537","RES","320-45868-2","TALSAC","375-95-1","Perfluorononanoic acid (PFNA)","0.864","ng/L","U","0.406","DL","","TRG","","","4.32","LOQ","YES","-99","","289.3","10.00","0.864",""
"NAWC-120418-FRB-098","537","RES","320-45868-2","TALSAC","STL00993","13C2 PFHxA","72.8","ng/L","","-99","DL","","SURR","84","","-99","LOQ","YES","86.4","","289.3","10.00","0",""
"NAWC-120418-FRB-098","537","RES","320-45868-2","TALSAC","STL00996","13C2 PFDA","76.6","ng/L","","-99","DL","","SURR","89","","-99","LOQ","YES","86.4","","289.3","10.00","0",""
"LCS 320-264464/2-A","537","RES","LCS 320-264464/2-A","TALSAC","1763-23-1","Perfluorooctanesulfonic acid (PFOS)","82.21","ng/L","","0.950","DL","","SPK","89","","5.00","LOQ","YES","92.8","","250","10.00","2.00",""
"LCS 320-264464/2-A","537","RES","LCS 320-264464/2-A","TALSAC","335-67-1","Perfluorooctanoic acid (PFOA)","93.64","ng/L","","2.70","DL","","SPK","94","","7.00","LOQ","YES","100","","250","10.00","6.00",""
"LCS 320-264464/2-A","537","RES","LCS 320-264464/2-A","TALSAC","355-46-4","Perfluorohexanesulfonic acid (PFHxS)","87.50","ng/L","","0.640","DL","","SPK","96","","5.00","LOQ","YES","91.0","","250","10.00","2.00",""
"LCS 320-264464/2-A","537","RES","LCS 320-264464/2-A","TALSAC","375-73-5","Perfluorobutanesulfonic acid (PFBS)","89.14","ng/L","","0.800","DL","","SPK","101","","5.00","LOQ","YES","88.4","","250","10.00","2.00",""
"LCS 320-264464/2-A","537","RES","LCS 320-264464/2-A","TALSAC","375-85-9","Perfluoroheptanoic acid (PFHpA)","91.44","ng/L","","1.30","DL","","SPK","91","","5.00","LOQ","YES","100","","250","10.00","3.00",""
"LCS 320-264464/2-A","537","RES","LCS 320-264464/2-A","TALSAC","375-95-1","Perfluorononanoic acid (PFNA)","88.85","ng/L","","0.470","DL","","SPK","89","","5.00","LOQ","YES","100","","250","10.00","1.00",""
"LCS 320-264464/2-A","537","RES","LCS 320-264464/2-A","TALSAC","STL00993","13C2 PFHxA","100.6","ng/L","","-99","DL","","SURR","101","","-99","LOQ","YES","100","","250","10.00","0",""
"LCS 320-264464/2-A","537","RES","LCS 320-264464/2-A","TALSAC","STL00996","13C2 PFDA","91.45","ng/L","","-99","DL","","SURR","91","","-99","LOQ","YES","100","","250","10.00","0",""
"LCSD 320-264464/3-A","537","RES","LCSD 320-264464/3-A","TALSAC","1763-23-1","Perfluorooctanesulfonic acid (PFOS)","86.94","ng/L","","0.950","DL","","SPK","94","6","5.00","LOQ","YES","92.8","LCS 320-264464/2-A","250","10.00","2.00",""
"LCSD 320-264464/3-A","537","RES","LCSD 320-264464/3-A","TALSAC","335-67-1","Perfluorooctanoic acid (PFOA)","90.24","ng/L","","2.70","DL","","SPK","90","4","7.00","LOQ","YES","100","LCS 320-264464/2-

A","250","10.00","6.00",""
"LCSD 320-264464/3-A","537","RES","LCSD 320-264464/3-A","TALSAC","355-46-4","Perfluorohexanesulfonic acid (PFHxS)","93.58","ng/L","","0.640","DL","","SPK","103","7","5.00","LOQ","YES","91.0","LCS 320-264464/2-A","250","10.00","2.00",""
"LCSD 320-264464/3-A","537","RES","LCSD 320-264464/3-A","TALSAC","375-73-5","Perfluorobutanesulfonic acid (PFBS)","88.28","ng/L","","0.800","DL","","SPK","100","1","5.00","LOQ","YES","88.4","LCS 320-264464/2-A","250","10.00","2.00",""
"LCSD 320-264464/3-A","537","RES","LCSD 320-264464/3-A","TALSAC","375-85-9","Perfluoroheptanoic acid (PFHpA)","95.06","ng/L","","1.30","DL","","SPK","95","4","5.00","LOQ","YES","100","LCS 320-264464/2-A","250","10.00","3.00",""
"LCSD 320-264464/3-A","537","RES","LCSD 320-264464/3-A","TALSAC","375-95-1","Perfluorononanoic acid (PFNA)","85.73","ng/L","","0.470","DL","","SPK","86","4","5.00","LOQ","YES","100","LCS 320-264464/2-A","250","10.00","1.00",""
"LCSD 320-264464/3-A","537","RES","LCSD 320-264464/3-A","TALSAC","STL00993","13C2 PFHxA","89.45","ng/L","","-99","DL","","SURR","89","","-99","LOQ","YES","100","LCS 320-264464/2-A","250","10.00","0",""
"LCSD 320-264464/3-A","537","RES","LCSD 320-264464/3-A","TALSAC","STL00996","13C2 PFDA","91.57","ng/L","","-99","DL","","SURR","92","","-99","LOQ","YES","100","LCS 320-264464/2-A","250","10.00","0",""
"MB 320-264464/1-A","537","RES","MB 320-264464/1-A","TALSAC","1763-23-1","Perfluorooctanesulfonic acid (PFOS)","2.00","ng/L","U","0.950","DL","","TRG","","","5.00","LOQ","YES","-99","","250","10.00","2.00",""
"MB 320-264464/1-A","537","RES","MB 320-264464/1-A","TALSAC","335-67-1","Perfluorooctanoic acid (PFOA)","6.00","ng/L","U M","2.70","DL","","TRG","","","7.00","LOQ","YES","-99","","250","10.00","6.00",""
"MB 320-264464/1-A","537","RES","MB 320-264464/1-A","TALSAC","355-46-4","Perfluorohexanesulfonic acid (PFHxS)","2.00","ng/L","U","0.640","DL","","TRG","","","5.00","LOQ","YES","-99","","250","10.00","2.00",""
"MB 320-264464/1-A","537","RES","MB 320-264464/1-A","TALSAC","375-73-5","Perfluorobutanesulfonic acid (PFBS)","2.00","ng/L","U","0.800","DL","","TRG","","","5.00","LOQ","YES","-99","","250","10.00","2.00",""
"MB 320-264464/1-A","537","RES","MB 320-264464/1-A","TALSAC","375-85-9","Perfluoroheptanoic acid (PFHpA)","3.00","ng/L","U M","1.30","DL","","TRG","","","5.00","LOQ","YES","-99","","250","10.00","3.00",""
"MB 320-264464/1-A","537","RES","MB 320-264464/1-A","TALSAC","375-95-1","Perfluorononanoic acid (PFNA)","1.00","ng/L","U","0.470","DL","","TRG","","","5.00","LOQ","YES","-99","","250","10.00","1.00",""
"MB 320-264464/1-A","537","RES","MB 320-264464/1-A","TALSAC","STL00993","13C2 PFHxA","76.02","ng/L","","-99","DL","","SURR","76","","-99","LOQ","YES","100","","250","10.00","0",""
"MB 320-264464/1-A","537","RES","MB 320-264464/1-A","TALSAC","STL00996","13C2 PFDA","73.56","ng/L","","-99","DL","","SURR","74","","-99","LOQ","YES","100","","250","10.00","0",""
"Unknown","Unknown","NAWC-120418-RW-098","12/04/2018 10:10","AQ","320-45868-1","NM","","5.10","537","METHOD","RES","12/11/2018 10:06","12/13/2018 00:40","TALSAC","COA","WET","NA","1","NA","NA","","100","320-264464","320-264464","NA","320-264881","320-45868-1","12/05/2018 10:05","12/07/2018 09:45",""
"Unknown","Unknown","NAWC-120418-FRB-098","12/04/2018 10:05","AQ","320-45868-2","FB","","5.10","537","METHOD","RES","12/11/2018 10:06","12/13/2018 00:47","TALSAC","COA","WET","NA","1","NA","NA","","100","320-264464","320-264464","NA","320-264881","320-45868-1","12/05/2018 10:05","12/07/2018 09:45",""
"Unknown","Unknown","LCS 320-264464/2-A","","AQ","LCS 320-264464/2-A","LCS","","-99","537","METHOD","RES","12/11/2018 10:06","12/13/2018 00:25","TALSAC","COA","WET","NA","1","NA","NA","","100","320-264464","320-264464","NA","320-264881","320-45868-1","12/11/2018 10:06","12/07/2018 09:45",""
"Unknown","Unknown","LCSD 320-264464/3-A","","AQ","LCSD 320-264464/3-A","LCSD","","-99","537","METHOD","RES","12/11/2018 10:06","12/13/2018 00:32","TALSAC","COA","WET","NA","1","NA","NA","","100","320-264464","320-264464","NA","320-264881","320-45868-1","12/11/2018 10:06","12/07/2018 09:45",""
"Unknown","Unknown","MB 320-264464/1-A","","AQ","MB 320-264464/1-A","MB","","-99","537","METHOD","RES","12/11/2018 10:06","12/13/2018 00:17","TALSAC","COA","WET","NA","1","NA","NA","","100","320-264464","320-264464","NA","320-

264881","320-45868-1","12/11/2018 10:06","12/07/2018 09:45",""

TETRA TECH

INTERNAL CORRESPONDENCE

TO: **A. FREBOWITZ** **DATE:** **JANUARY 7, 2019**

FROM: **TERRI L. SOLOMON** **COPIES:** **DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION –POLYFLUOROALKYL SUBSTANCES (PFAS)**
NAS JRB WILLOW GROVE
SAMPLE DELIVERY GROUP (SDG) 320-45868-1

SAMPLES: 1/Field Reagent Blank (FRB)
NAWC-120418-FRB-098

1/Drinking Water
NAWC-120418-RW-098

Overview

The sample set for NAS JRB Willow Grove, SDG 320-45868-1, consisted of one (1) drinking water sample and one (1) FRB sample. All samples were analyzed for select perfluorinated alkyl acids including pentadecafluorooctanoic acid (PFOA), perfluorobutane sulfonic acid (PFBS), perfluoroheptanoic acid (PFHpA), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA) and perfluorooctane sulfonic acid (PFOS). No field duplicate pairs were included in this SDG.

The samples were collected by Tetra Tech on December 4, 2018 and analyzed by Test America-Sacramento. All sample analyses were conducted in accordance with EPA Method 537 version 1.1 analytical and reporting protocols.

The data contained in this SDG was validated with regard to the following parameters: data completeness, holding times, mass calibration, mass spectral acquisition rate, instrument sensitivity check, peak asymmetry factor, initial/continuing calibrations, ion transitions, laboratory method/FRB results, surrogate spike recoveries, laboratory control sample / laboratory control sample duplicate results, injected internal standard areas and recoveries, chromatographic resolution, analyte identification, analyte quantitation, and detection limits. Areas of concern are listed below.

Major

No issues.

Minor

Detected results reported below the limit of quantitation (LOQ) but above the detection limit (DL) were qualified as estimated (J).

Notes

It was noted that a preservative was indicated on the chain of custody. However, Trizma was not listed as the preservative.

The sample with detections and its associated FRB are summarized below. No detected results were present in the FRB.

Sample	Associated FRB
NAWC-120418-RW-098	NAWC-120418-FRB-098

Non-detected results were reported to the Limit of Detection (LOD).

The buffering agent Trizma was added to all drinking water samples.

Executive Summary

Laboratory Performance: No issues.

Other Factors Affecting Data Quality: Results below the RL were estimated.

The data for these analyses were reviewed with reference to the Environmental Protection Agency document EPA/600/R-08/092, Method 537, "Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)", (September 2009), US EPA National Functional Guidelines for Organic Data Review (January 2017), and the Department of Defense (DoD) document entitled "Quality Systems Manual (QSM) for Environmental Laboratories" (July 2013) as applicable. The text of this report has been formulated to address only those areas affecting data quality.

Tetra Tech, Inc.
Terri L. Solomon
Chemist/Data Validator

Tetra Tech, Inc.
Joseph A. Samchuck
Data Validation Manager

Attachments:
Appendix A – Qualified Analytical Results
Appendix B – Results as Reported by the Laboratory
Appendix C – Support Documentation

Data Qualifier Definitions

The following definitions provide brief explanations of the validation qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted detection limit.
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the reporting limit).
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
UJ	The analyte was analyzed for, but was not detected. The reported detection limit is approximate and may be inaccurate or imprecise.
NJ	The analyte has been “tentatively identified” or “presumptively” as present and the associated numerical value is the estimated concentration in the sample.
R	The sample result (detected) is unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
UR	The sample result (nondetected) is unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
X	The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and 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, but exclusion of the data is recommended.

Appendix A

Qualified Analytical Results

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration Noncompliance (i.e., % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
C01 = GC/MS Tuning Noncompliance
D = MS/MSD Recovery Noncompliance
E = LCS/LCSD Recovery Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = ICP PDS Recovery Noncompliance; MSA's $r < 0.995$
K = ICP Interference - includes ICS % R Noncompliance
L = Instrument Calibration Range Exceedance
M = Sample Preservation Noncompliance
N = Internal Standard Noncompliance
N01 = Internal Standard Recovery Noncompliance Dioxins
N02 = Recovery Standard Noncompliance Dioxins
N03 = Clean-up Standard Noncompliance Dioxins
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues; i.e.chromatography,interferences, etc.)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = RPD between columns/detectors >40% for positive results determined via GC/HPLC
V = Non-linear calibrations; correlation coefficient $r < 0.995$
W = EMPC result
X = Signal to noise response drop
Y = Percent solids <30%
Z = Uncertainty at 2 standard deviations is greater than sample activity
Z1 = Tentatively Identified Compound considered presumptively present
Z2 = Tentatively Identified Compound column bleed
Z3 = Tentatively Identified Compound aldol condensate
Z4 = Sample activity is less than the at uncertainty at 3 standard deviations and greater than the MDC
Z5 = Sample activity is less than the at uncertainty at 3 standard deviations and less than the MDC

PROJ_NO: 08005-WE04	NSAMPLE	NAWC-120418-FRB-098			NAWC-120418-RW-098		
SDG: 320-45868-1	LAB_ID	320-45868-2			320-45868-1		
FRACTION: PFAS	SAMP_DATE	12/4/2018			12/4/2018		
MEDIA: WATER	QC_TYPE	FB			NM		
	UNITS	NG/L			NG/L		
	PCT_SOLIDS	0.0			0.0		
	DUP_OF						
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD
PENTADECAFLUOROOCTANOIC ACID (PFOA)		5.18	U		11.7		
PERFLUOROBUTANESULFONIC ACID (PFBS)		1.73	U		4.68		
PERFLUOROHEPTANOIC ACID (PFHPA)		2.59	U		3.48	J	P
PERFLUOROHEXANESULFONIC ACID (PFHXS)		1.73	U		4.28	J	P
PERFLUORONONANOIC ACID (PFNA)		0.864	U		1.28	J	P
PERFLUOROOCTANESULFONIC ACID (PFOS)		1.73	U		10		

FORM I
LCMS ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-45868-1

SDG No.:

Client Sample ID: NAWC-120418-RW-098 | Lab Sample ID: 320-45868-1

Matrix: Water | Lab File ID: 2018.12.12_537A_047.d

Analysis Method: 537 | Date Collected: 12/04/2018 10:10

Extraction Method: 537 | Date Extracted: 12/11/2018 10:06

Sample wt/vol: 275.5(mL) | Date Analyzed: 12/13/2018 00:40

Con. Extract Vol.: 10.00(mL) | Dilution Factor: 1

Injection Volume: 10(uL) | GC Column: GeminiC18 3x100 ID: 3(mm)

% Moisture: | GPC Cleanup:(Y/N) N

Analysis Batch No.: 264881 | Units: ng/L

CAS NO.	COMPOUND NAME	RESULT	Q	LOQ	LOD	DL
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	10.0		4.54	1.81	0.862
335-67-1	Perfluorooctanoic acid (PFOA)	11.7	~~M~~	6.35	5.44	2.45
375-95-1	Perfluorononanoic acid (PFNA)	1.28	J	4.54	0.907	0.426
355-46-4	Perfluorohexanesulfonic acid (PFHxS)	4.28	J	4.54	1.81	0.581
375-85-9	Perfluoroheptanoic acid (PFHpA)	3.48	J	4.54	2.72	1.18
375-73-5	Perfluorobutanesulfonic acid (PFBS)	4.68		4.54	1.81	0.726

CAS NO.	SURROGATE	%REC	Q	LIMITS
STL00993	13C2 PFHxA	100		70-130
STL00996	13C2 PFDA	96		70-130

01/07/2019

FORM I
LCMS ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-45868-1

SDG No.:

Client Sample ID: NAWC-120418-FRB-098 | Lab Sample ID: 320-45868-2

Matrix: Water | Lab File ID: 2018.12.12_537A_048.d

Analysis Method: 537 | Date Collected: 12/04/2018 10:05

Extraction Method: 537 | Date Extracted: 12/11/2018 10:06

Sample wt/vol: 289.3(mL) | Date Analyzed: 12/13/2018 00:47

Con. Extract Vol.: 10.00(mL) | Dilution Factor: 1

Injection Volume: 10(uL) | GC Column: GeminiC18 3x100 ID: 3(mm)

% Moisture: | GPC Cleanup:(Y/N) N

Analysis Batch No.: 264881 | Units: ng/L

CAS NO.	COMPOUND NAME	RESULT	Q	LOQ	LOD	DL
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	1.73	U	4.32	1.73	0.821
335-67-1	Perfluorooctanoic acid (PFOA)	5.18	U ~~M~~	6.05	5.18	2.33
375-95-1	Perfluorononanoic acid (PFNA)	0.864	U	4.32	0.864	0.406
355-46-4	Perfluorohexanesulfonic acid (PFHxS)	1.73	U	4.32	1.73	0.553
375-85-9	Perfluoroheptanoic acid (PFHpA)	2.59	U	4.32	2.59	1.12
375-73-5	Perfluorobutanesulfonic acid (PFBS)	1.73	U	4.32	1.73	0.691

CAS NO.	SURROGATE	%REC	Q	LIMITS
STL00993	13C2 PFHxA	84		70-130
STL00996	13C2 PFDA	89		70-130

01/07/2019

Appendix B

Results as Reported by the Laboratory

FORM I
LCMS ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Client Sample ID: NAWC-120418-RW-098 Lab Sample ID: 320-45868-1

Matrix: Water Lab File ID: 2018.12.12_537A_047.d

Analysis Method: 537 Date Collected: 12/04/2018 10:10

Extraction Method: 537 Date Extracted: 12/11/2018 10:06

Sample wt/vol: 275.5(mL) Date Analyzed: 12/13/2018 00:40

Con. Extract Vol.: 10.00(mL) Dilution Factor: 1

Injection Volume: 10(uL) GC Column: GeminiC18 3x100 ID: 3(mm)

% Moisture: GPC Cleanup:(Y/N) N

Analysis Batch No.: 264881 Units: ng/L

CAS NO.	COMPOUND NAME	RESULT	Q	LOQ	LOD	DL
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	10.0		4.54	1.81	0.862
335-67-1	Perfluorooctanoic acid (PFOA)	11.7	M	6.35	5.44	2.45
375-95-1	Perfluorononanoic acid (PFNA)	1.28	J	4.54	0.907	0.426
355-46-4	Perfluorohexanesulfonic acid (PFHxS)	4.28	J	4.54	1.81	0.581
375-85-9	Perfluoroheptanoic acid (PFHpA)	3.48	J	4.54	2.72	1.18
375-73-5	Perfluorobutanesulfonic acid (PFBS)	4.68		4.54	1.81	0.726

CAS NO.	SURROGATE	%REC	Q	LIMITS
STL00993	13C2 PFHxA	100		70-130
STL00996	13C2 PFDA	96		70-130

FORM I
LCMS ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-45868-1

SDG No.:

Client Sample ID: NAWC-120418-FRB-098 | Lab Sample ID: 320-45868-2

Matrix: Water | Lab File ID: 2018.12.12_537A_048.d

Analysis Method: 537 | Date Collected: 12/04/2018 10:05

Extraction Method: 537 | Date Extracted: 12/11/2018 10:06

Sample wt/vol: 289.3(mL) | Date Analyzed: 12/13/2018 00:47

Con. Extract Vol.: 10.00(mL) | Dilution Factor: 1

Injection Volume: 10(uL) | GC Column: GeminiC18 3x100 ID: 3(mm)

% Moisture: | GPC Cleanup:(Y/N) N

Analysis Batch No.: 264881 | Units: ng/L

CAS NO.	COMPOUND NAME	RESULT	Q	LOQ	LOD	DL
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	1.73	U	4.32	1.73	0.821
335-67-1	Perfluorooctanoic acid (PFOA)	5.18	U M	6.05	5.18	2.33
375-95-1	Perfluorononanoic acid (PFNA)	0.864	U	4.32	0.864	0.406
355-46-4	Perfluorohexanesulfonic acid (PFHxS)	1.73	U	4.32	1.73	0.553
375-85-9	Perfluoroheptanoic acid (PFHpA)	2.59	U	4.32	2.59	1.12
375-73-5	Perfluorobutanesulfonic acid (PFBS)	1.73	U	4.32	1.73	0.691

CAS NO.	SURROGATE	%REC	Q	LIMITS
STL00993	13C2 PFHxA	84		70-130
STL00996	13C2 PFDA	89		70-130

Appendix C

Support Documentation

TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605-1500
phone 916.373.5600 fax 303.467.7248

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☑ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	Project Manager: Andy Frebowitz	Site Contact: Mary Kay Bond	Date: 12/4/2018	COC No:
TetraTech	Tel/Fax: 610.382.2920	Lab Contact: Dave Alltucker	Carrier: FedEx	1 of 1 COCs
234 Mall Boulevard Suite 260	Analysis Turnaround Time			Sampler: Mary Kay Bond
King of Prussia, PA 19406	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
610-382-2924	TAT if different from Below 21			Walk-in Client:
610-491-9688	☑ 2 weeks			Lab Sampling:
Project Name: WE04	☐ 1 week			
Site: WE04	☐ 2 days			Job / SDG No.:
P O # 1132358 (through EarthToxics)	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	EPA 537 UCMR3	Sample Specific Notes:
NAWC-120418-RW-098	12/4/2018	10:10	G	DW	2	N	N	Y	
NAWC-120418-FRB-098	12/4/2018	10:05	G	DW	2	N	N	Y	Field Reagent Blank
								6	

320-45868 Chain of Custody

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Fed Ex Tracking: 773875655361

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: 5.1 Corr'd: 5.1 Therm ID No.: AE3

	Company:	Date/Time:		Company:	Date/Time:
Relinquished by:	Tetra Tech	12/4/2018 16:00	Received by:	TASac	12/5/18 1045
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.11, dated 1/24/2017

Job Narrative
320-45868-1

Receipt
The samples were received on 12/5/2018 10:05 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 5.1° C.

LCMS
Method(s) 537: The first level standard from the initial calibration curve is used to evaluate the tune criteria. The instrument mass windows are set at +/- 0.5amu; therefore, detection of the analyte serves as verification that the assigned mass is within +/- 0.5amu of the true value, which meets the DoD/DOE QSM tune criterion.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
Method(s) 537: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 320-264464.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Qualifiers

LCMS

Qualifier	Qualifier Description
J	Estimated: The analyte was positively identified; the quantitation is an estimation
M	Manual integrated compound.
U	Undetected at the Limit of Detection.

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
CFL	Contains Free Liquid
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)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
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)

Method Summary

Client: Tetra Tech, Inc. TestAmerica Job ID: 320-45868-1
Project/Site: Warminster: PFAS, NAS JRB Willow Grove

Method	Method Description	Protocol	Laboratory
537	Perfluorinated Alkyl Acids (LC/MS)	EPA	TAL SAC
537	Extraction of Perfluorinated Alkyl Acids	EPA	TAL SAC

Protocol References:

EPA = US Environmental Protection Agency

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Sample Summary

Client: Tetra Tech, Inc.
Project/Site: Warminster: PFAS, NAS JRB Willow Grove

TestAmerica Job ID: 320-45868-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
320-45868-1	NAWC-120418-RW-098	Water	12/04/18 10:10	12/05/18 10:05
320-45868-2	NAWC-120418-FRB-098	Water	12/04/18 10:05	12/05/18 10:05

FORM II
LCMS SURROGATE RECOVERY

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Matrix: Water Level: Low

GC Column (1): GeminiC18 3 ID: 3 (mm)

Client Sample ID	Lab Sample ID	PFHxA #	PFDA #
NAWC-120418-RW-098	320-45868-1	100	96
NAWC-120418-FRB-098	320-45868-2	84	89
	MB 320-264464/1-A	76	74
	LCS 320-264464/2-A	101	91
	LCSD 320-264464/3-A	89	92

	QC LIMITS
PFHxA = 13C2 PFHxA	70-130
PFDA = 13C2 PFDA	70-130

Column to be used to flag recovery values

FORM II 537

FORM III
LCMS LAB CONTROL SAMPLE RECOVERY

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Matrix: Water Level: Low Lab File ID: 2018.12.12_537A_045.d

Lab ID: LCS 320-264464/2-A Client ID:

COMPOUND	SPIKE ADDED (ng/L)	LCS CONCENTRATION (ng/L)	LCS % REC	QC LIMITS REC	#
Perfluorooctanesulfonic acid (PFOS)	92.8	82.21	89	70-130	
Perfluorooctanoic acid (PFOA)	100	93.64	94	70-130	
Perfluorononanoic acid (PFNA)	100	88.85	89	70-130	
Perfluorohexanesulfonic acid (PFHxS)	91.0	87.50	96	70-130	
Perfluoroheptanoic acid (PFHpA)	100	91.44	91	70-130	
Perfluorobutanesulfonic acid (PFBS)	88.4	89.14	101	70-130	

Column to be used to flag recovery and RPD values

FORM III 537

FORM III
LCMS LAB CONTROL SAMPLE DUPLICATE RECOVERY

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Matrix: Water Level: Low Lab File ID: 2018.12.12_537A_046.d

Lab ID: LCSD 320-264464/3-A Client ID:

COMPOUND	SPIKE ADDED (ng/L)	LCSD CONCENTRATION (ng/L)	LCSD % REC	% RPD	QC LIMITS RPD	QC LIMITS REC	#
Perfluorooctanesulfonic acid (PFOS)	92.8	86.94	94	6	30	70-130	
Perfluorooctanoic acid (PFOA)	100	90.24	90	4	30	70-130	
Perfluorononanoic acid (PFNA)	100	85.73	86	4	30	70-130	
Perfluorohexanesulfonic acid (PFHxS)	91.0	93.58	103	7	30	70-130	
Perfluoroheptanoic acid (PFHpA)	100	95.06	95	4	30	70-130	
Perfluorobutanesulfonic acid (PFBS)	88.4	88.28	100	1	30	70-130	

Column to be used to flag recovery and RPD values

FORM III 537

FORM IV
LCMS METHOD BLANK SUMMARY

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Lab File ID: 2018.12.12_537A_044.d Lab Sample ID: MB 320-264464/1-A

Matrix: Water Date Extracted: 12/11/2018 10:06

Instrument ID: A8_N Date Analyzed: 12/13/2018 00:17

Level:(Low/Med) Low

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES:

CLIENT SAMPLE ID	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
	LCS 320-264464/2-A	2018.12.12_537A_045.d	12/13/2018 00:25
	LCSD 320-264464/3-A	2018.12.12_537A_046.d	12/13/2018 00:32
NAWC-120418-RW-098	320-45868-1	2018.12.12_537A_047.d	12/13/2018 00:40
NAWC-120418-FRB-098	320-45868-2	2018.12.12_537A_048.d	12/13/2018 00:47

FORM I
LCMS ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento | Job No.: 320-45868-1

SDG No.:

Client Sample ID: | Lab Sample ID: MB 320-264464/1-A

Matrix: Water | Lab File ID: 2018.12.12_537A_044.d

Analysis Method: 537 | Date Collected:

Extraction Method: 537 | Date Extracted: 12/11/2018 10:06

Sample wt/vol: 250(mL) | Date Analyzed: 12/13/2018 00:17

Con. Extract Vol.: 10.00(mL) | Dilution Factor: 1

Injection Volume: 10(uL) | GC Column: GeminiC18 3x100 ID: 3(mm)

% Moisture: | GPC Cleanup:(Y/N) N

Analysis Batch No.: 264881 | Units: ng/L

CAS NO.	COMPOUND NAME	RESULT	Q	LOQ	LOD	DL
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	2.00	U	5.00	2.00	0.950
335-67-1	Perfluorooctanoic acid (PFOA)	6.00	U	7.00	6.00	2.70
375-95-1	Perfluorononanoic acid (PFNA)	1.00	U	5.00	1.00	0.470
355-46-4	Perfluorohexanesulfonic acid (PFHxS)	2.00	U	5.00	2.00	0.640
375-85-9	Perfluoroheptanoic acid (PFHpA)	3.00	U	5.00	3.00	1.30
375-73-5	Perfluorobutanesulfonic acid (PFBS)	2.00	U	5.00	2.00	0.800

CAS NO.	SURROGATE	%REC	Q	LIMITS
STL00993	13C2 PFHxA	76		70-130
STL00996	13C2 PFDA	74		70-130

FORM VIII
LCMS INTERNAL STANDARD AREA AND RETENTION TIME SUMMARY

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Instrument ID: A8_N Calibration Start Date: 12/07/2018 15:06

GC Column: GeminiC18 3x100 ID: 3(mm) Calibration End Date: 12/07/2018 15:50

Calibration ID: 42659

		13PFOA		PFOS			
		AREA #	RT #	AREA #	RT #	AREA #	RT #
INITIAL CALIBRATION MEAN AREA AND MEAN RT		3528472	3.19	2654650	3.59		
UPPER LIMIT		5292708	3.69	3981975	4.09		
LOWER LIMIT		1764236	2.69	1327325	3.09		
LAB SAMPLE ID	CLIENT SAMPLE ID						
CCVL 320-263818/10		3854163	3.20	2764360	3.59		
ICV 320-263818/12		3693184	3.19	2637299	3.57		
CCVL 320-264873/1		4054695	3.19	2861418	3.57		
CCV 320-264881/39 CCVIS		3533826	3.17	2640883	3.57		
MB 320-264464/1-A		4107455	3.17	2936150	3.56		
LCS 320-264464/2-A		3762705	3.17	2848346	3.56		
LCSD 320-264464/3-A		3920807	3.17	2767790	3.56		
320-45868-1	NAWC-120418-RW-098	3715088	3.19	2999960	3.57		
320-45868-2	NAWC-120418-FRB-098	4024732	3.17	2732047	3.56		
CCV 320-264881/51 CCVIS		3493319	3.17	2638815	3.56		

13PFOA = 13C2 PFOA
PFOS = 13C4 PFOS

Area Limit = 50%-150% of internal standard area
RT Limit = ± 0.5 minutes of internal standard RT

Column used to flag values outside QC limits

FORM VIII 537

FORM VIII
LCMS INTERNAL STANDARD AREA AND RETENTION TIME SUMMARY

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Sample No.: CCV 320-264881/39 Date Analyzed: 12/13/2018 00:02

Instrument ID: A8_N GC Column: GeminiC18 3x100 ID: 3(mm)

Lab File ID (Standard): 2018.12.12_537A_042 Heated Purge: (Y/N) N

Calibration ID: 42659

		13PFOA		PFOS			
		AREA #	RT #	AREA #	RT #	AREA #	RT #
12/24 HOUR STD		3533826	3.17	2640883	3.57		
UPPER LIMIT		4947356	3.67	3697236	4.07		
LOWER LIMIT		2473678	2.67	1848618	3.07		
LAB SAMPLE ID	CLIENT SAMPLE ID						
MB 320-264464/1-A		4107455	3.17	2936150	3.56		
LCS 320-264464/2-A		3762705	3.17	2848346	3.56		
LCSD 320-264464/3-A		3920807	3.17	2767790	3.56		
320-45868-1	NAWC-120418-RW-098	3715088	3.19	2999960	3.57		
320-45868-2	NAWC-120418-FRB-098	4024732	3.17	2732047	3.56		

13PFOA = 13C2 PFOA
PFOS = 13C4 PFOS

Area Limit = 70%-140% of internal standard area
RT Limit = ± 0.5 minutes of internal standard RT

Column used to flag values outside QC limits

FORM VIII 537

FORM VIII
LCMS INTERNAL STANDARD AREA AND RETENTION TIME SUMMARY

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Sample No.: CCV 320-264881/51 Date Analyzed: 12/13/2018 01:32

Instrument ID: A8_N GC Column: GeminiC18 3x100 ID: 3(mm)

Lab File ID (Standard): 2018.12.12_537A_054 Heated Purge: (Y/N) N

Calibration ID: 42659

		13PFOA		PFOS			
		AREA #	RT #	AREA #	RT #	AREA #	RT #
12/24 HOUR STD		3493319	3.17	2638815	3.56		
UPPER LIMIT		4890647	3.67	3694341	4.06		
LOWER LIMIT		2445323	2.67	1847171	3.06		
LAB SAMPLE ID	CLIENT SAMPLE ID						
MB 320-264464/1-A		4107455	3.17	2936150	3.56		
LCS 320-264464/2-A		3762705	3.17	2848346	3.56		
LCSD 320-264464/3-A		3920807	3.17	2767790	3.56		
320-45868-1	NAWC-120418-RW-098	3715088	3.19	2999960	3.57		
320-45868-2	NAWC-120418-FRB-098	4024732	3.17	2732047	3.56		

13PFOA = 13C2 PFOA
PFOS = 13C4 PFOS

Area Limit = 70%-140% of internal standard area
RT Limit = ± 0.5 minutes of internal standard RT

Column used to flag values outside QC limits

FORM VIII 537

FORM VI
LCMS BY INTERNAL STANDARD - INITIAL CALIBRATION DATA
CURVE EVALUATION

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1 Analy Batch No.: 263818

SDG No.:

Instrument ID: A8_N GC Column: GeminiC18 3 ID: 3(mm) Heated Purge: (Y/N) N

Calibration Start Date: 12/07/2018 15:06 Calibration End Date: 12/07/2018 15:50 Calibration ID: 42659

Calibration Files:

LEVEL:	LAB SAMPLE ID:	LAB FILE ID:
Level 1	IC 320-263818/2	2018.12.07_537ICAL_003.d
Level 2	IC 320-263818/3	2018.12.07_537ICAL_004.d
Level 3	IC 320-263818/4	2018.12.07_537ICAL_005.d
Level 4	IC 320-263818/5	2018.12.07_537ICAL_006.d
Level 5	IC 320-263818/6	2018.12.07_537ICAL_007.d
Level 6	IC 320-263818/7	2018.12.07_537ICAL_008.d
Level 7	IC 320-263818/8	2018.12.07_537ICAL_009.d

ANALYTE	RRF					CURVE TYPE	COEFFICIENT			#	MIN RRF	%RSD	#	MAX %RSD	R^2 OR COD	#	MIN R^2 OR COD
	LVL 1 LVL 6	LVL 2 LVL 7	LVL 3	LVL 4	LVL 5		B	M1	M2								
Perfluorobutanesulfonic acid (PFBS)	1.0988 1.1767	1.2086 1.1302	1.0474	1.1169	1.0674	Ave		1.1209				5.1		30.0			
Perfluoroheptanoic acid (PFHpA)	1.2239 1.0659	1.0707 1.0573	1.0359	1.0224	0.9766	Ave		1.0647				7.3		30.0			
Perfluorohexanesulfonic acid (PFHxS)	1.4212 1.5811	1.4959 1.4890	1.3853	1.5308	1.4287	Ave		1.4760				4.6		30.0			
Perfluorooctanoic acid (PFOA)	1.2538 1.0902	1.0919 1.0484	1.0827	1.0711	0.9868	Ave		1.0893				7.5		30.0			
Perfluorooctanesulfonic acid (PFOS)	1.2739 1.0826	1.1148 1.0827	1.0146	1.0841	1.0634	Ave		1.1023				7.4		30.0			
Perfluorononanoic acid (PFNA)	0.8864 0.8230	0.8400 0.8262	0.8111	0.8329	0.8003	Ave		0.8314				3.3		30.0			
13C2 PFHxA	0.9542 0.9684	0.9959 0.9973	0.9365	0.9604	0.8704	Ave		0.9547				4.5		30.0			
13C2 PFDA	0.7164 0.7292	0.7303 0.7164	0.7050	0.7335	0.6982	Ave		0.7184				1.9		30.0			

Note: The M1 coefficient is the same as Ave RRF for an Ave curve type.

FORM VI
LCMS BY INTERNAL STANDARD - INITIAL CALIBRATION DATA
RESPONSE AND CONCENTRATION

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1 Analy Batch No.: 263818

SDG No.:

Instrument ID: A8_N GC Column: GeminiC18 3 ID: 3(mm) Heated Purge: (Y/N) N

Calibration Start Date: 12/07/2018 15:06 Calibration End Date: 12/07/2018 15:50 Calibration ID: 42659

Calibration Files:

LEVEL:	LAB SAMPLE ID:	LAB FILE ID:
Level 1	IC 320-263818/2	2018.12.07_537ICAL_003.d
Level 2	IC 320-263818/3	2018.12.07_537ICAL_004.d
Level 3	IC 320-263818/4	2018.12.07_537ICAL_005.d
Level 4	IC 320-263818/5	2018.12.07_537ICAL_006.d
Level 5	IC 320-263818/6	2018.12.07_537ICAL_007.d
Level 6	IC 320-263818/7	2018.12.07_537ICAL_008.d
Level 7	IC 320-263818/8	2018.12.07_537ICAL_009.d

ANALYTE	IS REF	CURVE TYPE	RESPONSE					CONCENTRATION (NG/ML)				
			LVL 1 LVL 6	LVL 2 LVL 7	LVL 3	LVL 4	LVL 5	LVL 1 LVL 6	LVL 2 LVL 7	LVL 3	LVL 4	LVL 5
Perfluorobutanesulfonic acid (PFBS)	PFOS	Ave	27320 5447804	62153 10829607	265789	1062646	2667621	0.0221 4.42	0.0442 8.84	0.221	0.884	2.21
Perfluoroheptanoic acid (PFHpA)	13PFOA	Ave	43264 7185923	80008 14333785	365716	1393593	3642688	0.0250 5.00	0.0500 10.0	0.250	1.00	2.50
Perfluorohexanesulfonic acid (PFHxS)	PFOS	Ave	36374 7535367	79188 14686493	361859	1499172	3675806	0.0228 4.55	0.0455 9.10	0.228	0.910	2.28
Perfluorooctanoic acid (PFOA)	13PFOA	Ave	44364 7357085	81675 14227009	382620	1461416	3684632	0.0250 5.01	0.0501 10.0	0.250	1.00	2.50
Perfluorooctanesulfonic acid (PFOS)	PFOS	Ave	33250 5261445	60183 10890349	270284	1082696	2790009	0.0232 4.64	0.0464 9.28	0.232	0.928	2.32
Perfluorononanoic acid (PFNA)	13PFOA	Ave	31332 5548381	62765 11200160	286352	1135323	2985342	0.0250 5.00	0.0500 10.0	0.250	1.00	2.50
13C2 PFHxA	13PFOA	Ave	3372926 3264066	3720908 3379961	3306344	3272924	3246608	2.50 2.50	2.50 2.50	2.50	2.50	2.50
13C2 PFDA	13PFOA	Ave	2532483 2457743	2728445 2428151	2488961	2499615	2604411	2.50 2.50	2.50 2.50	2.50	2.50	2.50

Curve Type Legend:
Ave = Average ISTD

FORM VI
LCMS BY INTERNAL STANDARD - INITIAL CALIBRATION DATA
READBACK PERCENT ERROR

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1 Analy Batch No.: 263818

SDG No.:

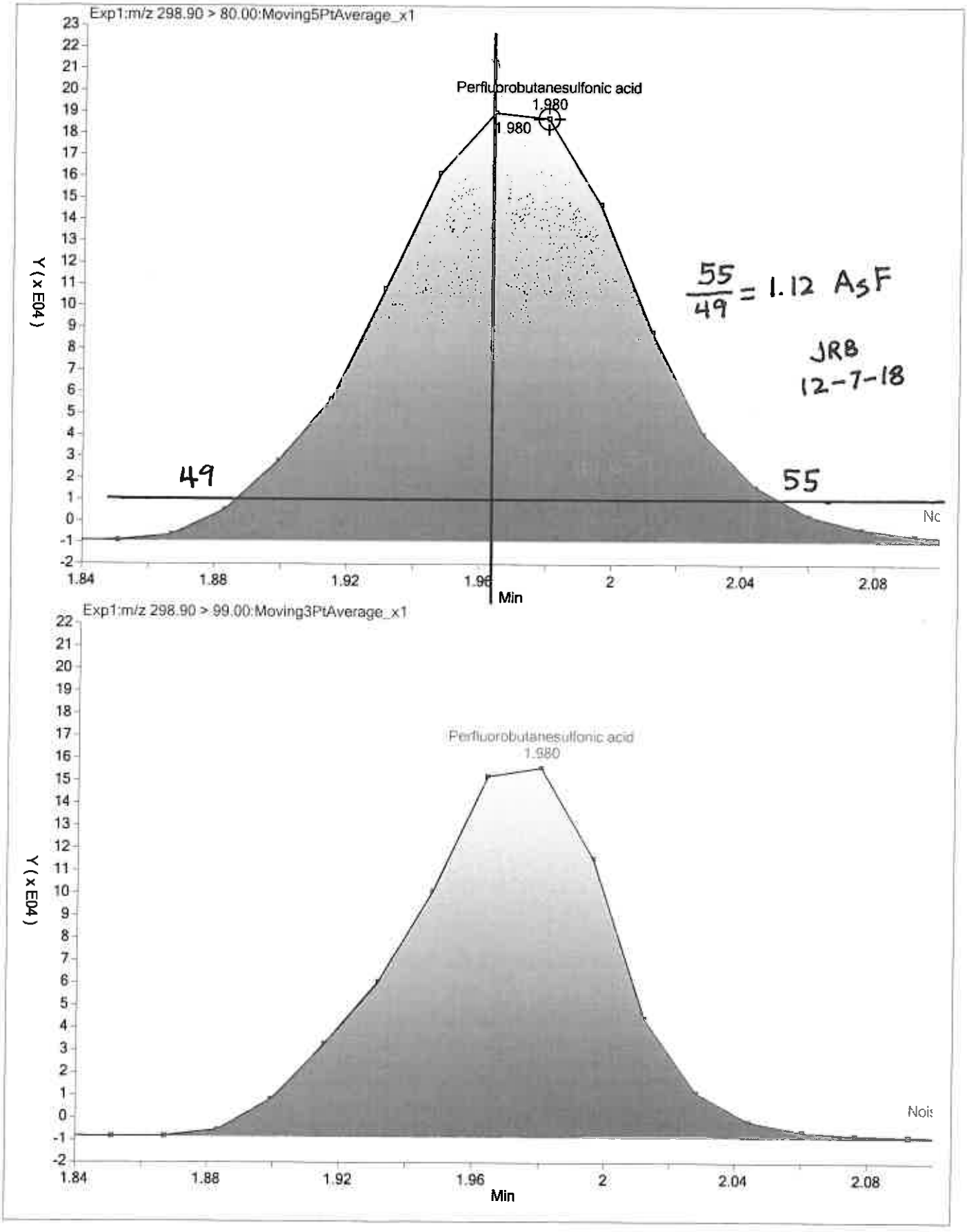
Instrument ID: A8_N GC Column: GeminiC18 3 ID: 3(mm) Heated Purge: (Y/N) N

Calibration Start Date: 12/07/2018 15:06 Calibration End Date: 12/07/2018 15:50 Calibration ID: 42659

Calibration Files:

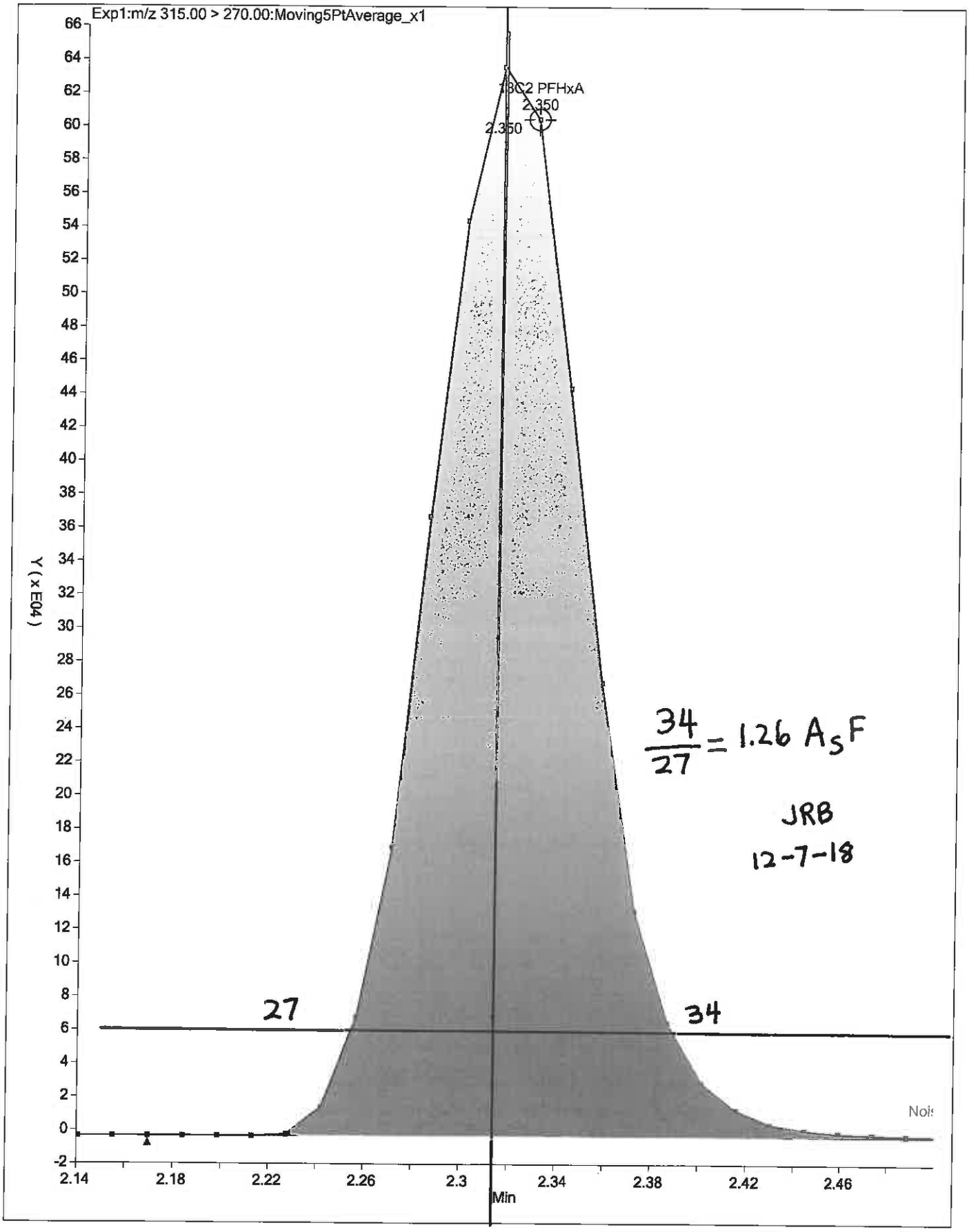
LEVEL:	LAB SAMPLE ID:	LAB FILE ID:
Level 1	IC 320-263818/2	2018.12.07_537ICAL_003.d
Level 2	IC 320-263818/3	2018.12.07_537ICAL_004.d
Level 3	IC 320-263818/4	2018.12.07_537ICAL_005.d
Level 4	IC 320-263818/5	2018.12.07_537ICAL_006.d
Level 5	IC 320-263818/6	2018.12.07_537ICAL_007.d
Level 6	IC 320-263818/7	2018.12.07_537ICAL_008.d
Level 7	IC 320-263818/8	2018.12.07_537ICAL_009.d

ANALYTE	PERCENT ERROR						PERCENT ERROR LIMIT					
	LVL 1 # LVL 7 #	LVL 2 #	LVL 3 #	LVL 4 #	LVL 5 #	LVL 6 #	LVL 1 LVL 7	LVL 2	LVL 3	LVL 4	LVL 5	LVL 6
Perfluorobutanesulfonic acid (PFBS)	-2.0 0.8	7.8	-6.6	-0.4	-4.8	5.0	50 30	30	30	30	30	30
Perfluoroheptanoic acid (PFHpA)	15.0 -0.7	0.6	-2.7	-4.0	-8.3	0.1	50 30	30	30	30	30	30
Perfluorohexanesulfonic acid (PFHxS)	-3.7 0.9	1.3	-6.1	3.7	-3.2	7.1	50 30	30	30	30	30	30
Perfluorooctanoic acid (PFOA)	15.1 -3.8	0.2	-0.6	-1.7	-9.4	0.1	50 30	30	30	30	30	30
Perfluorooctanesulfonic acid (PFOS)	15.6 -1.8	1.1	-8.0	-1.7	-3.5	-1.8	50 30	30	30	30	30	30
Perfluorononanoic acid (PFNA)	6.6 -0.6	1.0	-2.4	0.2	-3.7	-1.0	50 30	30	30	30	30	30
13C2 PFHxA	-0.1 4.5	4.3	-1.9	0.6	-8.8	1.4	30 30	30	30	30	30	30
13C2 PFDA	-0.3 -0.3	1.6	-1.9	2.1	-2.8	1.5	30 30	30	30	30	30	30


Exp1:m/z 298.90 > 80.00:Moving5PtAverage_x1
Perfluorobutanesulfonic acid
1.980
1.980
Y (x E04)
Min
49
55
55/49 = 1.12 AsF
JRB
12-7-18
Exp1:m/z 298.90 > 99.00:Moving3PtAverage_x1
Perfluorobutanesulfonic acid
1.980
Y (x E04)
Min

Chromatogram

IC L4 EXP1



Chrom

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FORM VII
LCMS CONTINUING CALIBRATION DATA

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Lab Sample ID: CCVL 320-263818/10 Calibration Date: 12/07/2018 16:05

Instrument ID: A8_N Calib Start Date: 12/07/2018 15:06

GC Column: GeminiC18 3x100 ID: 3.00(mm) Calib End Date: 12/07/2018 15:50

Lab File ID: 2018.12.07_537ICAL_011.d Conc. Units: ng/mL

ANALYTE	CURVE TYPE	AVE RRF	RRF	MIN RRF	CALC AMOUNT	SPIKE AMOUNT	%D	MAX %D
Perfluorobutanesulfonic acid (PFBS)	Ave	1.121	1.084		9.00	0.0442	-3.3	50.0
Perfluoroheptanoic acid (PFHpA)	Ave	1.065	1.081		1.00	0.0500	1.5	50.0
Perfluorohexanesulfonic acid (PFHxS)	Ave	1.476	1.539		3.00	0.0455	4.2	50.0
Perfluorooctanoic acid (PFOA)	Ave	1.089	1.107		2.00	0.0501	1.6	50.0
Perfluorononanoic acid (PFNA)	Ave	0.8314	0.8012		5.00	0.0500	-3.6	50.0
Perfluorooctanesulfonic acid (PFOS)	Ave	1.102	1.251		4.00	0.0464	13.5	50.0
13C2 PFHxA	Ave	0.9547	0.9343		2.45	2.50	-2.1	30.0
13C2 PFDA	Ave	0.7184	0.6646		2.31	2.50	-7.5	30.0
d5-NEtFOSAA	Ave	1.065	1.074		2.52	2.50	0.8	30.0

FORM VII
LCMS CONTINUING CALIBRATION DATA

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Lab Sample ID: ICV 320-263818/12 Calibration Date: 12/07/2018 16:20

Instrument ID: A8_N Calib Start Date: 12/07/2018 15:06

GC Column: GeminiC18 3x100 ID: 3.00(mm) Calib End Date: 12/07/2018 15:50

Lab File ID: 2018.12.07_537ICAL_013.d Conc. Units: ng/mL

ANALYTE	CURVE TYPE	AVE RRF	RRF	MIN RRF	CALC AMOUNT	SPIKE AMOUNT	%D	MAX %D
Perfluorobutanesulfonic acid (PFBS)	Ave	1.121	1.102		9.00	1.77	-1.7	30.0
Perfluoroheptanoic acid (PFHpA)	Ave	1.065	1.021		1.92	2.00	-4.1	30.0
Perfluorohexanesulfonic acid (PFHxS)	Ave	1.476	1.548		1.91	1.82	4.9	30.0
Perfluorooctanoic acid (PFOA)	Ave	1.089	1.035		1.90	2.00	-4.9	30.0
Perfluorooctanesulfonic acid (PFOS)	Ave	1.102	1.058		1.78	1.85	-4.0	30.0
Perfluorononanoic acid (PFNA)	Ave	0.8314	0.7865		5.00	2.00	-5.4	30.0
13C2 PFHxA	Ave	0.9547	0.9303		2.44	2.50	-2.6	30.0
13C2 PFDA	Ave	0.7184	0.6774		2.36	2.50	-5.7	30.0
d5-NEtFOSAA	Ave	1.065	1.097		2.57	2.50	2.9	30.0

FORM VII
LCMS CONTINUING CALIBRATION DATA

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Lab Sample ID: CCVL 320-264873/1 Calibration Date: 12/12/2018 19:19

Instrument ID: A8_N Calib Start Date: 12/07/2018 15:06

GC Column: GeminiC18 3x100 ID: 3.00(mm) Calib End Date: 12/07/2018 15:50

Lab File ID: 2018.12.12_537A_004.d Conc. Units: ng/mL

ANALYTE	CURVE TYPE	AVE RRF	RRF	MIN RRF	CALC AMOUNT	SPIKE AMOUNT	%D	MAX %D
Perfluorobutanesulfonic acid (PFBS)	Ave	1.121	1.087		9.00	0.0442	-3.0	50.0
Perfluoroheptanoic acid (PFHpA)	Ave	1.065	1.099		1.00	0.0500	3.2	50.0
Perfluorohexanesulfonic acid (PFHxS)	Ave	1.476	1.524		3.00	0.0455	3.2	50.0
Perfluorooctanoic acid (PFOA)	Ave	1.089	1.027		2.00	0.0501	-5.7	50.0
Perfluorooctanesulfonic acid (PFOS)	Ave	1.102	1.107		4.00	0.0464	0.4	50.0
Perfluorononanoic acid (PFNA)	Ave	0.8314	0.7375		5.00	0.0500	-11.3	50.0
13C2 PFHxA	Ave	0.9547	0.8436		2.21	2.50	-11.6	30.0
13C2 PFDA	Ave	0.7184	0.6600		2.30	2.50	-8.1	30.0
d5-NEtFOSAA	Ave	1.065	0.9818		2.30	2.50	-7.9	30.0

FORM VII
LCMS CONTINUING CALIBRATION DATA

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Lab Sample ID: CCV 320-264881/39 Calibration Date: 12/13/2018 00:02

Instrument ID: A8_N Calib Start Date: 12/07/2018 15:06

GC Column: GeminiC18 3x100 ID: 3.00(mm) Calib End Date: 12/07/2018 15:50

Lab File ID: 2018.12.12_537A_042.d Conc. Units: ng/mL

ANALYTE	CURVE TYPE	AVE RRF	RRF	MIN RRF	CALC AMOUNT	SPIKE AMOUNT	%D	MAX %D
Perfluorobutanesulfonic acid (PFBS)	Ave	1.121	1.155		9.00	0.884	3.1	30.0
Perfluoroheptanoic acid (PFHpA)	Ave	1.065	1.047		0.983	1.00	-1.7	30.0
Perfluorohexanesulfonic acid (PFHxS)	Ave	1.476	1.471		3.00	0.910	-0.4	30.0
Perfluorooctanoic acid (PFOA)	Ave	1.089	1.078		0.991	1.00	-1.0	30.0
Perfluorononanoic acid (PFNA)	Ave	0.8314	0.8273		5.00	1.00	-0.5	30.0
Perfluorooctanesulfonic acid (PFOS)	Ave	1.102	1.094		4.00	0.928	-0.7	30.0
13C2 PFHxA	Ave	0.9547	0.9413		2.47	2.50	-1.4	30.0
13C2 PFDA	Ave	0.7184	0.7183		2.50	2.50	-0.0	30.0
d5-NEtFOSAA	Ave	1.065	1.099		2.58	2.50	3.2	30.0

FORM VII
LCMS CONTINUING CALIBRATION DATA

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Lab Sample ID: CCV 320-264881/51 Calibration Date: 12/13/2018 01:32

Instrument ID: A8_N Calib Start Date: 12/07/2018 15:06

GC Column: GeminiC18 3x100 ID: 3.00(mm) Calib End Date: 12/07/2018 15:50

Lab File ID: 2018.12.12_537A_054.d Conc. Units: ng/mL

ANALYTE	CURVE TYPE	AVE RRF	RRF	MIN RRF	CALC AMOUNT	SPIKE AMOUNT	%D	MAX %D
Perfluorobutanesulfonic acid (PFBS)	Ave	1.121	1.210		4.77	4.42	8.0	30.0
Perfluoroheptanoic acid (PFHpA)	Ave	1.065	1.073		5.04	5.00	0.8	30.0
Perfluorohexanesulfonic acid (PFHxS)	Ave	1.476	1.523		4.69	4.55	3.2	30.0
Perfluorooctanoic acid (PFOA)	Ave	1.089	1.068		4.91	5.01	-2.0	30.0
Perfluorooctanesulfonic acid (PFOS)	Ave	1.102	1.060		4.46	4.64	-3.8	30.0
Perfluorononanoic acid (PFNA)	Ave	0.8314	0.8005		4.81	5.00	-3.7	30.0
13C2 PFHxA	Ave	0.9547	0.9572		2.51	2.50	0.3	30.0
13C2 PFDA	Ave	0.7184	0.7209		2.51	2.50	0.3	30.0
d5-NEtFOSAA	Ave	1.065	1.036		2.43	2.50	-2.7	30.0

LCMS ANALYSIS RUN LOG

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Instrument ID: A8_N Start Date: 12/07/2018 15:06

Analysis Batch Number: 263818 End Date: 12/07/2018 16:20

LAB SAMPLE ID	CLIENT SAMPLE ID	DATE ANALYZED	DILUTION FACTOR	LAB FILE ID	COLUMN ID
IC 320-263818/2		12/07/2018 15:06	1	2018.12.07_537I CAL 003.d	GeminiC18 3x100 3(mm)
IC 320-263818/3		12/07/2018 15:13	1	2018.12.07_537I CAL 004.d	GeminiC18 3x100 3(mm)
IC 320-263818/4		12/07/2018 15:21	1	2018.12.07_537I CAL 005.d	GeminiC18 3x100 3(mm)
IC 320-263818/5 ICISAV		12/07/2018 15:28	1	2018.12.07_537I CAL 006.d	GeminiC18 3x100 3(mm)
IC 320-263818/6		12/07/2018 15:36	1	2018.12.07_537I CAL 007.d	GeminiC18 3x100 3(mm)
IC 320-263818/7		12/07/2018 15:43	1	2018.12.07_537I CAL 008.d	GeminiC18 3x100 3(mm)
IC 320-263818/8		12/07/2018 15:50	1	2018.12.07_537I CAL 009.d	GeminiC18 3x100 3(mm)
CCVL 320-263818/10		12/07/2018 16:05	1	2018.12.07_537I CAL 011.d	GeminiC18 3x100 3(mm)
ICB 320-263818/11		12/07/2018 16:13	1		GeminiC18 3x100 3(mm)
ICV 320-263818/12		12/07/2018 16:20	1	2018.12.07_537I CAL 013.d	GeminiC18 3x100 3(mm)

LCMS ANALYSIS RUN LOG

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Instrument ID: A8_N Start Date: 12/12/2018 19:19

Analysis Batch Number: 264873 End Date: 12/12/2018 20:56

LAB SAMPLE ID	CLIENT SAMPLE ID	DATE ANALYZED	DILUTION FACTOR	LAB FILE ID	COLUMN ID
CCVL 320-264873/1		12/12/2018 19:19	1	2018.12.12_537A 004.d	GeminiC18 3x100 3(mm)
CCV 320-264873/2 CCVIS		12/12/2018 19:26	1		GeminiC18 3x100 3(mm)
ZZZZZ		12/12/2018 19:34	1		GeminiC18 3x100 3(mm)
CCV 320-264873/14 CCVIS		12/12/2018 20:56	1		GeminiC18 3x100 3(mm)

537

LCMS ANALYSIS RUN LOG

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Instrument ID: A8_N Start Date: 12/13/2018 00:02

Analysis Batch Number: 264881 End Date: 12/13/2018 01:32

LAB SAMPLE ID	CLIENT SAMPLE ID	DATE ANALYZED	DILUTION FACTOR	LAB FILE ID	COLUMN ID
CCV 320-264881/39 CCVIS		12/13/2018 00:02	1	2018.12.12_537A_042.d	GeminiC18 3x100 3(mm)
ZZZZZ		12/13/2018 00:10	1		GeminiC18 3x100 3(mm)
MB 320-264464/1-A		12/13/2018 00:17	1	2018.12.12_537A_044.d	GeminiC18 3x100 3(mm)
LCS 320-264464/2-A		12/13/2018 00:25	1	2018.12.12_537A_045.d	GeminiC18 3x100 3(mm)
LCSD 320-264464/3-A		12/13/2018 00:32	1	2018.12.12_537A_046.d	GeminiC18 3x100 3(mm)
320-45868-1		12/13/2018 00:40	1	2018.12.12_537A_047.d	GeminiC18 3x100 3(mm)
320-45868-2		12/13/2018 00:47	1	2018.12.12_537A_048.d	GeminiC18 3x100 3(mm)
ZZZZZ		12/13/2018 00:55	1		GeminiC18 3x100 3(mm)
ZZZZZ		12/13/2018 01:02	1		GeminiC18 3x100 3(mm)
ZZZZZ		12/13/2018 01:09	1		GeminiC18 3x100 3(mm)
ZZZZZ		12/13/2018 01:17	1		GeminiC18 3x100 3(mm)
ZZZZZ		12/13/2018 01:24	1		GeminiC18 3x100 3(mm)
CCV 320-264881/51 CCVIS		12/13/2018 01:32	1	2018.12.12_537A_054.d	GeminiC18 3x100 3(mm)

LCMS BATCH WORKSHEET

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Batch Number: 264464 Batch Start Date: 12/11/18 10:05 Batch Analyst: Long, Tyrel W

Batch Method: 537 Batch End Date: 12/11/18 14:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	GrossWeight	TareWeight	InitialAmount	FinalAmount	ReceivedpH	LC537-IS 00091
MB 320-264464/1		537, 537				250 mL	10.00 mL	7 SU	500 uL
LCS 320-264464/2		537, 537				250 mL	10.00 mL	7 SU	500 uL
LCSD 320-264464/3		537, 537				250 mL	10.00 mL	7 SU	500 uL
320-45868-A-1	NAWC-120418-RW-098	537, 537	T	303.75 g	28.24 g	275.5 mL	10.00 mL	7 SU	500 uL
320-45868-A-2	NAWC-120418-FRB-098	537, 537	T	317.43 g	28.15 g	289.3 mL	10.00 mL	7 SU	500 uL

Lab Sample ID	Client Sample ID	Method Chain	Basis	LC537-SU 00088	LC537MSP 00001	AnalysisComment			
MB 320-264464/1		537, 537		500 uL		Chlorine ND			
LCS 320-264464/2		537, 537		500 uL	500 uL	Chlorine ND			
LCSD 320-264464/3		537, 537		500 uL	500 uL	Chlorine ND			
320-45868-A-1	NAWC-120418-RW-098	537, 537	T	500 uL		Chlorine ND			
320-45868-A-2	NAWC-120418-FRB-098	537, 537	T	500 uL		Chlorine ND			

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

LCMS BATCH WORKSHEET

Lab Name: TestAmerica Sacramento Job No.: 320-45868-1

SDG No.:

Batch Number: 264464 Batch Start Date: 12/11/18 10:05 Batch Analyst: Long, Tyrel W

Batch Method: 537 Batch End Date: 12/11/18 14:00

Batch Notes	
Analyst ID - Aliquot Step	TWL
Batch Comment	Client labels match TA labels, TWL 12-11-18
Analyst ID - Final Volume Step	TWL
Internal Standard ID#	1451881
Manifold ID	Q,C
Methanol ID	1454398
pH Indicator ID	3718
Pipette ID	I46162G
Analyst ID - IS Reagent Drop	TWL
Analyst ID - IS Reagent Drop Witness	MYV
Analyst ID - SU Reagent Drop	TWL
Analyst ID - SU Reagent Drop Witness	MYV
Analyst ID - TA Reagent Drop	TWL
Analyst ID - TA Reagent Drop Witness	MYV
SPE Cartridge Lot ID	6413968-05
Trizma ID	SLBR5241V
Reagent Water ID	12-06-18

Basis	Basis Description
T	Total/NA

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

PFAS Calibration Calculations:

Initial Calibration 12/7/2018
Instrument A8_N

PFOA

Analyte Concentration	Analyte Response	Internal Standard Response	Internal Standard Amount	RRF	Reported RRF
0.025	44364	3534903	2.5	1.25503	1.2538
0.0501	81675	3736172	2.5	1.09085	1.0919
0.25	382620	3530447	2.5	1.08377	1.0827
1	1461416	3407730	2.5	1.07213	1.0711
2.5	3684632	3730120	2.5	0.98781	0.9868
5.01	7357085	3370676	2.5	1.08916	1.0902
10	14227009	3389257	2.5	1.04942	1.0484
			Average	1.08974	1.0893
			Standard Deviation	0.0813	
			RSD	0.0746	
			%RSD	7.46290	7.5

Continuing Calibration 12/12/2018 @ 19:19
PFOA

Analyte Concentration	Analyte Response	Internal Standard Response	Internal Standard Amount	RRF	%D	Reported RRF	Reported %D
0.0501	83394	4054695	2.5	1.0263	-5.78254	1.027	-5.7

Sample Identification NAWC-120418-RW-098
Compound PFOA

Compound Area	521573	Average RRF	1.0893
Internal Standard Amount (ng)	2.5	Sample Volume(ml)	275.5
Dilution Factor	1	Volume Extract (ml)	10
Internal Standard Area	3715088		
Concentration	11.6954 ng/L		
Reported Result	11.7 ng/L		

Surrogate PFHxA

Compound Area	3540908		
Internal Standard Amount (ng)	10		
Dilution Factor	1	Volume Extract (ml)	1
Internal Standard Area	3715088	Injection Volume (µl	1
Average RRF	0.9547		
Concentration	9.9834		
Surrogate %R	99.83	Spike amount	10

LCS/LCSD %R

320-264464/2-A

PFOA	Spike amount	LCS concentration
93.64	100	93.64

320-264464/3-A

PFOA	Spike amount	LCS concentration
90.24	100	90.24

MS/MSD RPD

3.70

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N

WARRINGTON

WARWICK

NORTHAMPTON

IVYLAND

WARMINSTER

HAGS

NASJRB
Willow Grove

HORSHAM

HATBORO

UPPER SOUTHAMPTON

UPPER MORELAND

LEGEND

- PFOA & PFOS BELOW DETECTION LIMITS
- SUM OF PFOA & PFOS CONCENTRATIONS AT OR BELOW 40 PPT
- SUM OF PFOA & PFOS CONCENTRATIONS BETWEEN 40 PPT AND 70 PPT
- SUM OF PFOA & PFOS CONCENTRATIONS ABOVE 70 PPT
- PUBLIC WATER CONNECTION (SOME NOT BY NAVY)
- SAMPLING AREA
- FORMER NAWC WARMINSTER
- TOWNSHIP BOUNDARY

3,000 1,500 0 3,000 6,000
Feet

NAVFAC

PFC SAMPLE RESULTS MAP
FORMER NAWC WAMINSTER
MONTGOMERY COUNTY, PENNSYLVANIA

SCALE	AS NOTED
FILE	NAWC
REV	0
DATE	01/24/19
FIGURE NUMBER	FIGURE 1