

TO: Richard Conforti
FROM: Clifford Yantz
RE: PFAS Sampling Event
FILE: 15388/64737/5
DATE: February 21, 2017

cc: Mr. Joseph Rogers - MDEQ
 Mr. John McCabe – MDEQ
 Mr. Grant Trigger – RACER Trust
 Mr. David Favero – RACER Trust
 Mr. Kevin Schneider – O’Brien & Gere

This technical memorandum has been prepared on behalf of the Revitalizing Auto Communities Environmental Response Trust (RACER Trust) to document the 2016 per- and polyfluorinated substances (PFAS) groundwater sampling event conducted in November 2016 at Coldwater Road Landfill facility located in Flint, Michigan (Site) ([Figure 1](#)). The groundwater sampling was conducted in response to a request by the Michigan Department of Environmental Quality (MDEQ) in an email dated July 13, 2016.

During this event PFAS samples were collected from both the Coldwater Road Industrial Land (former Peregrine) and Coldwater Road Landfill Facility. Both O’Brien & Gere (OBG) and GHD were on site and collected the samples in a collaborative effort in order to avoid discrepancies in the sampling method. GHD’s sample results are shared in a separate report.

BACKGROUND

The RACER Trust Coldwater Road Landfill facility is located north of the RACER Trust former Peregrine U.S., Inc. (RACER Trust former Peregrine) property ([Figure 1](#)). The RACER Trust Coldwater Road Landfill facility ([Figure 2](#)) consists of the wastewater treatment sludge monofill landfill, Remaining Materials Area (RMA, where nickel impacted soils were closed in place), former WWTP (decommissioned and demolished in 1999), restored wetlands, and leachate accumulation facility.

This facility is bordered on the south by the RACER Trust Coldwater Road Industrial Land, which formerly contained several manufacturing buildings and support facilities. The buildings on the Coldwater Road Industrial Land were decommissioned and demolished between 1999 and 2001.

During the facility operation there was a potential that PFAS were used in the manufacturing process and could have been processed through the wastewater treatment plant and incorporated in the wastewater treatment sludge stabilized and placed in the landfill.

Prior to sampling OBG and RACER reviewed historical reports and records to verify if chemicals used during manufacturing contained PFAS, in particular perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). Documentation on specific products and their use was fairly sparse but a reference to a PFAS containing material used in the plating operation and some lubricants containing PFAS were found. Generally, some product ingredients are proprietary or the ingredients are not listed because they are not required to be listed on the Safety Data Sheets. However, PFAS were generally used in the plating industry to suppress chrome plating fumes/mists during the time that the former facility was operational.

SAMPLING PROTOCOL

Special care was taken during sampling and transport of the samples to avoid contamination from clothing, sampling material and storage containers due to the extremely low detection limits for PFAS (<1 ng/L), because PFAS are used in a variety of applications and products, such as fire retardants, water repellent clothing, microwavable food wrappers, cosmetics, etc. [Table 1](#) and [Attachment A](#) provide detailed list of accepted and prohibited clothing and materials and a sampling checklist that was followed during sampling. For this sampling event, the sample team wore natural fiber (predominantly 100% cotton, or as near to 100% as possible) clothing (especially no water repellent materials [coats, gloves, shoes, etc.]) and avoided bathing with or

applying particular products (deodorants/antiperspirants, lotions, cosmetics, etc.) prior to sampling to avoid cross contamination.

Furthermore, all clothing worn by the field sampling crew was well laundered, at least 6 times, without the use of fabric softeners. Well laundered, 100% cotton sheets were utilized in place of plastic sheeting as ground cover, where needed, to avoid using non-high density polyethylene (HDPE) sheeting.

New HDPE and silicon tubing still in their unopened manufacturer's wrappers were utilized to avoid using rolls of tubing previously opened to further avoid potential exposure to PFAS during the transportation to the site. As much as possible, the sample containers, coolers, materials, and equipment utilized during sampling were stored and transported to avoid potential cross contamination by PFAS utilizing such precautions as transporting these things in the back of the company trucks, rather than within the carpeted cabin of the trucks that could have been treated with PFAS.

SAMPLING & ANALYSIS

The sample collection activities were completed on November 29, 2016 and November 30, 2016 in accordance with the PFOS-PFAS Work Plan dated October 7, 2016 (GHD, 2016 in collaboration with OBG), including OBG site-specific Groundwater Sampling Standard Operating Procedure.

Location

The following sample locations with the approval from the MDEQ were selected for collection at the Coldwater Road Landfill Facility ([Figure 2](#)):

- Coldwater Road Landfill
 - » Monitoring wells - B-7 and B-19Ar
 - » Sump D.

Sample Procedure

Prior to sampling, water level measurements were collected from monitoring wells at the Site and the offsite wells.

Low-flow groundwater sampling was performed using new HDPE sample tubing lowered approximately to the midpoint of the well screen and connected to either a peristaltic pump or Waterra® pump depending on the well depth. Monitoring well B-7 and Sump D were sampled using the peristaltic pump and B-19Ar was sampled using the Waterra® pump.

While each well was being purged, field indicator parameters consisting of pH, conductivity, temperature, oxidation-reduction potential (ORP), and dissolved oxygen (DO) were monitored continuously using an in-line meter. Turbidity was measured with a Hach® colorimeter. The field indicator parameters were recorded on sampling logs at five minute intervals and are provided in [Attachment B](#).

Monitoring wells B-7 and B-19Ar were both purged dry and sampled the following day because a drawdown of less than 0.3 ft or a maximum of 10% of the water column, whichever was greater could not be maintained as confirmed by the measurement of water levels in the monitoring well during purging. Once a drawdown of greater than 0.3 ft or 10% of the water column was confirmed, the pumping rate was increased and the well was purged dry and the sample was collected once the well had sufficiently recovered.

Samples selected for analysis were placed directly into clean, laboratory pre-preserved and supplied containers, labeled, placed in an ice-filled cooler, and transported to TestAmerica Laboratories, Inc. in Sacramento, California under appropriate chain-of custody (COC) protocols. The samples were submitted to the laboratory for analysis on a standard turnaround time.

Samples were analyzed for the presence of PFAS by United States Environmental Protection Agency (US EPA) Method 537 (no preservation). The three OBG samples from the Coldwater Road Landfill facility and the four GHD samples from the former Peregrine property were treated as one sample batch for the collection of Quality control (QC) samples. The following QC samples were collected in accordance with methods described in the Work Plan and MDEQ guidance: a field duplicate, a collocated, two matrix spike/matrix spike duplicates, two equipment blanks (one on the tubing used with the peristaltic pump low-flow sampling and the other on the Waterra® pump and associated tubing), and a field (ambient) blank. The collocated sample was collected at B-7, one of the two matrix spike/matrix spike duplicates was collected at Sump D, and the equipment blank associated with the peristaltic pump low-flow sampling were collected at the Coldwater Road Landfill facility and the rest of the QC samples were collected at the former Peregrine property.

Level III data deliverables were provided by TestAmerica Laboratories for the PFAS analyses (see [Attachment C](#)). OBG conducted a full validation of the analytical data for the samples collected at the Coldwater Road Landfill facility. The validation report concluded that overall data usability with respect to completeness is 100% for the data with no excursions; however, due to low level laboratory blank or control sample detections some detections less than the reporting limit of 2.0 ng/L were qualified as non-detect (U) at a detection limit of 2.0 ng/L (*i.e.*, <2.0 U). The data validation summary report is presented in [Attachment D](#).

ANALYTICAL RESULTS

The analytical results for the samples collected at the Coldwater Road Landfill facility, and the Waterra® pump rinsate (*i.e.*, equipment) blank and field (ambient) blank samples are presented in [Table 2](#) and discussed below. The complete analytical laboratory report is contained in [Attachment C](#).

Per- and polyfluorinated Compound	Well/Sample ID:	B-7	B-7 (Collocated)	B-19Ar	Sump D	Equipment Blank-1 (Low Flow Blank)	Waterra Rinsate Blank	Field Blank
		Sample Date: 11/30/2016	11/30/2016	11/30/2016	11/29/2016	11/29/2016 6	11/29/2016 6	11/30/2016 6
Perfluorobutanoic acid (PFBA)		9.2 J	7.1 J	1.0 J	440 J	<1.9	<1.8	<2.0
Perfluoropentanoic acid (PFPeA)		2.6	1.7 J	<2.0	300 J	<1.9	<1.8	<2.0
Perfluorohexanoic acid (PFHxA)		3.9	3.1	<2.0	99 JN	<1.9	<1.8	<2.0
Perfluoroheptanoic acid (PFHpA)		2.4	1.6 J	<2.0	24	<1.9	<1.8	<2.0
Perfluorooctanoic acid (PFOA)		9.2 JN	7.6 JN	0.84 JN	130 JN	<1.9	<1.8	<2.0
Perfluorononanoic acid (PFNA)		0.87 J	0.79 J	<2.0	7.1 JN	<1.9	<1.8	<2.0
Perfluorotetradecanoic acid (PFTeA)		<2.0 U	<2.0 U	<2.0 U	<19	<2.0 U	<2.0 U	<2.0 U
Perfluorobutanesulfonic acid (PFBS)		5.7	5.8	<2.0	74	<1.9	<1.8	<2.0
Perfluorohexanesulfonic acid (PFHxS)		23	22 JN	1.0 J	370	<1.9	<1.8	<2.0
Perfluoroheptanesulfonic Acid (PFHpS)		3.8	3.9	<2.0	83	<1.9	<1.8	<2.0
Perfluorooctanesulfonic acid (PFOS)		220	230	3.9	5,800	<1.9	<1.8	<2.0

Notes:
 Concentrations in ng/L
 Concentrations above the MDEQ proposed drinking water criteria area highlighted in yellow.

In September 2016 MDEQ proposed cleanup criteria of 80 ng/L (0.080 µg/L) for PFOS and 89 ng/L (0.089 µg/L) for PFOA.

- **B-7** – PFOS was detected at a concentration of 220 ng/L (0.22 µg/L) and 230 ng/L [0.23 µg/L] in the collocated sample from B-7 and both were above MDEQ proposed drinking water criterion. PFOA was detected at a concentration of 9.2 ng/L (0.0092 µg/L) and 7.6 ng/L [0.0076 µg/L] in the collocated sample from B-7, which are both below the MDEQ proposed drinking water criterion.



- **B-19Ar** – PFOS was detected at a concentration of 3.9 ng/L (0.0039 µg/L) and PFOA was detected at a concentration of 0.84 ng/L (0.00084 µg/L) in B-19Ar, which are below the MDEQ proposed drinking water criteria.
- **Sump-D** – PFOS was detected at a concentration of 5,800 ng/L (5.8 µg/L) in Sump D and PFOA was detected at a concentration of 130 ng/L (0.13 µg/L), which is above the MDEQ proposed drinking water criteria.

The levels of the other PFAS detected in B-7 and B-19Ar were relatively low, with the possible exception of the detection of perfluorohexanesulfonic acid (PFHxS) in B-7 at a concentration of 23 ng/L (0.023 µg/L). No criteria exists for PFHxS or the other PFAS at this time.

The duplicate sample results collected from monitoring well B-7 were comparable to the original sample. PFAS were not detected in Equipment Blank-1, Rinsate Blank, and Field Blank associated with this sampling event based on the validated results; therefore, the precautions taken by the sample team worked to prevent cross-contamination.

RECOMMENDATIONS

A step-wise approach should be utilized to further evaluate PFAS at the landfill. The proposed next steps include the following:

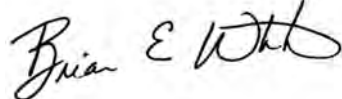
- Sample the remaining four (4) semi-annual groundwater monitoring shallow wells: B-9, B-18A, B-24r, and B-28 (**Figure 3**) to evaluate the presence and/or distribution of PFAS in the shallow groundwater at the site.
- Sample downgradient deep well B-27D to evaluate if PFAS are present and/or leaving the site in the regional aquifer.
- Sample Vault D to evaluate the concentrations of PFAS in the leak detection vault in comparison to Sump D and the shallow groundwater concentrations.
- Sample former WWTP area wells OBG MW7 and OBG MW-9 to evaluate if PFAS are present and/or leaving the site adjacent to the former WWTP.

Sampling can be completed in conjunction with the next semi-annual sampling event in June 2017.

If you have any questions regarding this technical memorandum, please contact Cliff at (248) 477-5701, ext. 16.

Very truly yours,

O'BRIEN & GERE ENGINEERS, INC.



Brian E. White, P.E.
Vice President
PE No. 6201056444 (MI)

Very truly yours,

O'BRIEN & GERE ENGINEERS, INC.



Clifford S. Yantz, PG
Scientist-3

ENCLOSURES:

Table 1 – Summary of Prohibited and Acceptable Items for PFAS Sampling
Table 2 – Analytical Results
Figure 1 – Site Location Map
Figure 2 – Sample Location Map
Figure 3 – Proposed Additional PFAS Sample Locations
Attachment A – Sampling Checklist
Attachment B – Groundwater Sampling Logs
Attachment C – Analytical Laboratory Results
Attachment D – Data Validation Summary Report



TABLES



Table 1. Summary of Prohibited and Acceptable Items for PFAS Sampling

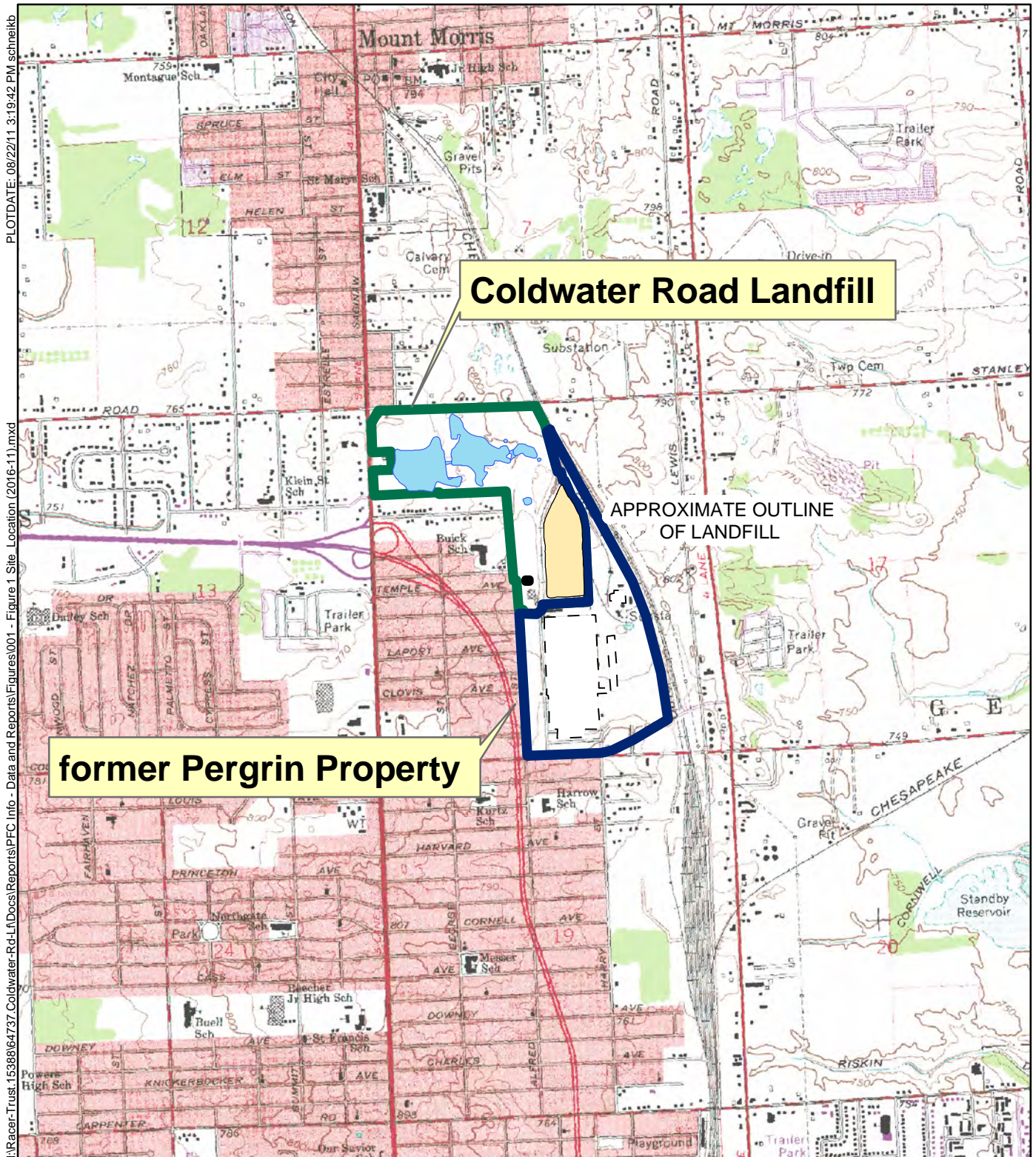
Prohibited	Acceptable
Field Equipment	
Teflon® containing materials	High density polyethylene (HDPE), stainless steel or polypropylene materials
Low density polyethylene (LDPE) materials	Acetate liners
	Silicon tubing
Waterproof field books, waterproof paper and waterproof sample bottle labels	Loose non-waterproof paper and non-waterproof sample labels
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
Waterproof markers / Sharpies®	Pens
Post-It Notes®	
Chemical (blue) ice packs	Regular ice
Field Clothing and PPE	
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing made of natural fibers (preferable cotton)
Clothing laundered using fabric softener	No fabric softener
Boots containing Gore-Tex™ or treated with water-resistant spray	Boots made with polyurethane and PVC
Tyvek®	Laundered cotton clothing
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	Sunscreens - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss My Face, and baby sunscreens that are "chemical free", "toxin free" or "natural"
Sunscreens or insecticides except as noted on right	Insect Repellents - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellent, Herbal Armor, California Baby Natural Bug Spray, Baby Ganics Sunscreen and insect repellent - Avon Skin So Soft Bug Guard Plus - SPF 30 Lotion
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Unlined polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Wet weather gear made of polyurethane and PVC only; field tents that are only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90®	Alconox® and/or Liquinox®
Water from an on-site well Potable water from untested public water supply	Potable water from tested (and PFAS free) public drinking water supply
Food Considerations	
All food and drink, with exceptions noted on right	Bottled water and hydration fluids (i.e., Gatorade® and Powerade®) to be brought and consumed only in the staging areas
Vehicle Considerations	
Vehicle fabrics, carpets and mats may contain PFAS	Avoid utilizing areas inside vehicle as sample staging areas.



FIGURES



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RACER TRUST
 COLDWATER ROAD LANDFILL FACILITY
 FLINT, MICHIGAN

SITE LOCATION MAP



Miles







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I:\Racer-Trust\15388\64737 Coldwater-Rd-LIDocs\Reports\PCF Info - Data and Reports\Figures\002 - Figure 2 GW_Report_Site_Layout (2016-11).mxd

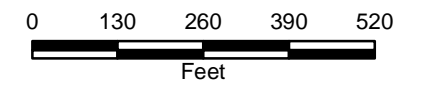


LEGEND

-  LEACHATE COLLECTION SUMP
-  ACCESS PORT FOR LEAK DETECTION VAULT
-  MONITORING WELL
-  ABANDONED WELL

RACER TRUST
COLDWATER ROAD
LANDFILL FACILITY
FLINT, MICHIGAN

SAMPLE LOCATION MAP



JANUARY 2017
15388/62658/002







O'BRIEN & GERE ENGINEERS, INC.

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I:\Racer-Trust\15388\64737 Coldwater-Rd-LI\Docs\Reports\PFAS Info - Data and Reports\Figures\003 - Figure 4 Proposed PFAS Well Locations.mxd

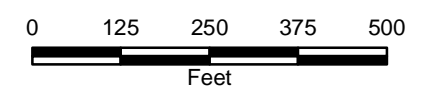


LEGEND

-  LEACHATE COLLECTION SUMP
-  ACCESS PORT FOR LEAK DETECTION VAULT
-  MONITORING WELL
-  ABANDONED WELL

RACER TRUST
COLDWATER ROAD
LANDFILL FACILITY
FLINT, MICHIGAN

**PROPOSED ADDITIONAL PFAS
SAMPLE LOCATIONS**



JANUARY 2017
15388/62658/002



O'BRIEN & GERE ENGINEERS, INC.

ATTACHMENT A
Sampling Checklist



Attachment A

PFAS Sampling Checklist

Date: _____

Weather (temp/precip): _____ Site Name: _____

Field Clothing and PPE:

- No clothing or boots containing Gore-Tex™
- No clothing or boots treated with water-resistant spray
- Safety boots made from polyurethane and PVC
- No materials containing Tyvek®
- Field crew has not used fabric softener on clothing
- Field crew has not used cosmetics, moisturizers, hand cream, or other related products this morning
- Field crew has not applied unauthorized sunscreen or insect repellent

Field Equipment:

- No Teflon® or LDPE containing materials
- All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books, waterproof paper or waterproof bottle labels, waterproof markers / Sharpies®
- No plastic clipboards, binders, or spiral hard cover notebooks
- No Post-It Notes®

- Coolers filled with regular ice only; no chemical (blue) ice packs in possession

Sample Containers:

- Sample containers made of HDPE or polypropylene
- Caps are unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- Wet weather gear made of polyurethane and PVC only

Equipment Decontamination:

- "PFAS-free" water on-site for decontamination of sample equipment; no other water sources to be used
- Alconox® and Liquinox® to be used as decontamination cleaning agents

Food Considerations:

- No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade® and Powerade®) that is available for consumption only in the staging area

Vehicle Considerations:

- Avoid utilizing areas inside vehicle as sample staging areas

If any applicable boxes cannot be checked, the field team leader shall describe the deviations below and work with field personnel to address issues prior to commencement of that day's work. If possible, materials identified as potentially containing PFAS (i.e., Tyvek® coveralls, spare equipment) should be relocated to a separate area of the site as far away as possible from the sampling location(s) and containerized if practicable. To assist in the assessment of QC data, the field team leader should document the presence of such items, their location, whether they have been containerized, and, if containerized, what type of container.

Describe any deviation(s) and the action/outcome and document the presence of any potential PFAS-containing materials:

Field Team Leader Name: _____

Field Team Leader Signature: _____ Time: _____

ATTACHMENT B

*Groundwater Sampling
Logs*

O'Brien & Gere Engineers, Inc.

Standard Groundwater Sampling Log

Date 11/29/16 - 11/30/16
 Site Name Coldwater Rd
 Location Flint
 Project No. 62658
 Personnel KBS

Weather mostly cloudy 50's
 Well # B-7
 Evacuation Method peristaltic
 Sampling Method well pumped DM

Well Information:

Depth of Well * 31.59 ft.
 Depth to Water * 19.22 ft.
 Length of Water Column 12.37 ft.
 Volume of Water in Well 2 gal.(s)
 3X Volume of Water in Well 6 gal.(s)

Water Volume /ft. for:
 X 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC
 6" Diameter Well = 1.469 X LWC

Volume removed before sampling 3 gal.(s)
 Did well go dry? Yes

* Measurements taken from Well Casing Protective Casing (Other, Specify)

Instrument Calibration: Calibrated within range

pH Yes
 ORP Yes
 Conductivity Yes
 DO Yes

Water parameters:

	Drawdown measured 0.3 feet or less	Temperature Celsius ±3 percent	Conductivity mS/cm ±3 percent	Dissolved Oxygen mg/L ±10 percent	pH ±0.1 pH units	ORP mV ±10 millivolts	Turbidity NTUs ±10 percent
initial	19.81	14.20	827.5	5.68	7.50	101.7	39.2
1145 5 min	20.71	13.22	805.5	6.39	7.30	87.0	22.8
1150 10 min	21.72	13.17	792.7	6.53	7.24	81.2	14.4
1155 15 min	22.95	13.22	788.7	6.46	7.22	78.6	13.0
1200 20 min	23.60	13.27	785.9	6.40	7.23	76.0	23.2
1205 25 min	24.76	13.22	789.2	6.13	7.21	74.2	39.6
1210 30 min	25.75	13.31	791.6	5.65	7.22	72.0	40.8
1215 35 min	26.65	13.32	792.4	4.84	7.21	69.9	46.4
1220 40 min	26.75	13.36	809.3	4.59	7.22	68.9	
1225 45 min	26.92	13.25	882.0	3.26	7.14	67.3	254
1230 50 min	26.90	13.31	936.8	1.58	7.06	65.3	48.9
1235 55 min	27.28	13.22	936.1	1.39	7.06	63.3	38.2
1240 60 min	27.61	13.16	939.7	1.09	7.04	61.8	58.1
							369

Water Sample:

Time Collected 1230

OVER →

Physical Appearance at Start

Color lightly cloudy
 Odor None
 Turbidity (> 100 NTU) 39.2
 Sheen/Free Product None

Physical Appearance at Sampling

Color Slightly cloudy
 Odor None
 Turbidity (> 100 NTU) 118
 Sheen/Free Product None

Samples collected:

Analyses	# Bottles	Bottle size/type	Preservative	Field Filtered
Dissolved Metals - Cu, Cr, Ni, Zn	1	125 ml Plastic	HNO ₃	yes
TOC	2	40 ml Glass	H ₂ SO ₄	
TOX	1	250 ml Amber Glass	H ₂ SO ₄	
Specific Conductivity	1	125 ml Plastic	None	

Notes: Turned up pumping rate from 200 ml/min to 400 ml/min @ 1225/40min
 multimeter used was in-situ smartDial from GHD

B-7 11/29/16

	DD	Temp	Cond	DO	pH	ORP	Turb
1250	28.20	13.13	929.7	1.74	7.05	62.9	369
1255	28.90	13.13	919.8	2.45	7.10	63.9	830
1300	29.25	13.16	914.4	2.86	7.13	64.5	

11/30/16 ^{Readings} collected after sample collection

DD	Temp	Cond	DO	pH	ORP	Turb
26.59	12.4	0.85	3.43	7.22	41.4	118

O'Brien & Gere Engineers, Inc.

Standard Groundwater Sampling Log

Date 11/29/10 - 11/30/10
 Site Name Coldwater Rd
 Location Flint, MI
 Project No. 62658
 Personnel KBS

Weather Mostly cloudy 50's
 Well # B-19A
 Evacuation Method Western Pump
 Sampling Method well pumped dry

Well Information:

Depth of Well * 46.5 ft.
 Depth to Water * 39.55 ft.
 Length of Water Column 6.95 ft.
 Volume of Water in Well 1.1 gal.(s)
 3X Volume of Water in Well 3.3 gal.(s)

Water Volume /ft. for:	
X	2" Diameter Well = 0.163 X LWC
	4" Diameter Well = 0.653 X LWC
	6" Diameter Well = 1.469 X LWC

Volume removed before sampling 2.6 gal.(s)
 Did well go dry? Yes

* Measurements taken from Well Casing Protective Casing (Other, Specify)

Instrument Calibration: Yes Calibrated within range

pH Yes
 ORP Yes
 Conductivity Yes
 DO Yes

Water parameters:

10:25
 DM
 10:45
 11/30/10

	Drawdown measured 0.3 feet or less	Temperature Celsius ±3 percent	Conductivity mS/cm ±3 percent	Dissolved Oxygen mg/L ±10 percent	pH ±0.1 pH units	ORP mV ±10 millivolts	Turbidity NTUs ±10 percent
initial	<u>42.10</u>	initial <u>11.45</u>	initial <u>1000.1</u>	initial <u>0.93</u>	initial <u>7.01</u>	initial <u>140.6</u>	initial <u>86.5</u>
5 min	<u>43.76</u>	<u>16.92</u>	<u>1027.2</u>	<u>0.09</u>	<u>7.19</u>	<u>70.2</u>	<u>125</u>
10 min	<u>44.72</u>	<u>11.14</u>	<u>1085.0</u>	<u>1.72</u>	<u>7.30</u>	<u>66.5</u>	<u>75.3</u>
15 min	<u>45.06</u>	<u>11.20</u>	<u>1091.5</u>	<u>0.12</u>	<u>7.39</u>	<u>54.4</u>	<u>237</u>
20 min	<u>45.22</u>						
25 min							
30 min							
35 min	<u>43.90</u>	<u>10.5</u>	<u>1.10</u>	<u>3.55</u>	<u>7.48</u>	<u>51.0</u>	<u>6520</u>
40 min							
45 min							
50 min							
55 min							
60 min							

Water Sample: 1310
 Time Collected

Physical Appearance at Start	Physical Appearance at Sampling
Color <u>light gray</u>	Color <u>light gray</u>
Odor <u>NONE</u>	Odor <u>NONE</u>
Turbidity (> 100 NTU) <u>86.5</u>	Turbidity (> 100 NTU) <u>6520</u>
Sheen/Free Product <u>NONE</u>	Sheen/Free Product <u>NONE</u>

Samples collected:

Analyses	# Bottles	Bottle size/type	Preservative	Field Filtered
Dissolved Metals - Cu, Cr, Ni, Zn	1	125 ml Plastic	HNO ₃	yes
TOC	2	40 ml Glass	H ₂ SO ₄	
TOX	1	250 ml Amber Glass	H ₂ SO ₄	
Specific Conductivity	1	125 ml Plastic	None	

Notes: 11/30/10 DM 43.90 | 11/30/10 DM Sample collected @ 1310 11/30/10 45.20

O'Brien & Gere Engineers, Inc.

Standard Groundwater Sampling Log

Date 11/29/16
 Site Name Coldwater
 Location Point
 Project No. 62658
 Personnel KBS

Weather Mostly cloudy 50's
 Well # SUMP-D
 Evacuation Method peristaltic
 Sampling Method _____

Well Information:

Depth of Well * _____ ft.
 Depth to Water * _____ ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)
 3X Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:	
X	2" Diameter Well = 0.163 X LWC
	4" Diameter Well = 0.653 X LWC
	6" Diameter Well = 1.469 X LWC

Volume removed before sampling _____ gal.(s)
 Did well go dry? No

* Measurements taken from Well Casing Protective Casing (Other, Specify) _____

Instrument Calibration:

Calibrated within range

pH yes
 ORP yes
 Conductivity yes
 DO yes

Water parameters:

100

Drawdown measured 0.3 feet or less	Temperature Celsius ±3 percent	Conductivity mS/cm ±3 percent	Dissolved Oxygen mg/L ±10 percent	pH ±0.1 pH units	ORP mV ±10 millivolts	Turbidity NTUs ±10 percent
initial _____	initial <u>12.17</u>	initial <u>5.848</u>	initial <u>0.83</u>	initial <u>10.48</u>	initial <u>20.9</u>	initial <u>20.4</u>
5 min _____	<u>11.75</u>	<u>5.901</u>	<u>0.22</u>	<u>10.48</u>	<u>25.5</u>	
10 min _____	<u>11.71</u>	<u>5.901</u>	<u>0.19</u>	<u>10.47</u>	<u>26.6</u>	<u>8.81</u>
15 min _____						
20 min _____						
25 min _____						
30 min _____						
35 min _____						
40 min _____						
45 min _____						
50 min _____						
55 min _____						
60 min _____						

Water Sample:

Time Collected 1110

Physical Appearance at Start

Physical Appearance at Sampling

Color clear / slight yellowish Color _____
 Odor slight Odor _____
 Turbidity (> 100 NTU) 20.4 Turbidity (> 100 NTU) _____
 Sheen/Free Product none Sheen/Free Product _____

Samples collected:

Analyses	# Bottles	Bottle size/type	Preservative	Field Filtered
Dissolved Metals - Cu, Cr, Ni, Zn	1	125 ml Plastic	HNO ₃	yes
TOC	2	40 ml Glass	H ₂ SO ₄	
TOX	1	250 ml Amber Glass	H ₂ SO ₄	
Specific Conductivity	1	125 ml Plastic	None	
<u>PFC</u>	<u>2</u>	<u>250 PLASTIC</u>	<u>NONE</u>	

Notes: Purged approx 10 min then collected sample

ATTACHMENT C
*Analytical Laboratory
Results*



TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Tel: (916)373-5600

TestAmerica Job ID: 320-23933-1
Client Project/Site: PFC Analysis

For:
O'Brien & Gere Inc of North America
37000 Grand River Ave
Suite 260
Farmington Hills, Michigan 48335

Attn: Mr. Clifford Yantz



Authorized for release by:
12/29/2016 2:16:45 PM

Jill Kellmann, Manager of Project Management
(916)374-4402
jill.kellmann@testamericainc.com

LINKS

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The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Definitions/Glossary

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Qualifiers

LCMS

Qualifier	Qualifier Description
*	Isotope Dilution analyte is outside acceptance limits.
F1	MS and/or MSD Recovery is outside acceptance limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F2	MS/MSD RPD exceeds control limits
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
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	Compound was found in the blank and sample.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	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, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
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
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)

Case Narrative

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Job ID: 320-23933-1

Laboratory: TestAmerica Sacramento

Narrative

Receipt

The samples were received on 12/1/2016 9:50 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 1.9° C.

LCMS

Method(s) 537 (modified): The following samples were diluted due to the nature of the sample matrix: SUMP D (320-23933-1), SUMP D (320-23933-1[MS]) and SUMP D (320-23933-1[MSD]). Elevated reporting limits (RLs) are provided.

Method(s) 537 (modified): Due to the high concentration of Perfluorobutanoic acid (PFBA), Perfluoroheptanoic acid (PFHpA), Perfluorohexanoic acid (PFHxA) and Perfluorooctanesulfonic acid (PFOS), 6:2FTS, Perfluorohexanesulfonic acid (PFHxS) and Perfluoropentanoic acid (PFPeA), the matrix spike / matrix spike duplicate (MS/MSD) for preparation batch 320-140894 and analytical batch 320-143551 could not be evaluated for accuracy and precision. The associated laboratory control sample (LCS) met acceptance criteria.

Method(s) 537 (modified): The Isotope Dilution Analyte (IDA) recovery associated with the following samples is below the method recommended limit: SUMP D (320-23933-1), SUMP D (320-23933-1[MS]), SUMP D (320-23933-1[MSD]), B-7 (320-23933-3), B-7 COLLOCATED (320-23933-4), B-19AR (320-23933-5), M2-6:2FTS: EQUIPMENT BLANK - 1 (320-23933-2), RE-12636-112916-SSH-4816 (320-23933-7), W-12636-113016-SSH-5116 (320-23933-10), (LCS 320-140894/2-A), (LCSD 320-141114/3-A) and (MB 320-140894/1-A). Generally, data quality is not considered affected if the IDA signal-to-noise ratio is greater than 10:1, which is achieved for all IDA in the sample(s). All detection limits are below the lower calibration.

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

Organic Prep

Method(s) 3535: The following samples had a dark brown color after concentrating and adding the methanol and water for the final volume. SUMP D (320-23933-1), SUMP D (320-23933-1[MS]) and SUMP D (320-23933-1[MSD])

Method(s) 3535: The following samples were yellow prior to extraction took place. After concentrating the samples, and adding the methanol and water, samples had a dark brown color. SUMP D (320-23933-1), SUMP D (320-23933-1[MS]) and SUMP D (320-23933-1[MSD])

Method(s) 3535: Due to the excessive amount of sediment in sample containers the aqueous portion of these samples was decanted to new containers prior to spiking and extraction. B-7 (320-23933-3), B-7 COLLOCATED (320-23933-4) and B-19AR (320-23933-5)

Method(s) 3535: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 320-141114.

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

Detection Summary

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Client Sample ID: SUMP D

Lab Sample ID: 320-23933-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorobutanoic acid (PFBA)	440		19	4.4	ng/L	10		537 (modified)	Total/NA
Perfluoropentanoic acid (PFPeA)	300	F2	19	9.5	ng/L	10		537 (modified)	Total/NA
Perfluorohexanoic acid (PFHxA)	99	F1	19	7.5	ng/L	10		537 (modified)	Total/NA
Perfluoroheptanoic acid (PFHpA)	24	F1	19	7.7	ng/L	10		537 (modified)	Total/NA
Perfluorooctanoic acid (PFOA)	130		19	7.2	ng/L	10		537 (modified)	Total/NA
Perfluorononanoic acid (PFNA)	7.1	J	19	6.3	ng/L	10		537 (modified)	Total/NA
Perfluorobutanesulfonic acid (PFBS)	74		19	8.8	ng/L	10		537 (modified)	Total/NA
Perfluorohexanesulfonic acid (PFHxS)	370		19	8.3	ng/L	10		537 (modified)	Total/NA
Perfluoroheptanesulfonic Acid (PFHpS)	83		19	6.8	ng/L	10		537 (modified)	Total/NA
Perfluorooctanesulfonic acid (PFOS) - DL	5800	J	190	120	ng/L	100		537 (modified)	Total/NA

Client Sample ID: EQUIPMENT BLANK - 1

Lab Sample ID: 320-23933-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorotetradecanoic acid (PFTeA)	0.61	J B	1.9	0.19	ng/L	1		537 (modified)	Total/NA

Client Sample ID: B-7

Lab Sample ID: 320-23933-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorobutanoic acid (PFBA)	9.2		2.0	0.46	ng/L	1		537 (modified)	Total/NA
Perfluoropentanoic acid (PFPeA)	2.6		2.0	0.99	ng/L	1		537 (modified)	Total/NA
Perfluorohexanoic acid (PFHxA)	3.9		2.0	0.79	ng/L	1		537 (modified)	Total/NA
Perfluoroheptanoic acid (PFHpA)	2.4		2.0	0.81	ng/L	1		537 (modified)	Total/NA
Perfluorooctanoic acid (PFOA)	9.2		2.0	0.75	ng/L	1		537 (modified)	Total/NA
Perfluorononanoic acid (PFNA)	0.87	J	2.0	0.66	ng/L	1		537 (modified)	Total/NA
Perfluorotetradecanoic acid (PFTeA)	0.85	J B	2.0	0.20	ng/L	1		537 (modified)	Total/NA
Perfluorobutanesulfonic acid (PFBS)	5.7		2.0	0.92	ng/L	1		537 (modified)	Total/NA
Perfluorohexanesulfonic acid (PFHxS)	23		2.0	0.88	ng/L	1		537 (modified)	Total/NA
Perfluoroheptanesulfonic Acid (PFHpS)	3.8		2.0	0.72	ng/L	1		537 (modified)	Total/NA
Perfluorooctanesulfonic acid (PFOS)	220		2.0	1.3	ng/L	1		537 (modified)	Total/NA

Client Sample ID: B-7 COLLOCATED

Lab Sample ID: 320-23933-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorobutanoic acid (PFBA)	7.1		2.0	0.45	ng/L	1		537 (modified)	Total/NA
Perfluoropentanoic acid (PFPeA)	1.7	J	2.0	0.96	ng/L	1		537 (modified)	Total/NA
Perfluorohexanoic acid (PFHxA)	3.1		2.0	0.77	ng/L	1		537 (modified)	Total/NA
Perfluoroheptanoic acid (PFHpA)	1.6	J	2.0	0.78	ng/L	1		537 (modified)	Total/NA
Perfluorooctanoic acid (PFOA)	7.6		2.0	0.73	ng/L	1		537 (modified)	Total/NA
Perfluorononanoic acid (PFNA)	0.79	J	2.0	0.64	ng/L	1		537 (modified)	Total/NA
Perfluorotetradecanoic acid (PFTeA)	0.62	J B	2.0	0.19	ng/L	1		537 (modified)	Total/NA
Perfluorobutanesulfonic acid (PFBS)	5.8		2.0	0.90	ng/L	1		537 (modified)	Total/NA
Perfluorohexanesulfonic acid (PFHxS)	22		2.0	0.85	ng/L	1		537 (modified)	Total/NA
Perfluoroheptanesulfonic Acid (PFHpS)	3.9		2.0	0.70	ng/L	1		537 (modified)	Total/NA
Perfluorooctanesulfonic acid (PFOS)	230		2.0	1.2	ng/L	1		537 (modified)	Total/NA

Client Sample ID: B-19AR

Lab Sample ID: 320-23933-5

This Detection Summary does not include radiochemical test results.

TestAmerica Sacramento

Detection Summary

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Client Sample ID: B-19AR (Continued)

Lab Sample ID: 320-23933-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorobutanoic acid (PFBA)	1.0	J	2.0	0.45	ng/L	1		537 (modified)	Total/NA
Perfluorooctanoic acid (PFOA)	0.84	J	2.0	0.74	ng/L	1		537 (modified)	Total/NA
Perfluorotetradecanoic acid (PFTeA)	0.56	J B	2.0	0.20	ng/L	1		537 (modified)	Total/NA
Perfluorohexanesulfonic acid (PFHxS)	1.0	J	2.0	0.86	ng/L	1		537 (modified)	Total/NA
Perfluorooctanesulfonic acid (PFOS)	3.9		2.0	1.3	ng/L	1		537 (modified)	Total/NA

Client Sample ID: RE-12636-112916-SSH-4816

Lab Sample ID: 320-23933-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorotetradecanoic acid (PFTeA)	0.31	J B	1.8	0.18	ng/L	1		537 (modified)	Total/NA

Client Sample ID: W-12636-113016-SSH-5116

Lab Sample ID: 320-23933-10

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorotetradecanoic acid (PFTeA)	0.93	J B	2.0	0.20	ng/L	1		537 (modified)	Total/NA

This Detection Summary does not include radiochemical test results.

TestAmerica Sacramento

Client Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Client Sample ID: SUMP D

Lab Sample ID: 320-23933-1

Date Collected: 11/29/16 11:10

Matrix: Water

Date Received: 12/01/16 09:50

Method: 537 (modified) - Perfluorinated Hydrocarbons

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	440		19	4.4	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluoropentanoic acid (PFPeA)	300	F2	19	9.5	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluorohexanoic acid (PFHxA)	99	F1	19	7.5	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluoroheptanoic acid (PFHpA)	24	F1	19	7.7	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluorooctanoic acid (PFOA)	130		19	7.2	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluorononanoic acid (PFNA)	7.1	J	19	6.3	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluorodecanoic acid (PFDA)	ND		19	4.2	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluoroundecanoic acid (PFUnA)	ND		19	7.2	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluorododecanoic acid (PFDoA)	ND		19	5.6	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluorotridecanoic Acid (PFTriA)	ND		19	5.3	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluorotetradecanoic acid (PFTeA)	ND		19	1.9	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluorobutanesulfonic acid (PFBS)	74		19	8.8	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluorohexanesulfonic acid (PFHxS)	370		19	8.3	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluoroheptanesulfonic Acid (PFHpS)	83		19	6.8	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluorodecanesulfonic acid (PFDS)	ND		19	12	ng/L		12/06/16 17:40	12/22/16 11:16	10
Perfluorooctane Sulfonamide (FOSA)	ND		19	6.1	ng/L		12/06/16 17:40	12/22/16 11:16	10
6:2FTS	ND		190	37	ng/L		12/06/16 17:40	12/22/16 11:16	10

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C8 FOSA	72		25 - 150	12/06/16 17:40	12/22/16 11:16	10
13C4 PFBA	2	*	25 - 150	12/06/16 17:40	12/22/16 11:16	10
13C2 PFHxA	61		25 - 150	12/06/16 17:40	12/22/16 11:16	10
13C4 PFOA	64		25 - 150	12/06/16 17:40	12/22/16 11:16	10
13C5 PFNA	86		25 - 150	12/06/16 17:40	12/22/16 11:16	10
13C2 PFDA	103		25 - 150	12/06/16 17:40	12/22/16 11:16	10
13C2 PFUnA	118		25 - 150	12/06/16 17:40	12/22/16 11:16	10
13C2 PFDoA	88		25 - 150	12/06/16 17:40	12/22/16 11:16	10
18O2 PFHxS	98		25 - 150	12/06/16 17:40	12/22/16 11:16	10
13C4 PFOS	88		25 - 150	12/06/16 17:40	12/22/16 11:16	10
13C4-PFHpA	68		25 - 150	12/06/16 17:40	12/22/16 11:16	10
13C5 PFPeA	16	*	25 - 150	12/06/16 17:40	12/22/16 11:16	10
M2-6:2FTS	98		25 - 150	12/06/16 17:40	12/22/16 11:16	10

Method: 537 (modified) - Perfluorinated Hydrocarbons - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanesulfonic acid (PFOS)	5800	J	190	120	ng/L		12/06/16 17:40	12/22/16 16:20	100

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFOS	146		25 - 150	12/06/16 17:40	12/22/16 16:20	100

Client Sample ID: EQUIPMENT BLANK - 1

Lab Sample ID: 320-23933-2

Date Collected: 11/29/16 11:30

Matrix: Water

Date Received: 12/01/16 09:50

Method: 537 (modified) - Perfluorinated Hydrocarbons

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	ND		1.9	0.44	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluoropentanoic acid (PFPeA)	ND		1.9	0.95	ng/L		12/05/16 19:37	12/22/16 12:46	1

TestAmerica Sacramento

Client Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Client Sample ID: EQUIPMENT BLANK - 1

Lab Sample ID: 320-23933-2

Date Collected: 11/29/16 11:30

Matrix: Water

Date Received: 12/01/16 09:50

Method: 537 (modified) - Perfluorinated Hydrocarbons (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanoic acid (PFHxA)	ND		1.9	0.76	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluoroheptanoic acid (PFHpA)	ND		1.9	0.77	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluorooctanoic acid (PFOA)	ND		1.9	0.72	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluorononanoic acid (PFNA)	ND		1.9	0.63	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluorodecanoic acid (PFDA)	ND		1.9	0.42	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluoroundecanoic acid (PFUnA)	ND		1.9	0.72	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluorododecanoic acid (PFDoA)	ND		1.9	0.56	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluorotridecanoic Acid (PFTriA)	ND		1.9	0.53	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluorotetradecanoic acid (PFTeA)	0.61	J B	1.9	0.19	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluorobutanesulfonic acid (PFBS)	ND		1.9	0.89	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluorohexanesulfonic acid (PFHxS)	ND		1.9	0.84	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		1.9	0.69	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluorooctanesulfonic acid (PFOS)	ND		1.9	1.2	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluorodecanesulfonic acid (PFDS)	ND		1.9	1.2	ng/L		12/05/16 19:37	12/22/16 12:46	1
Perfluorooctane Sulfonamide (FOSA)	ND		1.9	0.62	ng/L		12/05/16 19:37	12/22/16 12:46	1
6:2FTS	ND		19	3.7	ng/L		12/05/16 19:37	12/22/16 12:46	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C8 FOSA	3	*	25 - 150	12/05/16 19:37	12/22/16 12:46	1
13C4 PFBA	66		25 - 150	12/05/16 19:37	12/22/16 12:46	1
13C2 PFHxA	114		25 - 150	12/05/16 19:37	12/22/16 12:46	1
13C4 PFOA	114		25 - 150	12/05/16 19:37	12/22/16 12:46	1
13C5 PFNA	131		25 - 150	12/05/16 19:37	12/22/16 12:46	1
13C2 PFDA	140		25 - 150	12/05/16 19:37	12/22/16 12:46	1
13C2 PFUnA	140		25 - 150	12/05/16 19:37	12/22/16 12:46	1
13C2 PFDoA	124		25 - 150	12/05/16 19:37	12/22/16 12:46	1
18O2 PFHxS	126		25 - 150	12/05/16 19:37	12/22/16 12:46	1
13C4 PFOS	129		25 - 150	12/05/16 19:37	12/22/16 12:46	1
13C4-PFHpA	124		25 - 150	12/05/16 19:37	12/22/16 12:46	1
13C5 PFPeA	114		25 - 150	12/05/16 19:37	12/22/16 12:46	1
M2-6:2FTS	103		25 - 150	12/05/16 19:37	12/22/16 12:46	1

Client Sample ID: B-7

Lab Sample ID: 320-23933-3

Date Collected: 11/30/16 12:30

Matrix: Water

Date Received: 12/01/16 09:50

Method: 537 (modified) - Perfluorinated Hydrocarbons

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	9.2		2.0	0.46	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluoropentanoic acid (PFPeA)	2.6		2.0	0.99	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluorohexanoic acid (PFHxA)	3.9		2.0	0.79	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluoroheptanoic acid (PFHpA)	2.4		2.0	0.81	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluorooctanoic acid (PFOA)	9.2		2.0	0.75	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluorononanoic acid (PFNA)	0.87	J	2.0	0.66	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluorodecanoic acid (PFDA)	ND		2.0	0.44	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluoroundecanoic acid (PFUnA)	ND		2.0	0.75	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluorododecanoic acid (PFDoA)	ND		2.0	0.59	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluorotridecanoic Acid (PFTriA)	ND		2.0	0.55	ng/L		12/07/16 17:31	12/22/16 13:38	1

TestAmerica Sacramento

Client Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Client Sample ID: B-7

Lab Sample ID: 320-23933-3

Date Collected: 11/30/16 12:30

Matrix: Water

Date Received: 12/01/16 09:50

Method: 537 (modified) - Perfluorinated Hydrocarbons (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorotetradecanoic acid (PFTeA)	0.85	J B	2.0	0.20	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluorobutanesulfonic acid (PFBS)	5.7		2.0	0.92	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluorohexanesulfonic acid (PFHxS)	23		2.0	0.88	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluoroheptanesulfonic Acid (PFHpS)	3.8		2.0	0.72	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluorooctanesulfonic acid (PFOS)	220		2.0	1.3	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluorodecanesulfonic acid (PFDS)	ND		2.0	1.2	ng/L		12/07/16 17:31	12/22/16 13:38	1
Perfluorooctane Sulfonamide (FOSA)	ND		2.0	0.64	ng/L		12/07/16 17:31	12/22/16 13:38	1
6:2FTS	ND		20	3.8	ng/L		12/07/16 17:31	12/22/16 13:38	1
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
13C8 FOSA	10	*	25 - 150				12/07/16 17:31	12/22/16 13:38	1
13C4 PFBA	15	*	25 - 150				12/07/16 17:31	12/22/16 13:38	1
13C2 PFHxA	68		25 - 150				12/07/16 17:31	12/22/16 13:38	1
13C4 PFOA	86		25 - 150				12/07/16 17:31	12/22/16 13:38	1
13C5 PFNA	101		25 - 150				12/07/16 17:31	12/22/16 13:38	1
13C2 PFDA	108		25 - 150				12/07/16 17:31	12/22/16 13:38	1
13C2 PFUnA	112		25 - 150				12/07/16 17:31	12/22/16 13:38	1
13C2 PFDoA	107		25 - 150				12/07/16 17:31	12/22/16 13:38	1
18O2 PFHxS	88		25 - 150				12/07/16 17:31	12/22/16 13:38	1
13C4 PFOS	100		25 - 150				12/07/16 17:31	12/22/16 13:38	1
13C4-PFHpA	76		25 - 150				12/07/16 17:31	12/22/16 13:38	1
13C5 PFPeA	43		25 - 150				12/07/16 17:31	12/22/16 13:38	1
M2-6:2FTS	105		25 - 150				12/07/16 17:31	12/22/16 13:38	1

Client Sample ID: B-7 COLLOCATED

Lab Sample ID: 320-23933-4

Date Collected: 11/30/16 12:30

Matrix: Water

Date Received: 12/01/16 09:50

Method: 537 (modified) - Perfluorinated Hydrocarbons

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	7.1		2.0	0.45	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluoropentanoic acid (PFPeA)	1.7	J	2.0	0.96	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluorohexanoic acid (PFHxA)	3.1		2.0	0.77	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluoroheptanoic acid (PFHpA)	1.6	J	2.0	0.78	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluorooctanoic acid (PFOA)	7.6		2.0	0.73	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluorononanoic acid (PFNA)	0.79	J	2.0	0.64	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluorodecanoic acid (PFDA)	ND		2.0	0.43	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluoroundecanoic acid (PFUnA)	ND		2.0	0.73	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluorododecanoic acid (PFDoA)	ND		2.0	0.57	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluorotridecanoic Acid (PFTriA)	ND		2.0	0.54	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluorotetradecanoic acid (PFTeA)	0.62	J B	2.0	0.19	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluorobutanesulfonic acid (PFBS)	5.8		2.0	0.90	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluorohexanesulfonic acid (PFHxS)	22		2.0	0.85	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluoroheptanesulfonic Acid (PFHpS)	3.9		2.0	0.70	ng/L		12/07/16 17:31	12/22/16 13:46	1

TestAmerica Sacramento

Client Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Client Sample ID: B-7 COLLOCATED

Lab Sample ID: 320-23933-4

Date Collected: 11/30/16 12:30

Matrix: Water

Date Received: 12/01/16 09:50

Method: 537 (modified) - Perfluorinated Hydrocarbons (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanesulfonic acid (PFOS)	230		2.0	1.2	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluorodecanesulfonic acid (PFDS)	ND		2.0	1.2	ng/L		12/07/16 17:31	12/22/16 13:46	1
Perfluorooctane Sulfonamide (FOSA)	ND		2.0	0.62	ng/L		12/07/16 17:31	12/22/16 13:46	1
6:2FTS	ND		20	3.7	ng/L		12/07/16 17:31	12/22/16 13:46	1
<i>Isotope Dilution</i>	<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>				<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
13C8 FOSA	10	*	25 - 150				12/07/16 17:31	12/22/16 13:46	1
13C4 PFBA	16	*	25 - 150				12/07/16 17:31	12/22/16 13:46	1
13C2 PFHxA	77		25 - 150				12/07/16 17:31	12/22/16 13:46	1
13C4 PFOA	95		25 - 150				12/07/16 17:31	12/22/16 13:46	1
13C5 PFNA	117		25 - 150				12/07/16 17:31	12/22/16 13:46	1
13C2 PFDA	131		25 - 150				12/07/16 17:31	12/22/16 13:46	1
13C2 PFUnA	134		25 - 150				12/07/16 17:31	12/22/16 13:46	1
13C2 PFDoA	137		25 - 150				12/07/16 17:31	12/22/16 13:46	1
18O2 PFHxS	108		25 - 150				12/07/16 17:31	12/22/16 13:46	1
13C4 PFOS	117		25 - 150				12/07/16 17:31	12/22/16 13:46	1
13C4-PFHpA	90		25 - 150				12/07/16 17:31	12/22/16 13:46	1
13C5 PFPeA	47		25 - 150				12/07/16 17:31	12/22/16 13:46	1
M2-6:2FTS	134		25 - 150				12/07/16 17:31	12/22/16 13:46	1

Client Sample ID: B-19AR

Lab Sample ID: 320-23933-5

Date Collected: 11/30/16 13:10

Matrix: Water

Date Received: 12/01/16 09:50

Method: 537 (modified) - Perfluorinated Hydrocarbons

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	1.0	J	2.0	0.45	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluoropentanoic acid (PFPeA)	ND		2.0	0.98	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorohexanoic acid (PFHxA)	ND		2.0	0.78	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluoroheptanoic acid (PFHpA)	ND		2.0	0.80	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorooctanoic acid (PFOA)	0.84	J	2.0	0.74	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorononanoic acid (PFNA)	ND		2.0	0.65	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorodecanoic acid (PFDA)	ND		2.0	0.44	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluoroundecanoic acid (PFUnA)	ND		2.0	0.74	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorododecanoic acid (PFDoA)	ND		2.0	0.58	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorotridecanoic Acid (PFTriA)	ND		2.0	0.55	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorotetradecanoic acid (PFTeA)	0.56	J B	2.0	0.20	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorobutanesulfonic acid (PFBS)	ND		2.0	0.91	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorohexanesulfonic acid (PFHxS)	1.0	J	2.0	0.86	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		2.0	0.71	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorooctanesulfonic acid (PFOS)	3.9		2.0	1.3	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorodecanesulfonic acid (PFDS)	ND		2.0	1.2	ng/L		12/07/16 17:31	12/22/16 13:53	1
Perfluorooctane Sulfonamide (FOSA)	ND		2.0	0.63	ng/L		12/07/16 17:31	12/22/16 13:53	1
6:2FTS	ND		20	3.8	ng/L		12/07/16 17:31	12/22/16 13:53	1
<i>Isotope Dilution</i>	<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>				<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
13C8 FOSA	4	*	25 - 150				12/07/16 17:31	12/22/16 13:53	1

TestAmerica Sacramento

Client Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Client Sample ID: B-19AR

Date Collected: 11/30/16 13:10

Date Received: 12/01/16 09:50

Lab Sample ID: 320-23933-5

Matrix: Water

Method: 537 (modified) - Perfluorinated Hydrocarbons (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFBA	50		25 - 150	12/07/16 17:31	12/22/16 13:53	1
13C2 PFHxA	115		25 - 150	12/07/16 17:31	12/22/16 13:53	1
13C4 PFOA	109		25 - 150	12/07/16 17:31	12/22/16 13:53	1
13C5 PFNA	98		25 - 150	12/07/16 17:31	12/22/16 13:53	1
13C2 PFDA	91		25 - 150	12/07/16 17:31	12/22/16 13:53	1
13C2 PFUnA	94		25 - 150	12/07/16 17:31	12/22/16 13:53	1
13C2 PFDoA	106		25 - 150	12/07/16 17:31	12/22/16 13:53	1
18O2 PFHxS	131		25 - 150	12/07/16 17:31	12/22/16 13:53	1
13C4 PFOS	139		25 - 150	12/07/16 17:31	12/22/16 13:53	1
13C4-PFHpA	121		25 - 150	12/07/16 17:31	12/22/16 13:53	1
13C5 PFPeA	107		25 - 150	12/07/16 17:31	12/22/16 13:53	1
M2-6:2FTS	131		25 - 150	12/07/16 17:31	12/22/16 13:53	1

Client Sample ID: RE-12636-112916-SSH-4816

Date Collected: 11/29/16 15:00

Date Received: 12/01/16 09:50

Lab Sample ID: 320-23933-7

Matrix: Water

Method: 537 (modified) - Perfluorinated Hydrocarbons

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	ND		1.8	0.42	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluoropentanoic acid (PFPeA)	ND		1.8	0.90	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorohexanoic acid (PFHxA)	ND		1.8	0.72	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluoroheptanoic acid (PFHpA)	ND		1.8	0.73	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorooctanoic acid (PFOA)	ND		1.8	0.68	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorononanoic acid (PFNA)	ND		1.8	0.60	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorodecanoic acid (PFDA)	ND		1.8	0.40	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluoroundecanoic acid (PFUnA)	ND		1.8	0.68	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorododecanoic acid (PFDoA)	ND		1.8	0.53	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorotridecanoic Acid (PFTriA)	ND		1.8	0.50	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorotetradecanoic acid (PFTeA)	0.31	J B	1.8	0.18	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorobutanesulfonic acid (PFBS)	ND		1.8	0.84	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorohexanesulfonic acid (PFHxS)	ND		1.8	0.80	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		1.8	0.65	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorooctanesulfonic acid (PFOS)	ND		1.8	1.2	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorodecanesulfonic acid (PFDS)	ND		1.8	1.1	ng/L		12/05/16 19:37	12/22/16 11:46	1
Perfluorooctane Sulfonamide (FOSA)	ND		1.8	0.58	ng/L		12/05/16 19:37	12/22/16 11:46	1
6:2FTS	ND		18	3.5	ng/L		12/05/16 19:37	12/22/16 11:46	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C8 FOSA	4	*	25 - 150	12/05/16 19:37	12/22/16 11:46	1
13C4 PFBA	56		25 - 150	12/05/16 19:37	12/22/16 11:46	1
13C2 PFHxA	49		25 - 150	12/05/16 19:37	12/22/16 11:46	1
13C4 PFOA	56		25 - 150	12/05/16 19:37	12/22/16 11:46	1
13C5 PFNA	59		25 - 150	12/05/16 19:37	12/22/16 11:46	1
13C2 PFDA	75		25 - 150	12/05/16 19:37	12/22/16 11:46	1
13C2 PFUnA	97		25 - 150	12/05/16 19:37	12/22/16 11:46	1
13C2 PFDoA	109		25 - 150	12/05/16 19:37	12/22/16 11:46	1
18O2 PFHxS	133		25 - 150	12/05/16 19:37	12/22/16 11:46	1
13C4 PFOS	141		25 - 150	12/05/16 19:37	12/22/16 11:46	1

TestAmerica Sacramento

Client Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Client Sample ID: RE-12636-112916-SSH-4816

Lab Sample ID: 320-23933-7

Date Collected: 11/29/16 15:00

Matrix: Water

Date Received: 12/01/16 09:50

Method: 537 (modified) - Perfluorinated Hydrocarbons (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4-PFHpA	50		25 - 150	12/05/16 19:37	12/22/16 11:46	1
13C5 PFPeA	59		25 - 150	12/05/16 19:37	12/22/16 11:46	1
M2-6:2FTS	142		25 - 150	12/05/16 19:37	12/22/16 11:46	1

Client Sample ID: W-12636-113016-SSH-5116

Lab Sample ID: 320-23933-10

Date Collected: 11/30/16 09:00

Matrix: Water

Date Received: 12/01/16 09:50

Method: 537 (modified) - Perfluorinated Hydrocarbons

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	ND		2.0	0.46	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluoropentanoic acid (PFPeA)	ND		2.0	1.0	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorohexanoic acid (PFHxA)	ND		2.0	0.79	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluoroheptanoic acid (PFHpA)	ND		2.0	0.81	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorooctanoic acid (PFOA)	ND		2.0	0.75	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorononanoic acid (PFNA)	ND		2.0	0.66	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorodecanoic acid (PFDA)	ND		2.0	0.44	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluoroundecanoic acid (PFUnA)	ND		2.0	0.75	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorododecanoic acid (PFDoA)	ND		2.0	0.59	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorotridecanoic Acid (PFTriA)	ND		2.0	0.56	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorotetradecanoic acid (PFTeA)	0.93	J B	2.0	0.20	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorobutanesulfonic acid (PFBS)	ND		2.0	0.93	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorohexanesulfonic acid (PFHxS)	ND		2.0	0.88	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		2.0	0.72	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorooctanesulfonic acid (PFOS)	ND		2.0	1.3	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorodecanesulfonic acid (PFDS)	ND		2.0	1.2	ng/L		12/05/16 19:37	12/22/16 13:23	1
Perfluorooctane Sulfonamide (FOSA)	ND		2.0	0.64	ng/L		12/05/16 19:37	12/22/16 13:23	1
6:2FTS	ND		20	3.8	ng/L		12/05/16 19:37	12/22/16 13:23	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C8 FOSA	8	*	25 - 150	12/05/16 19:37	12/22/16 13:23	1
13C4 PFBA	26		25 - 150	12/05/16 19:37	12/22/16 13:23	1
13C2 PFHxA	25		25 - 150	12/05/16 19:37	12/22/16 13:23	1
13C4 PFOA	34		25 - 150	12/05/16 19:37	12/22/16 13:23	1
13C5 PFNA	40		25 - 150	12/05/16 19:37	12/22/16 13:23	1
13C2 PFDA	50		25 - 150	12/05/16 19:37	12/22/16 13:23	1
13C2 PFUnA	62		25 - 150	12/05/16 19:37	12/22/16 13:23	1
13C2 PFDoA	74		25 - 150	12/05/16 19:37	12/22/16 13:23	1
18O2 PFHxS	115		25 - 150	12/05/16 19:37	12/22/16 13:23	1
13C4 PFOS	118		25 - 150	12/05/16 19:37	12/22/16 13:23	1
13C4-PFHpA	30		25 - 150	12/05/16 19:37	12/22/16 13:23	1
13C5 PFPeA	27		25 - 150	12/05/16 19:37	12/22/16 13:23	1
M2-6:2FTS	106		25 - 150	12/05/16 19:37	12/22/16 13:23	1

TestAmerica Sacramento

Isotope Dilution Summary

Client: O'Brien & Gere Inc of North America
 Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Method: 537 (modified) - Perfluorinated Hydrocarbons

Matrix: Water

Prep Type: Total/NA

Lab Sample ID	Client Sample ID	Percent Isotope Dilution Recovery (Acceptance Limits)							
		3C8 FOS/ (25-150)	3C4 PFBA/ (25-150)	3C2 PFHx/ (25-150)	3C4 PFO/ (25-150)	3C5 PFNA/ (25-150)	3C2 PFDA/ (25-150)	3C2 PFUn/ (25-150)	3C2 PFDo/ (25-150)
320-23933-1	SUMP D	72	2 *	61	64	86	103	118	88
320-23933-1 - DL	SUMP D								
320-23933-1 MS	SUMP D	77	2 *	58	64	86	100	120	89
320-23933-1 MS - DL	SUMP D								
320-23933-1 MSD	SUMP D	66	2 *	54	58	75	87	100	76
320-23933-1 MSD - DL	SUMP D								
320-23933-2	EQUIPMENT BLANK - 1	3 *	66	114	114	131	140	140	124
320-23933-3	B-7	10 *	15 *	68	86	101	108	112	107
320-23933-4	B-7 COLLOCATED	10 *	16 *	77	95	117	131	134	137
320-23933-5	B-19AR	4 *	50	115	109	98	91	94	106
320-23933-7	RE-12636-112916-SSH-4816	4 *	56	49	56	59	75	97	109
320-23933-10	W-12636-113016-SSH-5116	8 *	26	25	34	40	50	62	74
LCS 320-140894/2-A	Lab Control Sample	10 *	133	128	135	134	141	137	128
LCS 320-141114/2-A	Lab Control Sample	30	131	121	133	137	140	138	128
LCSD 320-141114/3-A	Lab Control Sample Dup	18 *	128	122	132	135	141	137	133
MB 320-140894/1-A	Method Blank	13 *	136	126	137	134	145	138	130
MB 320-141114/1-A	Method Blank	25	113	106	119	121	121	119	108

Lab Sample ID	Client Sample ID	Percent Isotope Dilution Recovery (Acceptance Limits)				
		18O2 PFHx/ (25-150)	3C4 PFO/ (25-150)	3C4-PFHp/ (25-150)	3C5 PFPe/ (25-150)	12-6:2FTS/ (25-150)
320-23933-1	SUMP D	98	88	68	16 *	98
320-23933-1 - DL	SUMP D		146			
320-23933-1 MS	SUMP D	98	89	67	19 *	100
320-23933-1 MS - DL	SUMP D		148			
320-23933-1 MSD	SUMP D	81	81	59	16 *	82
320-23933-1 MSD - DL	SUMP D		149			
320-23933-2	EQUIPMENT BLANK - 1	126	129	124	114	103
320-23933-3	B-7	88	100	76	43	105
320-23933-4	B-7 COLLOCATED	108	117	90	47	134
320-23933-5	B-19AR	131	139	121	107	131
320-23933-7	RE-12636-112916-SSH-4816	133	141	50	59	142
320-23933-10	W-12636-113016-SSH-5116	115	118	30	27	106
LCS 320-140894/2-A	Lab Control Sample	132	142	129	135	117
LCS 320-141114/2-A	Lab Control Sample	128	136	132	134	110
LCSD 320-141114/3-A	Lab Control Sample Dup	128	135	128	134	114
MB 320-140894/1-A	Method Blank	130	138	131	139	118
MB 320-141114/1-A	Method Blank	116	116	122	116	96

Surrogate Legend

- 13C8 FOSA = 13C8 FOSA
- 13C4 PFBA = 13C4 PFBA
- 13C2 PFHxA = 13C2 PFHxA
- 13C4 PFOA = 13C4 PFOA
- 13C5 PFNA = 13C5 PFNA
- 13C2 PFDA = 13C2 PFDA
- 13C2 PFUnA = 13C2 PFUnA
- 13C2 PFDoA = 13C2 PFDoA
- 18O2 PFHxS = 18O2 PFHxS
- 13C4 PFOS = 13C4 PFOS

Isotope Dilution Summary

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

13C4-PFHpA = 13C4-PFHpA
13C5 PFPeA = 13C5 PFPeA
M2-6:2FTS = M2-6:2FTS

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QC Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Method: 537 (modified) - Perfluorinated Hydrocarbons

Lab Sample ID: MB 320-140894/1-A

Matrix: Water

Analysis Batch: 143551

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 140894

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	ND		2.0	0.46	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluoropentanoic acid (PFPeA)	ND		2.0	0.99	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorohexanoic acid (PFHxA)	ND		2.0	0.79	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluoroheptanoic acid (PFHpA)	ND		2.0	0.80	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorooctanoic acid (PFOA)	ND		2.0	0.75	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorononanoic acid (PFNA)	ND		2.0	0.65	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorodecanoic acid (PFDA)	ND		2.0	0.44	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluoroundecanoic acid (PFUnA)	ND		2.0	0.75	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorododecanoic acid (PFDoA)	ND		2.0	0.58	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorotridecanoic Acid (PFTriA)	ND		2.0	0.55	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorotetradecanoic acid (PFTeA)	0.610	J	2.0	0.20	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorobutanesulfonic acid (PFBS)	ND		2.0	0.92	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorohexanesulfonic acid (PFHxS)	ND		2.0	0.87	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		2.0	0.71	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorooctanesulfonic acid (PFOS)	ND		2.0	1.3	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorodecanesulfonic acid (PFDS)	ND		2.0	1.2	ng/L		12/06/16 17:40	12/22/16 11:01	1
Perfluorooctane Sulfonamide (FOSA)	ND		2.0	0.64	ng/L		12/06/16 17:40	12/22/16 11:01	1
6:2FTS	ND		20	3.8	ng/L		12/06/16 17:40	12/22/16 11:01	1

Isotope Dilution	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C8 FOSA	13	*	25 - 150	12/06/16 17:40	12/22/16 11:01	1
13C4 PFBA	136		25 - 150	12/06/16 17:40	12/22/16 11:01	1
13C2 PFHxA	126		25 - 150	12/06/16 17:40	12/22/16 11:01	1
13C4 PFOA	137		25 - 150	12/06/16 17:40	12/22/16 11:01	1
13C5 PFNA	134		25 - 150	12/06/16 17:40	12/22/16 11:01	1
13C2 PFDA	145		25 - 150	12/06/16 17:40	12/22/16 11:01	1
13C2 PFUnA	138		25 - 150	12/06/16 17:40	12/22/16 11:01	1
13C2 PFDoA	130		25 - 150	12/06/16 17:40	12/22/16 11:01	1
18O2 PFHxS	130		25 - 150	12/06/16 17:40	12/22/16 11:01	1
13C4 PFOS	138		25 - 150	12/06/16 17:40	12/22/16 11:01	1
13C4-PFHpA	131		25 - 150	12/06/16 17:40	12/22/16 11:01	1
13C5 PFPeA	139		25 - 150	12/06/16 17:40	12/22/16 11:01	1
M2-6:2FTS	118		25 - 150	12/06/16 17:40	12/22/16 11:01	1

Lab Sample ID: LCS 320-140894/2-A

Matrix: Water

Analysis Batch: 143551

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 140894

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Perfluorobutanoic acid (PFBA)	40.0	39.0		ng/L		97	74 - 138
Perfluoropentanoic acid (PFPeA)	40.0	37.2		ng/L		93	69 - 134
Perfluorohexanoic acid (PFHxA)	40.0	35.8		ng/L		89	70 - 136
Perfluoroheptanoic acid (PFHpA)	40.0	37.0		ng/L		92	63 - 135
Perfluorooctanoic acid (PFOA)	40.0	35.8		ng/L		90	63 - 141
Perfluorononanoic acid (PFNA)	40.0	37.0		ng/L		92	71 - 140
Perfluorodecanoic acid (PFDA)	40.0	35.5		ng/L		89	66 - 141
Perfluoroundecanoic acid (PFUnA)	40.0	32.7		ng/L		82	68 - 139

TestAmerica Sacramento

QC Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Method: 537 (modified) - Perfluorinated Hydrocarbons (Continued)

Lab Sample ID: LCS 320-140894/2-A
Matrix: Water
Analysis Batch: 143551

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 140894

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Perfluorododecanoic acid (PFDoA)	40.0	35.0		ng/L		87	71 - 139
Perfluorotridecanoic Acid (PFTriA)	40.0	34.9		ng/L		87	51 - 139
Perfluorotetradecanoic acid (PFTeA)	40.0	48.2		ng/L		121	47 - 130
Perfluorobutanesulfonic acid (PFBS)	35.4	39.1		ng/L		111	55 - 147
Perfluorohexanesulfonic acid (PFHxS)	36.4	33.3		ng/L		91	58 - 138
Perfluoroheptanesulfonic Acid (PFHpS)	38.1	35.5		ng/L		93	32 - 170
Perfluorooctanesulfonic acid (PFOS)	37.1	34.2		ng/L		92	47 - 162
Perfluorodecanesulfonic acid (PFDS)	38.6	33.9		ng/L		88	35 - 157
Perfluorooctane Sulfonamide (FOSA)	40.0	36.1		ng/L		90	59 - 163
6:2FTS	37.9	40.9		ng/L		108	60 - 140

Isotope Dilution	LCS %Recovery	LCS Qualifier	Limits
13C8 FOSA	10	*	25 - 150
13C4 PFBA	133		25 - 150
13C2 PFHxA	128		25 - 150
13C4 PFOA	135		25 - 150
13C5 PFNA	134		25 - 150
13C2 PFDA	141		25 - 150
13C2 PFUnA	137		25 - 150
13C2 PFDoA	128		25 - 150
18O2 PFHxS	132		25 - 150
13C4 PFOS	142		25 - 150
13C4-PFHpA	129		25 - 150
13C5 PFPeA	135		25 - 150
M2-6:2FTS	117		25 - 150

Lab Sample ID: 320-23933-1 MS
Matrix: Water
Analysis Batch: 143551

Client Sample ID: SUMP D
Prep Type: Total/NA
Prep Batch: 140894

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Perfluorobutanoic acid (PFBA)	440		39.2	490	4	ng/L		139	74 - 138
Perfluoropentanoic acid (PFPeA)	300	F2	39.2	307	4	ng/L		23	69 - 134
Perfluorohexanoic acid (PFHxA)	99	F1	39.2	178	F1	ng/L		202	70 - 136
Perfluoroheptanoic acid (PFHpA)	24	F1	39.2	80.4	F1	ng/L		144	63 - 135
Perfluorooctanoic acid (PFOA)	130		39.2	157		ng/L		73	63 - 141
Perfluorononanoic acid (PFNA)	7.1	J	39.2	46.0		ng/L		100	71 - 140
Perfluorodecanoic acid (PFDA)	ND		39.2	42.7		ng/L		109	66 - 141
Perfluoroundecanoic acid (PFUnA)	ND		39.2	41.6		ng/L		106	68 - 139
Perfluorododecanoic acid (PFDoA)	ND		39.2	40.3		ng/L		103	71 - 139

TestAmerica Sacramento

QC Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Method: 537 (modified) - Perfluorinated Hydrocarbons (Continued)

Lab Sample ID: 320-23933-1 MS

Matrix: Water

Analysis Batch: 143551

Client Sample ID: SUMP D

Prep Type: Total/NA

Prep Batch: 140894

Analyte	Sample	Sample	Spike	MS	MS	Unit	D	%Rec	%Rec. Limits
	Result	Qualifier	Added	Result	Qualifier				
Perfluorotridecanoic Acid (PFTriA)	ND		39.2	24.0		ng/L		61	51 - 139
Perfluorotetradecanoic acid (PFTeA)	ND		39.2	19.7	J	ng/L		50	47 - 130
Perfluorobutanesulfonic acid (PFBS)	74		34.6	108		ng/L		100	55 - 147
Perfluorohexanesulfonic acid (PFHxS)	370		35.6	399	4	ng/L		81	58 - 138
Perfluoroheptanesulfonic Acid (PFHpS)	83		37.3	115		ng/L		88	32 - 170
Perfluorodecanesulfonic acid (PFDS)	ND		37.8	41.0		ng/L		109	35 - 157
Perfluorooctane Sulfonamide (FOSA)	ND		39.2	45.1		ng/L		115	59 - 163
6:2FTS	ND		37.1	38.4	J	ng/L		103	60 - 140
MS MS									
Isotope Dilution	%Recovery	Qualifier	Limits						
13C8 FOSA	77		25 - 150						
13C4 PFBA	2 *		25 - 150						
13C2 PFHxA	58		25 - 150						
13C4 PFOA	64		25 - 150						
13C5 PFNA	86		25 - 150						
13C2 PFDA	100		25 - 150						
13C2 PFUnA	120		25 - 150						
13C2 PFDoA	89		25 - 150						
18O2 PFHxS	98		25 - 150						
13C4 PFOS	89		25 - 150						
13C4-PFHpA	67		25 - 150						
13C5 PFPeA	19 *		25 - 150						
M2-6:2FTS	100		25 - 150						

Lab Sample ID: 320-23933-1 MSD

Matrix: Water

Analysis Batch: 143551

Client Sample ID: SUMP D

Prep Type: Total/NA

Prep Batch: 140894

Analyte	Sample	Sample	Spike	MSD	MSD	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
	Result	Qualifier	Added	Result	Qualifier						
Perfluorobutanoic acid (PFBA)	440		37.9	564	4	ng/L		340	74 - 138	14	30
Perfluoropentanoic acid (PFPeA)	300	F2	37.9	178	4 F2	ng/L		-316	69 - 134	53	30
Perfluorohexanoic acid (PFHxA)	99	F1	37.9	150		ng/L		134	70 - 136	17	30
Perfluoroheptanoic acid (PFHpA)	24	F1	37.9	60.2		ng/L		95	63 - 135	29	30
Perfluorooctanoic acid (PFOA)	130		37.9	159		ng/L		81	63 - 141	1	30
Perfluorononanoic acid (PFNA)	7.1	J	37.9	42.4		ng/L		93	71 - 140	8	30
Perfluorodecanoic acid (PFDA)	ND		37.9	35.3		ng/L		93	66 - 141	19	30
Perfluoroundecanoic acid (PFUnA)	ND		37.9	37.1		ng/L		98	68 - 139	11	30
Perfluorododecanoic acid (PFDoA)	ND		37.9	35.6		ng/L		94	71 - 139	12	30
Perfluorotridecanoic Acid (PFTriA)	ND		37.9	21.2		ng/L		56	51 - 139	12	30
Perfluorotetradecanoic acid (PFTeA)	ND		37.9	18.7	J	ng/L		49	47 - 130	5	30

TestAmerica Sacramento

QC Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Method: 537 (modified) - Perfluorinated Hydrocarbons (Continued)

Lab Sample ID: 320-23933-1 MSD

Matrix: Water

Analysis Batch: 143551

Client Sample ID: SUMP D

Prep Type: Total/NA

Prep Batch: 140894

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Perfluorobutanesulfonic acid (PFBS)	74		33.5	105		ng/L		92	55 - 147	4	30
Perfluorohexanesulfonic acid (PFHxS)	370		34.4	371	4	ng/L		-0.1	58 - 138	7	30
Perfluoroheptanesulfonic Acid (PFHpS)	83		36.0	102		ng/L		55	32 - 170	12	30
Perfluorodecanesulfonic acid (PFDS)	ND		36.5	32.5		ng/L		89	35 - 157	23	30
Perfluorooctane Sulfonamide (FOSA)	ND		37.9	38.6		ng/L		102	59 - 163	16	30
6:2FTS	ND		35.9	39.0	J	ng/L		NC	60 - 140	2	30

Isotope Dilution	MSD %Recovery	MSD Qualifier	Limits
13C8 FOSA	66		25 - 150
13C4 PFBA	2	*	25 - 150
13C2 PFHxA	54		25 - 150
13C4 PFOA	58		25 - 150
13C5 PFNA	75		25 - 150
13C2 PFDA	87		25 - 150
13C2 PFUnA	100		25 - 150
13C2 PFDoA	76		25 - 150
18O2 PFHxS	81		25 - 150
13C4 PFOS	81		25 - 150
13C4-PFHpA	59		25 - 150
13C5 PFPeA	16	*	25 - 150
M2-6:2FTS	82		25 - 150

Lab Sample ID: MB 320-141114/1-A

Matrix: Water

Analysis Batch: 143551

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 141114

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	ND		2.0	0.46	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluoropentanoic acid (PFPeA)	ND		2.0	0.99	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorohexanoic acid (PFHxA)	ND		2.0	0.79	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluoroheptanoic acid (PFHpA)	ND		2.0	0.80	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorooctanoic acid (PFOA)	ND		2.0	0.75	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorononanoic acid (PFNA)	ND		2.0	0.65	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorodecanoic acid (PFDA)	ND		2.0	0.44	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluoroundecanoic acid (PFUnA)	ND		2.0	0.75	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorododecanoic acid (PFDoA)	ND		2.0	0.58	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorotridecanoic Acid (PFTriA)	ND		2.0	0.55	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorotetradecanoic acid (PFTeA)	0.541	J	2.0	0.20	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorobutanesulfonic acid (PFBS)	ND		2.0	0.92	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorohexanesulfonic acid (PFHxS)	ND		2.0	0.87	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		2.0	0.71	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorooctanesulfonic acid (PFOS)	ND		2.0	1.3	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorodecanesulfonic acid (PFDS)	ND		2.0	1.2	ng/L		12/07/16 17:31	12/22/16 13:01	1
Perfluorooctane Sulfonamide (FOSA)	1.43	J	2.0	0.64	ng/L		12/07/16 17:31	12/22/16 13:01	1

TestAmerica Sacramento

QC Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Method: 537 (modified) - Perfluorinated Hydrocarbons (Continued)

Lab Sample ID: MB 320-141114/1-A
Matrix: Water
Analysis Batch: 143551

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 141114

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
6:2FTS	ND		20	3.8	ng/L		12/07/16 17:31	12/22/16 13:01	1
<i>Isotope Dilution</i>	<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>				<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
13C8 FOSA	25		25 - 150				12/07/16 17:31	12/22/16 13:01	1
13C4 PFBA	113		25 - 150				12/07/16 17:31	12/22/16 13:01	1
13C2 PFHxA	106		25 - 150				12/07/16 17:31	12/22/16 13:01	1
13C4 PFOA	119		25 - 150				12/07/16 17:31	12/22/16 13:01	1
13C5 PFNA	121		25 - 150				12/07/16 17:31	12/22/16 13:01	1
13C2 PFDA	121		25 - 150				12/07/16 17:31	12/22/16 13:01	1
13C2 PFUnA	119		25 - 150				12/07/16 17:31	12/22/16 13:01	1
13C2 PFDoA	108		25 - 150				12/07/16 17:31	12/22/16 13:01	1
18O2 PFHxS	116		25 - 150				12/07/16 17:31	12/22/16 13:01	1
13C4 PFOS	116		25 - 150				12/07/16 17:31	12/22/16 13:01	1
13C4-PFHpA	122		25 - 150				12/07/16 17:31	12/22/16 13:01	1
13C5 PFPeA	116		25 - 150				12/07/16 17:31	12/22/16 13:01	1
M2-6:2FTS	96		25 - 150				12/07/16 17:31	12/22/16 13:01	1

Lab Sample ID: LCS 320-141114/2-A
Matrix: Water
Analysis Batch: 143551

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 141114

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Perfluorobutanoic acid (PFBA)	40.0	39.8		ng/L		99	74 - 138
Perfluoropentanoic acid (PFPeA)	40.0	36.7		ng/L		92	69 - 134
Perfluorohexanoic acid (PFHxA)	40.0	37.8		ng/L		95	70 - 136
Perfluoroheptanoic acid (PFHpA)	40.0	37.3		ng/L		93	63 - 135
Perfluorooctanoic acid (PFOA)	40.0	35.9		ng/L		90	63 - 141
Perfluorononanoic acid (PFNA)	40.0	36.4		ng/L		91	71 - 140
Perfluorodecanoic acid (PFDA)	40.0	37.3		ng/L		93	66 - 141
Perfluoroundecanoic acid (PFUnA)	40.0	32.4		ng/L		81	68 - 139
Perfluorododecanoic acid (PFDoA)	40.0	35.1		ng/L		88	71 - 139
Perfluorotridecanoic Acid (PFTriA)	40.0	38.3		ng/L		96	51 - 139
Perfluorotetradecanoic acid (PFTeA)	40.0	44.5		ng/L		111	47 - 130
Perfluorobutanesulfonic acid (PFBS)	35.4	39.6		ng/L		112	55 - 147
Perfluorohexanesulfonic acid (PFHxS)	36.4	33.1		ng/L		91	58 - 138
Perfluoroheptanesulfonic Acid (PFHpS)	38.1	35.5		ng/L		93	32 - 170
Perfluorooctanesulfonic acid (PFOS)	37.1	34.3		ng/L		92	47 - 162
Perfluorodecanesulfonic acid (PFDS)	38.6	33.5		ng/L		87	35 - 157
Perfluorooctane Sulfonamide (FOSA)	40.0	35.9		ng/L		90	59 - 163
6:2FTS	37.9	45.7		ng/L		121	60 - 140

TestAmerica Sacramento

QC Sample Results

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

<i>Isotope Dilution</i>	<i>LCS %Recovery</i>	<i>LCS Qualifier</i>	<i>Limits</i>
13C8 FOSA	30		25 - 150
13C4 PFBA	131		25 - 150
13C2 PFHxA	121		25 - 150
13C4 PFOA	133		25 - 150
13C5 PFNA	137		25 - 150
13C2 PFDA	140		25 - 150
13C2 PFUnA	138		25 - 150
13C2 PFDoA	128		25 - 150
18O2 PFHxS	128		25 - 150
13C4 PFOS	136		25 - 150
13C4-PFHpA	132		25 - 150
13C5 PFPeA	134		25 - 150
M2-6:2FTS	110		25 - 150

Lab Sample ID: LCSD 320-141114/3-A
Matrix: Water
Analysis Batch: 143551

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 141114

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Perfluorobutanoic acid (PFBA)	40.0	44.6		ng/L		111	74 - 138	11	30
Perfluoropentanoic acid (PFPeA)	40.0	41.2		ng/L		103	69 - 134	11	30
Perfluorohexanoic acid (PFHxA)	40.0	41.7		ng/L		104	70 - 136	10	30
Perfluoroheptanoic acid (PFHpA)	40.0	42.3		ng/L		106	63 - 135	13	30
Perfluorooctanoic acid (PFOA)	40.0	40.5		ng/L		101	63 - 141	12	30
Perfluorononanoic acid (PFNA)	40.0	41.7		ng/L		104	71 - 140	13	30
Perfluorodecanoic acid (PFDA)	40.0	40.7		ng/L		102	66 - 141	9	30
Perfluoroundecanoic acid (PFUnA)	40.0	37.5		ng/L		94	68 - 139	15	30
Perfluorododecanoic acid (PFDoA)	40.0	39.6		ng/L		99	71 - 139	12	30
Perfluorotridecanoic Acid (PFTriA)	40.0	43.0		ng/L		107	51 - 139	12	30
Perfluorotetradecanoic acid (PFTeA)	40.0	52.0		ng/L		130	47 - 130	15	30
Perfluorobutanesulfonic acid (PFBS)	35.4	43.7		ng/L		123	55 - 147	10	30
Perfluorohexanesulfonic acid (PFHxS)	36.4	36.9		ng/L		101	58 - 138	11	30
Perfluoroheptanesulfonic Acid (PFHpS)	38.1	39.8		ng/L		104	32 - 170	11	30
Perfluorooctanesulfonic acid (PFOS)	37.1	38.5		ng/L		104	47 - 162	12	30
Perfluorodecanesulfonic acid (PFDS)	38.6	39.3		ng/L		102	35 - 157	16	30
Perfluorooctane Sulfonamide (FOSA)	40.0	39.7		ng/L		99	59 - 163	10	30
6:2FTS	37.9	39.2		ng/L		103	60 - 140	15	30

<i>Isotope Dilution</i>	<i>LCSD %Recovery</i>	<i>LCSD Qualifier</i>	<i>Limits</i>
13C8 FOSA	18	*	25 - 150
13C4 PFBA	128		25 - 150
13C2 PFHxA	122		25 - 150
13C4 PFOA	132		25 - 150
13C5 PFNA	135		25 - 150
13C2 PFDA	141		25 - 150
13C2 PFUnA	137		25 - 150
13C2 PFDoA	133		25 - 150

TestAmerica Sacramento

QC Sample Results

Client: O'Brien & Gere Inc of North America
 Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Method: 537 (modified) - Perfluorinated Hydrocarbons (Continued)

Lab Sample ID: LCSD 320-141114/3-A
Matrix: Water
Analysis Batch: 143551

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 141114

<i>Isotope Dilution</i>	<i>%Recovery</i>	<i>LCSD Qualifier</i>	<i>Limits</i>
18O2 PFHxS	128		25 - 150
13C4 PFOS	135		25 - 150
13C4-PFHpA	128		25 - 150
13C5 PFPeA	134		25 - 150
M2-6:2FTS	114		25 - 150

Method: 537 (modified) - Perfluorinated Hydrocarbons - DL

Lab Sample ID: 320-23933-1 MS
Matrix: Water
Analysis Batch: 143645

Client Sample ID: SUMP D
Prep Type: Total/NA
Prep Batch: 140894

<i>Analyte</i>	<i>Sample Result</i>	<i>Sample Qualifier</i>	<i>Spike Added</i>	<i>MS Result</i>	<i>MS Qualifier</i>	<i>Unit</i>	<i>D</i>	<i>%Rec</i>	<i>Limits</i>
Perfluorooctanesulfonic acid (PFOS) - DL	5800	J	36.3	5850	4	ng/L	-	17	47 - 162
<i>Isotope Dilution</i>	<i>%Recovery</i>	<i>MS Qualifier</i>	<i>Limits</i>						
13C4 PFOS - DL	148		25 - 150						

Lab Sample ID: 320-23933-1 MSD
Matrix: Water
Analysis Batch: 143645

Client Sample ID: SUMP D
Prep Type: Total/NA
Prep Batch: 140894

<i>Analyte</i>	<i>Sample Result</i>	<i>Sample Qualifier</i>	<i>Spike Added</i>	<i>MSD Result</i>	<i>MSD Qualifier</i>	<i>Unit</i>	<i>D</i>	<i>%Rec</i>	<i>Limits</i>	<i>RPD</i>	<i>Limit</i>
Perfluorooctanesulfonic acid (PFOS) - DL	5800	J	35.1	5650	4	ng/L	-	-545	47 - 162	3	30
<i>Isotope Dilution</i>	<i>%Recovery</i>	<i>MSD Qualifier</i>	<i>Limits</i>								
13C4 PFOS - DL	149		25 - 150								

QC Association Summary

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

LCMS

Prep Batch: 140698

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-23933-2	EQUIPMENT BLANK - 1	Total/NA	Water	3535	
320-23933-7	RE-12636-112916-SSH-4816	Total/NA	Water	3535	
320-23933-10	W-12636-113016-SSH-5116	Total/NA	Water	3535	

Prep Batch: 140894

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-23933-1 - DL	SUMP D	Total/NA	Water	3535	
320-23933-1	SUMP D	Total/NA	Water	3535	
MB 320-140894/1-A	Method Blank	Total/NA	Water	3535	
LCS 320-140894/2-A	Lab Control Sample	Total/NA	Water	3535	
320-23933-1 MS	SUMP D	Total/NA	Water	3535	
320-23933-1 MS - DL	SUMP D	Total/NA	Water	3535	
320-23933-1 MSD - DL	SUMP D	Total/NA	Water	3535	
320-23933-1 MSD	SUMP D	Total/NA	Water	3535	

Prep Batch: 141114

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-23933-3	B-7	Total/NA	Water	3535	
320-23933-4	B-7 COLLOCATED	Total/NA	Water	3535	
320-23933-5	B-19AR	Total/NA	Water	3535	
MB 320-141114/1-A	Method Blank	Total/NA	Water	3535	
LCS 320-141114/2-A	Lab Control Sample	Total/NA	Water	3535	
LCSD 320-141114/3-A	Lab Control Sample Dup	Total/NA	Water	3535	

Analysis Batch: 143551

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-23933-1	SUMP D	Total/NA	Water	537 (modified)	140894
320-23933-3	B-7	Total/NA	Water	537 (modified)	141114
320-23933-4	B-7 COLLOCATED	Total/NA	Water	537 (modified)	141114
320-23933-5	B-19AR	Total/NA	Water	537 (modified)	141114
MB 320-140894/1-A	Method Blank	Total/NA	Water	537 (modified)	140894
MB 320-141114/1-A	Method Blank	Total/NA	Water	537 (modified)	141114
LCS 320-140894/2-A	Lab Control Sample	Total/NA	Water	537 (modified)	140894
LCS 320-141114/2-A	Lab Control Sample	Total/NA	Water	537 (modified)	141114
LCSD 320-141114/3-A	Lab Control Sample Dup	Total/NA	Water	537 (modified)	141114
320-23933-1 MS	SUMP D	Total/NA	Water	537 (modified)	140894
320-23933-1 MSD	SUMP D	Total/NA	Water	537 (modified)	140894

Analysis Batch: 143554

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-23933-2	EQUIPMENT BLANK - 1	Total/NA	Water	537 (modified)	140698
320-23933-7	RE-12636-112916-SSH-4816	Total/NA	Water	537 (modified)	140698
320-23933-10	W-12636-113016-SSH-5116	Total/NA	Water	537 (modified)	140698

Analysis Batch: 143645

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-23933-1 - DL	SUMP D	Total/NA	Water	537 (modified)	140894
320-23933-1 MS - DL	SUMP D	Total/NA	Water	537 (modified)	140894
320-23933-1 MSD - DL	SUMP D	Total/NA	Water	537 (modified)	140894

TestAmerica Sacramento

Lab Chronicle

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Client Sample ID: SUMP D

Date Collected: 11/29/16 11:10

Date Received: 12/01/16 09:50

Lab Sample ID: 320-23933-1

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			260.6 mL	0.5 mL	140894	12/06/16 17:40	VPM	TAL SAC
Total/NA	Analysis	537 (modified)		10			143551	12/22/16 11:16	SBC	TAL SAC
Total/NA	Prep	3535	DL		260.6 mL	0.5 mL	140894	12/06/16 17:40	VPM	TAL SAC
Total/NA	Analysis	537 (modified)	DL	100			143645	12/22/16 16:20	SBC	TAL SAC

Client Sample ID: EQUIPMENT BLANK - 1

Date Collected: 11/29/16 11:30

Date Received: 12/01/16 09:50

Lab Sample ID: 320-23933-2

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			259.1 mL	0.5 mL	140698	12/05/16 19:37	JER	TAL SAC
Total/NA	Analysis	537 (modified)		1			143554	12/22/16 12:46	SBC	TAL SAC

Client Sample ID: B-7

Date Collected: 11/30/16 12:30

Date Received: 12/01/16 09:50

Lab Sample ID: 320-23933-3

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			248.5 mL	0.5 mL	141114	12/07/16 17:31	VPM	TAL SAC
Total/NA	Analysis	537 (modified)		1			143551	12/22/16 13:38	SBC	TAL SAC

Client Sample ID: B-7 COLLOCATED

Date Collected: 11/30/16 12:30

Date Received: 12/01/16 09:50

Lab Sample ID: 320-23933-4

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			256.4 mL	0.5 mL	141114	12/07/16 17:31	VPM	TAL SAC
Total/NA	Analysis	537 (modified)		1			143551	12/22/16 13:46	SBC	TAL SAC

Client Sample ID: B-19AR

Date Collected: 11/30/16 13:10

Date Received: 12/01/16 09:50

Lab Sample ID: 320-23933-5

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			251.7 mL	0.5 mL	141114	12/07/16 17:31	VPM	TAL SAC
Total/NA	Analysis	537 (modified)		1			143551	12/22/16 13:53	SBC	TAL SAC

Lab Chronicle

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Client Sample ID: RE-12636-112916-SSH-4816

Lab Sample ID: 320-23933-7

Date Collected: 11/29/16 15:00

Matrix: Water

Date Received: 12/01/16 09:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			273.3 mL	0.5 mL	140698	12/05/16 19:37	JER	TAL SAC
Total/NA	Analysis	537 (modified)		1			143554	12/22/16 11:46	SBC	TAL SAC

Client Sample ID: W-12636-113016-SSH-5116

Lab Sample ID: 320-23933-10

Date Collected: 11/30/16 09:00

Matrix: Water

Date Received: 12/01/16 09:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			248.1 mL	0.5 mL	140698	12/05/16 19:37	JER	TAL SAC
Total/NA	Analysis	537 (modified)		1			143554	12/22/16 13:23	SBC	TAL SAC

Laboratory References:

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

Certification Summary

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Laboratory: TestAmerica Sacramento

Unless otherwise noted, all analytes for this laboratory were covered under each certification below.

Authority	Program	EPA Region	Certification ID	Expiration Date
Oregon	NELAP	10	4040	01-29-17

The following analytes are included in this report, but certification is not offered by the governing authority:

Analysis Method	Prep Method	Matrix	Analyte
537 (modified)	3535	Water	6:2FTS
537 (modified)	3535	Water	Perfluorobutanesulfonic acid (PFBS)
537 (modified)	3535	Water	Perfluorobutanoic acid (PFBA)
537 (modified)	3535	Water	Perfluorodecanesulfonic acid (PFDS)
537 (modified)	3535	Water	Perfluorodecanoic acid (PFDA)
537 (modified)	3535	Water	Perfluorododecanoic acid (PFDoA)
537 (modified)	3535	Water	Perfluoroheptanesulfonic Acid (PFHpS)
537 (modified)	3535	Water	Perfluoroheptanoic acid (PFHpA)
537 (modified)	3535	Water	Perfluorohexanesulfonic acid (PFHxS)
537 (modified)	3535	Water	Perfluorohexanoic acid (PFHxA)
537 (modified)	3535	Water	Perfluorononanoic acid (PFNA)
537 (modified)	3535	Water	Perfluorooctane Sulfonamide (FOSA)
537 (modified)	3535	Water	Perfluorooctanesulfonic acid (PFOS)
537 (modified)	3535	Water	Perfluorooctanoic acid (PFOA)
537 (modified)	3535	Water	Perfluoropentanoic acid (PFPeA)
537 (modified)	3535	Water	Perfluorotetradecanoic acid (PFTeA)
537 (modified)	3535	Water	Perfluorotridecanoic Acid (PFTriA)
537 (modified)	3535	Water	Perfluoroundecanoic acid (PFUnA)

Method Summary

Client: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Method	Method Description	Protocol	Laboratory
537 (modified)	Perfluorinated Hydrocarbons	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: O'Brien & Gere Inc of North America
Project/Site: PFC Analysis

TestAmerica Job ID: 320-23933-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
320-23933-1	SUMP D	Water	11/29/16 11:10	12/01/16 09:50
320-23933-2	EQUIPMENT BLANK - 1	Water	11/29/16 11:30	12/01/16 09:50
320-23933-3	B-7	Water	11/30/16 12:30	12/01/16 09:50
320-23933-4	B-7 COLLOCATED	Water	11/30/16 12:30	12/01/16 09:50
320-23933-5	B-19AR	Water	11/30/16 13:10	12/01/16 09:50
320-23933-7	RE-12636-112916-SSH-4816	Water	11/29/16 15:00	12/01/16 09:50
320-23933-10	W-12636-113016-SSH-5116	Water	11/30/16 09:00	12/01/16 09:50



Regulatory Program: DW NPDES RCRA Other:

Client Contact
Company Name: O'Brien & Gere
Address: 37000 Grand River St 260
City/State/Zip: Farmington Hills, MI 48335
Phone: 248-477-5701
Fax: 248-477-5962
Project Name: RACER Inst
Site: Calderwater Rd Landfill
PO # 11601027

Project Manager: Cliff Yantz
Tel/Fax: 248-477-5701
Analysis Turnaround Time
 CALENDAR DAYS WORKING DAYS
TAT if different from Below
 2 weeks
 1 week
 2 days
 1 day

Site Contact: Kevin Schneider
Lab Contact: Pat Abe
Date: 11/30/16
Carrier: FEDEX
COC No: 1 of 2 COCs
Sampler: Kevin Schneider
For Lab Use Only:
Walk-in Client:
Lab Sampling:
Job / SDG No.:

Sample Identification	Sample Date	Sample Time	Sample Type (C-Comp, G-Grab)	Matrix	# of Cont.	Perform MS / MSD (Y / N)		Sample Specific Notes:
						Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	
Sump D	11/29/16	1110	G	WSW	6	Y	X	MS/MSD
Equipment Blank-1	11/29/16	1130	G	QC	2	N	X	
B-7	11/30/16	1230	G	GW	2	N	X	
B-7 collected	11/30/16	1230	G	GW	2	N	X	
B-19AC	11/30/16	1310	G	GW	2	N	X	



Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4= HNO3; 5= NaOH; 6= Other

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-Hazardous Flammable Skin Irritant Poison B Unknown

Special Instructions/QC Requirements & Comments:
PFAS / PFOS

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
 Return to Client Disposal by Lab Archive for _____ Months

Custody Seal No.:
Company: O'Brien & Gere
Date/Time: 11/30/16 1345
Company: RACER
Date/Time: 11/30/16 1345
Company: GHD
Date/Time: 11/30/16 1600
Company: GHD
Date/Time: 11/30/16 1600

Received by: Kevin Schneider
Date/Time: 11/30/16 1345
Received by: Pat Abe
Date/Time: 12/1/16 0950
Received in Laboratory by:

Cooler Temp. (°C): Obs'd: 2.7 Cor'd: 1.7 Therm ID No.: 12



16341161 460 1161151011
 10448 Citation Dr
 Suite 200
 Brighton, MI 48116
 Phone: 810.229.2763 Fax:

Chain of Custody Record 190571

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING
 TestAmerica Laboratories, Inc.
 TAL-8210 (0713)

Regulatory Program: DW NPDES RCRA Other:

Client Contact Company Name: O'Brien & Gere Address: 37000 Grand River St #600 City/State/Zip: Farmington Hills, MI 48335 Phone: 248-477-5701 Fax: 248-477-5962 Project Name: RACER Inst Site: Caldera Rd Landfill PO# 11601027		Project Manager: Cliff Yantz Tel/Fax: 248-477-5701 Analysis Turnaround Time <input checked="" type="checkbox"/> CALENDAR DAYS <input type="checkbox"/> WORKING DAYS TAT if different from Below <input checked="" type="checkbox"/> 2 weeks <input type="checkbox"/> 1 week <input type="checkbox"/> 2 days <input type="checkbox"/> 1 day		Site Contact: Kevin Schneider Date: 11/30/16 Carrier: BDEX Lab Contact: Pat Abe Perform MS/MSD (Y/N)		COC No.: _____ of _____ COCs Sampler: Kevin Schneider For Lab Use Only: Walk-in Client: Lab Sampling: Job /SDG No.: Sample Specific Notes: MS/MSD	
Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS/MSD (Y/N)
SUMP D	11/29/16	1110	G	Wsw	6	Y	X
Equipment Blank-1	11/29/16	1130	G	QC	2	N	X
B-7	11/30/16	1230	G	Gw	2	N	X
B-7 relocated	11/30/16	1230	G	Gw	2	N	X
B-19A	11/30/16	1310	G	Gw	2	N	X



320-23933 Chain of Custody

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

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 Unknown

Special Instructions/QC Requirements & Comments: PFAS / PFOS

Custody Seal No.: Relinquished by: Z. E. E. OBG Relinquished by: [Signature] Relinquished by: [Signature]	Company: O'Brien & Gere Company: OBG Company: [Signature]	Date/Time: 11/30/16 Date/Time: 11/30/16 Date/Time: 11/30/16 1600	Cooler Temp. (°C): Obs'd: 2.3 Corrd: 1.9 Company: GHA Company: TAWOS Company:	Therm ID No.: 12 Date/Time: 11/30/16 1345 Date/Time: 12/1/16 0950 Date/Time:
--	---	--	---	---



Regulatory Program: DW NPDES RCRA Other:

Client Contact
 Company Name: O'Brien & Gere
 Address: 37000 Grand River St #200
 City/State/Zip: Farmington Hills, MI 48335
 Phone: 248-477-5701
 Fax: 248-477-5962
 Project Name: RACER Trust
 Site: Calderwater Rd Landfill
 P.O.# 11601027

Project Manager: Cliff Yantz
 Tel/Fax: 248-477-5701
 Analysis Turnaround Time
 CALENDAR DAYS WORKING DAYS
 TAT if different from Below
 2 weeks
 1 week
 2 days
 1 day

Site Contact: Kevin Schneider
 Lab Contact: Pat Abe
 Date: 11/30/16
 Carrier: FEDEX
 COC No: 1 of 2 COCs
 Sampler: Kevin Schneider
 For Lab Use Only:
 Walk-in Client:
 Lab Sampling:
 Job / SDG No.:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Sample Specific Notes:	
						Filtered Sample (Y/N)	Perform MS / MSD (Y/N)
Sump D	11/29/16	1110	G	WSW	6	Y	MS/MSD
Equipment Blank-1	11/29/16	1130	G	QC	2	N	
B-7	11/30/16	1230	G	GW	2	N	
B-7 collected	11/30/16	1230	G	GW	2	N	
B-19Ac	11/30/16	1310	G	GW	2	N	



320-23933 Chain of Custody

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4, 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification: 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 Unknown

Special Instructions/QC Requirements & Comments: PFAS / PFOS

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
 Return to Client Disposal by Lab Archive for _____ Months

Custody Seal No.:
 Relinquished by: K-ghl 066
 Date/Time: 11/30/16 1345
 Company: O'Brien & Gere

Relinquished by: KEVIN SCHNEIDER
 Date/Time: 12/1/16 0950
 Company: TAOS

Relinquished by: KEVIN SCHNEIDER
 Date/Time: 12/1/16 0950
 Company: TAOS

Cooler Temp. (°C): Obs'd: 2.8 Cor'd: 1.7 Therm ID No.: 12



Regulatory Program: DW NPDES RCRA Other:

Client Contact
Company Name: GHD
Address: 14916 N. Sheldon Rd Ste 200
City/State/Zip: Plymouth MI 48170
Phone: 734 1453 15123
Fax:
Project Name: Former Percutane
Site: SS0W 12636-210
P O #

Project Manager: M. Tomlin
Tel/Fax: 519 887 0510
Analysis Turnaround Time
 CALENDAR DAYS WORKING DAYS
TAT if different from Below
 2 weeks
 1 week
 2 days
 1 day

Site Contact: R. Chetfield Date: 11/29/16
Lab Contact: Pat Ahe Carrier: FedEx
COC No: 167065
2 of 2 COCs
Sampler: Hessinger
For Lab Use Only:
Walk-in Client:
Lab Sampling:
Job / SDG No.:

Sample Identification	Sample Date	Sample Time	Sample Type (C-Comp, G-Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	Sample Specific Notes:
<u>GW-12636-112916-SSH-4716</u>	<u>11/29/16</u>	<u>1431</u>	<u>G</u>	<u>GW</u>	<u>2</u>	<u>MMX</u>	<u>X</u>	
<u>RE-12636-112916-SSH-4816</u>		<u>1500</u>	<u>G</u>	<u>GW</u>	<u>2</u>	<u>MMX</u>	<u>X</u>	
<u>GW-12636-112916-SSH-4916</u>		<u>1601</u>	<u>G</u>	<u>GW</u>	<u>2</u>	<u>MMX</u>	<u>X</u>	
<u>GW-12636-112916-SSH-5016</u>		<u>1605</u>	<u>G</u>	<u>GW</u>	<u>2</u>	<u>MMX</u>	<u>X</u>	
<u>GW-12636-113016-SSH-5116</u>	<u>11/30/16</u>	<u>10900</u>	<u>G</u>	<u>GW</u>	<u>2</u>	<u>MMX</u>	<u>X</u>	
<u>GW-12636-113016-SSH-5216</u>		<u>1026</u>	<u>G</u>	<u>GW</u>	<u>4</u>	<u>MMX</u>	<u>X</u>	
<u>GW-12636-113016-SSH-5316</u>		<u>1136</u>	<u>G</u>	<u>GW</u>	<u>2</u>	<u>MMX</u>	<u>X</u>	<u>MS/MSD</u>

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other
Possible Hazard Identification: 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 Unknown Poison B

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
 Return to Client Disposal by Lab Archive for _____ Months

Special Instructions/QC Requirements & Comments: PFAS/PFOS

Custody Seal No.: 667419 Cooler Temp. (°C): Obs'd: 2.8 Cor'd: 1.7 Therm ID No.: 12
Relinquished by: J.A. Man Company: GHD Date/Time: 11/30/16 1600
Relinquished by: Pat Ahe Company: TAWS Date/Time: 12/1/16 0950
Relinquished by: _____ Company: _____ Date/Time: _____



Login Sample Receipt Checklist

Client: O'Brien & Gere Inc of North America

Job Number: 320-23933-1

Login Number: 23933

List Source: TestAmerica Sacramento

List Number: 1

Creator: Turpen, Troy

Question	Answer	Comment
Radioactivity wasn't checked or is \leq background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	667419
Sample custody seals, if present, are intact.	N/A	
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.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	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	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <math><6\text{mm}</math> (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

ATTACHMENT D

***Data Validation Summary
Report***

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

This report presents the results of data validation performed for environmental samples collected from the Revitalizing Auto Communities Environmental Response Trust (RACER) Trust, Coldwater Road Landfill & Peregrine Facilities Site in Flint, Michigan on November 29 and November 30, 2016. The environmental samples collected for this investigation and submitted for data validation consisted of aqueous samples, collocated sample, matrix spike/matrix spike duplicate, equipment blank, watera rinsate blank and field blank. The list of samples submitted for data validation is presented in [Appendix A](#).

1.2 DATA VALIDATION PROTOCOL

1.2.1 Data Validation Overview

Validation is a process of evaluating the suitability of a measurement system for providing usable analytical data. Data validation is essentially a three-step process in which the quality assurance/quality control (QA/QC) information for the analytical data is first compared to a series of QA/QC criteria. Based on the results of this comparison, the analytical data are then assigned qualifiers, which provide an indication of data usability. Finally, an overall evaluation of data usability is performed. The manner by which these three steps were completed for this project is described in the following subsections.

1.2.2 Comparison to QA/QC Criteria

Environmental samples were submitted to TestAmerica Laboratories, Inc. of Sacramento, California (TA Sacramento) for per- and polyfluorinated substances (PFAS) analysis by the laboratory's standard operating procedure (SOP) that reflects a modified version of USEPA Method 537.

Data generated for this investigation were evaluated by OBG using professional judgment and the QA/QC criteria established in the laboratory SOP which is based on a modified version of the following method:

- USEPA. 2009. *Method 537- Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)*, Version 1.1, Cincinnati, Ohio.

A full review of QA/QC data was performed for all the samples in the data set and consisted of a review of data summary forms and supportive analytical data provided in the deliverables data packages.

A Quality Assurance Project Plan (QAPP) was not provided for this project.

The following QA/QC parameters are reviewed in the full data validation process:

- Chain-of-custody records
- Sample collection and sample preservation
- Holding times
- Calibration
- Blank analysis
- Matrix spike (MS)/matrix spike duplicate (MSD) analysis
- Laboratory control sample (LCS) /Laboratory control sample duplicate (LCSD) analysis
- Field duplicate/Collocated samples analysis
- Isotopic Dilution Analyte (IDA) performance

- Target compound identification, quantitation, and reporting limits (RLs)
- Documentation completeness

1.2.3 General Guidance Used for Assignment of Qualifiers

Since data validation guidelines for Method 537 are not available at this time, application of qualifiers for excursions from the laboratory SOP criteria was based on the general approach used to qualify samples described in the following document:

- USEPA. 2016. *National Functional Guidelines for High Resolution Superfund Methods Data Review*. EPA-542-B-16-001. Washington, D.C.

The following qualifiers are used in this type of data validation:

- "R" Indicates that the reporting limit (RL) or sample result has been identified as unusable due to a major deficiency in the data generation process. The data were rejected and should not be used for any qualitative or quantitative purposes.
- "U" Indicates that the analyte was not detected and the sample RL is presented. This qualifier is also used to signify blank excursions.
- "J" Indicates that the concentration should be considered approximate. The target analyte was positively identified and the associated numerical value is the approximate concentration; either the data quality criteria were not met or the concentration of the target analyte was greater than the method detection limit (MDL) and below the RL.
- "UJ" Indicates that the analyte was analyzed for and was not detected; however, the RL is presented and should be considered approximate. This qualifier is used when data quality criteria were not met.
- "JN" – Indicates that the target analyte has been "tentatively identified" as present and the associated numerical value is the estimated concentration in the sample. This qualifier may be applied due to data interpretation issues.

The data quality evaluation results in only one type of qualifier for each analyte; in a case when several qualifiers are applicable to the same analyte, the cumulative effect of the various QA/QC excursions is employed in assigning the final data qualifiers. For example, if a sample result is affected by low LCS recovery, for which the "UJ" qualifier is applied, but low MS/MSD recoveries result in the rejection of the sample result (application of the "R" qualifier), the final data qualifier is the "R" qualifier. QA/QC excursions that do not result in the qualification of an analyte are not discussed, with the exception of those excursions that provide useful information to the data user.

The specific approach utilized during this data validation is presented in [Appendix B](#) of this report, and laboratory QA/QC analyses definitions are provided in [Appendix C](#).

1.2.4 Data Usability Evaluation

Based on the QA/QC information review and the qualifiers assigned to the analytical data, an overall evaluation of data usability is performed. Data usability is defined as the percent of laboratory reported data that remains unqualified or is qualified as approximate or non-detected due to blank excursions, divided by the data reported by the laboratory times 100). The percent usability excludes the data rejected due to major QA/QC excursions. The non-usable data are defined as the percent of the data qualified as rejected divided by the data reported by the laboratory times 100.

The data usability evaluation considers the data parameters of precision, sensitivity, accuracy, representativeness, comparability, and completeness, which are described as follows:

- Precision is evaluated through the review of field duplicate, collocated samples and MS/MSD samples
- Sensitivity is evaluated through the review of RLs
- Accuracy is evaluated through the review of MS samples, MSD samples, IDA, LCS recoveries and calibrations
- Representativeness is evaluated through the review of holding times, sample preservation and preparation, blank analysis and target analyte quantification
- Comparability is evaluated through the review of the analytical methods and reporting procedures for consistency
- Completeness is defined as the overall percent of sample results that are identified as usable

1.3 ANALYTICAL METHODS

Environmental samples were submitted to TA Sacramento for PFAS analysis by the following laboratory SOP for Modified USEPA Method 537:

- TestAmerica Sacramento. 2017. *Per- and Polyfluorinated Substances (PFAS) in Water, Soils, Sediments and Tissue (Method 537 Modified)*, SOP No. WS-LC-0025, Rev 2.2, 02/02/2017.

The laboratory SOP was based on the following method:

Analytical Method Reference		
Parameter	Method	Reference
Pre- and Polyfluorinated Substances (PFAS)	Laboratory Modified USEPA Method 537 Version 1.1	1
Notes:		
1. USEPA. 2009. <i>Modified - Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)</i> , Version 1.1, Cincinnati, Ohio.		

The following sections of this document summarize the QA/QC parameters that met validation criteria and describes qualifications performed on sample data when QA/QC criteria were not met. Sample submitted for analysis that required qualification are identified in the following sections by the sample location documented on the field chain of custody record. Sample identifications are presented in [Appendix A](#).

2. DATA QUALITY EVALUATION

2.1 COMPARISON TO QA/QC CRITERIA

This section presents the results of the comparison of the analytical data to the QA/QC criteria specified in Section 1.2, and the qualifiers assigned to the data when the QA/QC criteria were not met. Samples that required qualifiers are described in the following sections and are identified by the project field identifications documented on the sample chain-of-custody records.

2.1.1. PFAS analysis Evaluation Summary

The following QA/QC parameters were found to meet validation criteria or did not require additional comments:

- Sample collection and sample preservation
- Holding times
- Calibration

Deviations from QA/QC criteria that resulted in qualified data and additional observations are summarized below.

Chain of Custody Records

For samples collected 11/29/16 and 11/30/16 by OBG for this investigation, samples were relinquished by OBG to GHD on 11/30/16 at 13:45. GHD then shipped the sample coolers to the laboratory on 11/30/16 using Federal Express. The samples were received by the laboratory on 12/1/16 at 09:50. The Federal Express courier tracking number was not listed on the chain-of-custody record.

For samples collected 11/29/16 and 11/30/16 by GHD for this investigation, samples were shipped by GHD to the laboratory on 11/30/16 using Federal Express and were received by the laboratory on 12/1/16 at 09:50. The Federal Express courier tracking number was not listed on the chain-of-custody record.

Blank Analysis

Target analytes were detected in blank results for PFAS at concentrations less than the RL. As a result, the following samples were qualified as non-detected (U) for the minor representativeness excursions:

Blank Excursions for PFAS				
Blank Identification	Target Analyte	Excursion	Action*	Samples Affected
EQUIPMENT BLANK-1	Perfluorotetradecanoic acid (PFTeA)	0.61 J ng/L	2 ng/L U	B-7, B-7 COLLOCATED, B-19AR
RE-12636-112916-SSH-4816 (Watera Blank)	Perfluorotetradecanoic acid (PFTeA)	0.31 J ng/L	2 ng/L U	B-19AR
W-12636-113016-SSH-5116 (Field Blank)	Perfluorotetradecanoic acid (PFTeA)	0.93 J ng/L	2 ng/L U	B-7, B-7 COLLOCATED, B-19AR
MB – 320-140894-1	Perfluorotetradecanoic acid (PFTeA)	0.61 J ng/L	None	Data were not impacted **
MB – 320-141114-1	Perfluorotetradecanoic acid (PFTeA)	0.54 J ng/L	2 ng/L U	B-7, B-7 COLLOCATED, B-19AR
MB – 320-141114-1	Perfluorooctane Sulfonamide (FOSA)	1.43 J ng/L	None	Data were not impacted **
MB – 320-140698-1	Perfluorotetradecanoic acid (PFTeA)	0.56 J ng/L	None	Data were not impacted ***
Note: MB indicates laboratory method blank. * Validation action applied using the Blank Action Option, presented in Appendix B. ** The target analyte was not detected in the associated sample. *** EQUIPMENT BLANK-1, RE-12636-112916-SSH-4816 (Watera Blank) and W-12636-113016-SSH-5116 (Field Blank) were associated with the method blank result.				

MS/MSD Analysis

Accuracy and precision excursions were identified for the MS/MSD analysis of SUMP D. However data were not qualified since validation criteria were met.

LCS/LCSD Analysis

One LCS result was outside of the laboratory control limits of 47 to 130 percent recovery. As a result, one target analyte impacted by the minor recovery excursion was qualified as approximate (J) in the following samples:

LCS Excursions for PFAS				
LCS Identification	Target Analyte	Excursion	Action	Samples Affected
LCS-320-140698/2	Perfluorotetradecanoic acid (PFTeA)	138 %R	J	EQUIPMENT BLANK – 1, RE-12636-112916-SSH-4816 (Watera Blank), W-12636-113016-SSH-5116 (Field Blank)



LCS Identification	Target Analyte	Excursion	Action	Samples Affected
Note: LCS indicates laboratory control sample. %R indicates percent recovery.				

Field Duplicate/Collocated Analysis

A field duplicate was not submitted for data validation. However, a collocated sample set was collected by OBG, submitted for validation and met validation criteria.

IDA Performance

Isotope Dilution Analyte (IDA) results were outside of the laboratory control limits of 25 to 150 percent recovery. As a result, target analytes impacted by the minor recovery excursions were qualified as approximate (UJ, J) in the following samples:

IDA Excursions for PFAS					
Sample Identification	IDA	Excursion	Target Analyte	Action	Samples Affected
SUMP D	13C4 Perflurorbutanoic acid (PFBA)	2%R	PFBA	J	SUMP D
SUMP D	13C5 Perflurorpentanoic acid (PFPeA)	16%R	PFPeA	J	SUMP D
EQUIPMENT BLANK -1	13C4 Perflurorooctane Sulfonamide (FOSA)	3%R	FOSA	UJ	EQUIPMENT BLANK -1
B-7	13C4 Perflurorooctane Sulfonamide (FOSA)	10%R	FOSA	UJ	B-7
B-7	13C4 Perflurorbutanoic acid (PFBA)	15%R	PFBA	J	B-7
B-7 COLLOCATED	13C4 Perflurorooctane Sulfonamide (FOSA)	10%R	FOSA	UJ	B-7 COLLOCATED
B-7 COLLOCATED	13C4 Perflurorbutanoic acid (PFBA)	16%R	PFBA	J	B-7 COLLOCATED
B-19AR	13C4 Perflurorooctane Sulfonamide (FOSA)	4%R	FOSA	UJ	B-19AR
RE-12636-112916-SSH-4816 (Watera Blank)	13C4 Perflurorooctane Sulfonamide (FOSA)	4%R	FOSA	UJ	RE-12636-112916-SSH-4816 (Watera Blank)
W-12636-113016-SSH-5116 (Field Blank)	13C4 Perflurorooctane Sulfonamide (FOSA)	8%R	FOSA	UJ	W-12636-113016-SSH-5116 (Field Blank)

Note:
%R indicates percent recovery.

Target Analyte Quantitation, Identification and RLs

The validation approach utilized for this data set is presented in [Appendix B](#). The following major observations pertain to the laboratory target analyte quantitation and identification process applied to data using the laboratory SOP for modified Method 537:

- For this type of analysis, the isotope dilution technique is applied, which includes the utilization of IDAs which are added to samples in the sample extraction process. Since IDAs respond in the same manner as target analytes, the IDA is used for target analyte identification and for calculating sample concentrations.



- The laboratory analyst's experience and judgement are used to evaluate and report target analyte identification and concentrations, based on interpretation of target analyte peak shape, the chromatography baseline, target analyte retention time and signal strength. The laboratory did not utilize ion ratios for target analyte identification.
- During data validation, peak integration and identification interpretation performed by the laboratory analysts was reviewed. Validation qualifiers were applied to sample results when chromatography, retention times or peak shapes may have impacted sample identifications and/or concentrations.
- For this method, branched-chain isomers may be identified for perfluorooctanoic acid (PFOA), perfluorohexanesulfonic acid (PFHxS) and perfluorooctane sulfonic acid (PFOS). The laboratory only processes and evaluates PFOA, PFOS and PFHxS for both linear and branched isomers based on current literature. Other target analytes are quantitated based on a single linear isomer peak, defined by the calibration solutions in the initial calibration. The laboratory utilized a qualitative/technical mixture for the PFOA standard to determine retention times only for the PFOA branch-chain isomers. A separate, certified quantitation/calibration-quality standard source, which only includes the linear isomer, was used for calibration.
- Samples results are qualified as approximate (J) but bias is not assigned to sample results with branch-chain isomers when quantitated using linear calibration standards or standards that do not include the branches present in the samples.
- Dilutions were utilized by the laboratory during sample preparation for sample SUMP D due to elevated target analyte detections. A 1:10 dilution and a 1:100 dilution were performed and were combined in the final sample result, presented in [Appendix B](#).

Data validation qualifiers were applied to the following sample results:

- The result for perfluorohexanoic acid (PFHxA) in sample SUMP D (1:10) was qualified as approximate (JN) based on peak integration evaluation.
- The results for perfluorooctanoic acid (PFOA) in samples SUMP D (1:10), B-7, B-7 COLLOCATED and B-19AR were qualified as approximate (JN) since a branched-chain isomer was identified for PFOA in these samples and the associated PFOA calibration standard did not include the branched isomer.
- The result for perfluorononanoic acid (PFNA) in sample SUMP D (1:10) was qualified as approximate (JN) based on peak integration and retention time shift evaluation.
- The result for perfluorohexanesulfonic acid (PFHxS) in sample B-7 COLLOCATED was qualified as approximate (JN) based on retention time shift evaluation.
- The results for perfluorotetradecanoic acid (PFTeA) in samples B-19AR and RE-12636-112916-SSH-4816 (Watera Blank) were qualified as approximate (JN) based on peak integration evaluation.

Document Completeness

Supplemental laboratory information and clarifications addressing the laboratory analysis and data interpretation were requested during the validation process. The original data package did not include the method blank and LCS results for sample preparation batch 140698, associated with EQUIPMENT BLANK – 1, RE-12636-112916-SSH-4816 (Watera Blank) and W-12636-113016-SSH-5116 (Field Blank). The supplemental laboratory information was necessary to complete the validation process.

3 SUMMARY AND DATA USABILITY

The data from the samples presented in [Appendix A](#) were evaluated based on QA/QC criteria established by the laboratory SOP and data validation qualifiers were applied to data based on the general approach presented in the data validation guidelines listed in Section 1.2.3.

Major deficiencies which would have resulted in rejected data were not identified for data from this sampling event. Minor deficiencies in the data generation process resulted in approximation of some sample data and data qualified as non-detected.

This section summarizes the adherence of the analytical data to precision, accuracy, representativeness, comparability, completeness, and sensitivity data quality objectives as defined in Section 1.2.4. Data quality was evaluated using percent usability, defined as the percentage of sample results that are usable for qualitative and quantitative purposes.

Precision: Data usability with respect to precision is 100 percent.

Sensitivity: Sensitivity is established by RLs, which represent measurable concentrations of analytes that can be quantified with a designated level of confidence and are less than the project action limits established for the project. Dilutions were performed for one sample analysis, which elevated RLs reported for target analytes for that sample.

Accuracy: Data usability with respect to accuracy is 100 percent.

Representativeness: Data usability with respect to representativeness is 100 percent.

Comparability: Comparability is not compromised provided that the analytical method approach did not change over time. A major component of comparability is the use of standard reference materials for calibration and QC. Since the modified analytical method approach and reporting procedures were consistently used by the laboratory, the comparability criteria for the analytical data were met.

Completeness: Overall, considering the complete data set, 100 percent of the data were usable for quantitative and quantitative purposes based on the data validation performed.

Summary Table of Samples Validated

Laboratory Performing Analysis	Date Collected	Field Chain-of-Custody Sample Identification	Organization Collecting Samples	Laboratory Identification	Matrix	Analysis Requested
TA Sacramento	11/29/2016	SUMP D, MS/MSD	OBG	320-23933-1	Aqueous	PFAS by Laboratory SOP Based on Modified USEPA Method 537
TA Sacramento	11/29/2016	EQUIPMENT BLANK - 1	OBG	320-23933-2	Aqueous	PFAS by Laboratory SOP Based on Modified USEPA Method 537
TA Sacramento	11/30/2016	B-7	OBG	320-23933-3	Aqueous	PFAS by Laboratory SOP Based on Modified USEPA Method 537
TA Sacramento	11/30/2016	B-7 COLLOCATED	OBG	320-23933-4	Aqueous	PFAS by Laboratory SOP Based on Modified USEPA Method 537
TA Sacramento	11/30/2016	B-19AR	OBG	320-23933-5	Aqueous	PFAS by Laboratory SOP Based on Modified USEPA Method 537
TA Sacramento	11/29/2016	RE-12636-112916-SSH-4816 (Watera Blank)	GHD	320-23933-7	Aqueous	PFAS by Laboratory SOP Based on Modified USEPA Method 537
TA Sacramento	11/30/2016	W-12636-113016-SSH-5116 (Field Blank)	GHD	320-23933-10	Aqueous	PFAS by Laboratory SOP Based on Modified USEPA Method 537
Notes:						
TA Sacramento indicates TestAmerica Laboratories, Inc. located in Sacramento, California.						
PFAS indicates perfluorinated substances.						
MS/MSD indicates matrix spike/matrix spike duplicate.						
OBG indicates O'Brien & Gere Engineers						

O'Brien & Gere Data validation approach for PFAS in Aqueous Samples by TestAmerica Sacramento Laboratory - Modified USEPA Method 537

<p>General Validation Approach</p>	<p>The validation approach taken by O'Brien & Gere is a conservative one; qualifiers are applied to sample data to indicate both major and minor excursions so that data associated with any type of excursion are identified to the data user. Major excursions result in data being rejected (R), indicating that the data are considered unusable for either quantitative or qualitative purposes. Minor excursions result in sample data being qualified as approximate (J, UJ, JN) or non-detected (U) that is otherwise usable for quantitative or qualitative purposes.</p> <p>Excursions are subdivided into excursions that are within the laboratory's control and those that are out of the laboratory's control. Excursions involving laboratory control sample recovery, calibration response, method blank excursions, low or high spike recovery due to inaccurate spiking solutions or poor instrument response, holding times, interpretation errors, and quantitation errors are within the control of the laboratory. Excursions resulting from poor spike recovery due to interference from the sample matrix is an example of an excursion that is not within the laboratory's control if the laboratory has followed proper method procedures, including applying appropriate sample preparation techniques.</p>
<p>Applying professional judgment</p>	<p>USEPA data validation directs professional judgment to be used when applying qualifiers in some cases, considering the laboratory analysis approach and method requirements.</p>
<p>Validation Parameter</p>	<p>TestAmerica Sacramento's Laboratory standard operating procedure (SOP) reflects a modified version of USEPA Method 537, since Method 537 applies to only drinking water sample matrices. Therefore, evaluation of the other aqueous and solid data is based on the laboratory SOP's requirements. Since data validation guidelines for Method 537 are not available at this time, application of qualifiers for excursions from the laboratory SOP is based on the general approach used to qualify data described in the National Functional Guidelines for High Resolution Superfund Methods Data Review, April 2016.</p>
<p>Validation Qualifiers</p>	<p>U - Indicates that the analyte was not detected and the sample reporting limit (RL) is presented. This qualifier is also used to signify blank excursions.</p> <p>J - The analyte was positively identified and 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 greater than the method detection limit (MDL) and below the RL).</p> <p>UJ - Indicates that the analyte was analyzed for and was not detected; however, the RL is presented and should be considered approximate. This qualifier is used when data quality criteria were not met.</p> <p>JN – Indicates that the analyte has been “tentatively identified” as present and the associated numerical value is the estimated concentration in the sample. This qualifier may be applied due to data interpretation issues.</p> <p>R - Indicates that the RL or sample result has been identified as unusable due to a major deficiency in the data generation process. The data were rejected and should not be used for any qualitative or quantitative purposes.</p>
<p>Overall PFAS Method Summary</p>	<p>The Modified Method 537 utilizes liquid chromatography/ tandem mass spectrometry (LC/MS/MS) and isotope dilution technique to analyze environmental samples for Per- and Polyfluorinated Substances (PFAS). This includes the utilization of Isotope Dilution Analytes</p>

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	(IDAs) which are added to samples in the sample extraction process. Since IDAs respond in the same manner as target analytes, the IDA is used for target analyte identification and for calculating sample concentrations.
Cooler Temperature	<p>Results for samples submitted analyses that are impacted by coolers that did not contain ice, or if the ice melted upon receipt and the cooler temperatures are greater than 10°C, are qualified as approximate (UJ, J).</p> <p>If samples are delivered to the laboratory the same day as sample collection and samples did not have sufficient time to reach 10°C, samples are not qualified, unless proper preservation was not provided for samples between sample collection and sample receipt at the laboratory.</p> <p>Results for samples received at ambient temperature involved in extended shipment-day issues may be rejected, applying professional judgment.</p>
Percent Solids	Results for samples submitted for organic analyses that are impacted by percent solids of 50 percent or less are qualified as approximate (UJ, J).
PFAS Holding Time	<p>Samples are stored at 4±2°C.</p> <p>Aqueous samples must be extracted within 7 days of collection and extracts analyzed within 40 days of extraction.</p> <p>Results for samples properly preserved and analyzed outside of but less than two times the holding time window for preparation and/or analysis are qualified as approximate (UJ, J). Non-detected results for samples properly preserved and analyzed greater than two times the holding time window for preparation and/or analysis are rejected (R). Detected results for samples properly preserved and analyzed greater than two times the holding time window for preparation and/or analysis are qualified as approximate (J).</p>
PFAS Calibration Evaluation	<p>A minimum of five to six calibration standards are analyzed to generate average response factors, linear or quadratic fit calibration curves. The calibrations are evaluated using the criteria of less than 35 percent relative standard deviation (%RSD) for target analytes quantitated by isotope dilution analytes (IDAs), less than 50 %RSD for target analytes quantitated by internal standards (without IDAs) or a correlation coefficient (r) greater than 0.995 for a linear fit.</p> <p>Initial calibration verification (ICV) mid-range standard (from a separate source) must be within 60 to 140 percent recovery (%R) for target analytes associated with IDAs and within 50 to 150%R for target analytes without IDAs. IDAs in the ICV must be greater than or equal to 50%R and less than or equal to 150%R.</p> <p>Mid-level continuing calibration verifications (CCVs) are analyzed at the beginning of the analysis sequence, at the end, and after every 10 samples. The CCV recovery must be within 60 to 140 percent recovery (%R) for target analytes associated with IDAs and within 50 to 150%R for target analytes without IDAs. IDAs in the ICV must be greater than or equal to 50%R and less than or equal to 150%R.</p>
Calibration Actions	<p>Due to relative standard deviation (RSD) calibration excursions, detected results for analytes in samples associated with the calibration are qualified as approximate (J). Non-detected results associated with RSD excursions may be qualified as approximate (UJ) based on professional judgment.</p> <p>If the RSD calibration excursion is greater than 90, detected results for analytes in samples associated with the calibration are qualified as approximate (J) and non-detected results may be rejected (R), applying professional judgment.</p> <p>For ICV excursions, detected and non-detected results for analytes in samples associated with the calibration are qualified as approximate (J, UJ).</p>

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	Due to %D CCV excursions, detected and non-detected results for analytes in samples associated with the calibration are qualified as approximate (J, UJ).
Associating samples with Field and Laboratory QC Samples	Equipment blanks (Rinsate blanks) are associated with samples collected in the same day (or sampling event) using the same sample collection equipment and decontamination solutions. When sampling equipment or decontamination solutions are changed, a new equipment blank should be collected. Each sample should be associated with one equipment blank, which is collected as close to the sample collection date/time as possible.
	Field blanks are associated with the sample containers used to collect samples. When sampling container lots are changed, a new field blank should be collected.
	Method blanks are associated with samples prepared at the same time as the samples. Method blanks should reflect the sample matrix type.
	Laboratory Control Samples (LCSs) are solutions containing known amounts of target analytes, analyzed within the laboratory to evaluate recovery of target analytes without sample matrix impacts. The LCSs are associated with samples prepared at the same time as the samples.
	MS/MSD samples are collected in the field and spiked with known amounts of target analytes, analyzed in the laboratory to evaluate recovery and precision of target analytes. MS/MSDs measure the impact of matrix interference on target analytes. The MS/MSDs must be prepared using project samples and are associated with samples prepared at the same time with the same matrix type.
	Field duplicates and collocated samples are duplicate samples collected in the field to measure field precision and are associated with samples of the same matrix type.
	In the case that insufficient QC samples are provided due to field or laboratory problems, professional judgment is used to associate each sample with a QC sample that reflects the sample matrix and analysis conditions.
Evaluation and Actions for MS/MSD, LCS and Field Duplicate Data	In the case that excursions are identified in more than one quality control sample of the same matrix within one sample delivery group, samples are batched according to sample preparation or analysis date and qualified accordingly.
	In general, if percent recoveries are less than laboratory CLs but greater than 10%, non-detected and detected results are qualified as approximate (UJ, J).
	If percent recoveries are greater than laboratory CLs, detected results are qualified as approximate (J).
	If percent recoveries are less than 10%, detected results are qualified as approximate (J) and non-detected results may be rejected (R), applying professional judgement.
	If RPDs for MSDs are outside of laboratory CLs, detected results are qualified as approximate (J). Non-detected results may not be qualified, applying professional judgment.
	Qualification is performed only when both MS and MSD recoveries are outside of laboratory CLs.
	Qualification is not performed for MS/MSD results if the sample concentration is greater than 4 times the MS or MSD spike concentration.
	Non-detected data are rejected (R) in the case that both MS/MSD recoveries are less than 10%.
	Qualification is not performed if MS/MSD are outside of laboratory CLs if the analysis was performed using a dilution factor of 10 times or more, applying professional judgment.

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	<p>Qualification of data associated with MS/MSD or field duplicate excursions is limited to the un-spiked sample or the field duplicate pair, respectively.</p> <p>Field duplicate data are evaluated against relative percent difference (RPD) criteria of less than 50 percent for aqueous samples and less than 100 percent for soils when results are greater than or equal to five times the RL. When a field duplicate result is less than five times the RL, a control limit of plus or minus two times the RL (difference criterion) is applied. If RPDs or differences are outside of criterion, detected and non-detected results are qualified as approximate (UJ, J).</p>
<p>Evaluation and Actions for Blank Results (Method, Field, Equipment)</p>	<p>Blanks are analyzed to evaluate laboratory and/or field contamination of project samples. Method blanks evaluate potential laboratory contamination and field and equipment blanks evaluate potential field contamination.</p> <p>Blanks are not qualified due to contamination of another blank.</p> <p>Sample results qualified as non-detected (U) are treated as detected results when qualifying for other excursions.</p> <ol style="list-style-type: none"> 1. For blank results less than the RL, samples with concentrations less than the RL are reported at the RL and qualified as non-detected (U). Samples with concentrations greater than or equal to the RL are not qualified or the Blank Rule Option may be applied. 2. For blank results greater than the RL, samples with concentrations less than the RL are reported at the RL and qualified as non-detected (U). Samples with concentrations greater than or equal to the RL and less than the blank contamination level are reported and qualified as non-detected (U). Samples with concentrations greater than or equal to the RL and greater than or equal to the blank contamination level are not qualified or the Blank Rule Option may be applied. 3. For blank results equal to the RL, sample concentrations less than the RL are reported at the RL value and qualified as non-detected (U). Samples greater than or equal to the RL are not qualified or the Blank Rule Option may be applied. 4. For gross contamination in blanks (interference peaks, poor baselines), all associated sample detected results may be rejected (R) or qualified as non-detected (U), applying professional judgment. <p>Blank Rule Option- If a target analyte is detected in a blank at a concentration greater than the MDL, for samples with concentrations less than five times the blank concentration, the sample is qualified as non-detected (U) and reported at the RL.</p>
<p>Evaluation of Isotope Dilution Analytes (IDAs)</p>	<p>The isotope dilution technique is applied for this analysis. This includes the utilization of IDAs, which are carbon-13 labeled analogs, oxygen-18 labeled analogs or deuterated analogs of target analytes which are added to samples in the sample extraction process. Since IDAs respond in the same manner as target analytes, the IDA is used for target analyte identification and for calculating sample concentrations.</p> <p>The IDAs are evaluated in sample results using control limits of 25% to 150%. Based on the laboratory SOP, low recoveries of IDAs are acceptable as long as the signal-to-noise (S/N) ratio is greater than 10:1.</p> <p>Results for target analytes associated with IDAs with recoveries greater than or less than 10% <u>with a S/N of greater than 10:1</u> are qualified as approximate (J, UJ).</p> <p>Results for target analytes associated with IDA with recoveries less than 10% with a S/N of less than 10:1 are rejected (R), using professional judgment.</p>
<p>Target Analyte Identifications</p>	<p>If incorrect target analyte identifications were made due to laboratory errors, the associated result will be corrected or rejected (R), applying professional judgment.</p>

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**Laboratory SOP -
Target Analyte
Identification and
Quantitation
Approach**

1. The laboratory is performing identification and quantitation for sample data using the guidance presented in the USEPA Technical Advisory – Laboratory Analysis of Drinking Water Samples for PFOA using EPA Method 537 Rev. 1.1.
2. The laboratory analyst's experience and judgement are used to report both target analyte identification and concentrations, which are based on interpretation of peak shape, chromatography baseline, retention time and signal strength. The laboratory did not utilize ion ratios for target analyte identification for this method.
3. During data validation, peak integration and identification interpretation performed by the laboratory analysts is reviewed. Validation qualifiers are applied to sample results when overall chromatography, retention times or peak shapes may have impacted sample identifications and/or concentrations.
4. IDAs are utilized to identify target analytes (TAs), where certified quantitation/calibration- quality IDA standards are available for inclusion in the calibration. For target analytes without IDAs, an IDA is assigned for retention time identification and quantitation and are presented in the laboratory SOP.
5. Branched-chain isomers may be identified for perfluorooctanoic acid (PFOA), perfluorohexanesulfonic acid (PFHxS) and perfluorooctane sulfonic acid (PFOS). The laboratory only processes and evaluates PFOA, PFOS and PFHxS for both linear and branched isomers based on current literature. Other target analytes are quantitated based on a single linear isomer peak, defined by the calibration solutions in the initial calibration.
6. The certified quantitation/calibration- quality IDA associated with perfluorotetradecanoic acid (PFTeDA), 13C-PFTeDA, is not available for sample quantitation.
7. The laboratory utilizes a qualitative/technical mixture for the PFOA standard to determine retention times only for the PFOA branch-chain isomers. A separate, certified quantitation/calibration-quality standard source, which only includes the linear isomer, is used for calibration.
8. Samples results are qualified as approximate (J) but bias is not assigned to sample results with branch-chain isomers when quantitated using linear calibration standards or standards that do not include the branches present in the samples.
9. Target analytes are identified using TA and IDA comparisons of retention time (RT) and relative retention time (RRT - defined as the RT of the target analyte/RT of the IDA), as applicable.
10. According to the laboratory, the data system's integration parameters are optimized for minimal manual intervention. Laboratory analyst's experience and judgement are used to evaluate TA peaks. Should there be any issue with the data system's integration the analyst will overwrite the data report with a manual integration. This manual integration will take into account TA signal strength, overall chromatography and baseline determinations, which can vary from sample to sample, especially for low level detections.

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Laboratory QA/QC analyses definitions

QA/QC Term	Definition
Reporting limit (RL) or Quantitation limit (QL)	The level above which numerical results may be obtained with a specified degree of confidence; the minimum concentration of an analyte in a specific matrix that can be identified and quantified above the method detection limit and within specified limits of precision and bias during routine analytical operating conditions.
Method detection limit (MDL)	The minimum concentration of an analyte that undergoes preparation similar to the environmental samples and can be reported with a stated level of confidence that the analyte concentration is greater than zero.
Calibration	Compliance requirements for satisfactory instrument calibration are established to verify that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of analysis and calibration verifications document satisfactory maintenance and adjustment of the instrument on a day-to-day basis.
Relative standard deviation (RSD)	The standard deviation divided by the mean; a unit-free measure of variability.
Correlation coefficient	A measure of the strength of the relationship between two variables.
Relative Percent Difference (RPD)	Used to compare two values; the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero.
Percent Difference (%D)	Used to compare two values; the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero.
Percent Recovery (%R)	The act of determining whether or not the methodology measures all of the target analytes contained in a sample.
Calibration blank	Consists of acids and reagent water used to prepare samples for analysis. This type of blank is analyzed to evaluate whether contamination is occurring during the preparation and analysis of the sample.
Method blank	A water or soil blank that undergoes the preparation procedures applied to a sample (i.e., extraction, digestion, clean-up). These samples are analyzed to examine whether sample preparation, clean-up, and analysis techniques result in sample contamination.
Field/equipment blank	Collected and submitted for laboratory analysis, where appropriate. Field/equipment blanks are handled in the same manner as environmental samples. Equipment/field blanks are analyzed to assess contamination introduced during field sampling procedures.
Internal standards performance	Compounds not found in environmental samples which are spiked into samples and quality control samples at the time of sample preparation for organic analyses. Internal standards must meet retention time and recovery criteria specified in the analytical method. Internal standards are used as the basis for quantitation of the target analytes.
Surrogate recovery	Compounds similar in nature to the target analytes but not expected to be detected in the environmental media which are spiked into environmental samples, blanks, and quality control samples prior to sample preparation for organic analyses. Surrogates are used to evaluate analytical efficiency by measuring recovery.
Laboratory control sample (LCS)	Standard solutions that consist of known concentrations of the target analytes spiked into laboratory analyte-free water or sand. They are prepared or purchased from a certified manufacturer from a source independent from the calibration standards to provide an independent verification of the calibration procedure. They are prepared



Laboratory QA/QC analyses definitions

QA/QC Term	Definition
	and analyzed following the same procedures employed for environmental sample analysis to assess method accuracy independently of sample matrix effects.
Matrix	The material of which the sample is composed or the substrate containing the analyte of interest, such as drinking water, waste water, air, soil/sediment, biological material.
Retention time (RT)	The time a target analyte is retained on a chromatography column before elution. The identification of a target analyte is dependent on a target compound's retention time falling within the specified retention time window established for that compound.
Relative retention time (RRT)	The ratio of the retention time of a compound to that of a standard.
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