August 12, 2019

Michael Squire
Project Manager
New York State Department of Environmental Conservation
625 Broadway, 11th Floor
Albany, NY 12233-7014

Re: Supplemental Remedial Investigation Work Plan
City DPW Yard
New Rochelle, NY
NYSDEC Site Number C360101
Langan Project No.: 170331701

Dear Mr. Squire:

Langan Engineering, Environmental, Surveying, Landscape Architecture, and Geology, D.P.C (Langan) prepared this Supplemental Remedial Investigation Work Plan (SRIWP) on behalf of TP Echo Bay LLC (the Volunteer) for the property at 224 East Main Street in New Rochelle, New York (the site). The site was accepted into the New York State Brownfield Cleanup Program (BCP) as a Volunteer (BCP Site No. C360101) and a Brownfield Cleanup Agreement (BCA) was executed on August 21, 2015.

The New York Department of Environmental Conservation (NYSDEC) has requested that the scope of work outlined in the January 12, 2016 Remedial Investigation Work Plan (RIWP) is supplemented with an assessment of emerging contaminants (1,4-dioxane and per- and polyfluoroalkyl substances [PFAS]) in soil and groundwater. The Supplemental Remedial Investigation Work Plan (SRIWP) provides for this assessment and is consistent with the NYSDEC June 2019 Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances Guidance Document (Emerging Contaminant Guidance Document).

SCOPE OF WORK

The RIWP includes the collection of 50 soil samples from 24 soil borings and the collection of 16 groundwater samples from 16 newly installed groundwater monitoring wells and up to 11 groundwater samples from existing monitoring wells, if accessible and in-tact. This SRIWP supplements the laboratory analysis required by the RIWP with the following:

- NYSDEC List PFAS by USEPA Method 537

- 1,4-dioxane by USEPA Method 8270 SIM isotope dilution (SIM will be performed only in necessary based on the laboratory's calibrated reporting limits' compliance with the attached Quality Assurance Project Plan [QAPP])

Table 1 includes the list of emerging contaminants that will be analyzed. An updated sample collection summary, which now includes the additional emerging contaminant samples, is provided as Table 2. The QAPP was revised to include protocols for sampling soil borings and monitoring wells for emerging contaminants; the QAPP is included as Attachment A.

The SRIWP will be implemented in conjunction with the RIWP. The sampling will be started within 45 days of NYSDEC-approval of this work plan and revised QAPP.

Reporting

The results of the emerging contaminant analysis will be incorporated into the Remedial Investigation Report (RIR), as required by the RIWP. Analytical Service Protocol (ASP) Category B deliverables will be prepared by the laboratory, and analytical results will also be uploaded to the NYSDEC's EQuIS environmental information management system.

Sincerely,
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.

Michael O. Burke

Michael Burke, PG, CHMM
Principal/Vice President

Enclosure(s): Table 1 – Emerging Contaminant Analyte List
Table 2 – Proposed Sample Summary
Attachment A - Quality Assurance Project Plan (QAPP)

cc: I. Cam-Spanos, A. Schweitzer, E. Adkins

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TABLES

Table 1
Emerging Contaminant Analyte List
Supplemental Remedial Investigation Work Plan

City DPW Yard
New Rochelle, New York
Langan Project No. 170331701
BCP ID No. C360101

PFAS Compound Analyte				
Group	**Compound Name**	**Abbreviation**	**CAS Number**	**Analytical Method**
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5	USEPA Method 537
	Perfluorohexanesulfonic acid	PFHxS	355-46-4	
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8	
	Perfluorooctanesulfonic acid	PFOS	1763-23-1	
	Perfluorodecanesulfonic acid	PFDS	335-77-3	
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4	
	Perfluoropentanoic acid	PFPeA	2706-90-3	
	Perfluorohexanoic acid	PFHxA	307-24-4	
	Perfluoroheptanoic acid	PFHpA	375-85-9	
	Perfluorooctanoic acid	PFOA	335-67-1	
	Perfluorononanoic acid	PFNA	375-95-1	
	Perfluorodecanoic acid	PFDA	335-76-2	
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8	
	Perfluorododecanoic acid	PFDoA	307-55-1	
	Perfluorotridecanoic acid	PFTriA/PFTrD	72629-94-8	
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7	
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2	
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4	
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6	
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9	
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6	
1,4-Dioxane				
1,4-Dioxane	1,4-dioxane	None	123-91-1	USEPA Method 8270 SIM

Notes:
1. PFAS - per- and polyfluoroalkyl substances
2. USEPA = United States Environmental Protection Agency

Table 2
Proposed Sample Summary
Supplemental Remedial Investigation Work Plan

City DPW Yard
New Rochelle, New York
Langan Project No. 170331701
BCP ID No. C360101

No.	Boring Location	AOC Location	Sample Depth (feet bgs)	Rationale	Analysis
SOIL SAMPLES					
1	EB01	AOC 5	Greatest degree of impacts	Evaluate historic fill quality; horizontal delineation of any subsurface impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
2			First indication of clean or native soil	Vertical delineation of historic fill and subsurface impacts	
3	EB02	AOC 3 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS
4			First indication of clean or native soil	Evaluate historic fill quality; vertical delineation of petroleum impacts	
5	EB03	AOC 1 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, TPH-GRO/DRO, 1,4-Dioxane, PFAS
6			First indication of clean or native soil	Evaluate historic fill quality; vertical delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS
7	EB04	AOC 1 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, TPH-GRO/DRO, 1,4-Dioxane, PFAS
8			First indication of clean or native soil	Evaluate historic fill quality; vertical delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS
9	EB05	AOC 3 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS
10			First indication of clean or native soil	Evaluate historic fill quality; vertical delineation of petroleum impacts	
11	EB06	AOC 5	Greatest degree of impacts	Evaluate historic fill quality; horizontal delineation of any subsurface impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
12			First indication of clean or native soil	Vertical delineation of historic fill and subsurface impacts	
13	EB07	AOC 5	Greatest degree of impacts	Evaluate historic fill quality; horizontal delineation of any subsurface impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
14			First indication of clean or native soil	Vertical delineation of historic fill and subsurface impacts	
15	EB08	AOC 5	Greatest degree of impacts	Evaluate historic fill quality; horizontal delineation of any subsurface impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
16			First indication of clean or native soil	Vertical delineation of historic fill and subsurface impacts	
17	EB09	AOC 3 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS
18			First indication of clean soil	Evaluate historic fill quality; vertical delineation of petroleum impacts	
19	EB10	AOCs 1, 3 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, TPH-GRO/DRO, 1,4-Dioxane, PFAS
20			First indication of clean soil	Evaluate historic fill quality; vertical delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS
21	EB11	AOC 5	Greatest degree of impacts	Evaluate historic fill quality; horizontal delineation of any subsurface impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
22			First indication of clean or native soil	Vertical delineation of historic fill and subsurface impacts	
23	EB12	AOC 1 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, TPH-GRO/DRO, 1,4-Dioxane, PFAS
24			First indication of clean soil	Evaluate historic fill quality; vertical delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS

Table 2
Proposed Sample Summary
Supplemental Remedial Investigation Work Plan

City DPW Yard
New Rochelle, New York
Langan Project No. 170331701
BCP ID No. C360101

No.	Boring Location	AOC Location	Sample Depth (feet bgs)	Rationale	Analysis
25	EB13	AOC 4 and 5	0 - 0.5 feet bgs	Evaluate historic fill quality; vertical/horizontal delineation of potential PCB impacts	Part 375/TCL PCBs
26			0.5 to 1 feet bgs	Evaluate historic fill quality; vertical/horizontal delineation of potential PCB impacts	
27			1 to 1.5 feet bgs	Evaluate historic fill quality; vertical/horizontal delineation of potential PCB impacts	
28			1.5 to 2 feet bgs	Evaluate historic fill quality; vertical/horizontal delineation of potential PCB impacts	
29	EB14	AOCs 1, 4 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality and potential PCB impacts; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, TPH-GRO/DRO, 1,4-Dioxane, PFAS
30			First indication of clean soil	Evaluate historic fill quality; vertical delineation of petroleum and potential PCB impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS
31	EB15	AOCs 1, 2 and 5	Greatest degree of impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, TPH-GRO/DRO, 1,4-Dioxane, PFAS
32			First indication of clean soil	Evaluate historic fill quality; vertical delineation of petroleum and other subsurface impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
33	EB16	AOC 2 and 5	Greatest degree of impacts	Evaluate historic fill quality; horizontal delineation of subsurface impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
34			First indication of clean soil	Evaluate historic fill quality; vertical delineation of subsurface impacts	
35	EB17	AOC 2 and 5	Greatest degree of impacts	Evaluate historic fill quality; horizontal delineation of subsurface impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
36			First indication of clean soil	Evaluate historic fill quality; vertical delineation of subsurface impacts	
37	EB18	AOCs 1, 2 and 5	Greatest degree of impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, TPH-GRO/DRO, 1,4-Dioxane, PFAS
38			First indication of clean soil	Evaluate historic fill quality; vertical delineation of petroleum and other subsurface impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
39	EB19	AOC 1 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, TPH-GRO/DRO, 1,4-Dioxane, PFAS
40			First indication of clean soil	Evaluate historic fill quality; vertical delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS
41	EB20	AOC 1 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, TPH-GRO/DRO, 1,4-Dioxane, PFAS
42			First indication of clean soil	Evaluate historic fill quality; vertical delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS
43	EB21	AOC 1 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, TPH-GRO/DRO, 1,4-Dioxane, PFAS
44			First indication of clean soil	Evaluate historic fill quality; vertical delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS
45	EB22	AOC 5	Greatest degree of impacts	Evaluate historic fill quality; horizontal delineation of subsurface impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
46			First indication of clean or native soil	Vertical delineation of historic fill and subsurface impacts	
47	EB23	AOC 1 and 5	Greatest degree of petroleum impacts	Evaluate historic fill quality; horizontal delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, TPH-GRO/DRO, 1,4-Dioxane, PFAS
48			First indication of clean soil	Evaluate historic fill quality; vertical delineation of petroleum impacts	Part 375/TCL VOCs, SVOCs, PCBs, Metals, Hexavalent/Trivalent Chromium, 1,4-Dioxane, PFAS
49	EB24	AOC 5	Greatest degree of impacts	Evaluate historic fill quality; horizontal delineation of subsurface impacts	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
50			First indication of clean or native soil	Vertical delineation of historic fill and subsurface impacts	
51	EBXX	AOC 1	TBD	In-Situ Remediation Evaluation Parameters	Grain size, Porosity (Specific Gravity/Density), TOC, Sulfate, Nitrate
52	EBXX	AOC 1	TBD	In-Situ Remediation Evaluation Parameters	Grain size, Porosity (Specific Gravity/Density), TOC, Sulfate, Nitrate
53	EBXX	AOC 1	TBD	In-Situ Remediation Evaluation Parameters	Grain size, Porosity (Specific Gravity/Density), TOC, Sulfate, Nitrate

Table 2
Proposed Sample Summary
Supplemental Remedial Investigation Work Plan

City DPW Yard
New Rochelle, New York
Langan Project No. 170331701
BCP ID No. C360101

No.	Boring Location	AOC Location	Sample Depth (feet bgs)	Rationale	Analysis
54	SODUP01_date	TBD	TBD	Quality Assurance / Quality Control	Part 375/TCL VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Hexavalent/Trivalent Chromium, Cyanide, 1,4-Dioxane, PFAS
55	SODUP02_date	TBD	TBD		
56	SODUP03_date	TBD	TBD		
57	MS/MSD-SO01_date	TBD	TBD		
58	MS/MSD-SO02_date	TBD	TBD		
59	MS/MSD-SO03_date	TBD	TBD		
60	SOFB01_date	-	-		
61	SOFB02_date	-	-		
62	SOFB03_date	-	-		
63	SOFB04_date	-	-		1,4-Dioxane, PFAS (See Note 4)
64	SOTB01_date	-	-		Part 375/TCL VOCs
65	SOTB02_date	-	-		

Table 2
Proposed Sample Summary
Supplemental Remedial Investigation Work Plan

City DPW Yard
New Rochelle, New York
Langan Project No. 170331701
BCP ID No. C360101

No.	Boring Location	AOC Location	Sample Depth (feet bgs)	Rationale	Analysis
GROUNDWATER SAMPLES					
1	EW03	AOC 1	Middle of Screened Interval	Evaluate horizontal extents of LNAPL and dissolved-phased petroleum impacts	TCL VOCs and SVOCs, total and dissolved TAL Metals (including hexavalent/trivalent chromium), 1,4-Dioxane, PFAS
2	EW04	AOC 1	Middle of Screened Interval	Evaluate horizontal extents of LNAPL and dissolved-phased petroleum impacts	TCL VOCs and SVOCs, total and dissolved TAL Metals (including hexavalent/trivalent chromium), 1,4-Dioxane, PFAS
3	EW05	AOC 3	Middle of Screened Interval	Evaluate horizontal extent of petroleum impacts, if any	TCL VOCs and SVOCs, total and dissolved TAL Metals (including hexavalent/trivalent chromium), 1,4-Dioxane, PFAS
4	EW07	AOC 5	Middle of Screened Interval	Evaluate site groundwater quality	TCL VOCs, SVOCs, PCBs, Pesticides, and Herbicides, total and dissolved TAL metals (including hexavalent/trivalent chromium), Cyanide, 1,4-Dioxane, PFAS
5	EW10	AOCs 1 and 3	Middle of Screened Interval	Evaluate horizontal extents of LNAPL and dissolved-phased petroleum impacts	TCL VOCs and SVOCs, total and dissolved TAL Metals (including hexavalent/trivalent chromium), 1,4-Dioxane, PFAS
6	EW12	AOC 1	Middle of Screened Interval	Evaluate horizontal extents of LNAPL and dissolved-phased petroleum impacts	TCL VOCs and SVOCs, total and dissolved TAL Metals (including hexavalent/trivalent chromium), 1,4-Dioxane, PFAS
7	EW14	AOCs 1 and 4	Middle of Screened Interval	Evaluate horizontal extents of LNAPL, dissolved-phased petroleum, and PCBs impacts (if any)	TCL VOCs and SVOCs, total and dissolved TAL Metals (including hexavalent/trivalent chromium), 1,4-Dioxane, PFAS
8	EW15	AOCs 1 and 2	Middle of Screened Interval	Evaluate horizontal extents of LNAPL, dissolved-phased petroleum, and solvent impacts (if any)	TCL VOCs, SVOCs, PCBs, total and dissolved TAL metals (including hexavalent/trivalent chromium), Cyanide, 1,4-Dioxane, PFAS
9	EW16	AOC 2	Middle of Screened Interval	Evaluate horizontal extents dissolved-phased petroleum and solvent impacts (if any)	TCL VOCs, SVOCs, PCBs, total and dissolved TAL metals (including hexavalent/trivalent chromium), Cyanide, 1,4-Dioxane, PFAS
10	EW17	AOC 2	Middle of Screened Interval	Evaluate horizontal extents dissolved-phased petroleum and solvent impacts (if any)	TCL VOCs, SVOCs, PCBs, total and dissolved TAL metals (including hexavalent/trivalent chromium), Cyanide, 1,4-Dioxane, PFAS
11	EW18	AOCs 1 and 2	Middle of Screened Interval	Evaluate horizontal extents of LNAPL, and dissolved-phased petroleum, and solvent impacts (if any)	TCL VOCs, SVOCs, PCBs, total and dissolved TAL metals (including hexavalent/trivalent chromium), Cyanide, 1,4-Dioxane, PFAS
12	EW19	AOC 1	Middle of Screened Interval	Evaluate horizontal extents of LNAPL and dissolved-phased petroleum impacts	TCL VOCs and SVOCs, total and dissolved TAL Metals (including hexavalent/trivalent chromium), 1,4-Dioxane, PFAS
13	EW20	AOC 1	Middle of Screened Interval	Evaluate horizontal extents of LNAPL and dissolved-phased petroleum impacts	TCL VOCs and SVOCs, total and dissolved TAL Metals (including hexavalent/trivalent chromium), 1,4-Dioxane, PFAS
14	EW21	AOC 1	Middle of Screened Interval	Evaluate horizontal extents of LNAPL and dissolved-phased petroleum impacts	TCL VOCs and SVOCs, total and dissolved TAL Metals (including hexavalent/trivalent chromium), 1,4-Dioxane, PFAS
15	EW22	AOC 5	Middle of Screened Interval	Evaluate site groundwater quality	TCL VOCs, SVOCs, PCBs, Pesticides, and Herbicides, total and dissolved TAL metals (including hexavalent/trivalent chromium), Cyanide, 1,4-Dioxane, PFAS
16	EW23	AOC 1	Middle of Screened Interval	Evaluate horizontal extents of LNAPL and dissolved-phased petroleum impacts	TCL VOCs and SVOCs, total and dissolved TAL Metals (including hexavalent/trivalent chromium), 1,4-Dioxane, PFAS
17	EWXX	AOC 1	Middle of Screened Interval	In-Situ Remediation Evaluation Parameters	TOC, Sulfate, Nitrate, TDS, Alkalinity, Chloride
18	EWXX	AOC 1	Middle of Screened Interval	In-Situ Remediation Evaluation Parameters	TOC, Sulfate, Nitrate, TDS, Alkalinity, Chloride
19	EWXX	AOC 1	Middle of Screened Interval	In-Situ Remediation Evaluation Parameters	TOC, Sulfate, Nitrate, TDS, Alkalinity, Chloride
20	GWDUP01_date	TBD	Middle of Screened Interval	Quality Assurance / Quality Control	TCL VOCs, SVOCs, PCBs, Pesticides, and Herbicides, total and dissolved TAL metals (including hexavalent/trivalent chromium), Cyanide, 1,4-Dioxane, PFAS
21	GWDUP02_date	TBD	Middle of Screened Interval		
22	MS/MSD-GW01_date	TBD	Middle of Screened Interval		
23	MS/MSD-GW02_date	TBD	Middle of Screened Interval		
24	GWFB01_date	N/A	N/A		
25	GWFB02_date	N/A	N/A		
26	GWFB03_date	N/A	N/A		1,4-Dioxane, PFAS (See Note 4)
27	GWTB01_date	N/A	N/A		TCL VOCs

Table 2
Proposed Sample Summary
Supplemental Remedial Investigation Work Plan

City DPW Yard
New Rochelle, New York
Langan Project No. 170331701
BCP ID No. C360101

No.	Boring Location	AOC Location	Sample Depth (feet bgs)	Rationale	Analysis
SOIL VAPOR SAMPLES					
1	SSV-01	AOC 5	Sub-slab (6 inches below slab)	Evaluate soil vapor quality	TO-15 VOCs
2	SSV-02	AOC 5	Sub-slab (6 inches below slab)	Evaluate soil vapor quality	TO-15 VOCs
3	SSV-03	AOC 5	Sub-slab (6 inches below slab)	Evaluate soil vapor quality	TO-15 VOCs
4	SSV-04	AOC 1, 3, and 5	Sub-slab (6 inches below slab)	Evaluate soil vapor quality	TO-15 VOCs
5	SSV-05	AOC 2 and 5	Sub-slab (6 inches below slab)	Evaluate soil vapor quality	TO-15 VOCs
6	SSV-06	AOC 1, 2 and 5	Sub-slab (6 inches below slab)	Evaluate soil vapor quality	TO-15 VOCs
7	SV-01	AOC 5	Soil vapor (anticipated depth of foundations or 2 feet above groundwater, whichever is shallower)	Evaluate soil vapor quality	TO-15 VOCs
8	SV-02	AOC 1 , 3 and 5	Soil vapor (anticipated depth of foundations or 2 feet above groundwater, whichever is shallower)	Evaluate soil vapor quality	TO-15 VOCs
9	SV-03	AOC 1 and 5	Soil vapor (anticipated depth of foundations or 2 feet above groundwater, whichever is shallower)	Evaluate soil vapor quality	TO-15 VOCs
10	SV-04	AOC 1 and 5	Soil vapor (anticipated depth of foundations or 2 feet above groundwater, whichever is shallower)	Evaluate soil vapor quality	TO-15 VOCs
11	SV-05	AOC 5	Soil vapor (anticipated depth of foundations or 2 feet above groundwater, whichever is shallower)	Evaluate soil vapor quality	TO-15 VOCs
12	IA01	N/A	Indoor Air (3 to 5 feet above surface)	Evaluate indoor air qualiy	TO-15 VOCs
13	IA02	N/A	Indoor Air (3 to 5 feet above surface)	Evaluate indoor air qualiy	TO-15 VOCs
14	IA03	N/A	Indoor Air (3 to 5 feet above surface)	Evaluate indoor air qualiy	TO-15 VOCs
15	IA04	N/A	Indoor Air (3 to 5 feet above surface)	Evaluate indoor air qualiy	TO-15 VOCs
16	AA01	N/A	Ambient Air (3 to 5 feet above surface)	Evaluate outdoor/background air quality	TO-15 VOCs
17	AA02	N/A	Ambient Air (3 to 5 feet above surface)	Evaluate outdoor/background air quality	TO-15 VOCs
18	SVDUP01_date	N/A	TBD	Quality Assurance / Quality Control	TO-15 VOCs

Notes:
1. All borings will be used to characterize historic fill; however, not all borings will be sampled for the same parameters as samples collected to characterize AOC #5.
2. All volatile soil samples will be collected using Encore or Terra Core sampler kits.
3. Additional soil characterization samples may be collected when solvent- or petroleum-impacted material is encountered.
4. Field blanks/equipment blanks for emerging contaminants will be collected at a frequency of one per day during emerging contaminant sampling.
5. TBD - To be determined in the field
6. VOC- Volatile organic compounds
7. SVOC- Semivolatile organic compounds
8. PCBs - Polychlorinated biphenyls
9. PFAS - per- and polyfluoroakyl substances
10. TCL- Target compound list
11. TAL - Target analyte list
12. TPH-GRO - Total Petroleum Hydrocarbons - Gasoline Range Organics
13. TPH-DRO - Total Petroleum Hydrocarbons - Diesel Range Organics
14. TOC - Total organic carbon
15. TDS - Total dissolved solids
16. bgs - below grade surface
17. N/A - Not applicable

ATTACHMENT A
QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

for

City DPW Yard – 224 Main Street
New Rochelle, New York
NYSDEC BCP Site No. C360101

Prepared For:

TP Echo Bay LLC
200 Park Avenue, 17th Floor
New York, New York 10166

Prepared By:

Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
21 Penn Plaza
360 West 31st Street, 8th Floor
New York, New York 10001

October 16, 2015
(Revised August 12, 2019)
Langan Project No. 170331701

LANGAN

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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) was prepared on behalf of TP Echo Bay LLC (the Volunteer) for the City DPW property at 224 East Main Street in New Rochelle, New York (the "site"). The site was accepted into the New York State Brownfield Cleanup Program (BCP) as a Volunteer and a Brownfield Cleanup Agreement (BCA) was executed on August 21, 2015. Additional site information is provided in the Supplemental Remedial Investigation Work Plan (SRIWP).

This QAPP specifies analytical methods to be used to ensure that data collected during the Supplemental Remedial Investigation (SRI) are precise, accurate, representative, comparable, complete, and meet the sensitivity requirements of the project.

1.2 PROJECT OBJECTIVES

The objective of the Remedial Investigation (RI) is to investigate and characterize the nature and extent of on-site environmental impacts associated with potential areas of concern (AOC) and the historical usage of the site. The objective of the SRI is to assess the presence of emerging contaminants, including PFAS and 1,4-dioxane, in soil and groundwater. This QAPP addresses sampling and analytical methods that may be necessary in support of the RIWP and SRIWP. These objectives have been established in order to meet standards that will protect public health and the environment for the site.

1.3 SCOPE OF WORK

The scope of work covered in this QAPP is detailed in the RIWP and SRIWP. In general, the RIWP and SRIWP propose soil boring installation and sampling, groundwater monitoring well installation and sampling, and sub-slab and soil vapor sampling. A dust, odor, and organic vapor control and monitoring plan will be implemented during ground intrusive activities.

The SRI consists of the following activities:

- Collection of 46 soil samples from 23 soil borings, plus quality assurance/quality control (QA/QC) samples, for laboratory analysis.
- Collection of 16 groundwater samples from each groundwater monitoring well to be installed as part of the RI (EW03, EW04, EW05, EW07, EW10, EW12, and EW14 through EW23), plus QA/QC samples, for laboratory analysis.

2.0 DATA QUALITY OBJECTIVES AND PROCESS

Data Quality Objectives (DQOs) are qualitative and quantitative statements to help ensure that data of known and appropriate quality are obtained during the project. The overall project objective is to investigate subsurface conditions associated with AOCs for the Site. The sampling program will provide for collection of soil, soil vapor, indoor air, and groundwater samples. DQOs for sampling activities are determined by evaluating five factors:

- Data needs and uses: The types of data required and how the data will be used after it is obtained.
- Parameters of Interest: The types of chemical or physical parameters required for the intended use.
- Level of Concern: Levels of constituents, which may require remedial actions or further investigations.
- Required Analytical Level: The level of data quality, data precision, and QA/QC documentation required for chemical analysis.
- Required Detection Limits: The detection limits necessary based on the above information.

The quality assurance and quality control objectives for all measurement data include:

- **Precision** – an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Field sampling precision will be determined by analyzing coded duplicate samples and analytical precision will be determined by analyzing internal QC duplicates and/or matrix spike duplicates.
- **Accuracy** – a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern. For soil and groundwater samples, accuracy will be determined through the assessment of the analytical results of equipment blanks and trip blanks for each sample set. Analytical accuracy will be assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), internal standards, laboratory method blanks, instrument calibration, and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. For soil vapor or air samples, analytical accuracy will be assessed by examining the percent recoveries that are added to each sample, internal standards, laboratory method blanks, and instrument calibration.

- **Representativeness** – expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that specified sampling and analysis techniques are used. Representativeness in the laboratory is ensured by compliance to nationally-recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession. This is accomplished by following all applicable methods, laboratory-issued standard operating procedures (SOPs), the laboratory's Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.
- **Completeness** – the percentage of measurements made which are judged to be valid. Completeness will be assessed through data validation. The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested.
- **Comparability** – expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured using several procedures, including standard methods for sampling and analysis as documented in the QAPP, using standard reporting units and reporting formats, and data validation.
- **Sensitivity** – the ability of the instrument or method to detect target analytes at the levels of interest. The project manager will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection.

3.0 PROJECT ORGANIZATION

All work included with implementing the NYSDEC-approved RIWP will be overseen by Langan, on behalf of TP Echo Bay, LLC. Langan will collect media samples and will subcontract with a qualified driller and an ELAP-certified laboratory. Data validation services will be performed by an approved data validator.

For the scope of work described in the RIWP, sampling will be conducted by Langan, the analytical services will be performed by Alpha Analytical of Westborough, Massachusetts (NYSDOH ELAP certification number 11148). Data validation services will be performed by Emily Strake; resume attached (Attachment A).

Key contacts for this project are as follows:

TP Echo Bay, LLC:	Mr. Neil Duncan Telephone: (212) 704-2035
Langan Project Manager:	Mrs. Mimi Raygorodetsky Telephone: (212) 479-5441
Langan Quality Assurance Officer (QAO):	Ms. Ilkay Cam-Spanos Telephone: (212) 479-5410
Program Quality Assurance Monitor:	Mr. Andrew Schweitzer, PE Telephone: (212) 479-5598
Data Validator:	Ms. Emily Strake Telephone: (215) 491-6526
Laboratory Representative:	Alpha Analytical Ben Rao Telephone: (201) 812-2633

4.0 QUALITY ASSURANCE OBJECTIVES FOR COLLECTION OF DATA

The overall quality assurance objective is to develop and implement procedures for sampling, laboratory analysis, field measurements, and reporting that will provide data of sufficient quality for the remedial investigation at the site. The sample set, chemical analysis results, and interpretations must be based on data that meet or exceed quality assurance objectives established for the site. Quality assurance objectives are usually expressed in terms of accuracy or bias, sensitivity, completeness, representativeness, comparability, and sensitivity of analysis. Variances from the quality assurance objectives at any stage of the investigation will result in the implementation of appropriate corrective measures and an assessment of the impact of corrective measures on the usability of the data.

4.1 PRECISION

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision is assessed through the collection and measurement of field duplicates. Laboratory precision and sample heterogeneity also contribute to the uncertainty of field duplicate measurements. This uncertainty is taken into account during the data assessment process. For field duplicates, results less than 2x the reporting limit (RL) meet the precision criteria if the absolute difference is less than ±2x the RL and acceptable based on professional judgement. For results greater than 2x the RL, the acceptance criteria is a relative percent difference (RPD) of ≤50% (soil and air), <30% (water). RLs and method detection limits (MDL) are provided in Attachment B.

4.2 ACCURACY

Accuracy is the measurement of the reproducibility of the sampling and analytical methodology. It should be noted that precise data may not be accurate data. For the purpose of this QAPP, bias is defined as the constant or systematic distortion of a measurement process, which manifests itself as a persistent positive or negative deviation from the known or true value. This may be due to (but not limited to) improper sample collection, sample matrix, poorly calibrated analytical or sampling equipment, or limitations or errors in analytical methods and techniques.

Accuracy in the field is assessed through the use of equipment blanks and through compliance to all sample handling, preservation, and holding time requirements. All equipment blanks should be non-detect when analyzed by the laboratory. Any contaminant detected in an associated equipment blank will be evaluated against laboratory blanks (preparation or method) and evaluated against field samples collected on the same day to determine potential for bias. Trip blanks are not required for non-aqueous matrices but are planned for non-aqueous matrices where high concentrations of VOCs are anticipated.

Laboratory accuracy is assessed by evaluating the percent recoveries of matrix spike/matrix spike duplicate (MS/MSD) samples, laboratory control samples (LCS), surrogate compound recoveries, and the results of method preparation blanks. MS/MSD, LCS, and surrogate percent recoveries will be compared to either method-specific control limits or laboratory-derived control limits. Sample volume permitting, samples displaying outliers should be reanalyzed. All associated method blanks should be non-detect when analyzed by the laboratory.

4.3 COMPLETENESS

Laboratory completeness is the ratio of total number of samples analyzed and verified as acceptable compared to the number of samples submitted to the fixed-base laboratory for analysis, expressed as a percent. Three measures of completeness are defined:

- Sampling completeness, defined as the number of valid samples collected relative to the number of samples planned for collection;
- Analytical completeness, defined as the number of valid sample measurements relative to the number of valid samples collected; and
- Overall completeness, defined as the number of valid sample measurements relative to the number of samples planned for collection.

Air, soil vapor, soil, and groundwater data will meet a 90% completeness criterion. If the criterion is not met, sample results will be evaluated for trends in rejected and unusable data. The effect of unusable data required for a determination of compliance will also be evaluated.

4.4 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. Representativeness is dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that specified sampling and analysis techniques are used. This is performed by following applicable standard operating procedures (SOPs) and this QAPP. All field technicians will be given copies of appropriate documents prior to sampling events and are required to read, understand, and follow each document as it pertains to the tasks at hand.

Representativeness in the laboratory is ensured by compliance to nationally-recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession. This is performed by following all applicable EPA methods, laboratory-issued SOPs, the laboratory's Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.

4.5 COMPARABILITY

Comparability is an expression of the confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Requiring traceability of all analytical standards and/or source materials to the U.S. Environmental Protection Agency (EPA) or National Institute of Standards and Technology (NIST);
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable);
- Using standard reporting units and reporting formats including the reporting of QC data;
- Performing a complete data validation on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate; and
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

4.6 SENSITIVITY

Sensitivity is the ability of the instrument or method to detect target analytes at the levels of interest. The project director will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection and QC acceptance limits that meet established performance criteria. Concurrently, the project director will select the level of data assessment to ensure that only data meeting the project DQOs are used in decision-making.

Field equipment will be used that can achieve the required levels of detection for analytical measurements in the field. In addition, the field sampling staff will collect and submit full volumes of samples as required by the laboratory for analysis, whenever possible. Full volume aliquots will help ensure achievement of the required limits of detection and allow for reanalysis if necessary. The concentration of the lowest level check standard in a multi-point calibration curve will represent the reporting limit.

Analytical methods and quality assurance parameters associated with the sampling program are presented in Attachment C. The frequency of associated equipment blanks and duplicate samples will be based on the recommendations listed in DER-10, and as described in Section 5.3.

Site-specific MS and MSD samples will be prepared and analyzed by the analytical laboratory by spiking an aliquot of submitted sample volume with analytes of interest. Additional sample volume is not required by the laboratory for this purpose. An MS/MSD analysis will be analyzed at a rate of 1 out of every 20 samples, or one per analytical batch. MS/MSD samples are only required for soil and groundwater samples.

5.0 SAMPLE COLLECTION AND FIELD DATA ACQUISITION PROCEDURES

Soil and groundwater sampling, if necessary, will be conducted in accordance with the established NYSDEC protocols contained in DER-10/Technical Guidance for Site Investigation and Remediation (May 2010) and the NYSDEC "Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) Under DEC's Part 375 Remedial Programs" (June 2019). Air sampling will be conducted in accordance with the established New York State Department of Health (NYSDOH) protocols contained in the Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006). The following sections describe procedures to be followed for specific tasks.

5.1 FIELD DOCUMENTATION PROCEDURES

Field documentation procedures will include summarizing field observations in field books, logging soil borings and monitoring well construction, completing forms for groundwater and soil vapor sampling, and proper sample labeling. These procedures are described in the following sections.

5.1.1 Field Data and Notes

Field notebooks contain the documentary evidence regarding procedures conducted by field personnel. Hard cover, bound field notebooks will be used because of their compact size, durability, and secure page binding. The pages of the notebook will not be removed.

Entries will be made in waterproof, permanent blue or black ink. No erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark and the change initialed and dated by the team member making the change. Each entry will be dated. Entries will be legible and contain accurate and complete documentation of the individual or sampling team's activities or observations made. The level of detail will be sufficient to explain and reconstruct the activity conducted. Each entry will be signed by the person(s) making the entry.

The following types of information will be provided for each sampling task, as appropriate:

- Project name and number
- Reasons for being on-site or taking the sample
- Date and time of activity

- Sample identification numbers
- Geographical location of sampling points with references to the site, other facilities or a map coordinate system. Sketches will be made in the field logbook when appropriate
- Physical location of sampling locations such as depth below ground surface
- Description of the method of sampling including procedures followed, equipment used and any departure from the specified procedures
- Description of the sample including physical characteristics, odor, etc.
- Readings obtained from health and safety equipment
- Weather conditions at the time of sampling and previous meteorological events that may affect the representative nature of a sample
- Photographic information including a brief description of what was photographed, the date and time, the compass direction of the picture and the number of the picture on the camera
- Other pertinent observations such as the presence of other persons on the site, actions by others that may affect performance of site tasks, etc.
- Names of sampling personnel and signature of persons making entries

Field records will also be collected on field data sheets including boring logs, which will be used for geologic and drilling data during soil boring activities. Field data sheets will include the project-specific number and stored in the field project files when not in use. At the completion of the field activities, the field data sheets will be maintained in the central project file.

5.1.2 Sample Labeling

Each sample collected will be assigned a unique identification number in accordance with the sample nomenclature guidance included in Attachment D, and placed in an appropriate sample container. Each sample container will have a sample label affixed to the outside with the date and time of sample collection and project name. In addition, the label will contain the sample identification number, analysis required and chemical preservatives added, if any. All documentation will be completed in waterproof ink.

5.2 EQUIPMENT CALIBRATION AND PREVENTATIVE MAINTENANCE

A photoionization detector (PID) will be used during the sampling activities to evaluate work zone action levels, collect pre- and post-sample readings for air samples, screen soil samples, and collect monitoring well headspace readings. Field calibration and/or field checking of the PID will be the responsibility of the field team leader and the site HSO, and will be accomplished by following the procedures outlined in the operating manual for the instrument. At a minimum, field calibration and/or field equipment checking will be performed once daily, prior to use. Field calibration will be documented in the field notebook. Entries made into the logbook regarding the status of field equipment will include the following information:

- Date and time of calibration
- Type of equipment serviced and identification number (such as serial number)
- Reference standard used for calibration
- Calibration and/or maintenance procedure used
- Other pertinent information

A water quality meter (Horiba U-52 or similar) will be used during purging of groundwater to measure pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP), every five minutes. Water-quality meters should be calibrated and the results documented before use each day using standardized field calibration procedures and calibration checks.

Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent utilization. The equipment will be properly tagged to indicate that it is out of calibration. Such equipment will be repaired and recalibrated to the manufacturer's specifications by qualified personnel. Equipment that cannot be repaired will be replaced.

Off-site calibration and maintenance of field instruments will be conducted as appropriate throughout the duration of project activities. All field instrumentation, sampling equipment and accessories will be maintained in accordance with the manufacturer's recommendations and specifications and established field equipment practice. Off-site calibration and maintenance will be performed by qualified personnel. A logbook will be kept to document that established calibration and maintenance procedures have been followed. Documentation will include both scheduled and unscheduled maintenance.

5.3 SAMPLE COLLECTION

Soil Samples

Soil samples will be visually classified and field screened using a PID to assess potential impacts from VOCs and for health and safety monitoring. Soil samples collected for analysis of VOCs will be collected using either EnCore® or Terra Core® sampling equipment. For analysis of non-volatile parameters, samples will be homogenized and placed into glass jars or high density polyethylene (HDPE) containers. After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at 4°C ±2°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Section 5.4. Analysis and/or extraction and digestion of collected soil samples will meet the holding times required for each analyte as specified in Attachment C. In addition, analysis of collected soil sample will meet all quality assurance criteria set forth by this QAPP and DER-10.

Groundwater Samples

Groundwater sampling will be conducted using low-flow sampling procedures following USEPA guidance ("Low Stress [low flow] Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells", EQASOP-GW 001, January 19, 2010).

During purging, field parameters should be measured, including: water level drawdown, purge rate, pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP), every five minutes using a water quality meter (Horiba U-52 or similar) and a depth-to-water interface probe that should be decontaminated between wells. Samples should generally not be collected until the field parameters have stabilized. Field parameters will be considered stable once three sets of measurements are within ±0.1 standard units for pH, ±3% for conductivity and temperature, ±10 millivolts for ORP, and ±10% for turbidity and dissolved oxygen. Purge rates should be adjusted to keep the drawdown in the well to less than 0.3 feet, as practical. Additionally, an attempt should be made to achieve a stable turbidity reading of less than 10 Nephelometric Turbidity Units (NTU) prior to sampling. If the turbidity reading does not stabilize at reading of less than 10 NTU for a given well, then both filtered and unfiltered samples should be collected from that well. If necessary, field filtration should be performed using a 0.45 micron disposable in-line filter. Groundwater samples should be collected after parameters have stabilized as noted above or the readings are within the precision of the meter. Deviations from the stabilization and drawdown criteria, if any, should be noted on the sampling logs.

Samples should be collected directly into laboratory-supplied jars. After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at 4°C ±2°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Section 5.4. Analysis and/or extraction and digestion of collected groundwater samples will meet the holding times required for each analyte as specified in Attachment C. In addition, analysis of collected groundwater sample will meet all quality assurance criteria set forth by this QAPP and DER-10.

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Sample Equipment Blanks and Duplicates

Field blanks will be collected for quality assurance purposes at a rate of one per day per matrix for soil and groundwater emerging contaminant samples. Field blanks will be obtained by pouring laboratory-demonstrated analyte-free water on or through a decontaminated sampling device following use and implementation of decontamination protocols. The water will be collected off of the sampling device into a laboratory-provided sample container for analysis. Field blank samples will be analyzed for the complete list of analytes on the day of sampling.

Duplicate soil and groundwater samples will be collected and analyzed for quality assurance purposes. Duplicate samples will be collected at a frequency of 1 per 20 investigative soil samples per analysis and will be submitted to the laboratory as “blind” samples. If less than 20 samples are collected during a particular sampling event, one duplicate sample will be collected.

5.4 SAMPLE CONTAINERS AND HANDLING

Certified, commercially clean sample containers will be obtained from the analytical laboratory. For soil and groundwater samples, the laboratory will also prepare and supply the required trip blanks and equipment blank sample containers and reagent preservatives. Sample bottle containers, including the equipment blank containers, will be placed into plastic coolers by the laboratory. These coolers will be received by the field sampling team within 24 hours of their preparation in the laboratory. Prior to the commencement of field work, Langan field personnel will fill the plastic coolers with ice in Ziploc® bags (or equivalent) to maintain a temperature of 4° ±2° C.

Soil and groundwater samples collected in the field for laboratory analysis will be placed directly into the laboratory-supplied sample containers. Samples will then be placed and stored on-ice in laboratory provided coolers until shipment to the laboratory. Blue ice will not be used to cool PFAS samples. The temperature in the coolers containing samples and associated equipment blanks will be maintained at a temperature of 4°±2°C while on-site and during sample shipment to the analytical laboratory.

Possession of samples collected in the field will be traceable from the time of collection until they are analyzed by the analytical laboratory or are properly disposed. Chain-of-custody procedures, described in Section 5.9, will be followed to maintain and document sample possession. Samples will be packaged and shipped as described in Section 5.6.

5.5 SPECIAL CONSIDERATIONS FOR PFAS SAMPLE COLLECTION

The following special considerations apply to the collection of soil and groundwater samples for PFAS analysis to prevent cross-contamination:

- Field equipment will not contain Teflon®
- All sampling material will be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books will be used
- No plastic clipboards, binders, or spiral hard cover notebooks will be used
- No adhesives will be used
- No sharpies or permanent markers will be used; ball point pens are acceptable
- Aluminum foil will not be used
- PFAS samples will be kept in a separate cooler from other sampling containers
- Coolers will be filled only with regular ice

DER has developed a PFAS target analyte list. At minimum, the laboratory will report the following PFAS target compounds:

Group	Analyte Name	Abbreviation	CAS #
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

The PFAS compound sampling protocol is provided in Attachment E.

5.6 SAMPLE PRESERVATION

Sample preservation measures will be used in an attempt to prevent sample decomposition by contamination, degradation, biological transformation, chemical interactions and other factors during the time between sample collection and analysis. Preservation will commence at the time of sample collection and will continue until analyses are performed. Should chemical preservation be required, the analytical laboratory will add the preservatives to the appropriate sample containers before shipment to the office or field. Samples will be preserved according to the requirements of the specific analytical method selected, as shown in Attachment C.

5.7 SAMPLE SHIPMENT

5.7.1 Packaging

Soil and groundwater sample containers will be placed in plastic coolers. Ice in Ziploc® bags (or equivalent) will be placed around sample containers. PFAS samples will be stored in separate coolers, and blue ice will not be used to cool PFAS samples. Cushioning material will be added around the sample containers if necessary. Chains-of-custody and other paperwork will be placed in a Ziploc® bag (or equivalent) and placed inside the cooler. The cooler will be taped closed and custody seals will be affixed to one side of the cooler at a minimum. If the samples are being shipped by an express delivery company (e.g. FedEx) then laboratory address labels will be placed on top of the cooler.

5.7.2 Shipping

Standard procedures to be followed for shipping environmental samples to the analytical laboratory are outlined below.

- All environmental samples will be transported to the laboratory by a laboratory-provided courier under the chain-of-custody protocols described in Section 5.9.

- Prior notice will be provided to the laboratory regarding when to expect shipped samples. If the number, type or date of shipment changes due to site constraints or program changes, the laboratory will be informed.

5.8 DECONTAMINATION PROCEDURES

Decontamination procedures will be used for non-dedicated sampling equipment. Decontamination of field personnel is discussed in the site-specific sample Health and Safety Plan (HASP) included in Appendix B of the RIWP. Field sampling equipment that is to be reused will be decontaminated in the field in accordance with the following procedures:

1. Laboratory-grade glassware detergent and tap water scrub to remove visual contamination
2. Generous tap water rinse
3. Distilled/de-ionized water rinse

5.9 RESIDUALS MANAGEMENT

Debris (e.g., paper, plastic and disposable PPE) will be collected in plastic garbage bags and disposed of as non-hazardous industrial waste. Debris is expected to be transported to a local municipal landfill for disposal. If applicable, residual solids (e.g., leftover soil cuttings) will be placed back in the borehole from which it was sampled. If gross contamination is observed, soil will be collected and stored in Department of Transportation (DOT)-approved 55-gallon drums in a designated storage area at the Site. The residual materials stored in a designated storage area at the site for further characterization, treatment or disposal.

Residual fluids (such as purge water) will be collected and stored in DOT-approved (or equivalent) 55-gallon drums in a designated storage area at the site. The residual fluids will be analyzed, characterized and disposed off-site in accordance with applicable federal and state regulations. Residual fluids such as decontamination water may be discharged to the ground surface, however, if gross contamination is observed, the residual fluids will be collected, stored, and transported similar purge water or other residual fluids.

5.10 CHAIN OF CUSTODY PROCEDURES

A chain-of-custody protocol has been established for collected samples that will be followed during sample handling activities in both field and laboratory operations. The primary purpose of the chain-of-custody procedures is to document the possession of the samples from collection through shipping, storage and analysis to data reporting and disposal. Chain-of-custody refers to actual possession of the samples. Samples are considered to be in custody if they are within sight of the individual responsible for their security or locked in a secure location. Each person who takes possession of the samples, except the shipping courier, is responsible for sample integrity and safe keeping. Chain-of-custody procedures are provided below:

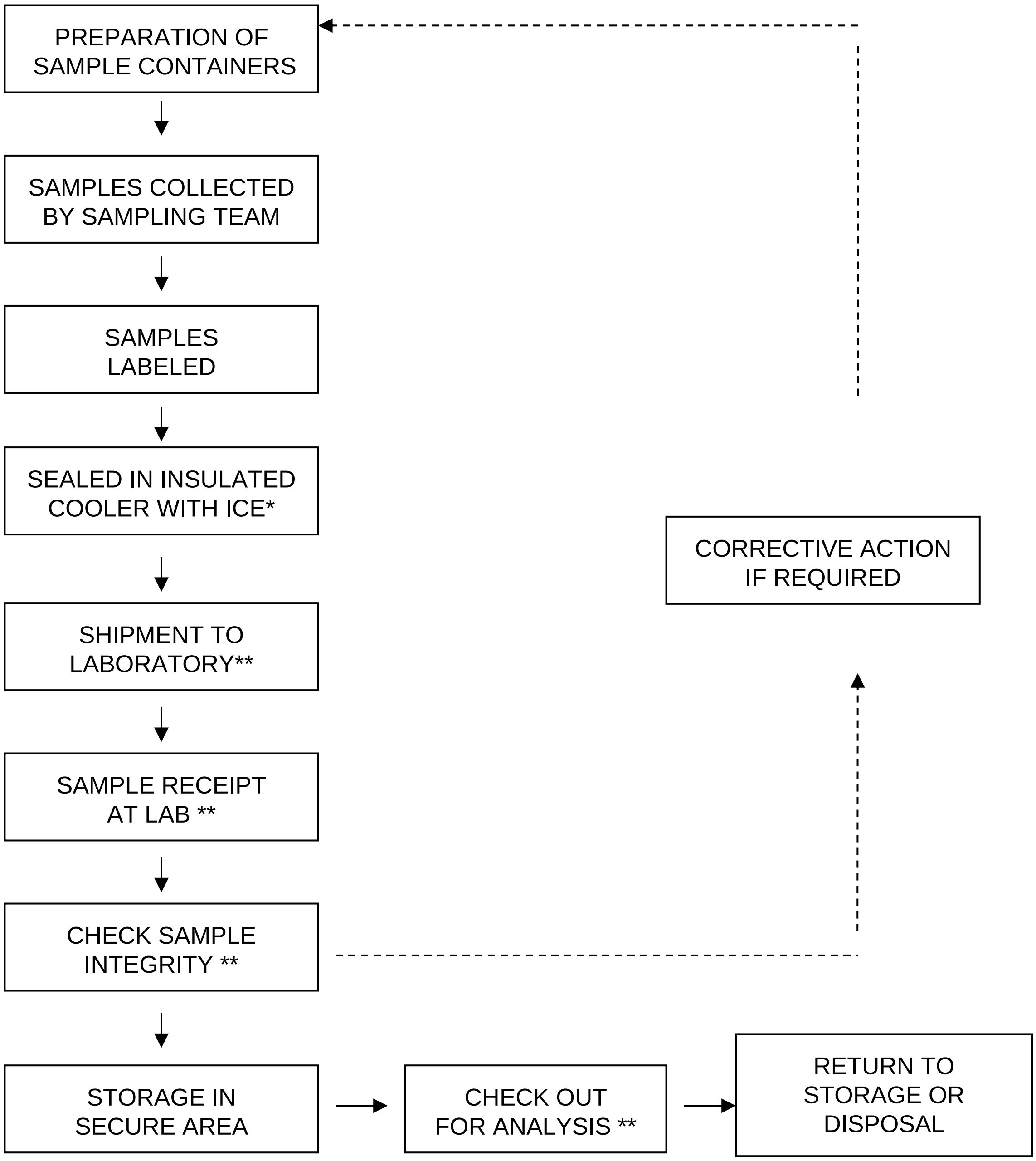
- Chain-of-custody will be initiated by the laboratory supplying the pre-cleaned and prepared sample containers. Chain-of-custody forms will accompany the sample containers.
- Following sample collection, the chain-of-custody form will be completed for the sample collected. The sample identification number, date and time of sample collection, analysis requested and other pertinent information (e.g., preservatives) will be recorded on the form. All entries will be made in waterproof, permanent blue or black ink.

- Langan field personnel will be responsible for the care and custody of the samples collected until the samples are transferred to another party, dispatched to the laboratory, or disposed. The sampling team leader will be responsible for enforcing chain-of-custody procedures during field work.
- When the form is full or when all samples have been collected that will fit in a single cooler, the sampling team leader will check the form for possible errors and sign the chain-of-custody form. Any necessary corrections will be made to the record with a single strike mark, dated, and initialed.

Sample coolers will be accompanied by the chain-of-custody form, sealed in a Ziploc® bag (or equivalent) and placed on top of the samples or taped to the inside of the cooler lid. If applicable, a shipping bill will be completed for each cooler and the shipping bill number recorded on the chain-of-custody form.

Samples will be packaged for shipment to the laboratory with the appropriate chain-of-custody form. A copy of the form will be retained by the sampling team for the project file and the original will be sent to the laboratory with the samples. Bills of lading will also be retained as part of the documentation for the chain-of-custody records, if applicable. When transferring custody of the samples, the individuals relinquishing and receiving custody of the samples will verify sample numbers and condition and will document the sample acquisition and transfer by signing and dating the chain-of-custody form. This process documents sample custody transfer from the sampler to the analytical laboratory. A flow chart showing a sample custody process is included as Figure 5.1. Blank chain-of-custody forms from Alpha are included as Figures 5.2 and 5.3.

Figure 5.1 Sample Custody



*SUMMA CANISTERS SHOULD NOT BE ICED
** REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Figure 5.2 Sample Chain-of-Custody Form – Air Sample

AIR ANALYSIS

CHAIN OF CUSTODY

PAGE_____ OF _____

ALPHA ANALYTICAL
320 Forbes Blvd, Mansfield, MA 02048
TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #:

Client Information	Project Information	Report Information - Data Deliverables	Billing Information
Client:	Project Name:	❑ FAX	❑ Same as Client info / PO #:
Address:	Project Location:	❑ ADEx	
	Project #:	Criteria Checker: _____ (Default based on Regulatory Criteria Indicated)	
Phone:	Project Manager:	Other Formats: _____	
Fax:	ALPHA Quote #:	❑ EMAIL (standard pdf report)	
Email:		❑ Additional Deliverables:	
❑ These samples have been previously analyzed by Alpha		Report to: (if different than Project Manager)	

Turn-Around Time

❑ Standard ❑ RUSH (only confirmed if pre-approved!)

Date Due: **Time:**

Regulatory Requirements/Report Limits

State/Fed	Program	Res / Comm

Other Project Specific Requirements/Comments:

Project-Specific Target Compound List: ❑

All Columns Below Must Be Filled Out

ANALYSIS

ALPHA Lab ID (Lab Use Only)	Sample ID	COLLECTION End Date	Start Time	End Time	Initial Vacuum	Final Vacuum	Sample Matrix*	Sampler's Initials	Can Size	I D Can	I D - Flow Controller	TO-15	TO-15 SIM	APH Subtract Non-petroleum HCs ❑	Fixed Gases	Sulfides & Mercaptans by TO-15			Sample Comments (i.e. PID)

*SAMPLE MATRIX CODES
AA = Ambient Air (Indoor/Outdoor)
SV = Soil Vapor/Landfill Gas/SVE
Other = Please Specify

Container Type

Relinquished By:	Date/Time	Received By:	Date/Time:

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions.
See reverse side.

Form No: 101-02 Rev: (25-Sep-15)

Figure 5.3 Sample Chain-of-Custody Form – Soil and Groundwater

NEW YORK CHAIN OF CUSTODY

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page ___ of ___

Date Rec'd in Lab

ALPHA Job #

Client Information	Project Information	Deliverables	Billing Information
Client:	Project Name:	☐ ASP-A ☐ ASP-B	☐ Same as Client Info
Address:	Project Location:	☐ EQuIS (1 File) ☐ EQuIS (4 File)	PO #
	Project #	☐ Other	
	(Use Project name as Project #) ☐	**Regulatory Requirement**	**Disposal Site Information**
	Project Manager:	☐ NY TOGS ☐ NY Part 375	Please identify below location of applicable disposal facilities.
	ALPHAQuote #:	☐ AWQ Standards ☐ NY CP-51	
Phone:	**Turn-Around Time**	☐ NY Restricted Use ☐ Other	Disposal Facility:
Fax:	Standard ☐ Due Date:	☐ NY Unrestricted Use	☐ NJ ☐ NY
Email:	Rush (only if pre approved) ☐ # of Days:	☐ NYC Sewer Discharge	☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	ANALYSIS								Sample Filtration ☐ Done ☐ Lab to do Preservation ☐ Lab to do (Please Specify below) Sample Specific Comments	Total Bottle

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Container Type								
Preservative								

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

Laboratory chain-of-custody will be maintained throughout the analytical processes as described in the laboratory's Quality Assurance Manual. The analytical laboratory will provide a copy of the chain-of-custody in the analytical data deliverable package. The chain-of-custody becomes the permanent record of sample handling and shipment.

5.11 LABORATORY SAMPLE STORAGE PROCEDURES

The subcontracted laboratory will use a laboratory information management system (LIMS) to track and schedule samples upon receipt by the analytical laboratories. Any sample anomalies identified during sample log-in must be evaluated on individual merit for the impact upon the results and the data quality objectives of the project. When irregularities do exist, the environmental consultant must be notified to discuss recommended courses of action and documentation of the issue must be included in the project file.

For samples requiring thermal preservation, the temperature of each cooler will be immediately recorded. Each sample and container will be will be assigned a unique laboratory identification number and secured within the custody room walk-in coolers designated for new samples. Samples will be, as soon as practical, disbursed in a manner that is functional for the operational team. The temperature of all coolers and freezers will be monitored and recorded using a certified temperature sensor. Any temperature excursions outside of acceptance criteria (i.e., below 2°C or above 6°C) will initiate an investigation to determine whether any samples may have been affected. Samples for VOCs will be maintained in satellite storage areas within the VOC laboratory. Following analysis, the laboratory's specific procedures for retention and disposal will be followed as specified in the laboratory's SOPs and/or QA manual.

6.0 DATA REDUCTION, VALIDATION, AND REPORTING

6.1 INTRODUCTION

Data collected during the field investigation will be reduced and reviewed by the laboratory QA personnel, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the USEPA SW-846 and subsequent updates. The data package provided by the laboratory will contain all items specified in the USEPA SW-846 appropriate for the analyses to be performed, and be reported in standard format.

The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

6.2 DATA REDUCTION

The Analytical Services Protocol (ASP) Category B data packages and an electronic data deliverable (EDD) will be provided by the laboratory after receipt of a complete sample delivery group. The Project Manager will immediately arrange for archiving the results and preparation of result tables. These tables will form the database for assessment of the site contamination condition.

Each EDD deliverable must be formatted using a Microsoft Windows operating system and the NYSDEC data deliverable format for EQuIS. To avoid transcription errors, data will be loaded directly into the ASCII format from the laboratory information management system (LIMS). If this cannot be accomplished, the consultant should be notified via letter of transmittal indicating that manual entry of data is required for a particular method of analysis. All EDDs must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The Project Manager or Task Manager will maintain close contact with the QA reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA review has been completed, the Project Manager may direct the Team Leaders or others to initiate and finalize the analytical data assessment.

6.3 DATA VALIDATION

Data validation will be performed in accordance with the USEPA validation guidelines for organic and inorganic data review. Validation will include the following:

- Verification of the QC sample results,
- Verification of the identification of sample results (both positive hits and non-detects),
- Recalculation of 10% of all investigative sample results, and
- Preparation of Data Usability Summary Reports (DUSR).

A DUSR will be prepared and reviewed by the QAO before issuance. The DUSR will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and COC procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. A detailed assessment of each SDG will follow. For each of the organic analytical methods, the following will be assessed:

- Holding times;
- Instrument tuning;
- Instrument calibrations;
- Blank results;
- System monitoring compounds or surrogate recovery compounds (as applicable);
- Internal standard recovery results;
- MS and MSD results;
- Target compound identification;
- Chromatogram quality;
- Pesticide cleanup (if applicable);
- Compound quantitation and reported detection limits;
- System performance; and
- Results verification.

For each of the inorganic compounds, the following will be assessed:

- Holding times;
- Calibrations;
- Blank results;
- Interference check sample;
- Laboratory check samples;
- Duplicates;
- Matrix Spike;
- Furnace atomic absorption analysis QC;
- ICP serial dilutions; and
- Results verification and reported detection limits.

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- "U" - Not detected. The associated number indicates the approximate sample concentration necessary to be detected significantly greater than the level of the highest associated blank;
- "UJ" - Not detected. Quantitation limit may be inaccurate or imprecise;
- "J" - Analyte is present. Reported value may be associated with a higher level of uncertainty than is normally expected with the analytical method
- "N" – Tentative identification. Analyte is considered present in the sample;
- "R" – Unreliable result; data is rejected or unusable. Analyte may or may not be present in the sample; and

NO FLAG - RESULT ACCEPTED WITHOUT QUALIFICATION.6.4 REPORTING

Upon receipt of validated analytical results, NYSDEC format electronic data deliverables (EDDs), compatible with EQuIS, will be prepared and submitted to the NYSDEC.

7.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

7.1 INTRODUCTION

Quality assurance audits may be performed by the project quality assurance group under the direction and approval of the QAO. These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate quality assurance management, the QAO may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

7.2 SYSTEM AUDITS

System audits may be performed by the QAO or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Project Manager requests, additional audits may be performed.

7.3 PERFORMANCE AUDITS

The laboratory may be required to conduct an analysis of Performance Evaluation samples or provide proof that Performance Evaluation samples submitted by USEPA or a state agency have been analyzed within the past twelve months.

7.4 FORMAL AUDITS

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the involved management. Non-compliances will be logged, and documented through audit findings, which are attached to and are a part of the integral audit report. These audit-finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAO prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

8.0 CORRECTIVE ACTION

8.1 INTRODUCTION

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

8.2 PROCEDURE DESCRIPTION

When a significant condition adverse to quality is noted at site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and
- As required by USEPA SW-846, and subsequent updates, or by the NYSDEC ASP.

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the sites, laboratories, or contractor locations. Activities, or documents ascertained to be noncompliant with quality assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

Personnel assigned to quality assurance functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (see next page). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

Figure 8.1

CORRECTIVE ACTION REQUEST

Number: ____________________ Date: __________

TO: ________________________________

You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by ____________

CONDITION:

REFERENCE DOCUMENTS:

RECOMMENDED CORRECTIVE ACTIONS:

Originator	Date	Approval	Date	Approval	Date

RESPONSE

CAUSE OF CONDITION

CORRECTIVE ACTION

(A) RESOLUTION

(B) PREVENTION

(C) AFFECTED DOCUMENTS

C.A. FOLLOWUP:

CORRECTIVE ACTION VERIFIED BY: ______________________________ DATE:______________

9.0 REFERENCES

NYSDEC. Division of Environmental Remediation. DER-10/Technical Guidance for Site Investigation and Remediation, dated May 3, 2010.

NYSDEC. Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) Under DEC’s Part 375 Remedial Programs, dated June 2019.

Taylor, J. K., 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Inc., Chelsea, Michigan

USEPA, 2014. "Test Method for Evaluating Solid Waste,” Update V dated July 2014 U.S. Environmental Protection Agency, Washington, D.C.

USEPA, 2016. Region II Standard Operating Procedure (SOP) #HW-34, “Trace Volatile Data Validation” (July 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

USEPA, 2016. Region II SOP #HW-35A, “Semivolatile Data Validation” (June 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

USEPA, 2016. Region II SOP #HW-36A, “Pesticide Data Validation” (June 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

USEPA, 2015. Region II SOP #HW-37A, “PCB Aroclor Data Validation” (June 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

USEPA 2016. Region II SOP #HW-3a, “ICP-AES Data Validation” (July 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

USEPA 2014. Hazardous Waste Support Section. Analysis of Volatile Organic Compounds in Air Contained in Canisters by Method TO-15. SOP No. HW-31, Revision 6, dated June 2014.

USEPA 2017. National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, EPA-540-R-2017-002, January 2017.

USEPA 2017b. National Functional Guidelines for Superfund Inorganic Methods Data Review, Office of Superfund Remediation and Technology Innovation, EPA-540-R-201 7-001, January 2017.

ATTACHMENT A

RESUMES

MIMI RAYGORODETSKY

SENIOR ASSOCIATE / VICE PRESIDENT

ENVIRONMENTAL ENGINEERING

Ms. Raygorodetsky sources and directs large, complex environmental remediation and redevelopment projects from the earliest stages of pre-development diligence, through the remediation/construction phase, to long-term operation and monitoring of remedial systems and engineering controls. She has a comprehensive understanding of federal, state and local regulatory programs and she uses this expertise to guide her clients through a preliminary cost benefit analysis to select the right program(s) given the clients' legal obligations, development desires and risk tolerance. She is particularly strong at integrating the requirements of selected programs and client development needs to develop and design targeted and streamlined diligence programs and remediation strategies. Ms. Raygorodetsky is also highly skilled in integrating remediation with construction on large urban waterfront projects, which tend to more complex than landside projects.

SELECTED PROJECTS

- 25 Kent Avenue, Due Diligence for Purchase of a Brownfields Location, Brooklyn, NY
- Ferry Point Waterfront Park, Redevelopment of a Former Landfill into a Park, Bronx, NY
- Battery Maritime Building (10 South Street), Phase I ESA, New York, NY
- Residential Development at 351-357 Broadway, Phase 1 ESA, New York, NY
- 450 Union Street, Phase I and Phase II Remediation (NYS DEC Brownfield Cleanup Program), New York, NY
- Echo Bay Center, NYS DEC Brownfield Cleanup Program, New York, NY
- 420 Kent Avenue, NYS DEC Brownfield Cleanup Program, Brooklyn, NY
- 416 Kent Avenue, NYS DEC Brownfield Cleanup Program, Brooklyn, NY
- 264 Fifth Avenue, Phase I ESA, New York, NY
- 262 Fifth Avenue, Phase I ESA, New York, NY
- ABC Blocks 25-27 (Mixed-Use Properties), Brownfield Cleanup Program, Long Island City, NY
- Residences at 100 Barrow Street, Phase I ESA, New York, NY
- Residences at 22-12 Jackson Avenue, Due Diligence for Building Sale, Long Island City, NY
- Residences at 2253-2255 Broadway, Phase I and Phase II Services, New York, NY
- Prince Point, Phase I ESA, Staten Island, NY
- 787 Eleventh Avenue (Office Building Renovation), Phase I UST Closure, New York, NY
- 218 Front Street/98 Gold Street, Planning and Brownfield Consulting, Brooklyn, NY
- Mark JCH of Bensonhurst, Phase I and HazMat Renovation, Brooklyn, NY
- 39 West 23rd Street, E-Designation Brownfield, New York, NY

EDUCATION

B.A., Biology and Spanish Literature
Colby College

AFFILIATIONS

New York Women Executives in Real Estate (WX), Member

New York Building Congress, Council of Industry Women, Committee Member

New York City Brownfield Partnership, Founding Member and President

NYC Office of Environmental Remediation Technical Task Force, Committee Member

- 250 Water Street, Phase I and Phase II Property Transaction, New York, NY
- 27-19 44th Drive, Residential Redevelopment, Long Island City, NY
- 515 West 42nd Street, E-Designation, New York, NY
- 310 Meserole Street, Due Diligence Property Purchase, Brooklyn, NY
- Former Georgetown Heating Plant, HazMat and Phase I ESA, Washington D.C.
- 80-110 Flatbush Avenue, Brooklyn, NY
- 132 East 23rd Street, New York, NY
- 846 Sixth Avenue, New York, NY
- Greenpoint Landing, Remediation/Redevelopment, Brooklyn, NY
- 711 Eleventh Avenue, Due Diligence/Owner's Representative, New York, NY
- Brooklyn Bridge Park, Pier 1, Waste Characterization and Remediation, Brooklyn, NY
- Post-Hurricane Sandy Mold Remediation, Various Private Homes, Far Rockaway, NY
- Brooklyn Bridge Park, One John Street Development, Pre-Construction Due Diligence and Construction Administration, Brooklyn, NY
- 7 West 21st Street, Brownfields Remediation, New York, NY
- 546 West 44th Street, Brownfields Remediation, New York, NY
- Post-Hurricane Sandy Mold Remediation, Various Private Homes, Nassau and Suffolk Counties, Long Island, NY
- 55 West 17th Street, Brownfield Site Support, New York, NY
- Pratt Institute, 550 Myrtle Avenue Renovations, Environmental Remediation, Brooklyn, NY
- 42-02 Crescent Street Redevelopment, Phase I and II Environmental, Long Island City, NY
- IAC Building (555 West 18th Street), New York, NY
- Retirement Communities on100-acre Parcels in ME, NJ, MA, CT, and NJ
- 363-365 Bond Street/400 Carroll Street, Brooklyn, NY
- 160 East 22nd Street, New York, NY
- 110 Third Avenue, New York, NY
- Lycee Francais (East 76th Street & York Avenue), New York, NY
- Winchester Arms Munitions Factory, New Haven, CT

IIKAY CAM-SPANOS, LEED GA

SENIOR PROJECT MANAGER

ENVIRONMENTAL ENGINEERING & PROJECT MANAGEMENT

Ms. Cam-Spanos is an environmental engineer with experience in Phase I Environmental Site Assessments, Phase II Environmental Site Investigations, site remediation (soil and groundwater), field and office management of remedial investigations and tank closures, preparation of environmental reports, indoor air sampling, health and safety, and environmental and geotechnical database management. She manages large redevelopment projects from due diligence phases through remedial closures.

Ms. Cam-Spanos has experience working with regulatory agencies such as New York State Department of Environmental Conservation (NYSDEC), New York City Department of Environmental Protection (NYCDEP), New York City Office of Environmental Remediation (OER), and the United States Environmental Protection Agency (EPA), and she works closely with project teams to integrate remediation strategies with construction and development activities. She is also experienced in underground storage tank closures, remedial excavation oversight, spill closures, design of sub-slab vapor mitigation, and excavation and off-site treatment and/or disposal of contaminated material.

In 2017, Ms. Cam-Spanos was honored at the Pioneering Women in Real Estate Awards Gala.

SELECTED PROJECTS

- 1802-1810 Second Avenue, Spill Closure and Waste Characterization, New York, NY
- Alley Creek, Soil Sampling, Bayside, NY
- 55 Bank Street, Brownfield Cleanup Program, White Plains, NY
- Monroe College, Brownfield Cleanup Program, (2409 Jerome Avenue), Bronx, NY
- 22-36 Second Avenue, Brownfield Cleanup Program, Brooklyn, NY
- Madison Square Boys and Girls Club, Environmental Assessments, New York, NY
- 19 East Houston, Phase II, Noise RAP and Waste Characterization, New York, NY
- 85 Jay Street, Environmental Due Diligence, Brooklyn, NY
- 400 West 42nd Street, Environmental Remediation, New York, NY
- Environmental Assessments, Sea Cliff, NY
- Phase I ESA, Trinity Real Estate, New York, NY
- Second Avenue/East 127th Street, Phase I ESA, New York, NY
- Oval Concierge, Peter Cooper Village/Stuyvesant Town, Site Characterization, New York, NY
- Trinity Square, Phase I ESA, New York, NY
- Phase I and II for Newburgh Waterfront Development, Newburgh, NY
- Confidential Residential Complex, New York, NY
- Gateway Center II Retail, Brooklyn, NY
- Columbia University, Manhattanville Development, New York, NY

EDUCATION

MBA, Masters of Business Administration, University of Cyprus

M.S., Environmental Science New Jersey Institute of Technology/Rutgers University

B.S., Environmental Engineering Marmara University, Turkey

PROFESSIONAL REGISTRATION

LEED Green Associate

OSHA 40-Hour HAZWOPER

OSHA HAZWOPER Site Supervisor

EQuIS Database Management

Turkish Professional Environmental Personnel

AFFILIATIONS

American Society of Civil Engineers (ASCE)

LANGAN

- Port Authority of New York and New Jersey (PANYNJ), Southwest Brooklyn Waterfront Study, Brooklyn, NY
- 50 West Street, Mixed-Use Hotel/Residential, New York, NY
- 261 Hudson Street, Brownfield Cleanup Program, New York, NY
- 42 Crosby Street, Voluntary Cleanup Program, New York, NY
- 422 West 15th Street, Spill Site, New York, NY
- Terracity Shopping Center, Environmental Due Diligence, Antalya, Turkey
- Port Authority of New York and New Jersey, Microsoft Access and EQuIS Databases, Newark, NJ
- NYCDEP Dewatering Permit, Private Client, New York, NY
- Element West 59th Street, Site Remediation, New York, NY
- The Shops at Atlas Park, Management of EQuIS Chemistry Database, Glendale, NY
- Columbia University, The Studebaker Building (615 West 131st Street), Environmental Services, New York, NY
- The Alexander Development Project, Soil Remediation, New York, NY
- Jacob Javits Convention Center Site Assessment, Management of EQuIS Chemistry Database, New York, NY
- Avalon Clinton (Apartments), Management of EQuIS Chemistry Database, New York, NY
- NYCSCA UST Investigations, New York, NY
- Schmid Labs, Monitoring Well Sampling, Little Falls, NJ
- Confidential Developers, Phase I, Phase II and Phase III Environmental Site Assessments, Various Locations, Nationwide
- Con Edison of New York, Management of EQuIS Chemistry Database, New York, NY
- Random House, NY Contaminated Soil Investigation, New York, NY
- Monitoring of Well Sampling, Penick Lyndhurst, NJ
- Gateway Shopping Center, Geotechnical Site Investigations, Brooklyn, NY
- Polytechnic University, Sampling of TPH Contaminated Soil, Brooklyn, NY
- 1st Avenue Properties (Con Edison), Site Investigation, New York, NY
- NYCSCA Primary School 192, Environmental Site Assessments, New York, NY

Selected Publications, Reports, and Presentations

Vitamin Effect on Bioremediation of Phenanthrene, Anthracene, Fluoranthene, and Pyrene in a Contaminated Soil from an Industrial Site. M.S Thesis, New Jersey Institute of Technology, New Jersey

Natural Polymers in Turkey: Their Application to Drinking Water Treatment. Senior Project, Marmara, University, Turkey

Society of Women Environmental Professionals – New Jersey

Commercial Real Estate Women (CREW)

Professional Women in Construction

Turkish Engineers and Architect Society

Emily G. Strake

Project Chemist/ Risk Assessor
Human Health Risk Assessment
Chemical Data Validation

15 years in the industry ~ 2 years with Langan

Ms. Strake has fifteen years of environmental chemistry, risk assessment, auditing, and quality assurance experience. Most recently, she has focused her efforts on human health risk assessment, and has been the primary author or key contributor of risk assessment reports and screening evaluations for projects governed under RCRA, CERCLA, SWRCB, DTSC, DNREC, PADEP, NJDEP, CTDEEP, ODEQ, NYSDEC and MDE. She has experience in site-specific strategy development, which has enabled her to perform assessments to focus areas of investigation and identify risk-based alternatives for reducing remediation costs. Ms. Strake is a member of the Interstate Technology and Regulatory Council Risk Assessment Team responsible for the development and review of organizational risk assessment guidance documents and serves as a National Trainer in risk assessment for the organization.

Ms. Strake has over nine years of experience assessing potential adverse health effect to humans from exposure to hazardous contaminants in soil, sediment, groundwater, surface water, ambient and indoor air, and various types of animal, fish, and plant materials. She understands and applies environmental cleanup guidance and policies associated with multiple federal and state agencies. Additionally, she has broad experience in the development of preliminary remediation goals and site-specific action levels. She is proficient with the USEPA and Cal/EPA Johnson and Ettinger Model for Subsurface Vapor Intrusion into Buildings, USEPA's Adult Lead Methodology, DTSC's Leadspread 7 and 8, and statistical evaluation of data using USEPA's ProUCL software.

Ms. Strake has extensive experience in environmental data validation, focused on ensuring laboratory deliverables follow specific guidelines as described by regulatory agencies and the analytical methods employed. In addition, she has experience in EQuIS chemical database management. She also has a broad range of environmental field experience and maintains current OSHA HAZWOPER certification.

Ms. Strake is experienced in auditing laboratory and field-sampling activities for compliance with Quality Assurance Project Plans (QAPPs), the National Environmental Laboratory Accreditation Conference Standards Quality Systems manual, and applicable USEPA Guidance. Ms. Strake has also audited on-site laboratories in support of groundwater treatment operations and implemented corrective actions. Her responsibilities include writing reports on the value of laboratory work, writing/editing QAPPs for clients and project-specific sites, peer reviewing colleague's work, and mentoring staff within the office. She has also served as the Quality Assurance officer for several long-term projects, responsible for the achievement of all forms of Quality Control/Quality Assurance by onsite personnel relating to sampling, analysis, and data evaluation.

Ms. Strake has several years' experience analyzing investigative samples, writing laboratory Standard Operating Procedures (SOPs), and managing all

Education

M.B.A., Business Administration
The University of Scranton

B.S., Chemistry
Cedar Crest College

Memberships

Interstate Technology and Regulatory Council

Society for Risk Analysis

Training

Candidate, Certified Industrial Environmental Toxicologist. National Registry of Environmental Professionals.

40 hr. OSHA HAZWOPER Training/Nov 2002

8 hr. HAZWOPER Supervisor/June 2004

8 hr. OSHA HAZWOPER Refresher/Oct 2012

American Red Cross First Aid & CPR certified

Publications/Presentations

Decision Making at Contaminated Sites: Issues and Options in Human Health Risk Assessment. Interstate Technology and Regulatory Council

Alternate Approaches for Act 2 Risk Assessments Using Site-Specific Information. Pennsylvania Brownfields Conference

Tools from NJDEP's Attainment Guidance to Support Site Closure
LSRP Summit V

EPA Region IX Vapor Intrusion Policy for Silicon Valley
2014 Environmental Workshop

aspects of procedures and analyses for Optical Emission Spectrometry, X-Ray Fluorescence, Ignition analysis, and Atomic Absorption. Her experience also includes operating and performing routine instrument maintenance for GC/MS and IR. Ms. Strake has worked extensively on developing rapid soil characterization programs for PCB and pesticide analyses utilizing enzyme-linked immunosorbent assays, and was also involved in efforts to develop new instrumentation to quantify microbial nitrification of ammonium.

Selected Project Experience

Human Health Risk Assessment

- Major League Soccer's San Jose Earthquakes Stadium – Utilized the Johnson and Ettinger advanced soil gas model to calculate risk and hazard associated with inhalation of chlorinated solvents for the redevelopment of a public soccer stadium. Soil gas data was modeled assuming three soil stratum and site-specific soil, building, and exposure parameters. The Earthquakes' stadium is set to open in 2015.
- Exelon - Developed a human health risk assessment for a utility-owned former Manufactured Gas Plant (MGP) site in Pennsylvania, under Pennsylvania's Act 2 Program. Used ProUCL 4.0 statistical software to determine upper limits for full data sets and non-detect data. Conducted vapor intrusion modeling (via the Johnson & Ettinger model) and prepared vapor intrusion reports showing that risks to volatile organic compounds in soils and groundwater were not impacting indoor air quality.
- Texas Instruments – Participated in a collaboration with Robert Ettinger and Geosyntec Consulting to develop comments to USEPA Region IX and the San Francisco Regional Water Quality Control Board regarding vapor intrusion at South Bay Superfund Sites. The focus of the response was to outline scientific and policy objections to EPA's recommended TCE interim short-term indoor air response action levels and guidelines, and to clarify the use of California-modified indoor air screening levels for assessing and responding to TCE and PCE subsurface vapor intrusion into indoor air.
- DuPont - Worked as a key participant in the human health risk evaluation of mercury associated with legacy contamination of the South River located in Waynesboro, Virginia.
- Veteran's Affairs - Completed a human health risk evaluation of the potential future risk associated with inhalation of indoor air for the Veteran's Administration. Soil, soil gas, and groundwater samples were collected as part of the site characterization. Achieved DTSC approval of the risk assessment approach and conclusions.
- Santa Clara Landfill – Developed a human health risk assessment to characterize risk associated with exposure to landfill gas at the Santa Clara All Purpose Landfill. The risk assessment evaluated specific compounds in landfill gas, their concentrations, spatial patterns, and extent throughout the site, and assessed the potential for vapor intrusion associated with a proposed future redevelopment.
- Avon - Completed a human health risk assessment in accordance with NYSDEC guidance for a redevelopment property located in Rye, New York. The objective of the evaluation was to characterize the risks associated with potential future human

exposures to soil and groundwater affected by a release from the Site's former No. 2 fuel oil UST. The intended future use of the Site was a playground to be utilized by the general public for open play on commercial recreational equipment.

- Golden Gate National Parks Conservancy – Peer reviewed a Preliminary Endangerment Assessment Report for the Battery East Trail. The assessment included a human health risk evaluation that estimated carcinogenic risk from exposure to PAHs and dioxin/furans in soil using toxic equivalency to benzo(a)pyrene and 2,3,7,8-TCDD.
- Sunoco Refineries – Derived site-specific soil PRGs for lead using the EPA's adult lead model for two former Sunoco refineries. Completed receptor evaluations in accordance with USEPA risk assessment guidance to develop exposure parameters under current and reasonably anticipated future land use scenarios.
- Honeywell - Completed a focused human health risk evaluation of PAH contaminants for under NJDEP's Site Remediation Program. Applied a blended approach of qualitative risk characterization and quantitative risk calculation to propose closure of AOCs following the remedial investigation.
- Delaware City Refinery - Performed comprehensive human health risk assessment for a petroleum refinery in Delaware City, Delaware. The risk assessment was the basis for a thorough characterization and assessment of potential risks posed by site-specific conditions. Developed various human exposure scenarios by using both Federal and State-Specific guidance for soil, groundwater, and surface water exposure.
- Occidental Chemical - Completed multiple AOC-specific risk assessments utilizing and applying the guidance set forth by the DTSC's Human Health Risk Assessment Note 1 (Default Exposure Factors for Use in Risk Assessment), Note 3 (Recommended Methodology for Use of USEPA Regional Screening Levels, and Note 4 (Screening Level Human Health Risk Assessments).
- Floreffe Terminal - Performed human health risk assessment for contamination resulting from a 3.9 million gallon diesel oil tank collapse along the Monongahela River. Evaluated potential impacts to human health via exposure to soil, groundwater, and surface water. Calculated site-specific standards for soil remediation.
- DOW Chemical - Calculated Medium Specific Concentrations (MSCs) for unregulated contaminants using the PADEP protocols to assist in the clean-up of a monomer tank explosion in Bristol, Pennsylvania. Selected appropriate surrogate toxicity data and evaluated novel on-site constituents by analogy.
- Ryder – Developed Alternative Direct Exposure Criteria for PAH-impacted fill material at a commercial facility. Site-specific soil screening levels for incidental ingestion of soil were calculated following a forward risk evaluation for current on-site receptors.
- Rohm and Haas - Prepared an Act 2 site-specific human health risk assessment for the oldest industrial facility in the United States, located in southeast Philadelphia. The objective of the risk assessment was to determine achievable possible future land-use options under Pennsylvania's Land Recycling Program. The risk assessment included evolution of multiple site-COPCs and constituent suites: VOCs, SVOCs, PCBs, pesticides, and metals

(including lead). Evaluated the potential for indoor air inhalation through J&E modeling of soil gas and groundwater.

- Regency - Conducted vapor intrusion modeling for a dry cleaning facility in the Philadelphia area. Predictive modeling using the Johnson and Ettinger approach indicated that estimated contaminant levels would not adversely affect human receptors.

Chemical Data Quality

- Audited multiple accredited laboratories in New Jersey and Pennsylvania on behalf of clients using USEPA Guidance on Technical Audits and Related Assessments for Environmental Data Operations. The audits included full-suite USEPA and SW-846 methodology; and included reviewing staff experience and training records, equipment and facilities, policies, practices, procedures, and documentation for sample receipt, analysis, instrument maintenance, standard preparation, calibration and traceability, control charting, corrective actions, data reduction and review, report generation, and waste disposal.
- Reviewed and validated data packages for RCRA Facilities Investigation at a Philadelphia-area chemical site; issued data validation reports to project personnel and regulatory agencies. The reviews included evaluation of quarterly groundwater, soil, and soil vapor matrices. Participated in RCRA groundwater sampling, developed and executed the investigation's QAPP, and coordinated with the laboratory to schedule and perform field-sampling events.
- Completed Data Usability Summary Reports in accordance with NYSDEC DER-10 guidance for soil, groundwater, sediment surface water, soil gas, ambient air and indoor air analytical results.
- Acted as the Quality Assurance Officer for several long-term projects in Pennsylvania, Maryland, and New Jersey, Delaware, responsible for the achievement of all forms of QA/QC as it related to sampling, analysis, and data evaluation.
- Participated in a CERCLA site investigation; assessed the usability of sample results for numerous matrices including dust, sediment, soils, and various aqueous matrices for a remedial investigation under the Contract Laboratory Program. Implemented an on-site pesticide immunoassay program to delineate soil contamination in real-time.
- EQuIS data manager for database migration of historical groundwater results associated with remediation activities; assisted with natural attenuation data evaluation and gained experience in geochemical trends associated with intrinsic biodegradation.
- Coordinated the collection of fish tissue samples and determined the validity of the analytical results associated with CERCLA and RCRA site characterizations. Assessed duck blood analytical results for the Connecticut Department of Energy and Environmental Protection Bureau of Natural Resources.

WILLIAM BOHRER, PG

PROJECT GEOLOGIST

GEOLOGIST

Mr. Bohrer is an experienced geologist responsible for managing Langan's environmental standards and Health and Safety compliance for projects throughout New York City. His services include dissemination of environmental protocols, troubleshooting at project sites, in-house/field training, and maintenance of quality standards across the environmental discipline. Mr. Bohrer has a diverse and extensive background in geophysics, hydrogeology, mining and petroleum, and geotechnical engineering. He has developed conceptual site models for public, industrial and commercial facilities nationwide.

SELECTED PROJECTS

- NYU Poly – 122 Johnson Street, Brooklyn, NY
- Con Edison of New York at Governor's Island, NY, NY
- 535 4th Avenue, Brooklyn, NY
- 27 Wooster Street, New York, NY
- 42 West Street, Brooklyn, NY
- 455 West 19th Street, New York, NY
- Kings Plaza Mall, Brooklyn, NY
- Hudson Yards "Terra Firma", New York, NY
- Hudson Yards, Platform Special Inspection, New York, NY
- PSAC II, Bronx, NY
- 595-647 Smith Street, Brooklyn, NY
- New York University, 7-13 Washington Square North Investigation, New York, NY
- NYU 4 Washington Square Village, New York, NY
- 125th Street and Lenox Avenue, New York, NY
- Sullivan Street Development, New York, NY
- Hudson Crossing II, New York, NY
- New York Aquarium, Shark Tank & Animal Care Facility, Brooklyn, NY
- 209-219 Sullivan Street, New York, NY
- 261 Hudson Street, New York, NY
- 460 Washington Street, New York, NY
- 552 West 24th Street, New York, NY
- Brooklyn Bridge Park Pier 1, New York, NY
- International Leadership Bronx Charter School, Bronx, NY
- 203 East 92nd Street, New York, NY
- HighLine 28-29, New York, NY
- 539 Smith Street Bulkhead, Brooklyn, NY
- Willets Point, Corona, NY
- Plume Migration and Fracture Flow Aquifer Investigation, Brunswick, MD
- Plume Migration and Fracture Flow Aquifer Investigation, Fallston, MD
- Emergency Response Site Investigation & Remediation, Wappingers Falls, NY

EDUCATION

Post Graduate Studies in Geophysics
Cornell University

B.S., Geology
Tufts University

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY

40 Hour OSHA HazWOPER

OSHA Construction Safety & Health

OSHA Supervisory Certification Credential (TWIC)

Transportation Worker Identification

NYS DEC- Protecting New York's Natural Resources with Better Construction Site Management

AFFILIATIONS

American Association of Petroleum Geologists

National Groundwater Association

Geological Society of America

LANGAN

- Emergency Response Site Investigation & Remediation, Allentown, PA
- Emergency Response Site Investigation & Remediation, Shamokin, PA
- Bermuda International Airport, Jet Fuel Release Investigation, Bermuda
- Little Missouri River Basin, Geotechnical Site Evaluation (Horizontal Drilling Pipeline Install), ND
- Seismic Susceptibility Evaluation (Class 2 Injection Wells), Litchfield, OH
- Bedrock Mapping, Bradford and Sullivan Counties, PA
- Soil Solidification, Carteret, NJ

PA Council of Professional Geologists

ATTACHMENT B

LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

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Langan Engineering & Environmental

TCL Volatiles - EPA 8260C/5035 High&Low (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - 1 Vial MeOH/2 Vial Water

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Methylene chloride	75-09-2	0.01	0.00165	mg/kg	70-130	30	70-130	30	30			
1,1-Dichloroethane	75-34-3	0.0015	0.00027	mg/kg	70-130	30	70-130	30	30			
Chloroform	67-66-3	0.0015	0.00037	mg/kg	70-130	30	70-130	30	30			
Carbon tetrachloride	56-23-5	0.001	0.000345	mg/kg	70-130	30	70-130	30	30			
1,2-Dichloropropane	78-87-5	0.0035	0.000228	mg/kg	70-130	30	70-130	30	30			
Dibromochloromethane	124-48-1	0.001	0.000176	mg/kg	70-130	30	70-130	30	30			
1,1,2-Trichloroethane	79-00-5	0.0015	0.000313	mg/kg	70-130	30	70-130	30	30			
Tetrachloroethene	127-18-4	0.001	0.000302	mg/kg	70-130	30	70-130	30	30			
Chlorobenzene	108-90-7	0.001	0.000348	mg/kg	70-130	30	70-130	30	30			
Trichlorofluoromethane	75-69-4	0.005	0.000417	mg/kg	70-139	30	70-139	30	30			
1,2-Dichloroethane	107-06-2	0.001	0.000246	mg/kg	70-130	30	70-130	30	30			
1,1,1-Trichloroethane	71-55-6	0.001	0.00035	mg/kg	70-130	30	70-130	30	30			
Bromodichloromethane	75-27-4	0.001	0.000308	mg/kg	70-130	30	70-130	30	30			
trans-1,3-Dichloropropene	10061-02-6	0.001	0.000208	mg/kg	70-130	30	70-130	30	30			
cis-1,3-Dichloropropene	10061-01-5	0.001	0.000231	mg/kg	70-130	30	70-130	30	30			
1,3-Dichloropropene, Total	542-75-6	0.001	0.000208	mg/kg				30	30			
1,3-Dichloropropene, Total	542-75-6	0.001	0.000208	mg/kg				30	30			
1,1-Dichloropropene	563-58-6	0.005	0.000328	mg/kg	70-130	30	70-130	30	30			
Bromoform	75-25-2	0.004	0.000237	mg/kg	70-130	30	70-130	30	30			
1,1,2,2-Tetrachloroethane	79-34-5	0.001	0.000298	mg/kg	70-130	30	70-130	30	30			
Benzene	71-43-2	0.001	0.000193	mg/kg	70-130	30	70-130	30	30			
Toluene	108-88-3	0.0015	0.000195	mg/kg	70-130	30	70-130	30	30			
Ethylbenzene	100-41-4	0.001	0.00017	mg/kg	70-130	30	70-130	30	30			
Chloromethane	74-87-3	0.005	0.000436	mg/kg	52-130	30	52-130	30	30			
Bromomethane	74-83-9	0.002	0.000338	mg/kg	57-147	30	57-147	30	30			
Vinyl chloride	75-01-4	0.002	0.000315	mg/kg	67-130	30	67-130	30	30			
Chloroethane	75-00-3	0.002	0.000316	mg/kg	50-151	30	50-151	30	30			
1,1-Dichloroethene	75-35-4	0.001	0.000372	mg/kg	65-135	30	65-135	30	30			
trans-1,2-Dichloroethene	156-60-5	0.0015	0.000241	mg/kg	70-130	30	70-130	30	30			
Trichloroethene	79-01-6	0.001	0.000302	mg/kg	70-130	30	70-130	30	30			
1,2-Dichlorobenzene	95-50-1	0.005	0.000182	mg/kg	70-130	30	70-130	30	30			
1,3-Dichlorobenzene	541-73-1	0.005	0.000218	mg/kg	70-130	30	70-130	30	30			
1,4-Dichlorobenzene	106-46-7	0.005	0.000182	mg/kg	70-130	30	70-130	30	30			
Methyl tert butyl ether	1634-04-4	0.002	0.000153	mg/kg	66-130	30	66-130	30	30			
p/m-Xylene	179601-23-1	0.002	0.000351	mg/kg	70-130	30	70-130	30	30			
o-Xylene	95-47-6	0.002	0.000338	mg/kg	70-130	30	70-130	30	30			
Xylene (Total)	1330-20-7	0.002	0.000338	mg/kg				30	30			
Xylene (Total)	1330-20-7	0.002	0.000338	mg/kg				30	30			
cis-1,2-Dichloroethene	156-59-2	0.001	0.000342	mg/kg	70-130	30	70-130	30	30			
1,2-Dichloroethene (total)	540-59-0	0.001	0.000241	mg/kg				30	30			
1,2-Dichloroethene (total)	540-59-0	0.001	0.000241	mg/kg				30	30			
Dibromomethane	74-95-3	0.01	0.000239	mg/kg	70-130	30	70-130	30	30			

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Langan Engineering & Environmental

TCL Volatiles - EPA 8260C/5035 High&Low (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - 1 Vial MeOH/2 Vial Water

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Styrene	100-42-5	0.002	0.000401	mg/kg	70-130	30	70-130	30	30			
Dichlorodifluoromethane	75-71-8	0.01	0.0005	mg/kg	30-146	30	30-146	30	30			
Acetone	67-64-1	0.01	0.00229	mg/kg	54-140	30	54-140	30	30			
Carbon disulfide	75-15-0	0.01	0.0011	mg/kg	59-130	30	59-130	30	30			
2-Butanone	78-93-3	0.01	0.00069	mg/kg	70-130	30	70-130	30	30			
Vinyl acetate	108-05-4	0.01	0.000153	mg/kg	70-130	30	70-130	30	30			
4-Methyl-2-pentanone	108-10-1	0.01	0.000244	mg/kg	70-130	30	70-130	30	30			
1,2,3-Trichloropropane	96-18-4	0.01	0.000177	mg/kg	68-130	30	68-130	30	30			
2-Hexanone	591-78-6	0.01	0.000666	mg/kg	70-130	30	70-130	30	30			
Bromochloromethane	74-97-5	0.005	0.000357	mg/kg	70-130	30	70-130	30	30			
2,2-Dichloropropane	594-20-7	0.005	0.00045	mg/kg	70-130	30	70-130	30	30			
1,2-Dibromoethane	106-93-4	0.004	0.000199	mg/kg	70-130	30	70-130	30	30			
1,3-Dichloropropane	142-28-9	0.005	0.000183	mg/kg	69-130	30	69-130	30	30			
1,1,1,2-Tetrachloroethane	630-20-6	0.001	0.000318	mg/kg	70-130	30	70-130	30	30			
Bromobenzene	108-86-1	0.005	0.000219	mg/kg	70-130	30	70-130	30	30			
n-Butylbenzene	104-51-8	0.001	0.000228	mg/kg	70-130	30	70-130	30	30			
sec-Butylbenzene	135-98-8	0.001	0.000217	mg/kg	70-130	30	70-130	30	30			
tert-Butylbenzene	98-06-6	0.005	0.000247	mg/kg	70-130	30	70-130	30	30			
o-Chlorotoluene	95-49-8	0.005	0.000221	mg/kg	70-130	30	70-130	30	30			
p-Chlorotoluene	106-43-4	0.005	0.000183	mg/kg	70-130	30	70-130	30	30			
1,2-Dibromo-3-chloropropane	96-12-8	0.005	0.000396	mg/kg	68-130	30	68-130	30	30			
Hexachlorobutadiene	87-68-3	0.005	0.000348	mg/kg	67-130	30	67-130	30	30			
Isopropylbenzene	98-82-8	0.001	0.000194	mg/kg	70-130	30	70-130	30	30			
p-Isopropyltoluene	99-87-6	0.001	0.000202	mg/kg	70-130	30	70-130	30	30			
Naphthalene	91-20-3	0.005	0.000138	mg/kg	70-130	30	70-130	30	30			
Acrylonitrile	107-13-1	0.01	0.000514	mg/kg	70-130	30	70-130	30	30			
n-Propylbenzene	103-65-1	0.001	0.000215	mg/kg	70-130	30	70-130	30	30			
1,2,3-Trichlorobenzene	87-61-6	0.005	0.000251	mg/kg	70-130	30	70-130	30	30			
1,2,4-Trichlorobenzene	120-82-1	0.005	0.000215	mg/kg	70-130	30	70-130	30	30			
1,3,5-Trimethylbenzene	108-67-8	0.005	0.000161	mg/kg	70-130	30	70-130	30	30			
1,2,4-Trimethylbenzene	95-63-6	0.005	0.000186	mg/kg	70-130	30	70-130	30	30			
1,4-Dioxane	123-91-1	0.04	0.0144	mg/kg	65-136	30	65-136	30	30			
1,4-Diethylbenzene	105-05-5	0.004	0.004	mg/kg	70-130	30	70-130	30	30			
4-Ethyltoluene	622-96-8	0.004	0.000234	mg/kg	70-130	30	70-130	30	30			
1,2,4,5-Tetramethylbenzene	95-93-2	0.004	0.000156	mg/kg	70-130	30	70-130	30	30			
Ethyl ether	60-29-7	0.005	0.00026	mg/kg	67-130	30	67-130	30	30			
trans-1,4-Dichloro-2-butene	110-57-6	0.005	0.000392	mg/kg	70-130	30	70-130	30	30			
1,2-Dichloroethane-d4	*17060-07-0*									*70-130*		
2-Chloroethoxyethane												
Toluene-d8	*2037-26-5*									*70-130*		
4-Bromofluorobenzene	*460-00-4*									*70-130*		
Dibromofluoromethane	*1868-53-7*									*70-130*		

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NYTCL Semivolatiles - EPA 8270D (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Acenaphthene	83-32-9	0.1332	0.0172494	mg/kg	31-137	50	31-137	50	50			
1,2,4-Trichlorobenzene	120-82-1	0.1665	0.0190476	mg/kg	38-107	50	38-107	50	50			
Hexachlorobenzene	118-74-1	0.0999	0.018648	mg/kg	40-140	50	40-140	50	50			
Bis(2-chloroethyl)ether	111-44-4	0.14985	0.0225774	mg/kg	40-140	50	40-140	50	50			
2-Chloronaphthalene	91-58-7	0.1665	0.0165168	mg/kg	40-140	50	40-140	50	50			
1,2-Dichlorobenzene	95-50-1	0.1665	0.0299034	mg/kg	40-140	50	40-140	50	50			
1,3-Dichlorobenzene	541-73-1	0.1665	0.028638	mg/kg	40-140	50	40-140	50	50			
1,4-Dichlorobenzene	106-46-7	0.1665	0.0290709	mg/kg	28-104	50	28-104	50	50			
3,3'-Dichlorobenzidine	91-94-1	0.1665	0.044289	mg/kg	40-140	50	40-140	50	50			
2,4-Dinitrotoluene	121-14-2	0.1665	0.0333	mg/kg	40-132	50	40-132	50	50			
2,6-Dinitrotoluene	606-20-2	0.1665	0.0285714	mg/kg	40-140	50	40-140	50	50			
Fluoranthene	206-44-0	0.0999	0.0191142	mg/kg	40-140	50	40-140	50	50			
4-Chlorophenyl phenyl ether	7005-72-3	0.1665	0.0178155	mg/kg	40-140	50	40-140	50	50			
4-Bromophenyl phenyl ether	101-55-3	0.1665	0.0254079	mg/kg	40-140	50	40-140	50	50			
Bis(2-chloroisopropyl)ether	108-60-1	0.1998	0.0284382	mg/kg	40-140	50	40-140	50	50			
Bis(2-chloroethoxy)methane	111-91-1	0.17982	0.0166833	mg/kg	40-117	50	40-117	50	50			
Hexachlorobutadiene	87-68-3	0.1665	0.0243756	mg/kg	40-140	50	40-140	50	50			
Hexachlorocyclopentadiene	77-47-4	0.47619	0.150849	mg/kg	40-140	50	40-140	50	50			
Hexachloroethane	67-72-1	0.1332	0.0269397	mg/kg	40-140	50	40-140	50	50			
Isophorone	78-59-1	0.14985	0.0216117	mg/kg	40-140	50	40-140	50	50			
Naphthalene	91-20-3	0.1665	0.0202797	mg/kg	40-140	50	40-140	50	50			
Nitrobenzene	98-95-3	0.14985	0.024642	mg/kg	40-140	50	40-140	50	50			
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	0.1332	0.0189477	mg/kg	36-157	50	36-157	50	50			
n-Nitrosodi-n-propylamine	621-64-7	0.1665	0.0257076	mg/kg	32-121	50	32-121	50	50			
Bis(2-Ethylhexyl)phthalate	117-81-7	0.1665	0.057609	mg/kg	40-140	50	40-140	50	50			
Butyl benzyl phthalate	85-68-7	0.1665	0.041958	mg/kg	40-140	50	40-140	50	50			
Di-n-butylphthalate	84-74-2	0.1665	0.0315684	mg/kg	40-140	50	40-140	50	50			
Di-n-octylphthalate	117-84-0	0.1665	0.05661	mg/kg	40-140	50	40-140	50	50			
Diethyl phthalate	84-66-2	0.1665	0.0154179	mg/kg	40-140	50	40-140	50	50			
Dimethyl phthalate	131-11-3	0.1665	0.034965	mg/kg	40-140	50	40-140	50	50			
Benzo(a)anthracene	56-55-3	0.0999	0.0187479	mg/kg	40-140	50	40-140	50	50			
Benzo(a)pyrene	50-32-8	0.1332	0.040626	mg/kg	40-140	50	40-140	50	50			
Benzo(b)fluoranthene	205-99-2	0.0999	0.0280386	mg/kg	40-140	50	40-140	50	50			
Benzo(k)fluoranthene	207-08-9	0.0999	0.02664	mg/kg	40-140	50	40-140	50	50			
Chrysene	218-01-9	0.0999	0.017316	mg/kg	40-140	50	40-140	50	50			
Acenaphthylene	208-96-8	0.1332	0.0257076	mg/kg	40-140	50	40-140	50	50			
Anthracene	120-12-7	0.0999	0.0324675	mg/kg	40-140	50	40-140	50	50			
Benzo(ghi)perylene	191-24-2	0.1332	0.0195804	mg/kg	40-140	50	40-140	50	50			
Fluorene	86-73-7	0.1665	0.0161838	mg/kg	40-140	50	40-140	50	50			
Phenanthrene	85-01-8	0.0999	0.0202464	mg/kg	40-140	50	40-140	50	50			
Dibenzo(a,h)anthracene	53-70-3	0.0999	0.0192474	mg/kg	40-140	50	40-140	50	50			
Indeno(1,2,3-cd)Pyrene	193-39-5	0.1332	0.0232101	mg/kg	40-140	50	40-140	50	50			

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NYTCL Semivolatiles - EPA 8270D (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Pyrene	129-00-0	0.0999	0.0165501	mg/kg	35-142	50	35-142	50	50			
Biphenyl	92-52-4	0.37962	0.038628	mg/kg	54-104	50	54-104	50	50			
4-Chloroaniline	106-47-8	0.1665	0.030303	mg/kg	40-140	50	40-140	50	50			
2-Nitroaniline	88-74-4	0.1665	0.0321012	mg/kg	47-134	50	47-134	50	50			
3-Nitroaniline	99-09-2	0.1665	0.0314019	mg/kg	26-129	50	26-129	50	50			
4-Nitroaniline	100-01-6	0.1665	0.068931	mg/kg	41-125	50	41-125	50	50			
Dibenzofuran	132-64-9	0.1665	0.0157509	mg/kg	40-140	50	40-140	50	50			
2-Methylnaphthalene	91-57-6	0.1998	0.0201132	mg/kg	40-140	50	40-140	50	50			
Acetophenone	98-86-2	0.1665	0.0206127	mg/kg	14-144	50	14-144	50	50			
2,4,6-Trichlorophenol	88-06-2	0.0999	0.0315684	mg/kg	30-130	50	30-130	50	50			
P-Chloro-M-Cresol	59-50-7	0.1665	0.0248085	mg/kg	26-103	50	26-103	50	50			
2-Chlorophenol	95-57-8	0.1665	0.0196803	mg/kg	25-102	50	25-102	50	50			
2,4-Dichlorophenol	120-83-2	0.14985	0.0267732	mg/kg	30-130	50	30-130	50	50			
2,4-Dimethylphenol	105-67-9	0.1665	0.054945	mg/kg	30-130	50	30-130	50	50			
2-Nitrophenol	88-75-5	0.35964	0.062604	mg/kg	30-130	50	30-130	50	50			
4-Nitrophenol	100-02-7	0.2331	0.067932	mg/kg	11-114	50	11-114	50	50			
2,4-Dinitrophenol	51-28-5	0.7992	0.077589	mg/kg	4-130	50	4-130	50	50			
4,6-Dinitro-o-cresol	534-52-1	0.4329	0.07992	mg/kg	10-130	50	10-130	50	50			
Pentachlorophenol	87-86-5	0.1332	0.03663	mg/kg	17-109	50	17-109	50	50			
Phenol	108-95-2	0.1665	0.0251415	mg/kg	26-90	50	26-90	50	50			
2-Methylphenol	95-48-7	0.1665	0.0258075	mg/kg	30-130.	50	30-130.	50	50			
3-Methylphenol/4-Methylphenol	106-44-5	0.23976	0.0260739	mg/kg	30-130	50	30-130	50	50			
2,4,5-Trichlorophenol	95-95-4	0.1665	0.0319014	mg/kg	30-130	50	30-130	50	50			
Benzoic Acid	65-85-0	0.53946	0.168498	mg/kg	10-110	50	10-110	50	50			
Benzyl Alcohol	100-51-6	0.1665	0.050949	mg/kg	40-140	50	40-140	50	50			
Carbazole	86-74-8	0.1665	0.0161838	mg/kg	54-128	50	54-128	50	50			
2-Fluorophenol	*367-12-4*									*25-120*		
Phenol-d6	*13127-88-3*									*10-120*		
Nitrobenzene-d5	*4165-60-0*									*23-120*		
2-Fluorobiphenyl	*321-60-8*									*30-120*		
2,4,6-Tribromophenol	*118-79-6*									*10-136*		
4-Terphenyl-d14	*1718-51-0*									*18-120*		

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TCL Pesticides - EPA 8081B (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Delta-BHC	319-86-8	0.007992	0.0015651	mg/kg	30-150	30	30-150	50	50			
Lindane	58-89-9	0.00333	0.00148851	mg/kg	30-150	30	30-150	50	50			
Alpha-BHC	319-84-6	0.00333	0.00094572	mg/kg	30-150	30	30-150	50	50			
Beta-BHC	319-85-7	0.007992	0.0030303	mg/kg	30-150	30	30-150	50	50			
Heptachlor	76-44-8	0.003996	0.00179154	mg/kg	30-150	30	30-150	50	50			
Aldrin	309-00-2	0.007992	0.00281385	mg/kg	30-150	30	30-150	50	50			
Heptachlor epoxide	1024-57-3	0.014985	0.0044955	mg/kg	30-150	30	30-150	50	50			
Endrin	72-20-8	0.00333	0.0013653	mg/kg	30-150	30	30-150	50	50			
Endrin aldehyde	7421-93-4	0.00999	0.0034965	mg/kg	30-150	30	30-150	50	50			
Endrin ketone	53494-70-5	0.007992	0.00205794	mg/kg	30-150	30	30-150	50	50			
Dieldrin	60-57-1	0.004995	0.0024975	mg/kg	30-150	30	30-150	50	50			
4,4'-DDE	72-55-9	0.007992	0.00184815	mg/kg	30-150	30	30-150	50	50			
4,4'-DDD	72-54-8	0.007992	0.00285048	mg/kg	30-150	30	30-150	50	50			
4,4'-DDT	50-29-3	0.014985	0.0064269	mg/kg	30-150	30	30-150	50	50			
Endosulfan I	959-98-8	0.007992	0.00188811	mg/kg	30-150	30	30-150	50	50			
Endosulfan II	33213-65-9	0.007992	0.00267066	mg/kg	30-150	30	30-150	50	50			
Endosulfan sulfate	1031-07-8	0.00333	0.00158508	mg/kg	30-150	30	30-150	50	50			
Methoxychlor	72-43-5	0.014985	0.004662	mg/kg	30-150	30	30-150	50	50			
Toxaphene	8001-35-2	0.14985	0.041958	mg/kg	30-150	30	30-150	50	50			
cis-Chlordane	5103-71-9	0.00999	0.00278388	mg/kg	30-150	30	30-150	50	50			
trans-Chlordane	5103-74-2	0.00999	0.00263736	mg/kg	30-150	30	30-150	50	50			
Chlordane	57-74-9	0.064935	0.0264735	mg/kg	30-150	30	30-150	50	50			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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Herbicides -EPA 8151A (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
2,4-D	94-75-7	0.1665	0.0104895	mg/kg	30-150	30	30-150	30	30			
2,4,5-T	93-76-5	0.1665	0.0051615	mg/kg	30-150	30	30-150	30	30			
2,4,5-TP (Silvex)	93-72-1	0.1665	0.0044289	mg/kg	30-150	30	30-150	30	30			
DCAA	*19719-28-9*									*30-150*		

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TCL PCBs - EPA 8082A (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Aroclor 1016	12674-11-2	0.0335	0.0037989	mg/kg	40-140	50	40-140	50	50			
Aroclor 1221	11104-28-2	0.0335	0.0050987	mg/kg	40-140	50	40-140	50	50			
Aroclor 1232	11141-16-5	0.0335	0.0032964	mg/kg	40-140	50	40-140	50	50			
Aroclor 1242	53469-21-9	0.0335	0.0041004	mg/kg	40-140	50	40-140	50	50			
Aroclor 1248	12672-29-6	0.0335	0.0037587	mg/kg	40-140	50	40-140	50	50			
Aroclor 1254	11097-69-1	0.0335	0.0027336	mg/kg	40-140	50	40-140	50	50			
Aroclor 1260	11096-82-5	0.0335	0.0034974	mg/kg	40-140	50	40-140	50	50			
Aroclor 1262	37324-23-5	0.0335	0.0027537	mg/kg	40-140	50	40-140	50	50			
Aroclor 1268	11100-14-4	0.0335	0.0023718	mg/kg	40-140	50	40-140	50	50			
PCBs, Total	1336-36-3	0.0335	0.001541	mg/kg				50	50			
PCBs, Total	1336-36-3	0.0335	0.001541	mg/kg				50	50			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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METALS by 6010C (SOIL)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Aluminum, Total	7429-90-5	4	1.08	mg/kg	48-151		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Antimony, Total	7440-36-0	2	0.152	mg/kg	1-208		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Arsenic, Total	7440-38-2	0.4	0.0832	mg/kg	79-121		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Barium, Total	7440-39-3	0.4	0.0696	mg/kg	83-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Beryllium, Total	7440-41-7	0.2	0.0132	mg/kg	83-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Cadmium, Total	7440-43-9	0.4	0.0392	mg/kg	83-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Calcium, Total	7440-70-2	4	1.4	mg/kg	81-119		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Chromium, Total	7440-47-3	0.4	0.0384	mg/kg	80-120		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Cobalt, Total	7440-48-4	0.8	0.0664	mg/kg	84-115		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Copper, Total	7440-50-8	0.4	0.1032	mg/kg	81-118		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Iron, Total	7439-89-6	2	0.3612	mg/kg	45-155		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Lead, Total	7439-92-1	2	0.1072	mg/kg	81-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Magnesium, Total	7439-95-4	4	0.616	mg/kg	76-124		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Manganese, Total	7439-96-5	0.4	0.0636	mg/kg	81-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Nickel, Total	7440-02-0	1	0.0968	mg/kg	83-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Potassium, Total	7440-09-7	100	5.76	mg/kg	71-129		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Selenium, Total	7782-49-2	0.8	0.1032	mg/kg	78-122		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Silver, Total	7440-22-4	0.4	0.1132	mg/kg	75-124		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Sodium, Total	7440-23-5	80	1.26	mg/kg	72-127		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Thallium, Total	7440-28-0	0.8	0.126	mg/kg	80-120		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Vanadium, Total	7440-62-2	0.4	0.0812	mg/kg	78-122		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Zinc, Total	7440-66-6	2	0.1172	mg/kg	82-118		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved

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METALS by 7471B (SOIL)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Mercury, Total	7439-97-6	0.08	0.016896	mg/kg	72-128		80-120	20	20		28 days	Metals Only-Glass 60mL/2oz unpreserved

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WETCHEM (SOIL)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Method	Holding Time	Container/Sample Preservation
Chromium, Hexavalent	18540-29-9	0.8	0.16	mg/kg	80-120	20	75-125	20	20	7196A	30 days	1 - Glass 120ml/4oz unpreserved
Cyanide, Total	57-12-5	1	0.212	mg/kg	80-120	35	75-125	35	35	9010C/9012B	14 days	1 - Glass 250ml/8oz unpreserved

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TCL Volatiles - EPA 8260C (WATER)

Holding Time: 14 days
Container/Sample Preservation: 3 - Vial HCl preserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Methylene chloride	75-09-2	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,1-Dichloroethane	75-34-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Chloroform	67-66-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Carbon tetrachloride	56-23-5	0.5	0.134	ug/l	63-132	20	63-132	20	20			
1,2-Dichloropropane	78-87-5	1	0.137	ug/l	70-130	20	70-130	20	20			
Dibromochloromethane	124-48-1	0.5	0.149	ug/l	63-130	20	63-130	20	20			
1,1,2-Trichloroethane	79-00-5	1.5	0.5	ug/l	70-130	20	70-130	20	20			
Tetrachloroethene	127-18-4	0.5	0.181	ug/l	70-130	20	70-130	20	20			
Chlorobenzene	108-90-7	2.5	0.7	ug/l	75-130	20	75-130	20	20			
Trichlorofluoromethane	75-69-4	2.5	0.7	ug/l	62-150	20	62-150	20	20			
1,2-Dichloroethane	107-06-2	0.5	0.132	ug/l	70-130	20	70-130	20	20			
1,1,1-Trichloroethane	71-55-6	2.5	0.7	ug/l	67-130	20	67-130	20	20			
Bromodichloromethane	75-27-4	0.5	0.192	ug/l	67-130	20	67-130	20	20			
trans-1,3-Dichloropropene	10061-02-6	0.5	0.164	ug/l	70-130	20	70-130	20	20			
cis-1,3-Dichloropropene	10061-01-5	0.5	0.144	ug/l	70-130	20	70-130	20	20			
1,3-Dichloropropene, Total	542-75-6	0.5	0.144	ug/l				20	20			
1,3-Dichloropropene, Total	542-75-6	0.5	0.144	ug/l				20	20			
1,1-Dichloropropene	563-58-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Bromoform	75-25-2	2	0.65	ug/l	54-136	20	54-136	20	20			
1,1,2,2-Tetrachloroethane	79-34-5	0.5	0.167	ug/l	67-130	20	67-130	20	20			
Benzene	71-43-2	0.5	0.159	ug/l	70-130	20	70-130	20	20			
Toluene	108-88-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Ethylbenzene	100-41-4	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Chloromethane	74-87-3	2.5	0.7	ug/l	64-130	20	64-130	20	20			
Bromomethane	74-83-9	2.5	0.7	ug/l	39-139	20	39-139	20	20			
Vinyl chloride	75-01-4	1	0.0714	ug/l	55-140	20	55-140	20	20			
Chloroethane	75-00-3	2.5	0.7	ug/l	55-138	20	55-138	20	20			
1,1-Dichloroethene	75-35-4	0.5	0.169	ug/l	61-145	20	61-145	20	20			
trans-1,2-Dichloroethene	156-60-5	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Trichloroethene	79-01-6	0.5	0.175	ug/l	70-130	20	70-130	20	20			
1,2-Dichlorobenzene	95-50-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,3-Dichlorobenzene	541-73-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,4-Dichlorobenzene	106-46-7	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Methyl tert butyl ether	1634-04-4	2.5	0.7	ug/l	63-130	20	63-130	20	20			
p/m-Xylene	179601-23-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
o-Xylene	95-47-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Xylene (Total)	1330-20-7	2.5	0.7	ug/l				20	20			
Xylene (Total)	1330-20-7	2.5	0.7	ug/l				20	20			
cis-1,2-Dichloroethene	156-59-2	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2-Dichloroethene (total)	540-59-0	2.5	0.7	ug/l				20	20			
1,2-Dichloroethene (total)	540-59-0	2.5	0.7	ug/l				20	20			
Dibromomethane	74-95-3	5	1	ug/l	70-130	20	70-130	20	20			

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TCL Volatiles - EPA 8260C (WATER)

Holding Time: 14 days
Container/Sample Preservation: 3 - Vial HCl preserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,2,3-Trichloropropane	96-18-4	2.5	0.7	ug/l	64-130	20	64-130	20	20			
Acrylonitrile	107-13-1	5	1.5	ug/l	70-130	20	70-130	20	20			
Styrene	100-42-5	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Dichlorodifluoromethane	75-71-8	5	1	ug/l	36-147	20	36-147	20	20			
Acetone	67-64-1	5	1.46	ug/l	58-148	20	58-148	20	20			
Carbon disulfide	75-15-0	5	1	ug/l	51-130	20	51-130	20	20			
2-Butanone	78-93-3	5	1.94	ug/l	63-138	20	63-138	20	20			
Vinyl acetate	108-05-4	5	1	ug/l	70-130	20	70-130	20	20			
4-Methyl-2-pentanone	108-10-1	5	1	ug/l	59-130	20	59-130	20	20			
2-Hexanone	591-78-6	5	1	ug/l	57-130	20	57-130	20	20			
Bromochloromethane	74-97-5	2.5	0.7	ug/l	70-130	20	70-130	20	20			
2,2-Dichloropropane	594-20-7	2.5	0.7	ug/l	63-133	20	63-133	20	20			
1,2-Dibromoethane	106-93-4	2	0.65	ug/l	70-130	20	70-130	20	20			
1,3-Dichloropropane	142-28-9	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,1,1,2-Tetrachloroethane	630-20-6	2.5	0.7	ug/l	64-130	20	64-130	20	20			
Bromobenzene	108-86-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
n-Butylbenzene	104-51-8	2.5	0.7	ug/l	53-136	20	53-136	20	20			
sec-Butylbenzene	135-98-8	2.5	0.7	ug/l	70-130	20	70-130	20	20			
tert-Butylbenzene	98-06-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
o-Chlorotoluene	95-49-8	2.5	0.7	ug/l	70-130	20	70-130	20	20			
p-Chlorotoluene	106-43-4	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2-Dibromo-3-chloropropane	96-12-8	2.5	0.7	ug/l	41-144	20	41-144	20	20			
Hexachlorobutadiene	87-68-3	2.5	0.7	ug/l	63-130	20	63-130	20	20			
Isopropylbenzene	98-82-8	2.5	0.7	ug/l	70-130	20	70-130	20	20			
p-Isopropyltoluene	99-87-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Naphthalene	91-20-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
n-Propylbenzene	103-65-1	2.5	0.7	ug/l	69-130	20	69-130	20	20			
1,2,3-Trichlorobenzene	87-61-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2,4-Trichlorobenzene	120-82-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,3,5-Trimethylbenzene	108-67-8	2.5	0.7	ug/l	64-130	20	64-130	20	20			
1,2,4-Trimethylbenzene	95-63-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,4-Dioxane	123-91-1	250	60.8	ug/l	56-162	20	56-162	20	20			
1,4-Diethylbenzene	105-05-5	2	0.7	ug/l	70-130	20	70-130	20	20			
4-Ethyltoluene	622-96-8	2	0.7	ug/l	70-130	20	70-130	20	20			
1,2,4,5-Tetramethylbenzene	95-93-2	2	0.542	ug/l	70-130	20	70-130	20	20			
Ethyl ether	60-29-7	2.5	0.7	ug/l	59-134	20	59-134	20	20			
trans-1,4-Dichloro-2-butene	110-57-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2-Dichloroethane-d4	*17060-07-0*									*70-130*		
Toluene-d8	*2037-26-5*									*70-130*		
4-Bromofluorobenzene	*460-00-4*									*70-130*		
Dibromofluoromethane	*1868-53-7*									*70-130*		

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NYTCL Semivolatiles - EPA 8270D (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Acenaphthene	83-32-9	2	0.591	ug/l	37-111	30	37-111	30	30			
1,2,4-Trichlorobenzene	120-82-1	5	0.661	ug/l	39-98	30	39-98	30	30			
Hexachlorobenzene	118-74-1	2	0.579	ug/l	40-140	30	40-140	30	30			
Bis(2-chloroethyl)ether	111-44-4	2	0.669	ug/l	40-140	30	40-140	30	30			
2-Chloronaphthalene	91-58-7	2	0.64	ug/l	40-140	30	40-140	30	30			
1,2-Dichlorobenzene	95-50-1	2	0.732	ug/l	40-140	30	40-140	30	30			
1,3-Dichlorobenzene	541-73-1	2	0.732	ug/l	40-140	30	40-140	30	30			
1,4-Dichlorobenzene	106-46-7	2	0.708	ug/l	36-97	30	36-97	30	30			
3,3'-Dichlorobenzidine	91-94-1	5	1.39	ug/l	40-140	30	40-140	30	30			
2,4-Dinitrotoluene	121-14-2	5	0.845	ug/l	24-96	30	24-96	30	30			
2,6-Dinitrotoluene	606-20-2	5	1.12	ug/l	40-140	30	40-140	30	30			
Fluoranthene	206-44-0	2	0.568	ug/l	40-140	30	40-140	30	30			
4-Chlorophenyl phenyl ether	7005-72-3	2	0.625	ug/l	40-140	30	40-140	30	30			
4-Bromophenyl phenyl ether	101-55-3	2	0.731	ug/l	40-140	30	40-140	30	30			
Bis(2-chloroisopropyl)ether	108-60-1	2	0.696	ug/l	40-140	30	40-140	30	30			
Bis(2-chloroethoxy)methane	111-91-1	5	0.626	ug/l	40-140	30	40-140	30	30			
Hexachlorobutadiene	87-68-3	2	0.658	ug/l	40-140	30	40-140	30	30			
Hexachlorocyclopentadiene	77-47-4	20	7.84	ug/l	40-140	30	40-140	30	30			
Hexachloroethane	67-72-1	2	0.682	ug/l	40-140	30	40-140	30	30			
Isophorone	78-59-1	5	0.601	ug/l	40-140	30	40-140	30	30			
Naphthalene	91-20-3	2	0.68	ug/l	40-140	30	40-140	30	30			
Nitrobenzene	98-95-3	2	0.753	ug/l	40-140	30	40-140	30	30			
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	2	0.644	ug/l	40-140	30	40-140	30	30			
n-Nitrosodi-n-propylamine	621-64-7	5	0.7	ug/l	29-132	30	29-132	30	30			
Bis(2-Ethylhexyl)phthalate	117-81-7	3	0.91	ug/l	40-140	30	40-140	30	30			
Butyl benzyl phthalate	85-68-7	5	1.26	ug/l	40-140	30	40-140	30	30			
Di-n-butylphthalate	84-74-2	5	0.689	ug/l	40-140	30	40-140	30	30			
Di-n-octylphthalate	117-84-0	5	1.14	ug/l	40-140	30	40-140	30	30			
Diethyl phthalate	84-66-2	5	0.628	ug/l	40-140	30	40-140	30	30			
Dimethyl phthalate	131-11-3	5	0.65	ug/l	40-140	30	40-140	30	30			
Benzo(a)anthracene	56-55-3	2	0.61	ug/l	40-140	30	40-140	30	30			
Benzo(a)pyrene	50-32-8	2	0.539	ug/l	40-140	30	40-140	30	30			
Benzo(b)fluoranthene	205-99-2	2	0.635	ug/l	40-140	30	40-140	30	30			
Benzo(k)fluoranthene	207-08-9	2	0.597	ug/l	40-140	30	40-140	30	30			
Chrysene	218-01-9	2	0.543	ug/l	40-140	30	40-140	30	30			
Acenaphthylene	208-96-8	2	0.658	ug/l	45-123	30	45-123	30	30			
Anthracene	120-12-7	2	0.645	ug/l	40-140	30	40-140	30	30			
Benzo(ghi)perylene	191-24-2	2	0.611	ug/l	40-140	30	40-140	30	30			
Fluorene	86-73-7	2	0.619	ug/l	40-140	30	40-140	30	30			
Phenanthrene	85-01-8	2	0.613	ug/l	40-140	30	40-140	30	30			
Dibenzo(a,h)anthracene	53-70-3	2	0.548	ug/l	40-140	30	40-140	30	30			
Indeno(1,2,3-cd)Pyrene	193-39-5	2	0.707	ug/l	40-140	30	40-140	30	30			

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NYTCL Semivolatiles - EPA 8270D (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Pyrene	129-00-0	2	0.569	ug/l	26-127	30	26-127	30	30			
Biphenyl	92-52-4	2	0.757	ug/l	54-104	30	54-104	30	30			
4-Chloroaniline	106-47-8	5	0.632	ug/l	40-140	30	40-140	30	30			
2-Nitroaniline	88-74-4	5	1.14	ug/l	52-143	30	52-143	30	30			
3-Nitroaniline	99-09-2	5	1.14	ug/l	25-145	30	25-145	30	30			
4-Nitroaniline	100-01-6	5	1.3	ug/l	51-143	30	51-143	30	30			
Dibenzofuran	132-64-9	2	0.656	ug/l	40-140	30	40-140	30	30			
2-Methylnaphthalene	91-57-6	2	0.72	ug/l	40-140	30	40-140	30	30			
Acetophenone	98-86-2	5	0.847	ug/l	39-129	30	39-129	30	30			
2,4,6-Trichlorophenol	88-06-2	5	0.681	ug/l	30-130	30	30-130	30	30			
P-Chloro-M-Cresol	59-50-7	2	0.617	ug/l	23-97	30	23-97	30	30			
2-Chlorophenol	95-57-8	2	0.631	ug/l	27-123	30	27-123	30	30			
2,4-Dichlorophenol	120-83-2	5	0.769	ug/l	30-130	30	30-130	30	30			
2,4-Dimethylphenol	105-67-9	5	1.64	ug/l	30-130	30	30-130	30	30			
2-Nitrophenol	88-75-5	10	1.52	ug/l	30-130	30	30-130	30	30			
4-Nitrophenol	100-02-7	10	1.77	ug/l	10-80	30	10-80	30	30			
2,4-Dinitrophenol	51-28-5	20	5.47	ug/l	20-130	30	20-130	30	30			
4,6-Dinitro-o-cresol	534-52-1	10	2.1	ug/l	20-164	30	20-164	30	30			
Pentachlorophenol	87-86-5	10	3.43	ug/l	9-103	30	9-103	30	30			
Phenol	108-95-2	5	1.89	ug/l	12-110	30	12-110	30	30			
2-Methylphenol	95-48-7	5	1.02	ug/l	30-130	30	30-130	30	30			
3-Methylphenol/4-Methylphenol	106-44-5	5	1.11	ug/l	30-130	30	30-130	30	30			
2,4,5-Trichlorophenol	95-95-4	5	0.715	ug/l	30-130	30	30-130	30	30			
Benzoic Acid	65-85-0	50	12.9	ug/l	10-110	30	10-110	30	30			
Benzyl Alcohol	100-51-6	2	0.725	ug/l	15-110	30	15-110	30	30			
Carbazole	86-74-8	2	0.627	ug/l	55-144	30	55-144	30	30			
2-Fluorophenol	*367-12-4*									*21-120*		
Phenol-d6	*13127-88-3*									*10-120*		
Nitrobenzene-d5	*4165-60-0*									*23-120*		
2-Fluorobiphenyl	*321-60-8*									*15-120*		
2,4,6-Tribromophenol	*118-79-6*									*10-120*		
4-Terphenyl-d14	*1718-51-0*									*41-149*		

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NYTCL Semivolatiles -EPA 8270D-SIM (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Acenaphthene	83-32-9	0.1	0.035	ug/l	37-111	40	37-111	40	40			
2-Chloronaphthalene	91-58-7	0.2	0.035	ug/l	40-140	40	40-140	40	40			
Fluoranthene	206-44-0	0.1	0.038	ug/l	40-140	40	40-140	40	40			
Hexachlorobutadiene	87-68-3	0.5	0.036	ug/l	40-140	40	40-140	40	40			
Naphthalene	91-20-3	0.1	0.043	ug/l	40-140	40	40-140	40	40			
Benzo(a)anthracene	56-55-3	0.1	0.018	ug/l	40-140	40	40-140	40	40			
Benzo(a)pyrene	50-32-8	0.1	0.039	ug/l	40-140	40	40-140	40	40			
Benzo(b)fluoranthene	205-99-2	0.1	0.016	ug/l	40-140	40	40-140	40	40			
Benzo(k)fluoranthene	207-08-9	0.1	0.042	ug/l	40-140	40	40-140	40	40			
Chrysene	218-01-9	0.1	0.038	ug/l	40-140	40	40-140	40	40			
Acenaphthylene	208-96-8	0.1	0.035	ug/l	40-140	40	40-140	40	40			
Anthracene	120-12-7	0.1	0.035	ug/l	40-140	40	40-140	40	40			
Benzo(ghi)perylene	191-24-2	0.1	0.042	ug/l	40-140	40	40-140	40	40			
Fluorene	86-73-7	0.1	0.037	ug/l	40-140	40	40-140	40	40			
Phenanthrene	85-01-8	0.1	0.015	ug/l	40-140	40	40-140	40	40			
Dibenzo(a,h)anthracene	53-70-3	0.1	0.039	ug/l	40-140	40	40-140	40	40			
Indeno(1,2,3-cd)Pyrene	193-39-5	0.1	0.04	ug/l	40-140	40	40-140	40	40			
Pyrene	129-00-0	0.1	0.04	ug/l	26-127	40	26-127	40	40			
2-Methylnaphthalene	91-57-6	0.1	0.045	ug/l	40-140	40	40-140	40	40			
Pentachlorophenol	87-86-5	0.8	0.22	ug/l	9-103	40	9-103	40	40			
Hexachlorobenzene	118-74-1	0.8	0.032	ug/l	40-140	40	40-140	40	40			
Hexachloroethane	67-72-1	0.8	0.03	ug/l	40-140	40	40-140	40	40			
2-Fluorophenol	*367-12-4*									*21-120*		
Phenol-d6	*13127-88-3*									*10-120*		
Nitrobenzene-d5	*4165-60-0*									*23-120*		
2-Fluorobiphenyl	*321-60-8*									*15-120*		
2,4,6-Tribromophenol	*118-79-6*									*10-120*		
4-Terphenyl-d14	*1718-51-0*									*41-149*		

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TCL Pesticides - EPA 8081B (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 500ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Delta-BHC	319-86-8	0.02	0.00467	ug/l	30-150	20	30-150	30	30			
Lindane	58-89-9	0.02	0.00434	ug/l	30-150	20	30-150	30	30			
Alpha-BHC	319-84-6	0.02	0.00439	ug/l	30-150	20	30-150	30	30			
Beta-BHC	319-85-7	0.02	0.0056	ug/l	30-150	20	30-150	30	30			
Heptachlor	76-44-8	0.02	0.0031	ug/l	30-150	20	30-150	30	30			
Aldrin	309-00-2	0.02	0.00216	ug/l	30-150	20	30-150	30	30			
Heptachlor epoxide	1024-57-3	0.02	0.00415	ug/l	30-150	20	30-150	30	30			
Endrin	72-20-8	0.04	0.00429	ug/l	30-150	20	30-150	30	30			
Endrin aldehyde	7421-93-4	0.04	0.0081	ug/l	30-150	20	30-150	30	30			
Endrin ketone	53494-70-5	0.04	0.00477	ug/l	30-150	20	30-150	30	30			
Dieldrin	60-57-1	0.04	0.00429	ug/l	30-150	20	30-150	30	30			
4,4'-DDE	72-55-9	0.04	0.00381	ug/l	30-150	20	30-150	30	30			
4,4'-DDD	72-54-8	0.04	0.00464	ug/l	30-150	20	30-150	30	30			
4,4'-DDT	50-29-3	0.04	0.00432	ug/l	30-150	20	30-150	30	30			
Endosulfan I	959-98-8	0.02	0.00345	ug/l	30-150	20	30-150	30	30			
Endosulfan II	33213-65-9	0.04	0.00519	ug/l	30-150	20	30-150	30	30			
Endosulfan sulfate	1031-07-8	0.04	0.00481	ug/l	30-150	20	30-150	30	30			
Methoxychlor	72-43-5	0.2	0.00684	ug/l	30-150	20	30-150	30	30			
Toxaphene	8001-35-2	0.2	0.0627	ug/l	30-150	20	30-150	30	30			
cis-Chlordane	5103-71-9	0.02	0.00666	ug/l	30-150	20	30-150	30	30			
trans-Chlordane	5103-74-2	0.02	0.00627	ug/l	30-150	20	30-150	30	30			
Chlordane	57-74-9	0.2	0.0463	ug/l	30-150	20	30-150	30	30			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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TCL PCBs - EPA 8082A (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Aroclor 1016	12674-11-2	0.083	0.019588	ug/l	40-140	50	40-140	50	50			
Aroclor 1221	11104-28-2	0.083	0.031872	ug/l	40-140	50	40-140	50	50			
Aroclor 1232	11141-16-5	0.083	0.027058	ug/l	40-140	50	40-140	50	50			
Aroclor 1242	53469-21-9	0.083	0.029548	ug/l	40-140	50	40-140	50	50			
Aroclor 1248	12672-29-6	0.083	0.022576	ug/l	40-140	50	40-140	50	50			
Aroclor 1254	11097-69-1	0.083	0.034611	ug/l	40-140	50	40-140	50	50			
Aroclor 1260	11096-82-5	0.083	0.01992	ug/l	40-140	50	40-140	50	50			
Aroclor 1262	37324-23-5	0.083	0.017098	ug/l	40-140	50	40-140	50	50			
Aroclor 1268	11100-14-4	0.083	0.027058	ug/l	40-140	50	40-140	50	50			
PCBs, Total	1336-36-3	0.083	0.017098	ug/l				50	50			
PCBs, Total	1336-36-3	0.083	0.017098	ug/l				50	50			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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METALS by 6020A (WATER)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Aluminum, Total	7429-90-5	0.01	0.00327	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Aluminum, Dissolved	7429-90-5	0.01	0.00327	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Antimony, Total	7440-36-0	0.004	0.000429	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Antimony, Dissolved	7440-36-0	0.004	0.000429	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Arsenic, Total	7440-38-2	0.0005	0.000165	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Arsenic, Dissolved	7440-38-2	0.0005	0.000165	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Barium, Dissolved	7440-39-3	0.0005	0.000173	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Barium, Total	7440-39-3	0.0005	0.000173	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Beryllium, Dissolved	7440-41-7	0.0005	0.000107	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Beryllium, Total	7440-41-7	0.0005	0.000107	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Cadmium, Total	7440-43-9	0.0002	0.0000599	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Cadmium, Dissolved	7440-43-9	0.0002	0.0000599	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Calcium, Total	7440-70-2	0.1	0.0394	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Calcium, Dissolved	7440-70-2	0.1	0.0394	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Chromium, Total	7440-47-3	0.001	0.000178	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Cobalt, Total	7440-48-4	0.0005	0.000163	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Copper, Total	7440-50-8	0.001	0.000384	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Chromium, Dissolved	7440-47-3	0.001	0.000178	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Iron, Total	7439-89-6	0.05	0.0191	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Lead, Total	7439-92-1	0.001	0.000343	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Cobalt, Dissolved	7440-48-4	0.0005	0.000163	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Copper, Dissolved	7440-50-8	0.001	0.000384	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Magnesium, Total	7439-95-4	0.07	0.0242	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Manganese, Total	7439-96-5	0.001	0.00044	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Iron, Dissolved	7439-89-6	0.05	0.0191	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Lead, Dissolved	7439-92-1	0.001	0.000343	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Magnesium, Dissolved	7439-95-4	0.07	0.0242	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Nickel, Total	7440-02-0	0.002	0.000556	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Manganese, Dissolved	7439-96-5	0.001	0.00044	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Potassium, Total	7440-09-7	0.1	0.0309	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Selenium, Total	7782-49-2	0.005	0.00173	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Silver, Total	7440-22-4	0.0004	0.000163	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Sodium, Total	7440-23-5	0.1	0.0293	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Nickel, Dissolved	7440-02-0	0.002	0.000556	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Potassium, Dissolved	7440-09-7	0.1	0.0309	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Thallium, Total	7440-28-0	0.0005	0.000143	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Selenium, Dissolved	7782-49-2	0.005	0.00173	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Vanadium, Total	7440-62-2	0.005	0.00157	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Zinc, Total	7440-66-6	0.01	0.00341	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Silver, Dissolved	7440-22-4	0.0004	0.000163	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Sodium, Dissolved	7440-23-5	0.1	0.0293	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Thallium, Dissolved	7440-28-0	0.0005	0.000143	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved

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METALS by 6020A (WATER)

0
0

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Vanadium, Dissolved	7440-62-2	0.005	0.00157	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Zinc, Dissolved	7440-66-6	0.01	0.00341	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved

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METALS by 7470A (WATER)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Mercury, Dissolved	7439-97-6	0.0002	0.0002	mg/l	80-120		75-125	20	20		28 days	1 - Plastic 500ml HNO3 preserved
Mercury, Total	7439-97-6	0.0002	0.000066	mg/l	80-120		75-125	20	20		28 days	1 - Plastic 500ml HNO3 preserved

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WETCHEM (WATER)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Method	Holding Time	Container/Sample Preservation
Chromium, Hexavalent	18540-29-9	0.01	0.003	mg/l	85-115	20	85-115	20	20	7196A	24 hours	1 - Plastic 500ml unpreserved
Cyanide, Total	57-12-5	0.005	0.0018	mg/l	85-115	20	80-120	20	20	9010C/9012B	14 days	1 - Plastic 250ml NaOH preserved

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NYTCL Semivolatiles - EPA 8270D (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,4-Dioxane	123-91-1	25.05	7.682	ug/kg	40-140	50	40-140	50	50			
2-Fluorophenol	*367-12-4*									*25-120*		
Phenol-d6	*13127-88-3*									*10-120*		
Nitrobenzene-d5	*4165-60-0*									*23-120*		
2-Fluorobiphenyl	*321-60-8*									*30-120*		
2,4,6-Tribromophenol	*118-79-6*									*10-136*		
4-Terphenyl-d14	*1718-51-0*									*18-120*		

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1,4 Dioxane via EPA 8270D-SIM (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 250ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,4-Dioxane	123-91-1	150	33.9	ng/l	40-140	30	40-140	30	30			
1,4-Dioxane-d8	*17647-74-4*									*15-110*		
1,4-Dioxane-d8 (IS)	17647-74-4			ng/l								

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NY PFAAs via EPA 537(M)-Isotope Dilution (SOIL)

Holding Time: 28 days
Container/Sample Preservation: 1 - Plastic 8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	1	0.0227	ug/kg	71-135	30	71-135	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	1	0.046	ug/kg	69-132	30	69-132	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	1	0.039	ug/kg	72-128	30	72-128	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	1	0.0525	ug/kg	70-132	30	70-132	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	1	0.0451	ug/kg	71-131	30	71-131	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	1	0.0605	ug/kg	67-130	30	67-130	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	1	0.0419	ug/kg	69-133	30	69-133	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	1	0.1795	ug/kg	64-140	30	64-140	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	1	0.1365	ug/kg	70-132	30	70-132	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	1	0.075	ug/kg	72-129	30	72-129	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	1	0.13	ug/kg	68-136	30	68-136	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	1	0.067	ug/kg	69-133	30	69-133	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	1	0.287	ug/kg	65-137	30	65-137	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	1	0.2015	ug/kg	63-144	30	63-144	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	1	0.0468	ug/kg	64-136	30	64-136	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	1	0.153	ug/kg	59-134	30	59-134	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	1	0.098	ug/kg	67-137	30	67-137	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	1	0.0845	ug/kg	61-139	30	61-139	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	1	0.07	ug/kg	69-135	30	69-135	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	1	0.2045	ug/kg	66-139	30	66-139	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	1	0.054	ug/kg	69-133	30	69-133	30	30			
PFOA/PFOS, Total		1	0.0419	ug/kg				30	30			
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*60-153*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*65-182*		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*70-151*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*61-147*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*62-149*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*63-166*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*62-152*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*32-182*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*61-154*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*65-151*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*65-150*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*25-186*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*45-137*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*64-158*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*1-125*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*42-136*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*56-148*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*26-160*		

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NY PFAAs via EPA 537(M)-Isotope Dilution (WATER)

Holding Time: 14 days
Container/Sample Preservation: 1 - 2 Plastic/1 Plastic/1 H20 Plastic

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	2	0.408	ng/l	67-148	30	67-148	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	2	0.396	ng/l	63-161	30	63-161	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	2	0.238	ng/l	65-157	30	65-157	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	2	0.328	ng/l	69-168	30	69-168	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	2	0.2252	ng/l	58-159	30	58-159	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	2	0.376	ng/l	69-177	30	69-177	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	2	0.236	ng/l	63-159	30	63-159	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	2	1.332	ng/l	49-187	30	49-187	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	2	0.688	ng/l	61-179	30	61-179	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	2	0.312	ng/l	68-171	30	68-171	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	2	0.504	ng/l	52-151	30	52-151	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	2	0.304	ng/l	63-171	30	63-171	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	2	1.212	ng/l	56-173	30	56-173	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	2	0.648	ng/l	60-166	30	60-166	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	2	0.26	ng/l	60-153	30	60-153	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	2	0.98	ng/l	38-156	30	38-156	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	2	0.58	ng/l	46-170	30	46-170	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	2	0.804	ng/l	45-170	30	45-170	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	2	0.372	ng/l	67-153	30	67-153	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	2	0.3272	ng/l	48-158	30	48-158	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	2	0.248	ng/l	59-182	30	59-182	30	30			
PFOA/PFOS, Total		2	0.236	ng/l				30	30			
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*2-156*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*16-173*		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*31-159*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*21-145*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*30-139*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*47-153*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*36-149*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*1-244*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*34-146*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*42-146*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*38-144*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*7-170*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*1-181*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*40-144*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*1-87*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*23-146*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*24-161*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*33-143*		

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ATTACHMENT C

ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE

ATTACHMENT C

ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE

Matrix Type	Field Parameters	Laboratory Parameters	Analytical Methods	Sample Preservation	Sample Container Volume and Type	Sample Hold Time	Field Duplicate Samples	Equipment Blank Samples	Trip Blank Samples	Ambient Air Samples	MS/MSD Samples
Groundwater	Temperature, Turbidity, pH, ORP, Conductivity	Part 375 and TCL VOCs	EPA 8260C	Cool to 4°C; HCl to pH <2; no headspace	Three 40-mL VOC vials with Teflon® -lined cap	Analyze within 14 days of collection	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	1 per Shipment of VOC samples	NA	1 per 20 samples
		Part 375 and TCL SVOCs	EPA 8270D and 8270D with SIM	Cool to 4°C	Two 1-Liter Amber Glass	7 days to extract; 40 days after extraction to analyze			NA		
		Part 375 and TCL Pesticides	EPA 8081B	Cool to 4°C	Two 1-Liter Amber Glass	7 days to extract; 40 days after extraction to analyze					
		PCBs	EPA 8082A	Cool to 4°C							
		Part 375 and TAL Metals	EPA 6010C, 6020A, 7470A	Cool to 4°C; HNO_3 to pH <2	250 mL plastic	6 months, except Mercury 28 days					
		Hexavalent Chromium	EPA 7196A	Cool to 4°C	250 mL plastic	24 Hours					
		Cyanide	EPA 9012B/SM4500 C/E	NaOH plus 0.6g ascorbic acid	250 mL plastic	14 days					
		PFAS**	EPA 537M	Cool to 4°C; Trizma	Three 250-mL HDPE or polypropylene container	14 days to extract; 28 days after extraction to analyze		1 per sampling day			
		1,4-Dioxane as SVOC***	EPA 8270D with SIM	Cool to 4°C	Two 250-mL Amber Glass	7 days to extract; 40 days after extraction to analyze		1 per sampling day			
Soil	Total VOCs via PID	Part 375 and TCL VOCs	EPA 8260C	Cool to 4°C	Two 40-mL VOC Vials with 5mL H_2O, one with MeOH	48 hours after sampling if not frozen to -70 or extruded into methanol. If frozen. analyze within 14 days of collection	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	1 per Shipment of VOC samples	NA	1 per 20 samples
		Part 375 and TCL SVOCs	EPA 8270D and 8270D with SIM	Cool to 4°C	4 oz. jar*	14 days to extract; 40 days after extraction to analyze			NA		
		Part 375 and TCL Pesticides	EPA 8081B	Cool to 4°C	4 oz. jar*	14 days to extract; 40 days after extraction to analyze					
		PCBs	EPA 8082A	Cool to 4°C							
		Part 375 and TAL Metals	EPA 6010C, 7471B	Cool to 4°C	2 oz. jar*	6 months, except Mercury 28 days					
		PFAS**	EPA 537M	Cool to 4°C; Trizma	One plastic 8 oz. jar	14 days to extract; 40 days after extraction to analyze		1 per sampling day			
		1,4-Dioxane as SVOC***	EPA 8270D	Cool to 4°C	8 oz. jar	14 days		1 per sampling day			
		Percent Solids	SM 2540G			NA		NA			NA
Soil Gas	Total VOCs via PID	TO-15 Listed VOCs	EPA TO-15	Ambient Temperature	6-Liter Summa Canister	Analyze within 30 days of collection	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	NA	1 per 10 samples	NA
Indoor Air	Total VOCs via PID	TO-15 Listed VOCs	EPA TO-15	Ambient Temperature	6-Liter Summa Canister	Analyze within 30 days of collection	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	NA	1 per 10 samples	NA

Notes:
ORP - Oxidation-Reduction Potential
VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls
PFAS - Per- and Polyfluoroalkyl Substances
SIM - Selected Ion Monitoring
HCl - Hydrochloric Acid
HNO_3 - Nitric Acid
MeOH - Methanol
NaOH - Sodium Hydroxide
*Can be combined in one or more 8 oz. jars
**The Reporting Limit for PFAS compounds in soil is 1 µg/kg and in water is 2 ng/L
***The Reporting Limits for 1,4-Dioxane in soil is 25.05 µg/kg and in water is 0.15 µg/L.

ATTACHMENT D

SAMPLE NOMENCLATURE

SOP #01 – Sample Nomenclature

INTRODUCTION

The Langan Environmental Group conducts an assortment of site investigations where samples (Vapor, Solids, and Aqueous) are collected and submitted to analytical laboratories for analysis. The results of which are then evaluated and entered into a data base allowing quick submittal to the state regulatory authority (New York State Division of Environmental Conservation [NYSDEC]). In addition, Langan is linking their data management system to graphic and analytical software to enable efficient evaluation of the data as well as creating client-ready presentational material.

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the general framework for labeling vapor, solid (soil) and aqueous (groundwater) samples that will be submitted for laboratory analysis. The nomenclature being introduced is designed to meet the NYSDEC EQuIS standard and has been incorporated into Langan software scripts to assist project personnel in processing the data. While this SOP is applicable to all site investigation; unanticipated conditions may arise which may require considerable flexibility in complying with this SOP. Therefore, guidance provided in this SOP is presented in terms of general steps and strategies that should be applied; but deviation from this SOP must be reported to the Project Manager (PM) immediately.

GENERAL SAMPLE IDENTIFICATION CONSIDERATIONS

Sample Labels

All sample ware must have a label. Recall that when you are using the Encore™ samples (see below); they are delivered in plastic lined foil bags. You are to label the bags[1]:

All other samples containers including Terra Cores™ must be labeled with laboratory provided self-adhesive labels.

Quick Breakdown of Sample Format

The general format for sample nomenclature is:

[1]Both Alpha and York laboratories permit the combining of the three Encore™ into a single bag. This may not be appropriate for all laboratories so please confirm with the labs themselves

LLNN_ID

Where

LL is a grouping of two (2) to four (4) letters signifying the sample media source. In older nomenclature SOPs this portion of the sample identification is commonly referred to as the *Sample Investigation Code*

NN represents a two digit number identifying the specific sample location or sample sequence number

_ ***(underscore)*** is required between the sample lettering and numeric identification and additional modifying data that determines the date of sampling or the depth of the sample interval

ID is a modifier specific to the sample type media (depth of soil sample or date of groundwater sample)

LL – Sample Investigation Code

Langan has devised a list of two to four letters to insure a quick ability to identify the sample investigation.

Code	Investigation
AA	Ambient Air
DS	Drum
EPB	Endpoint Location - Bottom (Excavation)
EPSW	Endpoint Location - Sidewall (Excavation)
FP	Free Product
IA	Indoor Air
IDW	Investigation Derived Waste (Soil Pile)
MW	Monitoring Well (Permanent)
SB	Soil Boring
SG	Staff Gauge (Stream Gauging)
SL	Sludge
SV	Soil Vapor Point
SVE	Soil Vapor Extraction Well
SW	Surface Water
TMW	Temporary Monitoring Well
TP	Test Pit (Excavated Material from Test Pit Not Associated With Sidewall or Bottom Samples)
WC	Waste Characterization Boring
COMP	Composite Sample
TB	Trip Blank (QA/QC Sampling – All Investigations)
FB	Field Blank (QA/QC Sampling – All Investigations)
DUP	Duplicate (QA/QC Sampling – All Investigations)

NN – Numeric Identifier

The two digit number that follows the sample investigation code (LL) identifies the specific sample based on the soil boring, monitoring well, endpoint or other location identification. For a subset of samples where there is no specific location identifier, the two digit number is the sequence number for the sample submitted. For example, an aqueous sample from a monitoring well identified as MW-1 would have the sample investigation code of MW and the numeric identifier as 01. Note there is no hyphen. The same can be done for soil borings, a soil sample collected from soil boring 9 (SB-9) would be have the LLNN identification of SB09 (again, no hyphen).

Note however that there is a subset of samples related to laboratory analytical quality assurance, among these includes TB, FB, and DUP. On many investigations, the Scope will require multiple collections of these types of samples, therefore the numerical number represents the sequence sample count where the first sample is 01, the second sample is 02, and the third sample is 03 and so on.

_ Underscore

The underscore is required. It separates the investigation code and numeric identifier from the modifier specific to the sample itself. Note that every effort should be made to insure that the underscore is clear on the sample label and chain of custody (COC).

ID – Modifier Specific to Type Media

Each sample investigation code and numeric identifier is further modified by an ID specific to the sample type media. In general, soil samples (soil borings or endpoint samples) use an ID that indicates the depth at which the sample was taken. Aqueous samples (groundwater or surface water samples) are identified by the date the sample was collected. Other types of samples including quality control (TB, FB, and DUP), Vapor samples (AA, IA, SV or SVE), other soil type samples (IDW, sludge, free product, drum, and others) are also identified by a date. The following rules apply to the ID when using sample depth or sample date.

Sample Depth

The sample depth must be whole numbers (no fractions) separated by a hyphen. Thus for a soil sample collected from the soil boring SB-1 from a depth of 6 feet to 8 feet, the sample would be identified as:

SB01_6-8

Unfortunately, the NYSDEC EQuIS system does not accept fractions. Therefore, if your sample interval is a fraction of a foot (6.5-7.5), round up to the larger interval (6-8).

Sample Date

The sample date is always in the format of MMDDYY. Note that the year is two digits. Thus for a groundwater sample collected on July 1, 2015 from the monitoring well MW-1, the sample would be identified as:

MW01_070115

Special Cases

There are a couple of specific sample types that require further explanation.

Endpoint Sampling

End point sidewall samples are sometimes modified by magnetic direction (N, S, E, and W). For example, the first sidewall endpoint sample from the north wall of an excavation at a depth of 5 feet would be written as:

EPSW01_N_5

Again, note that the N in the identification refers to north and is separated from the prefix investigation code/numeric identifier and ID modifier suffix by underscores.

Vapor Extraction Well Sample
As with the sidewall endpoint samples, the sample name is altered by inserting a middle modifier between the prefix and suffix of the sample name. The middle modifier is used to identify the source of the sample (inlet sample port, midpoint sample port or outlet sample port). For example the midpoint port of the vapor extraction well number 1 sampled on July 1, 2015 would be written as;

SVE01_MID_070115

Matrix Spike and Matrix Spike Duplicate
On occasion, a Langan investigation will collect a sample to be used to provide the lab with a site specific medium to spike to determine the quality of the analytical method. This special case of sampling requires additional information to be used in the sample name, specifically, a suffix specifying whether the sample is the matrix spike (MS) or the matrix spike duplicate (MSD). In the following example, the sample is collected from soil boring number 1 at a depth of 2-4 feet. For the matrix spike sample:

SB01_2-4_MS

and for the matrix spike duplicate sample:

SB01_2-4_MSD

Multiple Interval Groundwater Sampling
Although not currently a common practice, low flow sampling facilitates stratigraphic sampling of a monitoring well. If the scope requires stratigraphic sampling then groundwater samples will be labeled with a lower case letter following the well number. For example, placing the pump or sampling tube at 10 feet below surface in MW01 on July 1, 2015 would require the sample to be labeled as:

MW01a_070115

While a second sample where the pump or tubing intake is placed at 20 feet would be labeled as:

MW01b_070115

Note that it is important that you record what depth the intake for each sample represents in your field notes; as this information is going to be critical to interpreting the results.

ATTACHMENT E

PFAS SAMPLING PROTOCOLS

Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) Under DEC's Part 375 Remedial Programs

Objective

The Department of Environmental Conservation (DEC) is requiring sampling of all environmental media and subsequent analysis for the emerging contaminants 1,4-Dioxane and PFAS as part of all remedial programs implemented under 6 NYCRR Part 375, as further described in the guidance below.

Sample Planning

The number of samples required for emerging contaminant analyses is to be the same number of samples where "full TAL/TCL sampling" would typically be required in an investigation or remedial action compliance program.

Sampling of all media for ECs is required at all sites coming into or already in an investigative phase of any DER program. In other words, if the sampling outlined in the guidance hasn't already been done or isn't part of an existing work plan to be sampled for in the future, it will be necessary to go back out and perform the sampling prior to approving a SC report or issuing a decision document.

PFAS and 1,4-dioxane shall be incorporated into the investigation of potentially affected media, including soil, groundwater, surface water, and sediment as an addition to the standard "full TAL/TCL sampling." Biota sampling may be necessary based upon the potential for biota to be affected as determined pursuant to a Fish and Wildlife Impact analysis. Soil vapor sampling for PFAS and 1,4-dioxane is not required.

Upon an emerging contaminant being identified as a contaminant of concern (COC) for a site, those compounds must be assessed as part of the remedy selection process in accordance with Part 375 and DER-10 and included as part of the monitoring program upon entering the site management phase.

Special Testing Requirements for Import or Reuse of Soil: Soil imported to a site for use in a soil cap, soil cover, or as backfill must be tested for 1,4-dioxane and PFAS contamination in general conformance with DER-10, Section 5.4(e). Soil samples must be analyzed for 1,4-dioxane using EPA Method 8270, as well as the full list of PFAS compounds (currently 21) using EPA Method 537.1 (modified).

For 1,4-dioxane, soil exceeding the Unrestricted SCO of 0.1 ppm must be rejected per DER 10: Appendix 5 - Allowable Constituent Levels for Imported Fill or Soil, Subdivision 5.4(e).

If PFOA or PFOS is detected in any sample at or above 1 ppb, then a soil sample must be tested by the Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed. If the SPLP results exceed 70 ppt combined PFOA/S, then the source of backfill must be rejected. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays.

The work plan should explicitly describe analysis and reporting requirements, including laboratory analytical procedures for modified methods discussed below.

Analysis and Reporting

Labs should provide a full category B deliverable, and a DUSR should be prepared by an independent 3rd party data validator. QA/QC samples should be collected as required in DER-10, Section 2.3(c). The electronic data submission should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

PFAS analysis and reporting: DEC has developed a *PFAS Analyte List* (below) for remedial programs. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any compounds, the DEC project manager, in consultation with the DEC remedial program chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site.

Currently, ELAP does not offer certification for PFAS compounds in matrices other than finished drinking water. However, laboratories analyzing environmental samples (e.g., soil, sediments, and groundwater) are required by DER to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537 or ISO 25101. Labs must also adhere to the requirements and criteria set forth in the Laboratory Guidance for Analysis of PFAS in Non-Potable Water and Solids.

Modified EPA Method 537 is the preferred method to use for environmental samples due to its ability to achieve very low detection limits. Reporting limits for PFAS in groundwater and soil are to be 2 ng/L (ppt) and 1 ug/kg (ppb), respectively. If contract labs or work plans submitted by responsible parties indicate that they are not able to achieve these reporting limits for the entire list of 21 PFAS, site-specific decisions will need to be made by the DEC project manager in consultation with the DEC remedial program chemist. Note: Reporting limits for PFOA and PFOS in groundwater should not exceed 2 ng/L.

Additional laboratory methods for analysis of PFAS may be warranted at a site. These methods include Synthetic Precipitation Leaching Procedure (SPLP) by EPA Method 1312 and Total Oxidizable Precursor Assay (TOP Assay).

SPLP is a technique for determining the potential for chemicals in soil to leach to groundwater and may be helpful in determining the need for addressing PFAS-containing soils or other solid material as part of the remedy. SPLP sampling need not be considered if there are no elevated PFAS levels in groundwater. If elevated levels of PFAS are detected in water, and PFAS are also seen in soil, then an SPLP test should be considered to better understand the relationship between the PFAS in the two media.

The TOP Assay can assist in determining the potential PFAS risk at a site. For example, some polyfluoroalkyl substances may transform to form perfluoroalkyl substances, resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from the site. To conceptualize the amount and type of oxidizable perfluoroalkyl substances which could be liberated in the environment, a “TOP Assay” analysis can be performed, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized.

PFAS-containing materials can be made up of per- and polyfluoroalkyl substances that are not analyzable by routine analytical methodology (LC-MS/MS). The TOP assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by current analytical methodology. Please note that analysis of highly contaminated samples, such as those from an AFFF site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. Please consult with a DEC remedial program chemist for assistance interpreting the results.

1,4-Dioxane analysis and reporting: The reporting limit for 1,4-dioxane in groundwater should be no higher than 0.35 µg/L (ppb) and no higher than 0.1 mg/kg (ppm) in soil. Although ELAP offers certification for both EPA Method 8260 and EPA Method 8270 for 1,4-dioxane, DER is advising the use of Method 8270 SIM for water samples and EPA Method 8270 for soil samples. EPA Method 8270 SIM is not necessary for soils if the lab can achieve the required reporting limits without the use of SIM. Note: 1,4-dioxane is currently listed as a VOC in the Part 375 SCO tables but will be moved to the SVOC table with the next update to Part 375.

Refinement of sample analyses: As with other contaminants that are analyzed for at a site, the emerging contaminant analyte list may be refined for future sampling events based on investigative findings. Initially, however, sampling using this PFAS Analyte List and 1,4-dioxane is needed to understand the nature of contamination.

PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

DRAFT

Issue: NYSDEC has committed to analyzing representative groundwater samples at remediation sites for emerging contaminants (1,4-dioxane and PFAS) as described in the below guidance.

Implementation

NYSDEC project managers will be contacting site owners to schedule sampling for these chemicals. Only groundwater sampling is required. The number of samples required will be similar to the number of samples where "full TAL/TCL sampling" would typically be required in a remedial investigation. If sampling is not feasible (e.g., the site no longer has any monitoring wells in place), sampling may be waived on a site-specific basis after first considering potential sources of these chemicals and whether there are water supplies nearby.

Upon a new site being brought into any program (i.e., SSF, BCP), PFAS and 1,4-dioxane will be incorporated into the investigation of groundwater as part of the standard "full TAL/TCL" sampling. Until an SCO is established for PFAS, soil samples do not need to be analyzed for PFAS unless groundwater contamination is detected. Separate guidance will be developed to address sites where emerging contaminants are found in the groundwater. The analysis currently performed for SVOCs in soil is adequate for evaluation of 1,4-dioxane, which already has an established SCO.

Analysis and Reporting

Labs should provide a full category B deliverable including preparation of a DUSR.

The work plan should explicitly describe analysis and reporting requirements.

PFAS sample analysis: Samples should be analyzed by an environmental laboratory certified by ELAP to use EPA method 537 or ISO 25101. ELAP does not currently offer certification for PFAS analysis of non-drinking water samples (including groundwater, soil and sediment), so there is no requirement to use an ELAP certified method. The preferred method is the modified EPA Method 537. Labs have been able to achieve reporting limits for PFOA and PFOS of 2 ng/l (part per trillion). If labs are not able to achieve similar reporting limits, the NYSDEC project manager will make case-by-case decisions as to whether the analysis can meet the needs for the specific site.

PFAS sample reporting: DER has developed a PFAS target analyte list (below) with the intent of achieving reporting consistency between labs for commonly reportable analytes. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. This list may be updated in the future as new information is learned and as labs develop new capabilities. If lab and/or matrix specific issues are encountered for any particular compounds, the NYSDEC project manager will make case-by-case decisions as to whether particular analytes may be temporarily or permanently discontinued from analysis for each site. Any technical lab issues should be brought to the attention of a NYSDEC chemist.

Some sampling using this full PFAS target analyte list is needed to understand the nature of contamination. It may also be critical to differentiate PFAS compounds associated with a site from other sources of these chemicals. Like routine refinements to parameter lists based on investigative findings, the full PFAS target analyte list may not be needed for all sampling intended to define the extent of contamination. Project managers may approve a shorter analyte list (e.g., just the UCMR3 list) for some reporting on a case by case basis.

<u>1,4-Dioxane Analysis and Reporting:</u> The method detection limit (MDL) for 1,4-dioxane should be no higher than 0.28 µg/l (ppb). ELAP offers certification for both EPA Methods 8260 and 8270. In order to get the appropriate detection limits, the lab would need to run either of these methods in “selective ion monitoring” (SIM) mode. DER is advising PMS to use 8270, since this method provides a more robust extraction procedure, uses a larger sample volume, and is less vulnerable to interference from chlorinated solvents (we acknowledge that 8260 has been shown to have a higher recovery in some studies).

Full PFAS Target Analyte List

Perfluoroalkyl sulfonates	**Perfluorobutanesulfonic acid**	**PFBS**	**375-73-5**
	Perfluorohexanesulfonic acid	**PFHxS**	**355-46-4**
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	**PFOS**	**1763-23-1**
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	**PFHpA**	**375-85-9**
	Perfluorooctanoic acid	**PFOA**	**335-67-1**
	Perfluorononanoic acid	**PFNA**	**375-95-1**
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Bold entries depict the 6 original UCMR3 chemicals

Collection of Groundwater Samples for Perfluorooctanoic Acid (PFOA) and Perfluorinated Compounds (PFCs) from Monitoring Wells Sample Protocol

Samples collected using this protocol are intended to be analyzed for perfluorooctanoic acid (PFOA) and other perfluorinated compounds by Modified (Low Level) Test Method 537.

The sampling procedure used must be consistent with the NYSDEC March 1991 <u>SAMPLING GUIDELINES AND PROTOCOLS</u>
http://www.dec.ny.gov/regulations/2636.html with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE) and polypropylene. Additional materials may be acceptable if proven not to contain PFCs. **NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps).** <u>All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials</u> including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse should be considered for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples.

Collect one field duplicate for every sample batch, not to exceed 20 samples.

Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category A or B) and an electronic data deliverable.

EPA 537 Field Sampling Guidelines

Sampling for PFAAs via EPA 537 can be challenging due to the prevalence of these compounds in consumer products. The following guidelines are strongly recommended when conducting sampling.

Reference-NHDES https://www.des.nh.gov/organization/divisions/waste/hwrb/documents/pfc-stakeholder-notification-20161122.pdf

Field Clothing and PPE

- No clothing or boots containing Gore-TexTM
- All safety boots made from polyurethane and PVC
- No materials containing Tyvek®
- Do not use fabric softener on clothing to be worn in field
- Do not used cosmetics, moisturizers, hand cream, or other related products the morning of sampling
- Do not use unauthorized sunscreen or insect repellant (see reference above for acceptable products)

Sample Containers

- All 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

- "PFC-free" water on-site for decontamination of sample equipment. No other water sources to be used.
- Only Alconox and Liquinox can be used as decontamination materials

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

Other Recommendations

Sample for PFCs first! Other containers for other methods may have PFCs present on their sampling containers

Field Equipment

- Must not contain Teflon® (aka PTFE) or LDPE materials
- All sampling materials must be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books can be used
- No plastic clipboards, binders, or spiral hard cover notebooks can be used
- No adhesives (i.e.Post-It Notes) can be used
- Sharpies and permanent markers not allowed; regular ball point pens are acceptable
- Aluminum foil must not be used
- Keep PFC samples in separate cooler, away from sampling containers that may contain PFCs
- Coolers filled with regular ice only. Do not use chemical (blue) ice packs.

EPA Method 537 (PFAS) Sampling Instructions

Please read instructions entirely prior to sampling event.

*Sampler must wash hands before wearing nitrile gloves in order to limit contamination during sampling.

Each sample set* requires a set of containers to comply with the method as indicated below.
*sample set is composed of samples collected from the same sample site and at the same time.

Container Count	Container Type	Preservative
3 Sampling Containers - Empty	250 mL container	Pre preserved with 1.25 g Trizma
Reagent Water for Field Blank use	250 mL container	Pre preserved with 1.25 g Trizma
1 Field Blank (FRB) Container - Empty	250 mL container	Unpreserved

**** Sampling container <u>must be filled to the neck</u>. For instructional purposes a black line has been drawn to illustrate the required fill level for each of the 3 Sample containers****

Field blanks are recommended and the containers have been provided, please follow the instructions below.

Field Blank Instructions:

1. Locate the Reagent Water container from the bottle order. The Reagent Water container will be prefilled with PFAS-free water and is preserved with Trizma.
2. Locate the empty container labeled "Field Blank".
3. Open both containers and proceed to transfer contents of the "Reagent Water" container into the "Field Blank" container.
4. If field blanks are to be analyzed, they need to be noted on COC, and will be billed accordingly as a sample.

Both the <u>empty</u> Reagent Water container and the <u>filled</u> Field Blank container must be returned to the laboratory along with the samples taken.

Sampling Instructions:

1. Each sampling event requires 3 containers to be filled to the neck of the provided containers for each sampling location.
2. Before sampling, remove faucet aerator, run water for 5 min, slow water to flow of pencil to avoid splashing and fill sample containers to neck of container (as previously illustrated) and invert 5 times.
3. Do not overfill or rinse the container.
4. Close containers securely. Place containers in sealed ZipLoc bags, and in a separate cooler (no other container types).
5. Ensure Chain-of-Custody and all labels on containers contain required information.Place sample, Field Blank and empty Reagent Blank containers in ice filled cooler (do not use blue ice) and return to the laboratory. Samples should be kept at 4°C ±2. Samples must not exceed 10°C during first 48 hours after collection. Hold time is 14 days.

Please contact your project manager with additional questions or concerns.