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October 18, 2019

Mr. Christopher Smith
Remedial Project Manager
EPA Region 1
5 Post Office Square, Suite 100
Mail Code OSRR 07-4
Boston, MA 02109-3912

Subject: Nuclear Metals, Inc. Superfund Site
Groundwater Non-Time-Critical Removal Action
Concord, Massachusetts
QAPP Addendum

Dear Mr. Smith:

Attached please find the following Quality Assurance Project Plan (QAPP) elements necessary to include perfluorinated alkyl substances (PFAS) as a groundwater analyte. These are provided as an addendum to the Groundwater NTCRA Removal Design Work Plan QAPP approved on August 31, 2018. These include:

- Table 6.1.3 – Analytical Services Summary
- Table 7.2.1 – Measurement Performance Criteria
- Table 9.2.1 – Analytical Methods, Container, Preservation, and Holding Time Requirements
- Table 13.0.1 – Analytical Instrument Calibration
- Laboratory Analysis Standard Operating Procedure for Determination of Selected Perfluorinated Alkyl Substances by Solid Phase Extraction and Liquid Chromatography / Tandem Mass Spectrometry Isotope Dilution (LC/MS/MS)

Please contact me if you have any questions.

Sincerely,

Bruce Thompson
Project Coordinator

TABLE 6.1.3
ANALYTICAL SERVICES SUMMARY

Medium	**Analytical Parameter**	Proposed in RI/FS	Concentrati on Level	Analytical Method	**SOP1**	**No. Bottles**	**Bottle Size and Type**	Holding Time and Preservation	**Data Package Turn around Time**	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)
Aqueous	TCL VOCs (including Ethyl Alcohol, MTBE, TAME, TBA)	*	Low	5030C/8260C	2108, Rev. 17	3	40-mL septum vial	14 days HCL, pH<2, zero headspace, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	1,4-Dioxane	*	Low	3510C/8270D SIM	2164, Rev. 11	2	1-liter amber glass	Extract within 7 days, analyze within 40 days 4±2 degrees C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	SVOCs and Low-Level PAHs	*	Low	8270D SIM Modified - Low Level PAH	2111, Rev. 14	2	1-liter amber glass	Extract within 7 days, analyze within 40 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	1,2 - Dibromoethane		Low	504.1	2113, Rev. 10	2	40-mL septum vial	Extract within 14 days, $Na_2S_2O_3$, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	Perchlorate		Low	332	2251, Rev.6	2	120 mL plastic cup	Field filter; allow 1/3 headspace in sample bottle; 28 days	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	PFAS		Low	Modifed 537 Isotope Dilution	23528, Rev. 12	2	250mL HDPE with unlined plastic screw cap	Extract within 14 days; analyze within 28 days; 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	Chloride, Bromide, Fluoride, Nitrate-N, Sulfate		Low	300.0	2214, Rev. 6	1	250-mL plastic (chloride, nitrate, sulfate, 500 mL plastic (fluoride)	Extract within 28 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	Chlorine, Total Residual		Low	4500Cl-D	2236, Rev. 6	1	500-mL plastic	**24 hours**, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	Chromium, Hexavalent		Low	7196A	2204, Rev. 7	1	500-mL plastic	**24 hours**, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	Cyanide, Total		Low	4500CN-CE	2210, Rev. 9	1	250-mL plastic	14 days, NaOH, pH>12,4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	Iron, Total	*	Low	200.7	18711, Rev. 3	1	500-mL plastic	180 days HNO_3, pH<2, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186

TABLE 6.1.3
ANALYTICAL SERVICES SUMMARY

Medium	**Analytical Parameter**	Proposed in RI/FS	Concentrati on Level	Analytical Method	**SOP[1]**	**No. Bottles**	**Bottle Size and Type**	Holding Time and Preservation	**Data Package Turn around Time**	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)
Aqueous	Mercury, Total		Low	245.1	18715, Rev. 2	1	500-mL plastic	28 days, HNO_3, pH<2, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	Nitrogen, Ammonia		Low	SM4500	2206, Rev. 7	1	250-mL plastic	28 days, H_2SO_4, pH<2, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	PCBs, Total		Low	8082A	2129, Rev. 6	2	1000-mL amber glass	Extract within 14 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	Solids, Total Suspended (TSS)		Low	SM2540D	2220, Rev. 10	1	1000-mL plastic	7 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	TAL Metals, (except Mercury and Iron)		Low	6020A	2137, Rev. 13	1	500-mL plastic	180 days HNO_3, pH<2, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	TCL PAHs	*	Low	8270D SIM Modified - Low Level PAH	2109, Rev. 11	2	1000-mL amber glass	Extract within 7 days, analyze within 40 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	TPH		Low	1664A	2209, Rev. 10	2	1000-mL amber glass	28 days, HCl, pH<2, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Aqueous	Specialty Metals (molybdenum, thorium, titanium, tungsten, uranium and zirconium)	*	Low	3005A/6020	GL-MA-E-014	1	50-mL plastic	6 months HNO_3, pH<2, 4°C	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Aqueous	Hardness, Total as CaCO3	*	Low	SM2340B	GL-GC-E-025	1	250-mL plastic	6 months HNO_3, pH<2, 4°C	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Aqueous	TOC	*	Low	415.1	GL-GC-E-062	2	250-mL plastic	28 days H_2SO_4, pH<2, zero headspace, 4°C	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Aqueous	Gamma Emitting Radionuclides	*	Low/Medium	Gamma Spectroscopy	GL-RAD-A-013	1	2000-ml plastic	6 months HNO_3, pH<2	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Aqueous	Uranium and Thorium Isotopes	*	Low/Medium	Alpha Spectroscopy	GL-RAD-A-011	2	1000-mL plastic	6 months HNO_3, pH<2	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171

TABLE 6.1.3
ANALYTICAL SERVICES SUMMARY

Medium	**Analytical Parameter**	Proposed in RI/FS	Concentrati on Level	Analytical Method	**SOP1**	**No. Bottles**	**Bottle Size and Type**	Holding Time and Preservation	**Data Package Turn around Time**	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)
Aqueous	Hard to Detect Radionuclides	*	Low/Medium	Various (Gas Flow, Liquid Scintillation, Gamma Spectroscopy)	GL-RAD-A-032 GL-RAD-A-035 GL-RAD-A-004 GL-RAD-A-005	3	1000-mL plastic	6 months HNO_3, pH<2	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Aqueous	Ferrous Iron	*	Low	SM 3500 – Fe-D	GL-GC-E-099	1	250-mL amber glass	HCL, 4oC 24 hours	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Aqueous	Ferric Iron	*	Low	SM 3500 – Fe-D	GL-GC-E-099 GL-GC-E-014	1	250-mL amber glass	HCL, 4oC 24 hours	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Aqueous	Sulfide	*	Low	EPA 376.2/HACH 8131	GL-GC-E-052	1	1-liter plastic	7 days Zinc acetate and NaOH to pH>9, 4oC	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Aqueous	Sulfate, Nitrite, Nitrate, Fluoride	*	Low	EPA 300.0 or SW846 9056	GL-GC-E-086	1	250-mL plastic (chloride, nitrate, sulfate, 500 mL plastic (fluoride)	48 hours for Nitrate & Nitrite, 28 days for Sulfate and Fluoride 4oC	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Aqueous	EPH		Low	MADEP	GL-OA-E-003	2	1-liter amber glass	Extract within 14 days, analyze within 40 days HCL, pH<2, 4oC	21 Days	General Engineering1 Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Aqueous	TCLP		Low	1311	GL-LB-E-006	Metals: 1 VOCs: 1 Extractable: 3	Metals: 250-mL plastic VOCs: 40-mL Extractable: 1-liter amber glass	Metals: If less than 5% solids, analyze within 6 months (28 days for Hg) VOCs: If less than 5% solids, analyze within 14 days SVOC, Pest/PCBs: If less than 5% solids, extract within 7 days, analyze within 40 days 4oC	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171

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ANALYTICAL SERVICES SUMMARY

Medium	**Analytical Parameter**	Proposed in RI/FS	Concentrati on Level	Analytical Method	**SOP1**	**No. Bottles**	**Bottle Size and Type**	Holding Time and Preservation	**Data Package Turn around Time**	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)
Solid	TCL VOCs (including Ethyl Alcohol, MTBE, TAME, TBA)	*	Low	5030C/8260C	2108, Rev. 17	3	40-mL vial with stirbar	14 days , 5-mLdi H_2O, 4±2°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Solid	1,4-Dioxane	*	Low	3510C/8270D SIM	2164, Rev. 11	1	8 oz amber glass with a Teflon lined screw lid	Extract within 14 days, analyze within 40 days 4±2 °C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Solid	TCL SVOCs	*	Low	8270D	2111, Rev. 14	1		Extract within 14 days, analyze within 40 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Solid	Chloride, Bromide, Fluoride, Nitrate, Nitrite, Sulfate		Low	300.0	2214, Rev. 6	1	4-oz amber glass	Extract within 28 days expect Nitrate/Nitrite, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Solid	Chromium, Hexavalent		Low	7196A	2204, Rev. 7	1	4-oz amber glass	30 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Solid	Cyanide, Total		Low	4500CN-CE	2210, Rev. 9	1	4-oz amber glass	14 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Solid	Iron, Total	*	Low	200.7	18711, Rev. 3	1	250-mL wide mouth jar	180 days 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Solid	Nitrogen, Ammonia		Low	SM4500	2206, Rev. 7	1	4-oz amber glass	28 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Solid	PCBs, Total		Low	8082A	2129, Rev. 6	1	4-oz amber glass	Extract within 14 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Solid	TCL PAHs	*	Low	8270D Low Level PAH	2109, Rev. 11	1	4-oz amber glass, Teflon lined	Extract within 14 days, analyze within 40 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Solid	TPH		Low	1664A	2209, Rev. 10	1	4-oz amber glass, Teflon lined	28 days, 4°C	5 Days	Alpha Analytical, Inc., 8 Walkup Drive, Westborough, MA 01581, Karyn Raymond, 508*439*5186
Solid	Specialty Metals (molybdenum, thorium, titanium, tungsten, uranium and zirconium)	*	Low/Medium	3050A/6020	GL-MA-E-014	1	Plastic, Glass as long as no B or Si is required) - 2g	6 months, 4°C	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171

TABLE 6.1.3
ANALYTICAL SERVICES SUMMARY

Medium	**Analytical Parameter**	Proposed in RI/FS	Concentrati on Level	Analytical Method	**SOP[1]**	**No. Bottles**	**Bottle Size and Type**	Holding Time and Preservation	**Data Package Turn around Time**	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)
Solid	SPLP Metals		Medium	1312/6020	GL-LB-E-024	1	Plastic or glass depending on test 130 g	Leach within 28 days; analyze within 6 months (28 days for Hg) 4°C	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Solid	AVS:SEM	*	Low/Medium	USEPA 1991	Proprietary	1	2-oz amber glass filled completely	14 days, 4°C	21 Days	Woods Hole Group 81 Technology Park Drive East Falmouth, MA 02536 Mr. Jerry Zschau 508*822*9300
Solid	Grain size		N/A	ASTM D422	ASTMD422 – Method Followed (no SOP)	1	Any type of container (500 gams minimum of sample)	None	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Solid	TOC	*	Low/Medium	9060	GL-GC-E-062	1	8-oz amber glass	28 days, 4°C	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Solid	EPH	*	Low/Medium	MADEP/8015	GL-OA-E-003	1	8-oz amber glass	Extract within 14 days, analyze within 40 days, 4°C	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Solid	Gamma Emitting Radionuclides	*	Low/Medium	Gamma Spectroscopy	GL-RAD-A-013	1	250-mL plastic	6 months	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Solid	Uranium and Thorium Isotopes	*	Low/Medium	Alpha Spectroscopy	GL-RAD-A-011	1	250-mL plastic	6 months	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Solid	Hard to Detect Radionuclides	*	Low	Various (Gas Flow, Liquid Scintillation, Gamma Spectroscopy)	GL-RAD-A-032 GL-RAD-A-035 GL-RAD-A-004 GL-RAD-A-005	1	250-mL plastic	6 months	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171
Solid	TCLP	*	Low	1311	GL-LB-E-006	1	16-oz amber glass, 40 mL vial (VOA)	Leach within 14 days, except metals which are 28 days VOC: 14 days SVOC, PEST/PCBs: extract within 7 days; analyze within 40 days; Inorganics: 6 months (28 days for Hg), 4°C	21 Days	General Engineering Laboratories, LLC 2040 Savage Road Charleston, SC 29417 Ms. Edie Kent 843*556*8171

TABLE 6.1.3
ANALYTICAL SERVICES SUMMARY

Medium	**Analytical Parameter**	Proposed in RI/FS	Concentrati on Level	Analytical Method	**SOP[1]**	**No. Bottles**	**Bottle Size and Type**	Holding Time and Preservation	**Data Package Turn around Time**	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)
Soil Vapor	VOCs		Low	TO-14	Proprietary	1	6-liter Summa Canister	14 days	21 Days	Air Toxics LTD 180-B Blue Ravine Road Folsom, CA 95630 Ms. Dede Dodge 800*985*5955

NOTES:
VOCs = Volatile Organic Compounds
TICs = tentatively identified compounds SVOCs = semivolatile organic compounds EPH = extractable petroleum hydrocarbons PCBs = polychlorinated biphenyls
PAHs = polynuclear aromatic hydrocarbons TOC = total organic carbon
TCL = target compound list TAL = target analyte list
TCLP = toxicity characteristic leaching procedure SPLP = synthetic precipitation leaching procedure
AVS:SEM = acid volatile sulfide:simultaneously extractable metals
1 = Analysis may be subcontracted to GEL, Ohio to accommodate holding time/analytical requirements.

TABLE 7.2.1
MEASUREMENT PERFORMANCE CRITERIA

Medium/Matrix	Aqueous
Analytical Parameter	PFAS
Concentration Level	LOW

Sampling Procedure	Analytical Method	Data Quality Indicators (DQIs)	Measurement Performance Criteria Goals	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
QAPP Section 9.0	Modified 537 Isotope Dilution	Precision	RPD ±30% (for analytes 2X RL)	Field duplicates, Lab Duplicates	S
		Precision	RPD<30	MS/MSD	A
		Accuracy/Bias	50-150% Recovery (lab limits) 70-130% Recovery (validation criteria)	MS/MSD	A
		Accuracy/Bias - Lab	50-150 % Recovery (lab limits) 70-130% Recovery (validation limits)	Laboratory Control Sample (LCS)	A
		Accuracy/Bias	No target compounds > ½ RLs	Field, Equipment Rinse, Method Blanks,	S & A
		Sensitivity	Within 2 to 3 times the detection limit	Annual Limit of Detection (LOD) Check	A

TABLE 9.2.1
ANALYTICAL METHODS, CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS

ANALYTE	MEDIUM	ANALYSIS	NO. OF BOTTLES	BOTTLE SIZE AND TYPE	PRESERVATIVE	HOLDING TIME
VOCs	Aqueous	8260C	3	40-mL septum vial	HCl, pH < 2, zero headspace and 4±2°C	14 days
1,4-Dioxane	Aqueous	8270D-SIM Modified	2	1-liter amber glass	4±2°C	Extract within 7 days; analyze within 40 days
SVOCs	Aqueous	8270C	2	1-liter amber glass	4±2°C	Extract within 7 days; analyze within 40 days
1,2-Dibromoethane	Aqueous	504.1	2	40-mL amber glass, Teflon lined	Na2S2O3, 4°C	Extract within 14 days
Chloride, fluoride, nitrate, sulfate	Aqueous	300.0	1	250-mL plastic (chloride, nitrate, sulfate, 500 mL plastic (fluoride)	4°C	Extract Chloride within 28 days, 48 hours for Nitrate; 28 days for Fluoride & Sulfate
Chlorine, Total Residual	Aqueous	4500Cl-D	1	500-mL plastic	4°C	24 hours

TABLE 9.2.1
ANALYTICAL METHODS, CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS

ANALYTE	MEDIUM	ANALYSIS	NO. OF BOTTLES	BOTTLE SIZE AND TYPE	PRESERVATIVE	HOLDING TIME
Chromium, Hexavalent	Aqueous	7196A	1	500-mL plastic	4°C	24 hours
Cyanide, Total	Aqueous	4500CN-CE	1	250-mL plastic	NaOH, pH>12, 4°C	14 days
Iron, Total	Aqueous	200.7	1	500-mL plastic	HNO3, pH<2, 4°C	180 days
Mercury, Total	Aqueous	245.1	1	500-mL plastic	HNO3, pH<2, 4°C	28 days
Nitrogen, Ammonia	Aqueous	SM4500	1	250-mL plastic	H2SO4, pH<2, 4°C	28 days
Perchlorate	Aqueous	332.0	2	120 mL plastic cup	Filter; leave 1/3 headspace	28 days
PFAS	Aqueous	Modified 537 Isotope Dilution	2	250mL HDPE with unlined plastic screw cap	4°C	Extract within 14 days; analyze within 28 days
PCBs, Total	Aqueous	8082A	2	1000-mL amber glass	4°C	Extract within 14 days

TABLE 9.2.1
ANALYTICAL METHODS, CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS

ANALYTE	MEDIUM	ANALYSIS	NO. OF BOTTLES	BOTTLE SIZE AND TYPE	PRESERVATIVE	HOLDING TIME
Solids, Total Suspended	Aqueous	SM2540D	1	1000-mL plastic	4°C	7 days
TAL Metals, (except Mercury and Iron)	Aqueous	200.8	1	500-mL plastic	HNO3, pH<2, 4°C	180 days
TCL PAHs	Aqueous	8270D Low Level PAH	2	1000-mL amber glass	4°C	Extract within 7 days, analyze within 40 days
TPH	Aqueous	1664A	2	1000-mL amber glass	HCl, pH<2, 4°C	28 days
Hardness	Aqueous	SM2340B	1	250-mL plastic	HNO_3, pH <2, 4±2°C	6 months
TOC	Aqueous	415.1	2	250-mL amber glass	H_2SO_4, pH < 2, zero headspace and 4±2°C	28 days
Gamma Emitting Radionuclides	Aqueous	HASL 300, 4.5.2.3, EPA 901.1	1	2000-mL plastic	HNO_3, pH <2	6 months
Uranium and Thorium Isotopes	Aqueous	HASL 300 U-20-Rc Mod, HASL 300 Th-01-Rc Mod	2	1000-mL plastic	HNO_3, pH <2	6 months
Hard to Detect Radionuclides	Aqueous	HASL 300 Pu-11-RC, HASL 300 Am-05-RC, HASL 300, EPA 905.0, HASL 300 Tc-02-Rc Mod	3	1000-mL plastic	HNO_3, pH <2	6 months

TABLE 9.2.1
ANALYTICAL METHODS, CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS

ANALYTE	MEDIUM	ANALYSIS	NO. OF BOTTLES	BOTTLE SIZE AND TYPE	PRESERVATIVE	HOLDING TIME
Ferrous Iron	Aqueous	SM 3500 – Fe-D	1	250-mL amber glass	Filtered prior to preservation; HCL pH <2, 4±2°C	filtration within 24 hours, 6 months
Ferric Iron	Aqueous	SM 3500 – Fe-D	1	250-mL amber glass	HCL, pH<2, 4±2°C	6 months
Sulfide	Aqueous	EPA 376.2/HACH 8131	1	1-liter plastic	Zinc acetate and NaOH to pH>9, 4±2°C	7 days
MADEP EPH	Aqueous	8015	2	1-liter amber glass	HCL, pH < 2, 4±2°C	Extract within 7 days, analyze within 40 days
TCLP Volatiles	Aqueous	1311/8260B	1	40 ml vial	4±2°C	If less than 5% solids, analyze within 14 days
TCLP Metals	Aqueous	1311/6020/7470A	1	250 ml plastic	4±2°C	If less than 5% solids, analyze within 6 months (Hg 28 days)

TABLE 9.2.1
ANALYTICAL METHODS, CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS

ANALYTE	MEDIUM	ANALYSIS	NO. OF BOTTLES	BOTTLE SIZE AND TYPE	PRESERVATIVE	HOLDING TIME
TCLP Extractable	Aqueous	1311/8270C/8081A/8151A	3	1-liter amber glass	4±2°C	If less than 5% solids, extract within 7 days, analyze within 40 days
VOCs	Solid	8260C	3	40 mL vial with stir bar	4±2°C, 5-mL di H_2O	Freeze within 48 hours, ,14 days for analysis
1,4-Dioxane	Solid	8270D	1	8 oz. amber glass with a Teflon lined screw lid	4±2°C	Extract within 14 days; analyze within 40 days
Chloride, bromide, fluoride, nitrate, nitrite, sulfate	Solid	300.0	1	4 oz glass	4°C	28 Days (extraction) except Nitrate/Nitrite
Chromium, Hexavalent	Solid	7196A	1	4 oz amber glass	4°C	30 days
Cyanide, Total	Solid	4500CN-CE	1	4 oz amber glass	4°C	14 days

TABLE 9.2.1
ANALYTICAL METHODS, CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS

ANALYTE	MEDIUM	ANALYSIS	NO. OF BOTTLES	BOTTLE SIZE AND TYPE	PRESERVATIVE	HOLDING TIME
Iron, Total	Solid	200.7	1	250-mL wide mouth jar	4°C	180 days
Nitrogen, Ammonia	Solid	SM4500	1	4 oz amber glass	4°C	28 days
PCBs, Total	Solid	8082A	1	4 oz amber glass, Teflon lined	4°C	Extract within 14 days
TCL PAHs	Solid	8270D Low Level PAH	1	4 oz ambler glass, Teflon lined	4°C	Extract within 14 days, analyze within 40 days
TPH	Solid	1664A	1	4 oz amber glass, Teflon lined	4°C	28 days
AVS:SEM	Solid	USEPA 1991	1	2 oz amber glass filled completely	4±2°C	14 days

TABLE 9.2.1
ANALYTICAL METHODS, CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS

ANALYTE	MEDIUM	ANALYSIS	NO. OF BOTTLES	BOTTLE SIZE AND TYPE	PRESERVATIVE	HOLDING TIME
Grain Size	Solid	ASTM D422	1	Any type of container (500 grams minimum of	None	None
TOC	Solid	9060	1	8 oz. amber glass	4±2°C	28 days
MADEP EPH	Solid	8015	1	8 oz. amber glass	4±2°C	Extract within 14 days; analyze within 40 days
Gamma Emitting Radionuclides	Solid	HASL 300, 4.5.2.3, EPA 901.1	1	250 ml plastic	None	6 months
Uranium and Thorium Isotopes	Solid	HASL 300 U-20-Rc Mod, HASL 300 Th-01-Rc Mod	1	250 ml plastic	None	6 months
Hard to Detect Radionuclides	Solid	HASL 300 Pu-11-RC, HASL 300 Am-05-RC, HASL 300, EPA 905.0, HASL 300 Tc-02-Rc Mod	1	250 ml plastic	None	6 months

TABLE 9.2.1
ANALYTICAL METHODS, CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS

ANALYTE	MEDIUM	ANALYSIS	NO. OF BOTTLES	BOTTLE SIZE AND TYPE	PRESERVATIVE	HOLDING TIME
TCLP – Full Suite	Solid	1311/8260B/8270C/8081A /8151A	1	16 oz. amber glass 40 mL vial (VOA)	4±2°C	Leach within 14 days, except metals which are 28 days VOC: 14 days
VOCs	Soil Vapor	TO-14	1	6-liter Summa Canister	None	14 days

Notes:
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
PCBs = polychlorinated biphenyls
Hg = mercury
TCLP = toxicity characteristic leaching procedure
CVAA = Cold Vapor Atomic Absorption
USEPA = United States Environmental Protection Agency
MADEP = Massachusetts Department of Environmental Protection
HCl = Hydrochloric Acid
HNO_3 = Nitric Acid
mL = milliliters

TABLE 13.0.1
(AQUEOUS)

Medium/Matrix	**Aqueous**					
Analytical Parameter	PFAS by Modified 537 Isotope Dilution					
Concentration Level	Low					
Analytical Method/ SOP Reference	23528 Rev. 12					
Laboratory Name	Alpha Analytical					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	One blank per day or per prep batch not to exceed 20 samples; whichever is more frequent	No detections > ½ RL	Re-inject the blank. If failure continues, sample analysis is terminated; corrective action is needed and may involve re-extraction of the batch after source of contamination is	Analysts/Supervisor	Contamination	< ½ RL
Tune	Prior to initial calibration; sample analysis	Defined in SOP.	Adjust mass calibration	Analysts/Supervisor		Defined in SOP.
Initial Calibration	After Tune	R^2 > 0.99;low standard 50-150% of true value; all other standards 70-130% of true value.	Recalibrate	Analysts/Supervisor	Accuracy	R^2 > 0.99;low standard 50-150% of true value; all other standards 70-130% of true value.
Initial calibration verification (ICV)-Second source	After IC	70-130% Recovery	Reanalyze/ if ICV fails again, investigate source of error, correct, and recalibrate	Analysts/Supervisor	Accuracy	70-130% Recovery
Continuing Calibration Verification (CCV)	Low concentration standard at the beginning of each sequence; alternate medium and low concentration every 10 injections.	All target analytes must be within ±30% of true value; all extraction injection standards (EIS) must be within ±50% of true value.	Reinject, and terminate the analyses if failure continues	Analysts/Supervisor	Accuracy	Recoveries must be 70-130% for all but lowest and 50-150% for lowest concentration. Alternate concentrations should be used. All extraction injection standards (EIS)[1] must be within ±40% of true value.
RL standard	Beginning of each sequence;	50-150%	Reinject, and terminate the analyses if failure continues	Analysts/Supervisor	Accuracy	50-150%
Matrix Spike/Matrix Spike Duplicate	1 per batch of 20 samples of the same matrix	50-150% Recovery	Reanalyze if analytical error is suspected. Note in the narrative.	Analysts/Supervisor	Accuracy/bias	70-130% Recovery

TABLE 13.0.1
(AQUEOUS)

Duplicate	1 per 20. Can be performed on a field sample, MS or LCS	RPD<30 for analytes >2X RL.	Reanalyze if analytical error is suspected. Note in the narrative.	Analysts/Supervisor	Accuracy/bias	;RPD<30 for analytes >2X RL.
LCS	One per prep batch up to 20 samples of the same matrix. If no MS/MSD, then perform LCS/LCSD	50-150 % Recovery	Reanalyze if analytical error is suspected. If still out of control reanalyze the LCS and the associated samples.	Analysts/Supervisor	Accuracy/bias	70-130 % Recovery
Extraction Internal Standards (EISs)[1]	All standards, QC samples and samples	±50% of EIS response in opening CCV	Reanalyze	Analysts/Supervisor	Accuracy/bias	±30%; <10% non-detects will be rejected

[1] – Labeled Analogs

RPD = relative percent difference
RL = reporting limit

IC initial calibration
RT- retention time
CCV-continuing calibration standard
LCS = laboratory control sample