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SUPERFUND TECHNICAL ASSESSMENT & RESPONSE TEAM V
EPA CONTRACT NO.: 68HE0319D0004

April 21, 2021

Mr. Peter Lisichenko, On-Scene Coordinator
U.S. Environmental Protection Agency, Region II
Superfund and Emergency Management Division
2890 Woodbridge Avenue
Edison, NJ 08837

EPA CONTRACT No: 68HE0319D0004
TD No.: TO-0036-0021
DC No.: STARTV-02-D-0127
SUBJECT: SITE-SPECIFIC UFP QUALITY ASSURANCE PROJECT PLAN
HOLY TRINITY CEMETERY SITE, AREA 6 & 7
LEWISTON, NIAGARA COUNTY, NEW YORK

Dear Mr. Lisichenko,

Enclosed please find the Site-Specific Uniform Federal Policy (UFP) Quality Assurance Project Plan for the Removal Action (RV2) activities to be conducted by the U.S. Environmental Protection Agency, Region II (EPA) with the support of Weston Solutions, Inc., Superfund Technical Assessment & Response Team V (START V) at the Holy Trinity Cemetery Site, Area 6 & 7 (the Site) in Lewiston, Niagara County, New York. The RV2 activities will begin at the Site on April 26, 2021.

If you have any questions or comments, please do not hesitate to contact me at (732) 425-1175.

Sincerely,

WESTON SOLUTIONS, INC.

Sean Quinn
START V Site Project Manager

Enclosure:
cc: TD File: TO-0036-0021

SITE-SPECIFIC UFP QUALITY ASSURANCE PROJECT PLAN

HOLY TRINITY CEMETERY SITE, AREA 6 & 7

Lewiston, Niagara County, New York

Site Code: A23M
CERCLIS Code: NYN000206698

Prepared by:

Superfund Technical Assessment & Response Team V
Weston Solutions, Inc.
Federal East Division
Edison, New Jersey 08837

Prepared for:

U.S. Environmental Protection Agency, Region II
Superfund and Emergency Management Division
2890 Woodbridge Avenue
Edison, New Jersey 08837

DC No: STARTV-02-D-0127
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April 2021

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LIST OF ATTACHMENTS

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ATTACHMENT B: Standard Operating Procedures (SOPs)
- ERT SOP # 2001: General Field Sampling Guidelines
- ERT SOP # 2012: Soil Sampling
- ERT SOP # 2078: Operation of DustTrak
- Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)
- NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation, May 3, 2010
- Field Sampling Protocols to Avoid Cross-Contamination at Perfluorinated Chemical Sites
- Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) NYSDEC Part 375 Remedial Program, October 2020

ATTACHMENT C: Action Levels
- EPA Removal Management Levels (RMLs)
- NYSDEC Residential Use Soil Cleanup Objectives (RUSCO)

ATTACHMENT D: Laboratory Method Detection Limits

LIST OF ACRONYMS

ADR	Automated Data Review
ANSETS	Analytical Services Tracking System
AOC	Acknowledgment of Completion
ASTM	American Society for Testing and Materials
CEO	Chief Executive Officer
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Program
CFM	Contract Financial Manager
CO	Contract Officer
COI	Conflict of Interest
COO	Chief Operations Officer
CRDL	Contract Required Detection Limit
CRTL	Core Response Team Leader
CRQL	Contract Required Quantitation Limit
CQLOSS	Corporate Quality Leadership and Operations Support Services
CWA	Clean Water Act
DCN	Document Control Number
DI	Deionized Water
DPO	Deputy Project Officer
DQI	Data Quality Indicator
DQO	Data Quality Objective
EM	Equipment Manager
EDD	Electronic Data deliverable
ENVL	Environmental Unit Leader
EPA	Environmental Protection Agency
ERT	Environmental Response Team
FASTAC	Field and Analytical Services Teaming Advisory Committee
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/MS	Gas Chromatography/Mass Spectrometry
HASP	Health and Safety Plan
HRS	Hazard Ranking System
HSO	Health and Safety Officer
ITM	Information Technology Manager
LEL	Lower Explosive Limit
LSASD	Laboratory Services and Applied Science Division
MSA	Mine Safety Appliances
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration

LIST OF ACRONYMS (Concluded)

OSWER	Office of Solid Waste and Emergency Response
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, Sensitivity
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PIO	Public Information Officer
PM	Program Manager
PO	Project Officer
PRP	Potentially Responsible Party
PT	Proficiency Testing
QA	Quality Assurance
QAL	Quality Assurance Leader
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RC	Readiness Coordinator
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
RSCC	Regional Sample Control Coordinator
RST	Removal Support Team
SARA	Superfund Amendments and Reauthorization Act
SEDD	Staged Electronic Data Deliverable
SOP	Standard Operating Practice
SOW	Statement of Work
SPM	Site Project Manager
START	Superfund Technical Assessment & Response Team
STR	Sampling Trip Report
TAL	Target Analyte List
TD	Technical Direction Document
TDL	Technical Direction Letter
TO	Task Order
TQM	Total Quality Management
TSCA	Toxic Substances Control Act
UFP	Uniform Federal Policy
VOA	Volatile Organic Analysis

TABLE 1: Crosswalk

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
A. Project Management and Objectives			
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7, & 8	Personnel Qualifications and Sign-Off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certifications
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
10	Conceptual Site Model (CSM)	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP ELEMENTS FOR EVALUATING EXISTING DATA
14 & 16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection/Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
B. Measurement/Data Acquisition			
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field Quality Control (QC) Sample Summary	2.3.5	QC Requirements
21	Field Standard Operating Procedures (SOPs)	2.3.2	Sampling Procedures and Requirements

TABLE 1: Crosswalk (Concluded)

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
B. Measurement/Data Acquisition			
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical QC and Corrective Action	2.3.5	QC Requirements
29	Project Documents and Records	2.2.8	Document and Records Requirements
C. Assessment/Oversight			
31, 32, & 33	Assessments and Corrective Action	2.4	ASSESSMENTS AND DATA REVIEW (CHECK)
		2.5.5	Reports to Management
D. Data Review			
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

QAPP Worksheet #1& 2: Title and Approval Page

1. Project Identifying Information

a) Site Name/Project Name: Holy Trinity Cemetery Site

b) Site Location/No.: Lewiston, Niagara County, New York / NYN000206698

c) Contract/Work Assignment No.: 68HE0319D0004 / TDD#: 0036-0021

2. Lead Organization

Weston Solutions, Inc.
1090 King Georges Post Road, Suite 201
Edison, New Jersey 08837

Lead Organization's Site Project Manager:

Sean Quinn		04/21/2021
Printed Name/Title	Signature	Date

Lead Organization's Technical Review:

Bernard Nwosu		4/21/2021
Printed Name/Title	Signature	Date

Lead Organization's QA/QC Chemist:

Smita Sumbaly		4/21/2021
Printed Name/Title	Signature	Date

EPA Region II On-Scene Coordinator:

Peter Lisichenko		
Printed Name/Title	Signature	Date

EPA Region II Quality Assurance Officer:

Printed Name/Title	Signature	Date

QAPP Worksheet #1& 2: Title and Approval Page (Concluded)

3. List plans and reports from previous investigation relevant to this project.

08/06/2015, Stie-Specific QAPP, Holy Trinity Cemetery Radiological Assessment, (RST3-02-D-0037)

04/12/2016, Site-Specific QAPP- Radiological Survey, Holy Trinity Cemetery Radiological Assessment, (RST3-02-D-0250)

08/17/2016, Site-Specific UFP Quality Assurance Project Plan, Holy Trinity Cemetery Assessment, (RST3-03-D-0230)

05/02/2017, Site-Specific UFP QAPP, Revision 1, Holy Trinity Cemetery Assessment, (RST3-03-D-0258)

09/11/2019, Removal Assessment Report, Area 6 and 7, Holy Trinity Cemetery, (STARTV-01-D-0065)

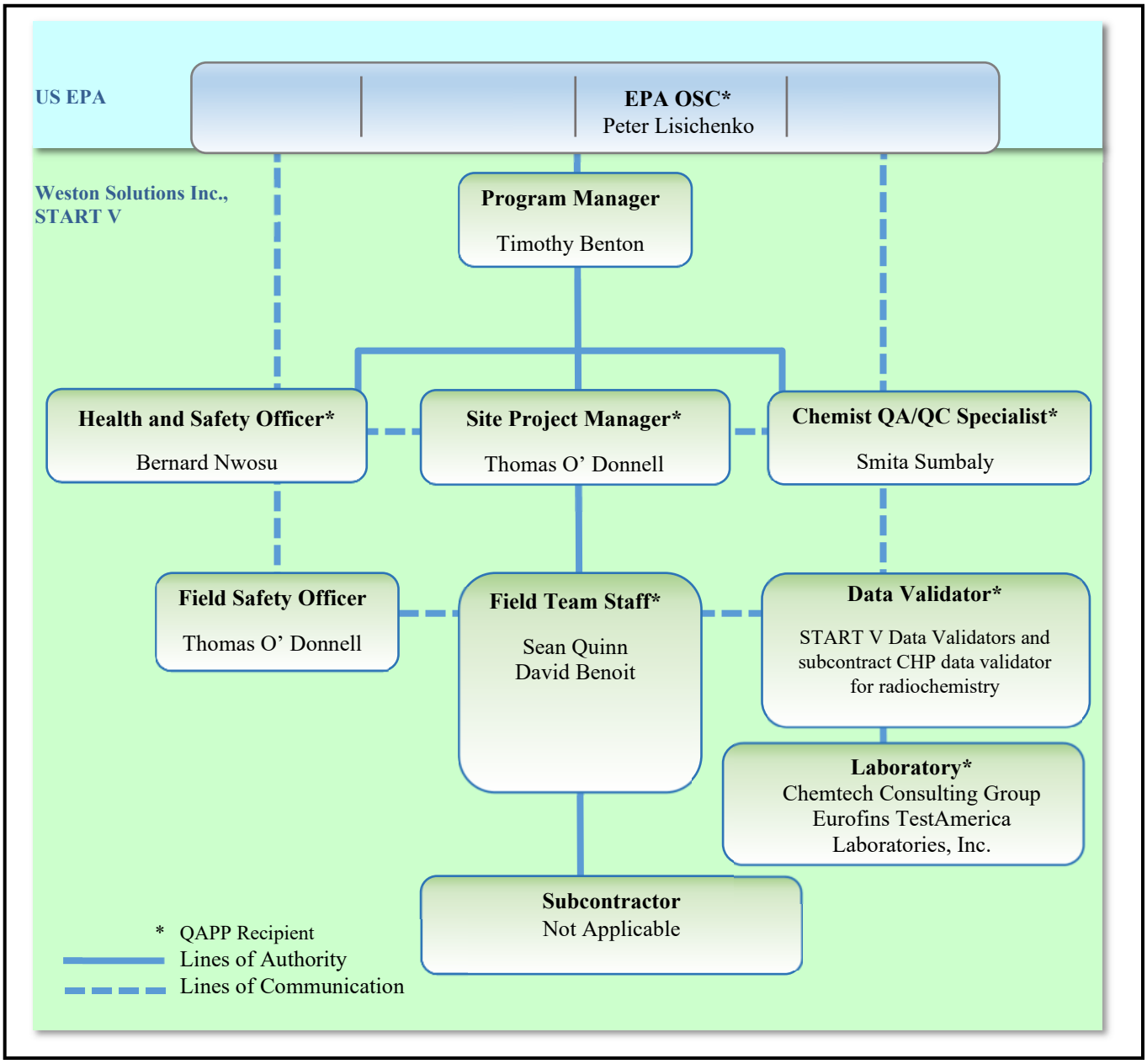
11/05/2020 Site-Specific UFP QAPP, Holy Trinity Cemetery Assessment, (STARTV-02-D-0059)

01/03/2021 Removal Action Sampling Report – Area 6 and 7 (STARTV-02-D-0109)

Exclusions:

Not applicable.

QAPP Worksheet #3 & 5: Project Organizational and QAPP Distribution



Acronyms:
EPA – U.S. Environmental Protection Agency
OSC – On-Scene Coordinator
QA/QC – Quality Assurance/Quality Control
START V – Superfund Technical Assessment & Response Team V
QAPP – Quality Assurance Project Plan

QAPP Worksheet #3 & 5: Project Organizational and QAPP Distribution (Concluded)

QAPP Recipient	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Peter Lisichenko	OSC	EPA, Region II	(347) 276-6251	Not Applicable	lisichenko.peter@epa.gov	STARTV-02-D-0127
Thomas O' Donnell	Field Personnel	Weston Solutions, Inc., START V	(732) 585-4441	Not Applicable	Thomas.ODonnell@WestonSolutions.com	STARTV-02-D-0127
Sean Quinn	SPM	Weston Solutions, Inc., START V	(732) 585-4411	Not Applicable	Sean.Quinn@WestonSolutions.com	STARTV-02-D-0127
David Benoit	Field Personnel	Weston Solutions, Inc., START V	(732) 585-4449	Not Applicable	David.Benoit@westonsolutions.com	STARTV-02-D-0127
Smita Sumbaly	QAO	Weston Solutions, Inc., START V	(732) 585-4410	Not Applicable	s.sumbaly@westonsolutions.com	STARTV-02-D-0127
Bernard Nwosu	HSO	Weston Solutions, Inc., START V	(732) 585-4413	Not Applicable	Ben.Nwosu@westonsolutions.com	STARTV-02-D-0127
Site TD File	START V Site TD File	Weston Solutions, Inc., START V	Not Applicable	Not Applicable	Not Applicable	STARTV-02-D-0127

QAPP – Quality Assurance Project Plan
EPA – U.S. Environmental Protection Agency
OSC – On-Scene Coordinator
SPM – Site Project Manager
START V – Superfund Technical Assessment & Response Team V
QAO – Quality Assurance Officer
HSO – Health & Safety Officer
TD – Technical Direction

QAPP Worksheet #4, 7 & 8: Personnel Qualification and Sign-off Sheet

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates[1]	Date of Training
[Specify location of training records and certificates for samplers]							
QAPP Training	This training is presented to all START V personnel to introduce the provisions, requirements, and responsibilities detailed in the UFP QAPP. The training presents the relationship between the site-specific QAPPs, SOPs, work plans, and the Generic QAPP. QAPP refresher training will be presented to all employees following a major QAPP revision.	Weston Solutions, Inc., (In House Training)	As needed	All START V field personnel upon initial employment and as refresher training	Weston Solutions, Inc.	Within Division	August 2020
Health & Safety Training	Health and safety training will be provided to ensure compliance with Occupational Safety and Health Administration (OSHA) as established in 29 CFR 1910.120.	Weston Solutions, Inc., (In House Training)	Yearly at a minimum	All Employees upon initial employment and as refresher training every year	Weston Solutions, Inc.	Within Division	March 2021
Others	Scribe, ICS 100 and 200, and Air Monitoring Equipment Trainings provided to all employees	EPA ERT (In-House Training) FEMA (On-line Training) Weston Solutions, Inc., (In House training)	Upon initial employment and as needed				March 2021
	Dangerous Goods Shipping	Weston Solutions, Inc., (In House Training)	Every 3 years				March 2021

All team members are trained in the concepts and procedures in recognizing opportunities for continual improvement, and the approaches required to improve procedures while maintaining conformance with legal, technical, and contractual obligations.

[1]All members, including subcontractors, certifications are in possession of Health & Safety Officer.

QAPP Worksheet #4, 7 & 8: Personnel Qualification and Sign-off Sheet

Organization: Weston Solutions, Inc., START V

Name*	Project Title/Role	Education and Experience Qualifications	Specialized Training/ Certifications	Organizational Affiliation	Signature	Date
Sean Quinn	SPM, START V	3+ year*	Implementing and executing technical, QA and health and safety during sampling event, sample collection and sample management.	Weston Solutions, Inc.		4/21/2021
Thomas O' Donnell	Field Personnel, START V	2+ years*	Sample Collection/Sample Management	Weston Solutions, Inc.		4/21/2021
David Benoit	Field Personnel, START V	2+ years*	Sample Collection/Sample Management	Weston Solutions, Inc.		4/21/2021
Bernard Nwosu	HSO, START V	25+ years*	Remote support during execution of sampling event, Health and Safety Officer	Weston Solutions, Inc.		4/21/2021
Smita Sumbaly	QAO, START V	30+ years*	Chemist QA/QC Specialist	Weston Solutions, Inc.		4/21/2021

*All START V members and subcontractor's resumes are in possession of Program Manager, EPA Project Officer, and Contracting officers
SPM – Site Project Manager
START V – Superfund Technical Assessment & Response Team V
QAO – Quality Assurance Officer
HSO – Health & Safety Officer
QA/QC – Quality Assurance/Quality Control

Organization: EPA Region II

Name	Project Title/Role	Education and Experience Qualifications	Specialized Training/ Certifications	Organizational Affiliation	Signature	Date
Peter Lisichenko	EPA OSC	NA	All project coordination, direction and decision making.	EPA, Region II		

EPA – U.S. Environmental Protection Agency
OSC – On-Scene Coordinator

QAPP Worksheet #6: Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Point of contact with EPA OSC	SPM, Weston Solutions, Inc., START V	Thomas O'Donnell	(732) 585-4441	All technical, QA and decision-making matters in regard to the project (verbal, written or electronic)
Adjustments to QAPP	SPM, Weston Solutions, Inc., START V	Thomas O'Donnell	(732) 585-4441	QAPP approval dialogue
Health and Safety On-Site Meeting	HSO, Weston Solutions, Inc., START V	Bernard Nwosu	(732) 585-4413	Explain Site hazards, personnel protective equipment, hospital location, etc.
Lab Data Quality Issues (including sample receipt variances and laboratory quality control variances)	Laboratories Project Managers: Eurofins TestAmerica Chemtech Consulting Group	 Mike Franks Kurt Hummler	 (314) 289-8566 (908) 728-3143	Laboratory PMs will report any issues with project samples to the WESTON Chemist QA/QC Specialist within 1 business day of notification. The WESTON Chemist QA/QC Specialist will contact the field sampler if necessary, to resolve sample receiving discrepancies.
Data verification and data validation issues	START V Data Validators	Smita Sumbaly	(732) 585-4410	START V Data Validator will review non-CLP data verification and validation.
Analytical Corrective Actions	WESTON Chemist QA/QC Specialist START V Data Validator or Laboratory PMs	Smita Sumbaly	(732) 585-4410	If laboratory corrective actions are necessary, the WESTON Chemist QA/QC Specialist will communicate with laboratory project manager.
Data Tracking and Management, Release of Analytical Data	WESTON Chemist QA/QC Specialist WESTON Operations Manager WESTON SPM	Smita Sumbaly Bernard Nwosu Thomas O'Donnell	(732) 585-4410 (732) 585-4413 (732) 585-4441	The need for corrective actions will be determined by the SPM upon review of the data. No analytical data will be released prior to validation and all releases must be approved by the Chemist QA/QC Specialist, SPM, and EPA OSC/TM.

OSC: On-Scene Coordinator
SPM: Site Project Manager
HSO: Health and Safety Officer
QA/QC: Quality Assurance/Quality Control
START V: Superfund Technical Assistance & Response Team V
CHP: Certified Health Physicist

QAPP Worksheet #9: Project Planning Session Summary

Date of Planning Session: 04/01/2021
Location: Phone Call
Purpose: Scoping meeting for HTC RV2 for EPA Region II Superfund Technical Assessment & Response Team V

Name	Title/Role	Organization	E-mail Address	Phone No.
Peter Lisichenko	EPA OSC	EPA	lisichenko.peter@epa.gov	(603)-512-4350
Sean Quinn	START V	WESTON	Sean.Quin@WestonSolutions.com	(732) 425-1175

Site-Specific Initial Scoping Meeting Notes/Comments:

Weston Solutions, Inc., (Weston) Superfund Technical Assessment & Response Team V (START V) has been tasked by the U.S. Environmental Protection Agency, Region II (EPA) with providing field sampling support as part of Removal Action (RV2) activities at the Holy Trinity Cemetery Site, Area 6 & 7 (the Site) in Lewiston, Niagara County, New York. The anticipated scope of work (SOW) for this initial mobilization includes baseline community air monitoring for PM_{10} (particulate matter smaller than 10 microns) using DustTrak particulate monitors, baseline air sampling for particulates using RADēCO volumetric air samplers with filter media attachment, and fill material sampling. Air monitoring utilizing DustTrack particulate monitors will consist of continuous, real-time air quality monitoring and data collection. Monitoring locations will be upwind and downwind. The monitoring stations will be linked via EPA's VIPER system (a wireless network-based communications system) which will provide instantaneous real-time air quality readings through a computer server. The RADēCO volumetric air samplers will be deployed (and co-located with the DustTracks) at each air monitoring station to collect ambient air samples which will be analyzed for radioactive dust particles using Ludlum Model 3030 (Ludlum-3030) Alpha Beta counter. Up to four air monitoring stations will be established on-site and up to four baseline air filter samples will be collected. Fill material sampling will be conducted at an off-site fill material vendor facility to be selected by the EPA On-Scene Coordinator (OSC). Fill material samples will be collected from two stockpiles, including 2-inch crusher run stone (clean fill) stockpile and topsoil stockpile. The number of fill material samples to be collected per matrix will be in accordance with New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation-10 (DER-10) Technical Guidance for Site Investigation and Remediation, May 3, 2010 and based on an estimated 200 cubic yards (yd^3) of contaminated soil anticipated to be excavated from the Site. Utilizing dedicated stainless-steel scoops and dedicated plastic scoops, START V will collect clean fill/topsoil samples, including quality assurance/quality control (QA/QC) samples, from the stockpiles for laboratory analyses, including full target analyte list (TAL) (volatile organic compounds [VOCs], semivolatile organic compounds [SVOCs], polychlorinated biphenyls [PCBs], pesticides, herbicides, metals including mercury, and cyanide), per- and poly-fluoroalkyl substances (PFAS), and radiochemistry (alpha and gamma spectroscopy), analyses. PFAS samples will be collected in accordance with Weston's Field Sampling Protocols to Avoid Cross-Contamination at Perfluorinated Chemical Sites, and Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances NYSDEC Part 375 Remedial Program, October 2020.

QAPP Worksheet #9: Project Planning Session Summary (Concluded)

Consensus Decisions Made:

START V will conduct baseline air monitoring and sampling at the Site and perform fill material (clean fill and topsoil) sampling at an off-site fill material vendor facility on the week of April 26, 2021. Baseline air monitoring and sampling will be conducted to determine the air quality at the Site under normal conditions prior to initiating removal operations, and to establish baseline air quality data, which will be compared with air monitoring and sampling data during removal operations. The analytical results of the clean fill and topsoil samples will be compared with the EPA Site-Specific Preliminary Remediation Goals (PRGs) for radiological parameters, EPA Removal Management Levels (RMLs), NYSDEC Residential Use Soil Cleanup Objectives (RUSCO), and NYSDEC PFAS guidance values for residential use, all of which will be utilized to verify that the fill materials are in compliance with EPA and NYSDEC regulations in order to be used on-site to backfill excavations during removal operations.

Action Items:

Action	Responsible Party	Due Date
Prepare CLP Analytical Request Form	SPM, START V	04/02/2021
Prepare RST Analytical Request Form	SPM, START V	04/05/2021
Develop Health and Safety Plan	SPM, START V	04/26/2021
Develop Community Air Monitoring Plan	SPM, START V	04/26/2021
Develop Quality Assurance Project Plan	SPM, START V	04/26/2021
Develop Work Plan (driller, sampler, survey, etc.)	SPM, START V	Not Applicable
Develop Equipment List	SPM, START V	04/13/2021
Develop Site-Specific Data Management Plan	SPM, START V	Not Applicable

QAPP Worksheet #10: Conceptual Site Model

Background Information:

The Site consists of approximately 2.91 acres of radionuclide contamination located at a cemetery that is approximately 31.5 acres in size. The Site is owned by Holy Trinity Cemetery of Divine Mercy Parish in Lewiston, Niagara County, New York. The areas of observed contamination in the north-western portion of the property on a relatively flat and slightly elevated grassy field, under existing roadways, and at an isolated area adjacent to the Interstate 190 (I-190) corridor. There is one building on the Site which is utilized as both a residence and a cemetery maintenance facility. The Site is bordered to the north and east by I-190; to the south by Gate of Heaven Cemetery; and to the west by Robert Avenue and a residential area.

Based on historical information, EPA identified nine AOCs at the Site, including six on-site AOCs and three off-site AOCs. The on-site AOCs are identified as Area 1 through Area 4 and Area 8, comprising the grassy open fields and undeveloped portions of the Site, and Area 9, comprising portions of the non-public Site road network. The off-site AOCs are identified as Area 5 through Area 7, comprising three residences located adjacent to the Site, including 5374 Robert Avenue (Area 5), 5380 Robert Avenue (Area 6), and 5382 Robert Avenue (Area 7).

In 1978, the U.S. Department of Energy (DOE) conducted an aerial radiological survey of the Niagara Falls region and identified more than 15 properties having elevated levels of radiation above background levels. It is believed that, in the early 1960s, slag from an unknown source was used as fill on the properties prior to paving. Based on the original survey and subsequent investigations, it is believed that the radioactive slag was deposited on the Site.

In February 1980, the New York State Department of Health (NYSDOH) Bureau of Radiological Health and the Niagara County Health Department conducted a ground radiological survey of the Site to identify areas with elevated radioactivity resulting from the use of radioactive slag as fill on the property. The survey was conducted based on information that the slag used at the cemetery was from the same source used at two other locations in nearby Niagara Falls, which had been identified by the NYSDOH as containing elevated levels of radioactivity. During the survey, cemetery personnel showed NYSDOH a slag pile located near the caretaker's garage in the western portion of the property. Cemetery personnel stated that this slag was used as fill for the cemetery roads throughout the property.

In addition, the slag was used as fill for the base of two proposed roadbeds that extended approximately 500 to 600 feet from the caretaker's garage, northwest toward Robert Avenue. At the time of the survey, the construction of these roads had been abandoned. The underlying slag base was covered with an unknown amount of soil and was left as an open field. Using an Eberline PRM-7 radiation meter, ground radiological survey of the slag pile indicated gamma radiation measuring 250 microroentgens per hour (μR/hr) and along cemetery roads, gamma readings ranged from 5 μR/hr (*i.e.*, background concentration) to 30 μR/hr. Gamma readings along the abandoned roadbeds ranged from 200 μR/hr to 400 μR/hr. Samples of the slag were collected as part of the investigation. Laboratory analysis of the samples indicated that the concentrations of isotopic uranium, isotopic thorium, radium-226 (Ra-226), and radium-228 (Ra-228), were significantly higher than background values.

QAPP Worksheet #10: Conceptual Site Model (Continued)

In October 2006, the New York State Department of Environmental Conservation (NYSDEC) and the Niagara County Health Department conducted a reconnaissance of the Site. At the time, the slag pile previously observed near the caretaker's garage was no longer on the Site; the current caretaker had neither knowledge of the slag pile, nor what happened to it. The caretaker also indicated that children living nearby used this area for recreation. Since the 1980 NYSDOH site investigation, trees had grown through the abandoned slag roadbeds, pushing the slag to the surface. As part of the Site visit, NYSDEC conducted a ground radiological survey with an Exploranium GR-135. Radiological measurements taken while walking along the roadbed indicated gamma readings ranging from 200 to 450 µR/hr at waist height (approximately 1 meter/3 feet above the ground) and contact reading (approximately 1 inch above the ground) ranging from 450 to 570 µR/hr. Contact reading taken next to exposed slag near a tree was documented at 700 µR/hr. The NYSDEC collected four slag samples which were analyzed for isotopic uranium and isotopic thorium via gamma-ray spectroscopy. Laboratory analytical results indicated the presence of uranium-238/234 (U-238/234) at concentrations ranging from 114 picocuries per gram (pCi/g) to 1,664 pCi/g and thorium-232 (Th-232) from 114 pCi/g to 898 pCi/g.

In May 2007, NYSDEC visited the Site to verify contamination in an on-site debris pile using gamma-ray spectroscopy. During a 5-minute static survey, Ra-226 was the only radionuclide identified. A similar survey conducted on one of the roadbeds confirmed the presence of Th-232. During a reconnaissance performed by the NYSDOH and NYSDEC in July 2013, a ground radiological survey of on-site roadways and along the back roadway leading off-site was conducted using a pressurized ion chamber (PIC) and a sodium iodide (NaI) 2x2 scintillator. Measurements taken along the roadways with the PIC indicated gamma levels up to 51 µR/hr and up to 50,000 counts per minute (cpm) with the NaI scintillator.

On December 12 and 13, 2013, EPA's contractor, Weston Solutions, Inc., Site Assessment Team (SAT), collected a total of 14 subsurface soil samples and three slag samples from the Site. Soil samples were also collected from two locations suspected to be outside of the source area in order to document background conditions. At each sample location, soil samples were collected directly beneath slag material; at locations where a radioactive fill layer was not visually observed the soil sample was collected at the equivalent depth interval. Each slag sample consisted of one single piece of slag material. The soil samples were analyzed by Test America Laboratories (TestAmerica) for target analyte list (TAL) metals via EPA SW846; isotopic thorium and isotopic uranium via DOE alpha spectroscopy Health and Safety Laboratory (HASL)-300 Method A-01-R; Ra-226, Ra-228, and other gamma emitting radioisotopes via DOE gamma spectroscopy HASL-300 Method GA-01-R. The slag samples were analyzed for the same radiological parameters as the soil samples but were not analyzed for TAL metals. Analytical results indicated that concentrations of radionuclides in all the slag samples and seven soil samples including the field duplicate, were significantly higher than at background conditions.

On May 1, 2014, SAT collected radon and thoron concentration measurements from locations on and in the vicinity of the Site. At the selected locations in background areas, above the source material, and off the source area, radon, and thoron concentration measurements in picocuries per

QAPP Worksheet #10: Conceptual Site Model (Continued)

liter (pCi/L) were collected with RAD7 radon/thoron detectors. The radon and thoron measurements were collected at heights of one meter above the ground surface. Radon and thoron concentrations were at normal background levels.

On August 10 through 13, 2015, EPA and RST 3, currently START V, conducted a Removal Assessment of the Site. The presence/absence of radon, thoron, and gamma radiation was verified through ground radiological surveys. Areas of observed contamination were delineated by comparing radiological survey measurements from suspected source areas with measurements obtained from a background location. Laboratory analytical results were used to verify the concentration of radon in living spaces of the one on-site building and to determine the presence of residual contamination and potential releases of radiation-containing material in soil and fill at the Site. Ground radiological survey measurements were collected on-site using fluke pressurized ionization chamber (FPIC), Ludlum-2241, and Reuter-Stokes high pressure ion chamber (HPIC). To define the basis for comparing ground radiological survey results, it was necessary to establish background reading at the Site. Background readings were collected with each of the instruments from locations on-site that were presumed to be unaffected by historic Site activities. Background gamma measurements included readings collected with Ludlum-2241 (9,900 to 10,700 cpm), FPIC (7 to 16 µR/hr at waist height and 9 to 17 µR/hr at contact), and HPIC (9.52 µR/hr). Specific isotopes were identified using a Berkeley Nucleonics Corporation (BNC) SAM 940™ (SAM 940) portable radioisotope identification system. A Durridge RAD7 electronic radon/thoron detector was utilized to measure the concentration of radon and thoron in ambient air. Background radon/thoron concentrations ranged from 0 to less than (<) 4.0 pCi/L, and no radionuclides were detected with the SAM-940 at the selected background location.

During the August 2015 radiological investigation, gamma measurements taken with the Ludlum-2241 in the one on-site building were generally at background levels, with a few locations indicating gamma readings that were slightly above background. The highest gamma measurement collected in the one on-site building was 16,100 cpm in the viewing room. Gamma measurements taken with the Ludlum-2241 in exterior locations throughout the Site were generally above background, with the highest reading at 569,000 cpm (more than 53 times [53x] above background). Gamma measurements collected with the FPIC in the one on-site building were generally at background levels ranging from 3 µR/hr (at waist height) to 19 µR/hr (at contact). Gamma measurements taken with the HPIC at three locations in the one on-site building ranged from 9.56 µR/hr to 10.94 µR/hr. Exterior HPIC gamma measurements were generally above background. The HPIC gamma measurements collected from eight locations selected on-site for soil sampling ranged from 10.02 µR/hr to 256.34 µR/hr (more than 26x above background). At one location on the east side of the on-site dirt road, Ra-226 was detected with the SAM-940. Based upon results from radon/thoron surveys conducted with RAD7, radon and thoron concentrations were at normal background levels in the on-site building; however, at all eight soil sampling locations, radon concentration was above background in contact measurement collected from one soil sampling location, thoron concentrations were above background in waist-level measurements collected at five soil sampling locations and above background in contact measurements collected at two soil sampling locations.

QAPP Worksheet #10: Conceptual Site Model (Continued)

On August 10 through 13, 2015, RST-3 procured National Radon Safety Board (NRSB)-certified company, Accu-View Property Inspections (Accu-View), utilized passive activated charcoal canisters (radon canisters) to conduct short-term radon sampling tests that lasted a minimum of approximately 72 hours. A total of 15 radon canisters, including two field duplicates, and one field blank, were deployed in the one on-site building. Radon testing locations were focused on frequently occupied spaces in the building. Analytical results indicated that concentrations of radon were below the EPA Site-Specific Action Level (SSAL) of 4.0 pCi/L in all the living spaces sampled in the building.

On August 12, 2015, RST 3 conducted a soil sampling event to verify the presence of residual radioactive material in on-site soil. Based on radiological survey data from SAT's prior site investigation, and survey data from the August 2015 radiological investigation, soil sampling locations suspected to contain radionuclides and metals/metalloids were identified on-site by EPA. A total of nine soil samples, including one field duplicate, were collected at depths 0 to 4 feet below ground surface (bgs) from eight location on-site. The soil samples were analyzed by TestAmerica for TAL metals (including mercury) via EPA SW846; isotopic thorium and isotopic uranium via alpha spectroscopy HASL-300-A-01-R; Ra-226 (21 days ingrowth), Ra-228 and other gamma emitting radioisotopes via gamma spectroscopy HASL-300-GA-01-R. Analytical results indicated that concentrations of Ra-226 exceeded the EPA SSAL (established by EPA in August 2015) of 4.06 pCi/g in three of the nine soil samples. The concentration of cobalt was above the EPA Removal Management Level (RML) of 70 milligrams per kilograms (mg/kg) in one soil sample with exceedance concentration at 110 mg/kg. Thallium concentration was above the EPA RML of 2.3 mg/kg in one soil sample with exceedance concentration at 2.4 mg/kg.

On August 12, 2015, EPA collected four wipe samples including one field blank, from access doorways in the on-site building. The wipe samples were collected to determine if radiation-containing material was being tracked into the building. The wipe samples were analyzed by EPA using Ludlum-3030. Based upon the analytical results of the wipe samples for the selected counting durations, the minimum detectable concentration (MDC) for 100 square centimeters (cm^2) were determined as 0.80 disintegrations per minute (dpm) and 29.5 dpm respectively, for alpha and beta particles. These levels were below the 100 dpm and 1,000 dpm respectively, for alpha and beta counts outlined in the *New York City* Department of Health and Mental Hygiene (NYC DOHMH) Article 175 of the NYC Health Code, "Radiation Control", §175.03 - Release of Materials or Facilities, which was adopted by EPA as the SSAL for alpha and beta particles. Alpha and beta counts for all the wipe samples were at the natural background level conservatively estimated by counting a blank wipe.

In April 2016, EPA performed Removal Assessment activities at AOCs associated with the Site. Utilizing an all-terrain vehicle (ATV), RST 3 conducted ground radiological survey at seven of the nine AOCs to identify locations indicating presence of radiation-containing material and to define the extent of contamination in the AOCs. Air monitoring and sampling was performed daily at the on-site AOCs during the radiological survey activities to verify that the survey activities being performed on-site were not generating fugitive dust to levels that would potentially expose on-site personnel and the public to site-related contaminants. Based on the results of the ground

QAPP Worksheet #10: Conceptual Site Model (Continued)

radiological survey, approximately 50 percent (%) of Area 1; portions northeast, south, and southwest of Area 2, as well as portions of the non-public Site road network immediately south of Area 2; discontinuous hot spots identified in the southern and southeast portions of Area 3; a dirt pile located on the eastern portion of Area 4; and portions of Area 9 immediately south of Area 1 and Area 3; all indicated gamma readings exceeding 3x background. Gamma readings at Area 5 and Area 8 were at normal background levels. Baseline air monitoring results indicated that particulate concentrations were generally below 50 micrograms per cubic meter ($\mu g/m^3$). Daily air monitoring results indicated that particulate concentrations during radiological survey activities were generally below the minimum SSAL of 100 $\mu g/m^3$. Screening results of air filter samples collected with the RADēCO during radiological survey activities indicated that alpha, beta, and gamma particles were at normal background levels.

On April 22 through 24, 2016, RST-3 procured NRSB-certified Company, Accu-View, conducted radon sampling in the residence at Area 5 by to verify if radon was present in living spaces of the residence and, subsequently determine if the installation of a radon mitigation system in the residence was necessary. Analytical results of 12 pre-mitigation radon samples, including one field duplicate, and one field blank, collected from the residence in Area 5 indicated radon concentrations were equal to or exceeded the EPA SSAL of 4.0 picocuries per liter (pCi/L) in five of the samples. Based on the pre-mitigation radon analytical results, on May 24, 2016, EPA conducted a walk-through at Area 5 and identified a location in the residence to install a radon mitigation system. On June 15, 2016, a radon mitigation system was installed in the residence at Area 5. On August 1 through 4, 2016, a post-mitigation radon sampling event was performed to verify the effectiveness of the radon mitigation system in reducing the concentration of radon in the residence. Analytical results of the post-mitigation radon sampling event indicated that radon concentrations were at normal background levels.

On August 18, 2016, RST 3 collected a total of 30 soil samples from seven soil sampling locations identified by the EPA at Area 5. Using non-dedicated hand shovels and pickaxe, test pits were advanced to depths bgs. Soil samples were collected from six locations at depths 0 to 6, 6 to 12, 12 to 18, and 18 to 24 inches bgs, and from one location at depths 2 to 8, 8 to 14, 14 to 20, and 20 to 26 inches bgs. All the soil samples were analyzed by PACE Analytical Services (PACE) for isotopic thorium, isotopic uranium, and other alpha emitting actinides via alpha spectroscopy HASL-300 Method U-02; radium-226 (21-day ingrowth), radium-228, and other gamma emitting radioisotopes via gamma spectroscopy EPA Method 901.1. Analytical results of the 30 soil samples, including two field duplicates, collected from Area 5, indicated that concentrations of target radionuclides were below the EPA SSALs.

On October 14, 2016, RST 3 utilized the Ludlum-2241 and NaI 3x3 scintillator with the VIPER setup to perform exterior radiological survey at two off-site AOCs, Area 6 and Area 7. Background gamma reading was approximately 13 µR/hr. Radiological survey completed at both AOCs indicated portions of the property boundary between Area 6 and Area 7 had gamma readings ranging from 26 µR/hr to 39 µR/hr, which exceeds 2x to 3x background, respectively. Consequently, RST 3 advanced two test pits in Area 6 and one test pit in Area 7 using non-dedicated hand shovels and pickaxes to a depth of 2 feet bgs. at the locations where elevated

QAPP Worksheet #10: Conceptual Site Model (Concluded)

gamma measurements were identified. The soil samples were screened using HPGe and then submitted for laboratory gamma spectroscopy and alpha spectroscopy, analyses. Based on screening and analytical results, concentrations of Ra-226 exceeded the EPA SSAL of 4.06 pCi/g in the soil samples collected from both properties.

On May 12 through 15, 2017, RST 3-procured NRSB-certified company, Accu-View, performed radon sampling in the residences at Area 6 and Area 7. A total of 17 radon canister samples, including one field duplicate (co-located sample), were collected from the residence at Area 6 and a total of 18 radon canister samples, including one field duplicate, were collected from the residence at Area 7. Analytical results of the radon samples collected from both properties were below the EPA Action Level of 4.0 pCi/L for radon.

On May 16, 2017, RST 3 conducted test pit soil sampling at Area 6 and Area 7. Utilizing a mini excavator, one test pit each was advanced to depths 4 feet bgs. at the selected locations in both AOCs. A total of eight heterogeneous samples of soil/slag/rock were collected from the one test pit in Area 6 and nine heterogeneous samples of soil/slag/rock, including one field duplicate, were collected from the one test pit in Area 7. The samples were submitted for laboratory radiochemistry (gamma spectroscopy and alpha spectroscopy) analysis. Based on analytical results, concentrations of Ra-226 exceeded the EPA SSAL of 4.06 pCi/g in the soil samples collected from both properties.

QAPP Worksheet #11: Project/Data Quality Objectives

1. State the Problem:

During exterior radiological survey conducted at Area 6 and Area 7, EPA identified hot spots within the driveway areas. Soil samples were collected for laboratory analysis from the hot spots and a background location to verify the presence of radionuclide contamination at the AOCs. Based on the elevated gamma readings documented during the initial soil sampling event and analytical results from soil samples collected from the AOCs, EPA has determined that a Removal Action is warranted to mitigate the health threat posed by the presence of radiological contamination within the residential AOCs associated with radiological material from the Site. As part of initial RV2 activities, EPA has requested START V to provide support for baseline perimeter air monitoring and sampling at the Site and conducting clean fill and topsoil sampling at an off-site vendor facility.

2. Identify the Goals of the Study:

- Baseline air monitoring and sampling will be conducted to determine the air quality at the Site under normal conditions prior to initiating removal operations, and to establish baseline air quality data, which will be compared with air monitoring and sampling data during removal operations.

- Clean fill and topsoil analytical results will be compared against the EPA Site-Specific PRGs, EPA RMLs, NYSDEC RUSCO, and NYSDEC PFAS guidance values, which will be utilized by EPA to assess the fill materials for compliance with EPA and NYSDEC regulations prior to being used on-site to backfill proposed excavations.

3. Identify Information Inputs:

In accordance with NYSDEC DER-10 and based on 200 yd^3 of proposed excavation extent, five grab samples each, including one field duplicate each, of clean fill and topsoil will be collected from stockpiles at the selected fill material vendor facility for TAL VOCs, analysis. Additionally, two composite samples each, including one field duplicate each, of clean fill and topsoil will be collected from stockpiles at the selected fill material vendor facility for TAL: SVOCs, PCBs, pesticides, herbicides, metals including mercury, and cyanide, radiochemistry, and PFAS, analyses. QA/QC clean fill/topsoil samples will be collected as necessary, and one rinsate blank will be collected as per PFAS soil sampling requirement.

4. Define the Boundaries of the Study:

Overall project objectives include: To utilize analytical results to determine if the selected fill material meets the regulatory requirement for use as imported fill on-site.

Who will use the data? Data will be used by EPA, Region II OSC.

QAPP Worksheet #11: Project/Data Quality Objectives (Continued)

5. Develop the Analytic Approach:

Analytical Techniques:
Clean fill/topsoil radiological parameter: Gamma spectroscopy/Ra-226 (ingrowth) by EPA Method 901.1 and alpha spectroscopy by A-01-R.

Clean fill/topsoil full TAL parameters: TAL Metals (SW-846 6010D), mercury (SW-846 3050B), cyanide (SW-846 9012B/9010C), TAL VOCs (SW-846 8260D), TAL SVOCs (SW-846 8270E), TAL Pesticides (SW-846 8081A), TAL PCBs (SW-846 8082A), Herbicides (SW-846 8151A).

Aqueous Rinsate Blank: PFAS by EPA Method 537.1

Type of Data: Definitive data

Matrix: Soil, Aqueous (Rinsate blank)

Parameters:

Five grab samples each, including one field duplicate each, of clean fill and topsoil will be collected for TAL VOCs analysis. Two composite samples each, including one field duplicate each, of clean fill and topsoil will be collected for TAL: SVOCs, PCBs, pesticides, herbicides, metals including mercury, and cyanide, and PFAS, analyses. One rinsate blank will be collected as per PFAS soil sampling requirement. Two composite samples each, including one field duplicate each, of clean fill and topsoil will be collected for radiochemistry analysis as follows:

<u>Gamma Spectrometry</u> – homogenized with 21-day ingrowth
- Ra-226 using Bi-214 and/or Pb-214 (if only one progeny radionuclide is used, either Bi-214 or Pb-214, provide the other radionuclide's activity)
- From the Uranium Decay Chain: Th-234, Pa-234m
- From the Thorium Decay Chain: Ra-228 and/or Ac-228, Ra-224, Pb-212, Bi-212, Tl-208
- Other gamma emitting radionuclides: Cs-137 and K-40

<u>Alpha Spectrometry</u> – total dissolution of the sample to ensure complete homogenization of dense, rock-like contaminant in sample.
- Isotopic Uranium: U-233/234, U-235/236, U-238
- Isotopic Thorium: Th-230, Th-232, Th-228

<u>Isotopic Uranium/Thorium:</u>
- Isotopic Uranium: U-233/234, U-235/236, U-238
- Isotopic Thorium: Th-232, and Th-230 if possible

Sampling Equipment: Plastic scoops, glass sample jars, Encore samplers, 40 milliliters (mL) volatile organic analysis (VOA) vails, poly sample bottles, glass sample bottles, stainless-steel hand scoops, and re-sealable plastic bags.

Access Agreement: Obtained by EPA, Region II OSC.

QAPP Worksheet #11: Project/Data Quality Objectives (Continued)

Sampling Locations: Sample locations will be identified by the EPA OSC.

How much data are needed? In accordance with NYSDEC DER-10 and based on 200 yd^3 of proposed excavation extent, five grab samples each, including one field duplicate each, of clean fill and topsoil will be collected for TAL VOCs, analysis. Additionally, two composite samples each, including one field duplicate each, of clean fill and topsoil will be collected for TAL: SVOCs, PCBs, pesticides, herbicides, metals including mercury, and cyanide, radiochemistry, and PFAS, analyses. For QC purpose, samples of clean fill/topsoil will be collected for matrix spike/matrix spike duplicate (MS/MSD) analyses. As per PFAS soil sampling requirement, one rinsate blank will be collected.

6. Specify Performance or Acceptance Criteria:

How "good" does the data need to be in order to support the environmental decision?
Sampling/analytical measurement performance criteria (MPC) for Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) parameters will be established. Refer to Worksheet #12, criteria for performance measurement for definitive data.

Where, when, and how should the data be collected/generated?
Up to five grab samples each, including one field duplicate each, of clean fill and topsoil will be collected for TAL VOCs, analysis. Additionally, two composite samples each, including one field duplicate each, of clean fill and topsoil will be collected for TAL: SVOCs, PCBs, pesticides, herbicides, metals including mercury, and cyanide, radiochemistry, and PFAS, analyses. For QC purpose, samples of clean fill/topsoil will be collected for MS/MSD analyses. As per PFAS soil sampling requirement, one rinsate blank will be collected. The sampling event is scheduled for the week of April 26, 2021. All field and sampling activities will be performed in accordance with methods outlined in EPA's ERT/Scientific, Engineering, Response and Analytical Services (SERAS) contractor's Standard Operating Procedures (SOPs), the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Weston's Field Sampling Protocols to Avoid Cross-Contamination at Perfluorinated Chemicals (PFC) Sites, and NYSDEC Part 375 Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Remedial Program, October 2020.

7. Develop the Detailed Plan for Obtaining Data

Who will collect and generate the data?
START V will collect all the clean fill and topsoil samples. Samples for radiochemistry and PFAS analyses will be analyzed, and data generated by Eurofins TestAmerica (TestAmerica). Samples for full TAL will be analyzed, and data generated by Chemtech Consulting Group (Chemtech). Clean fill and topsoil analytical data for radiological parameters will be validated by a subcontracted Certified Health Physicist (CHP). Clean fill and topsoil analytical data for full TAL, full TCLP, and PFAS will be validated by the START V data validator.

How will the data be reported? All data will be reported by the assigned laboratory (Preliminary, Electronic, and Hard Copy format). The Site Project Manager will provide a Sampling Trip

QAPP Worksheet #11: Project/Data Quality Objectives (Concluded)

Report, Status Reports, Maps/Figures, Analytical Report, and Data Validation Report to the EPA OSC.

How will the data be archived? Electronic data deliverables will be archived in a Scribe database. Non-CLP data will be archived in EPA's document control room.

QAPP Worksheet #12: Measurement Performance Criteria Table
QAPP Worksheet #12A: Gamma Spectroscopy by EPA Method 901.1 (Non-CLP Worksheet)

Matrix: Soil
Analytical Group/Method: Radiochemistry (Gamma Spectroscopy)
Concentration Level: Low/Medium (Activity per Gram)

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria[1]
Bias/Contamination	Method Blank	No radionuclides detected above the target detection limit (MDC)
Accuracy/Bias	LCS	Recovery limits as specified in Worksheet #28A
Precision	Sample Duplicate	RPD Limit of 40% or Normalized Difference < 3

QAPP Worksheet #12: Measurement Performance Criteria Table (Continued)
QAPP Worksheet #12B: Alpha Spectroscopy - A-01-R (Non-CLP Worksheet)

Matrix: Soil
Analytical Group/Method: Radiochemistry (Alpha Spectroscopy)
Concentration Level: Low/Medium (Activity per Gram)

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria[1]
Bias/Contamination	Method Blank	No radionuclides detected above the target detection limit (MDC)
Accuracy/Bias	LCS	Recovery limits as specified in Worksheet #28B
Precision	Sample Duplicate	RPD Limit of 40% or Normalized Difference < 3
Accuracy/Bias	Tracer (every sample)	Recovery limits of 30-110%

QAPP Worksheet #12: Measurement Performance Criteria (Continued)
QAPP Worksheet #12C: Volatile Organic Compounds (VOCs) – Soil (Non-CLP Worksheet)

Matrix: Soil
Analytical Group/Method: TAL VOCs / SW-846 8260D
Concentration Level: Low

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria[1]
Precision - Overall	Field Duplicates: 1 per 20 field samples	Soil RPD: ≤50%
Precision - Laboratory	MS/MSD	One set per extraction batch when sufficient sample volume is provided or as requested per client
Accuracy/Bias - Laboratory	LCS: 1 per analysis batch of up to 20 samples (Full list LCS is required for EPA 8260B/C/D)	%R within statistically derived laboratory acceptance limits
Accuracy/Bias – Laboratory (matrix interference)	MS/MSD: 1 per 20 samples of each matrix	One set per extraction batch when sufficient sample volume is provided or as requested per client
Accuracy/Bias – Laboratory	Surrogates added to each field and QC sample as specified by the method and/or laboratory SOP	%R within statistically-derived control limits developed by the laboratory
Accuracy/Bias (Laboratory Contamination)	Laboratory Blanks include: Method blank for EPA 8260B/C/D: 1 per 12-hour shift Instrument blank (all methods): after samples with analytes exceeding the instrument calibration range or detector saturation	EPA 8260B/C/D Blanks: ▪Method: analyte concentrations <MDL or <5% of regulatory limit or <5% of the sample result for the analyte, whichever is greater ▪Instrument: analyte concentrations < MDL ▪Storage: not required; trip blank results may be used to monitor for contamination during storage Storage: none, refer to field reagent blank
Overall Accuracy/Bias (Contamination)	Field Blanks include: None	Not applicable
Sensitivity (method)	Review Laboratory RLs and MDLs	Action Level at least 3 to 10x > CRQL or RL

QC Samples for VOCs by GC/MS are listed along with their method-specified frequency and MPCs
[1]Laboratory may use/develop in-house QC

QAPP Worksheet #12: Measurement Performance Criteria Table (Continued)
QAPP Worksheet #12D: Semivolatile Organic Compounds (SVOCs) (Non-CLP Worksheet)

Matrix: Soil
Analytical Group/Method: TAL SVOCs / SW-846 8270E
Concentration Level: Low

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria[1]
Precision - Overall	Field Duplicates: 1 per 20 field samples	Soil RPD: ≤50%
Precision - Laboratory	MS/MSD[2]	One set per extraction batch when sufficient sample volume is provided or as requested per client
Accuracy/Bias - Laboratory	LCS: 1 per analysis batch of up to 20 samples of each matrix (Full list LCS is required for EPA 8270C/D/E)	%R within statistically derived laboratory acceptance limits
Accuracy/Bias – Laboratory (matrix interference)	MS/MSD: 1 per 20 samples of each matrix	One set per extraction batch when sufficient sample volume is provided or as requested per client
Accuracy/Bias – Laboratory	Surrogates added to each field and QC sample as specified by the method and laboratory SOP	EPA 8270C/D/E: %R within statistically-derived control limits developed by the laboratory
Accuracy/Bias (Laboratory Contamination)	Laboratory Blanks include: Method blank (all methods): 1 per extraction batch of 20 samples Instrument blank (all methods): run after high concentration samples or detector saturation	EPA 8270C/D/E Blanks: • Method: analyte concentrations <MDL or <5% of regulatory limit or <5% of the sample result for the analyte, whichever is greater • Instrument: analyte concentrations < MDL
Overall Accuracy/Bias (Contamination)	Field Blanks include: None	Not Applicable
Sensitivity (method)	Review Laboratory RLs and MDLs against action limits	Action Level at least 3 to 10x > CRQL or RL

[1]Laboratory may use/develop in-house QC

QAPP Worksheet #12: Measurement Performance Criteria Table (Continued)
QAPP Worksheet #12E: Organochlorine (OC) Pesticides by GC/ECD (Non-CLP Worksheet)

Matrix: Soil
Analytical Group/Method: TAL Pesticides / SW-846 8081B
Concentration Level: Medium

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria[1]
Precision - Overall	Field Duplicates: 1 per 20 field samples	Soil RPD: ≤50%
Precision - Laboratory	MS and MSD (all pesticide methods): 1 per 20 samples of each matrix	EPA 8081B: RPDs within statistically derived laboratory acceptance limits
Accuracy/Bias - Laboratory	LCS: 1 per analysis batch of up to 20 samples of each matrix	EPA 8081B: %R within statistically derived laboratory acceptance limits
Accuracy/Bias – Laboratory (matrix interference)	MS/MSD: 1 per 20 samples of each matrix	EPA 8081B: %R within statistically derived laboratory acceptance limits
Accuracy/Bias – Laboratory	Surrogates added to each field and QC sample as specified by the method and laboratory SOP	EPA 8081B: %R within statistically derived laboratory acceptance limits
Accuracy/Bias (Laboratory Contamination)	Laboratory Blanks include: Method blank (all methods): 1 per extraction batch Instrument blank (EPA 8081B): as specified by method	EPA 8081B Blanks: • Method: analyte concentrations <MDL or <5% of regulatory limit or <5% of the sample result for the analyte, whichever is greater • Instrument: analyte concentrations < MDL
Overall Accuracy/Bias (Contamination)	Field Blanks include: None	Not applicable
Sensitivity (method)	Review Laboratory RLs and MDLs against action limits	Action Level at least 3 to 10x > CRQL or RL

[1]Laboratory may use/develop in-house QC

QAPP Worksheet #12: Measurement Performance Criteria Table (Continued)
QAPP Worksheet #12F: Polychlorinated Biphenyls (PCBs) as Aroclors by GC/ECD (Non-CLP Worksheet)

Matrix: Soil
Analytical Group/Method: Aroclors (PCBs) / SW-846 8082A
Concentration Level: Medium

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria[1]
Precision - Overall	Field Duplicates: 1 per 20 field samples	Soil RPD: ≤50%
Precision - Laboratory	MS and MSD (all PCB methods): 1 per 20 samples of each matrix	EPA 8082A: RPDs within statistically derived laboratory acceptance limits
Accuracy/Bias - Laboratory	LCS: 1 per analysis batch of up to 20 samples of each matrix	EPA 8082A: %R within statistically derived laboratory acceptance limits
Accuracy/Bias – Laboratory (matrix interference)	MS/MSD: 1 per 20 samples of each matrix	EPA 8082A: %R within statistically derived laboratory acceptance limits
Accuracy/Bias – Laboratory	Surrogates added to each field and QC sample as specified by the method and laboratory SOP	EPA 8082A: %R within statistically derived laboratory acceptance limits
Accuracy/Bias (Laboratory Contamination)	Laboratory Blanks include: Instrument blank (all methods): At the frequency specified in EPA Method and/or after high concentration samples	EPA 8082A Blanks: • Method: analyte concentrations <MDL or <5% of regulatory limit or <5% of the sample result for the analyte, whichever is greater • Instrument: analyte concentrations < MDL
Overall Accuracy/Bias (Contamination)	Field Blanks include: None	Not applicable
Sensitivity (method)	Review Laboratory RLs and MDLs against action limits	Action Level at least 3 to 10x > CRQL or RL

[1]Laboratory may use/develop in-house QC

QAPP Worksheet #12: Measurement Performance Criteria Table (Continued)
QAPP Worksheet #12G: Chlorinated Herbicides by GC/ECD (Non-CLP Worksheet)

Matrix: Soil Leachate
Analytical Group/Method: Herbicides/ SW-846 8151A
Concentration Level: Low/Medium

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision - Overall	Field Duplicates: 1 per 20 field samples (soil matrix; not required for TCLP leachate)	Soil RPD: ≤50%
Precision – Laboratory	MS and MSD: 1 per 20 samples of each matrix	RPDs within statistically derived laboratory acceptance limits
Accuracy/Bias - Laboratory	LCS: 1 per extraction batch of up to 20 samples of each matrix (*Full list spike is required)*	%R within statistically derived laboratory acceptance limits
Accuracy/Bias – Laboratory (matrix interference)	MS/MSD: 1 per 20 samples of each matrix	%R within statistically derived laboratory acceptance limits
Accuracy/Bias – Laboratory	Surrogates added to each field and QC sample as specified by the method and laboratory SOP	%R within statistically derived laboratory acceptance limits
Accuracy/Bias (Laboratory Contamination)	Laboratory Blanks include: Method blank: 1 per extraction batch Instrument blank: After high concentration samples	EPA 8151A Blanks: • Method: analyte concentrations <MDL or <5% of regulatory limit or <5% of the sample result for the analyte, whichever is greater • Instrument: analyte concentrations < MDL
Overall Accuracy/Bias (Contamination)	Field Blanks include: Equipment Blank	All analyte concentrations < CRQL or RL
Sensitivity (method)	Review Laboratory RLs and MDLs against action limits [2]	Action Level at least 3 to 10x > RL

[1]Laboratory may use/develop in-house QC

QAPP Worksheet #12: Measurement Performance Criteria Table (Continued)
QAPP Worksheet #12H: Metals and Mercury (Non-CLP Worksheet)

Matrix: Soil
Analytical Group/Method: TAL Metals and Mercury / SW-846 6010D/3050B
Concentration Level: Low

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision - Overall	Field Duplicates: 1 per 20 field samples (Required for soil; not required for TCLP leachates)	Soil RPD: ≤50%
Precision - Laboratory	Lab Duplicate: (Required for soil; not required for TCLP leachates)	Other methods: RPD within statistically-derived control limits developed by the laboratory
Accuracy/Bias - Laboratory	LCS: 1 per analysis batch of up to 20 samples of similar matrix. (NOTE: LCS is required for other mercury methods.)	Other Methods: %R within statistically-derived control limits developed by the laboratory
Accuracy/Bias – Laboratory (matrix interference)	MS: (Required for soil)	Other methods: %R within statistically-derived control limits developed by the laboratory
Accuracy/Bias (Laboratory Contamination)	Laboratory Blanks include: Method blank: 1 per digestion batch Instrument blank: at beginning of analytical run (ICB), and after every 10 analytical samples (CCB)	Other Methods: • Method: analyte concentrations <1/10 the Lower Limit of Quantitation check standard or <10% of regulatory limit or <10% of the lowest sample concentration in the preparation batch, whichever is greater • Instrument: analyte concentrations < established lower limit of quantitation
Overall Accuracy/Bias (Contamination)	Field Blanks include: Equipment Blank	All analyte concentrations < CRQL (ISM02.4) or RL (other methods)
Sensitivity (method)	Review Laboratory RLs and MDLs against action limits	Action Level at least 3 to 10x > CRQL or RL

Metals methods include Inductively-Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES), Inductively-Coupled Plasma-Mass Spectroscopy (ICP-MS), and Cold Vapor Atomic Absorption (CVAA).
[1]Laboratory may use/develop in-house QC criteria

QAPP Worksheet #12: Measurement Performance Criteria Table (Continued)
QAPP Worksheet #12I: Total Cyanide (Non-CLP Worksheet)

Matrix: Soil
Analytical Group/Method: Total Cyanide /SW-846 9012B/9010C
Concentration Level: Low/Medium

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision - Overall	Field Duplicates: 1 per 20 field samples (Required for soil matrix)	Soil RPD: ≤50%
Precision - Laboratory	Lab Duplicate: (Required for soil)	Other methods: RPD within statistically-derived control limits developed by the laboratory
Accuracy/Bias - Laboratory	LCS: 1 per analysis batch of up to 20 samples (NOTE: A "distilled ICV" is required for cyanide by ISM02.4 but an LCS is required for other cyanide methods.)	Other methods: %R within statistically-derived control limits developed by the laboratory
Accuracy/Bias – Laboratory (matrix interference)	MS: (Required for water, drinking water, and soil/sediment; not required for Solid or Waste)	Other methods: %R within statistically-derived control limits developed by the laboratory
Accuracy/Bias (Laboratory Contamination)	Laboratory Blanks include: Method blank: 1 per distillation batch Instrument blank: at beginning of analytical run (ICB), and after every 10 analytical samples (CCB)	Other Methods: • Method: analyte concentrations <1/10 the Lower Limit of Quantitation check standard or <10% of regulatory limit or <10% of the lowest sample concentration in the preparation batch, whichever is greater • Instrument: analyte concentrations < established lower limit of quantitation
Overall Accuracy/Bias (Contamination)	Field Blanks include: Equipment Blank	All analyte concentrations < CRQL (ISM02.4) or RL (other methods)
Sensitivity (method)	Review Laboratory RLs and MDLs against action limits	Action Level at least 3 to 10x > CRQL or RL

[1]Laboratory may use/develop in-house QC criteria

QAPP Worksheet #12: Measurement Performance Criteria (Concluded)
QAPP Worksheet #12J: PFAS (Non-CLP Worksheet)

Matrix: Soil/Aqueous*
Analytical Group/Method: PFAS / EPA Method 537.1
Concentration Level: Low

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Recoveries should be within 70-130%. ≤ 30 % RPD.	LCS control spike
Accuracy	Peak area counts for all ISs in all injections must be within +/- 50% of the average peak area calculated during the initial calibration.	Internal Standards
Accuracy	Recoveries should be within 70-130%, RPD ≤ 30 %.	Matrix Spike/Matrix Spike Duplicate
Accuracy	70-130 % of the true value.	Surrogate Compounds
Accuracy	Demonstrate that all method analytes are below the RL.	Method Blank
Precision	RPD ≤ 30 %	Field Duplicate

Note: For analytical method see QAPP Worksheet #23.
*aqueous sample is a rinse blank.

QAPP Worksheet #13: Secondary Data Criteria and Limitations

Data Type	Data Source (Originating Organization, Report Title, and Date)	Data Uses Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
Removal Assessment	Weston Solutions Inc., Removal Assessment Sampling Report, March 2021, DC No. STARTV-01-D-0069	To determine presence of contamination on-site and the extent of excavation for removal operations.	None
Removal Action	Weston Solutions Inc., Removal Action Sampling Report, March 2021 DC No. STARTV-02-D-0109	To determine disposal facility for removal operations.	None

QAPP Worksheet #14 & 16: Project Tasks and Schedules

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Develop Project-Specific Health and Safety Plan (HASP)	WESTON	4/7/2021	04/12/2021	HASP	04/26/2021
Develop Project-Specific Community Air Monitoring Plan (CAMP)	WESTON	4/7/2021	4/12/2021	CAMP	4/26/2021
Develop Project-Specific QAPP/Revisions	WESTON	04/09/2021	04/19/2021	QAPP	04/19/2021
Coordination with EPA Region II RSCC for Regional or CLP analytical support or procure WESTON-subcontracted laboratory for analytical services	WESTON	04/07/2021	04/12/2021	Region II RSCC documentation (laboratory assignment) or WESTON Purchase Order for analytical services	NA
Scoping meeting Operations Manager, SPM, HSO, and sampling team to discuss data collection activities, objectives, and logistics	WESTON	04/01/2021	04/01/2021	Meeting Notes	NA
Mobilization/Demobilization	WESTON	04/19/2021	04/23/2021	Field Notes	NA
Sample Collection Tasks	WESTON	04/19/2021	04/23/2021	Field Notes	NA
Analytical Tasks	WESTON	04/19/2021	04/23/2021	Field Notes/Laboratory Reports	04/23/2021
Quality Control Tasks	WESTON	04/19/2021	04/23/2021	Report of Analyses/Data Package	04/23/2021
Data Validation	WESTON	04/30/2021	05/07/2021	Validation Summary Report	05/10/2021
Summarize Data	WESTON	05/10/2021	05/17/2021	Project-Specific Summary Report/Table	05/17/2021
Develop Project-Specific Report	WESTON	05/10/2021	06/12/2021	Draft Project-Specific Report	06/12/2021
Address EPA comments on Draft Project-Specific Report	WESTON	06/19/2021	06/23/2021	Project-Specific Report	06/23/2021
Contract Closeout	WESTON	07/01/2020	6/30/2021	Contract Closeout Report	6/30/2021

Note: All dates listed above are approximate dates, actual deliverable will be provided based on sampling date and the date analytical data will be received from the lab.
NA – Not Applicable

QAPP Worksheet #14 & 16: Project Tasks and Schedules (Continued)

Sampling Tasks:

START V has been tasked with sampling fill material from two stockpiles, including 2-inch crusher run stone (clean fill) and topsoil stockpiles. Up to five grab samples each, including one field duplicate each, of clean fill and topsoil will be collected for TAL VOCs analysis. Additionally, two composite samples each, including one field duplicate each, of clean fill and topsoil will be collected for TAL: SVOCs, PCBs, pesticides, herbicides, metals including mercury, and cyanide, radiochemistry, and PFAS, analyses. As per PFAS soil sampling requirement, one rinsate blank will be collected.

Analysis Tasks:

Soil: Radiological parameter: Gamma spectroscopy/Ra-226 (ingrowth) by EPA Method 901.1, alpha spectroscopy by HASL 300/A-01-R.

Soil: Full TAL parameters: TAL Metals (SW-846 6010D, 7470A/7471B), Hg (SW-846 7471B), CN (SW-846 9012B), TAL VOCs (SW-846 8260C), TAL SVOCs (SW-846 8270D), TAL Pesticides (SW-846 8081A) PCBs (SW-846 8082A), Herbicides (SW-846 8151A),

Soil/Aqueous (Rinsate Blank): PFAS, EPA Method 537.1

Decontamination: Dedicated sampling equipment will be utilized for sample collection; therefore, decontamination of sampling equipment is not necessary. However, in accordance with EPA Method 537.1 for PFAS analysis, equipment/rinsate blank will be collected during fill material sampling.

Quality Control Tasks: The soil and rinsate samples will be analyzed for definitive data deliverable. For QA/QC purposes, field duplicate and additional sample volumes designated as MS/MSD, will be collected at the rate of one per 20 field samples. In accordance with EPA modified Method 537.1 for PFAS and SPLP analyses, although dedicated sampling equipment will be utilized, equipment/rinsate blank will be collected for clean fill/topsoil samples.

Data Management Tasks: Activities under this project will be reported in status and trip reports and other deliverables (e.g., analytical reports, final reports) described herein. Activities will also be summarized in appropriate format for inclusion in monthly and annual reports. The following deliverables will be provided under this project:

Trip Report: A trip report will be prepared to provide a detailed accounting of what occurred during each sampling mobilization. The trip report will be prepared within two weeks of the last day of each sampling mobilization. Information will be provided on time of major events, dates, and personnel on-site (including affiliations).

Maps/Figures: Maps depicting site layout, contaminant source areas, and sample locations will be included in the trip report, as appropriate.

QAPP Worksheet #14 & 16: Project Tasks and Schedules (Continued)

Analytical Report: An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods or procedures employed, sample results, QA/QC results, chain-of-custody documentation, laboratory correspondence, and raw data will be provided within this deliverable.

Data Review: A review of the data generated under this plan will be undertaken. The assessment of data acceptability or usability will be provided separately, or as part of the analytical report.

Documentation and Records:

All sample documents will be completed legibly, in ink. Any corrections or revisions will be made by lining through the incorrect entry and by initialing the error.

Field Logbook: The field logbook is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. Field logbook will be bound and paginated. All entries will be dated and signed by the individuals making the entries, and should include (at a minimum) the following

1. Site name and project number
2. Name(s) of personnel on-site
3. Dates and times of all entries (military time preferred)
4. Descriptions of all site activities, site entry and exit times
5. Noteworthy events and discussions
6. Weather conditions
7. Site observations
8. Sample and sample location identification and description*
9. Subcontractor information and names of on-site personnel
10. Date and time of sample collections, along with chain of custody information
11. Record of photographs
12. Site sketches

* The description of the sample location will be noted in such a manner as to allow the reader to reproduce the location in the field at a later date.

Sample Labels: Sample labels will clearly identify the particular sample, and should include the following:

1. Site/Project number
2. START V Sample identification number.
3. Sample collection date and time
4. Analytical Parameters
5. Sample preservation

Sample labels will be written in indelible ink and securely affixed to the sample container. Tie-on labels can be used if properly secured.

QAPP Worksheet #14 & 16: Project Tasks and Schedules (Concluded)

Custody Seals: Custody seals demonstrate that a sample container has not been tampered with or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook.

Assessment/Audit Tasks: No performance audit of field operations is anticipated at this time. If conducted, performance and system audit will be in accordance with the project plan.

Data Review Tasks: All non-CLP data will be validated by the START V data validators/CHP.

The data generated under this QA/QC Sampling Plan will be evaluated according to guidance in the Uniform Federal Policy for Implementing Environmental Quality Systems: Evaluating, Assessing and Documenting Environmental Data Collection and Use Programs Part 1: UFP-QAPP (EPA-105-B-04-900A, March 2005); Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities (EPA-105-B-04-900B, March 2005). Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity.

Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity.

QAPP Worksheet #15: Project Action Limits and Laboratory Specific Detection/Quantitation Limits
Worksheet #15A – Soil Radiological Parameters

Matrix: Soil
Analytical Group: Gamma Spec-GA-01-R/Alpha Spec-a-01-R
Concentration Level: Low/Medium

Analyte	CAS Number	Site-Specific Action Level (pCi/g)	Laboratory Method Detection/Quantitation Limits (mg/L)
Gamma Spec			
Actinium 228	14331-83-0	207,000	1.00
Bismuth-212	14913-49-6	10,400,000	3.00
Bismuth-214	14733-03-0	2,110,000	1.00
Cesium-137	10045-97-3	18	0.200
Lead-212	15092-94-1	1,060,000	0.300
Lead-214	15067-28-4	11,800,000	1.00
Potassium-40	13966-00-2	43	1.50
Protactinium-234	378783-76-7	116,000	1.50
Radium-224	13233-32-4	1,400,000	5.00
Radium-226	13982-63-3	4.06	1.00
Radium-228	15262-20-1	26.3	1.00
Thallium-208	14913-50-9	5,470,000	0.200
Thorium-234	15065-10-8	76,700	4.00
Isotopic Uranium (Alpha Spec)			
Uranium-233/234	13966-29-5	10,300	1.00
Uranium-235/236	15117-96-1	60.9	1.00
Uranium-238	7440-61-1	11,700	1.00
Isotopic Thorium (Alpha Spec)			
Thorium-228	14274-82-9	31,000	1.00
Thorium-230	14269-63-7	6,160	1.00
Thorium-232	7440-29-1	6,260	1.00

Note: There are no EPA Site-Specific Action Levels for aqueous samples.
pCi/g – Picocuries per gram

QAPP Worksheet #15: Project Action Limits and Laboratory Specific Detection/Quantitation Limits (Continued)
Worksheet #15B: TAL VOCs – Soil (Non-CLP Worksheet)

Matrix: Soil
Analytical Group: TAL VOCs
Concentration Level: Low/Medium

Analyte	CAS Number	Action Level	Laboratory Method Detection/Quantitation Limits
1,1,1-Trichloroethane	71-55-6	See Attachment C	See Attachment D
1,1,2,2-Tetrachloroethane	79-34-5		
1,1,2-Trichloroethane	79-00-5		
1,1,2-Trichlorotrifluoroethane	76-13-1		
1,1-Dichloroethane	75-34-3		
1,1-Dichloroethene	75-35-4		
1,2,3-Trichlorobenzene	87-61-6		
1,2,4-Trichlorobenzene	120-82-1		
1,2-Dibromo-3-chloropropane	96-12-8		
1,2-Dibromoethane	106-93-4		
1,2-Dichlorobenzene	95-50-1		
1,2-Dichloroethane	107-06-2		
1,2-Dichloropropane	78-87-5		
1,3-Dichlorobenzene	541-73-1		
1,4-Dichlorobenzene	106-46-7		
2-Butanone	78-93-3		
2-Hexanone	591-78-6		
4-Methyl-2-pentanone	108-10-1		
Acetone	67-64-1		
Benzene	71-43-2		
Bromochloromethane	74-97-5		
Bromodichloromethane	75-27-4		
Bromoform	75-25-2		
Bromomethane	74-83-9		
Carbon disulfide	75-15-0		
Carbon tetrachloride	56-23-5		
Chlorobenzene	108-90-7		
Chlorodibromomethane	124-48-1		
Chloroethane	75-00-3		
Chloroform	67-66-3		
Chloromethane	74-87-3		
cis-1,2-Dichloroethene	156-59-2		
cis-1,3-Dichloropropene	10061-01-5		
Cyclohexane	110-82-7		
Dichlorodifluoromethane	75-71-8		
Ethyl Benzene	100-41-4		
Hexachlorobutadiene	87-68-3		
Hexachloroethane	67-72-1		

QAPP Worksheet #15: Project Action Limits and Laboratory Specific Detection/Quantitation Limits (Continued)
Worksheet #15B: TAL VOCs – Soil (Non-CLP Worksheet) (Concluded)

Matrix: Soil
Analytical Group: TAL VOCs
Concentration Level: Low/Medium

Analyte	CAS Number	Action Level	Laboratory Method Detection/Quantitation Limits
Isopropylbenzene	98-82-8	See Attachment C	See Attachment D
Methyl Cyclohexane	108-87-2		
Methyl tert-butyl Ether	1634-04-4		
Methylene chloride	75-09-2		
o-xylene	95-47-6		
Styrene	100-42-5		
t-1,3-Dichloropropene	10061-02-6		
Tetrachloroethene	127-18-4		
Toluene	108-88-3		
Trans-1,2-dichloroethene	156-60-5		
Trichloroethene	79-01-6		
Trichlorofluoromethane	75-69-4		
Vinyl chloride	75-01-4		

QAPP Worksheet #15: Project Action Limits and Laboratory Specific Detection/Quantitation Limits (Continued)
Worksheet #15C: TAL SVOCs – Soil (Non-CLP Worksheet)

Matrix: Soil
Analytical Group: TAL SVOCs
Concentration Level: Low/Medium

Analyte	CAS Number	Action Level	Laboratory Method Detection/Quantitation Limits
1,1-Biphenyl	92-52-4	See Attachment C	See Attachment D
1,2,4,5-Tetrachlorobenzene	95-94-3		
1,4-Dioxane	123-91-1		
2,2-oxybis(1-Chloropropane) {Bis(2-chloroisopropyl) Ether}	108-60-1		
2,3,4,6-Tetrachlorophenol	58-90-2		
2,4,5-Trichlorophenol	95-95-4		
2,4,6-Trichlorophenol	88-06-2		
2,4-Dichlorophenol	120-83-2		
2,4-Dimethylphenol	105-67-9		
2,4-Dinitrophenol	51-28-5		
2,4-Dinitrotoluene	121-14-2		
2,6-Dinitrotoluene	606-20-2		
2-Chloronaphthalene	91-58-7		
2-Chlorophenol	95-57-8		
2-Methylnaphthalene	91-57-6		
2-Methylphenol	95-48-7		
2-Nitroaniline	88-74-4		
2-Nitrophenol	88-75-5		
3,3-Dichlorobenzidine	91-94-1		
3+4-Methylphenols (3-Methylphenol and 4-Methyl phenol)	65794-96-9		
3-Nitroaniline	99-09-2		
4,6-Dinitro-2-methylphenol	534-52-1		
4-Bromophenyl-phenylether	101-55-3		
4-Chloro-3-methylphenol	59-50-7		
4-Chloroaniline	106-47-8		
4-Chlorophenyl-phenylether	7005-72-3		
4-Nitroaniline	100-01-6		
4-Nitrophenol	100-02-7		
Acenaphthene	83-32-9		
Acenaphthylene	208-96-8		
Acetophenone	98-86-2		
Anthracene	120-12-7		
Atrazine	1912-24-9		
Benzaldehyde	100-52-7		
Benzo(a)anthracene	56-55-3		
Benzo(a)pyrene	50-32-8		
Benzo(b)fluoranthene	205-99-2		
Benzo(g,h,I)perylene	191-24-2		
Benzo(k)fluoranthene	207-08-9		
bis(2-Chloroethoxy)methane	111-91-1		
bis(2-Chloroethyl)ether	111-44-4		
bis(2-Ethylhexyl)phthalate	117-81-7		
Butylbenzylphthalate	85-68-7		

QAPP Worksheet #15: Project Action Limits and Laboratory Specific Detection/Quantitation Limits (Continued)
Worksheet #15C: TAL SVOCs – Soil (Non-CLP Worksheet) (Continued)

Matrix: Soil
Analytical Group: TAL SVOCs
Concentration Level: Low/Medium

Analyte	CAS Number	Action Level	Laboratory Method Detection/Quantitation Limits
Caprolactam	105-60-2	See Attachment C	See Attachment D
Carbazole	86-74-8		
Chrysene	218-01-9		
Dibenzo(a,h)anthracene	53-70-3		
Dibenzofuran	132-64-9		
Diethylphthalate	84-66-2		
Dimethylphthalate	131-11-3		
Di-n-butylphthalate	84-74-2		
Di-n-octyl phthalate	117-84-0		
Fluoranthene	206-44-0		
Fluorene	86-73-7		
Hexachlorobenzene	118-74-1		
Hexachlorobutadiene	87-68-3		
Hexachlorocyclopentadiene	77-47-4		
Hexachloroethane	67-72-1		
Indeno(1,2,3-cd)pyrene	193-39-5		
Isophorone	78-59-1		
Naphthalene	91-20-3		
Nitrobenzene	98-95-3		
N-Nitroso-di-n-propylamine	621-64-7		
n-Nitrosodiphenylamine	86-30-6		
Pentachlorophenol	87-86-5		
Phenanthrene	85-01-8		
Phenol	108-95-2		
Pyrene	129-00-0		
Caprolactam	105-60-2		
Carbazole	86-74-8		
Chrysene	218-01-9		
Dibenzo(a,h)anthracene	53-70-3		
Dibenzofuran	132-64-9		
Diethylphthalate	84-66-2		
Dimethylphthalate	131-11-3		
Di-n-butylphthalate	84-74-2		
Di-n-octyl phthalate	117-84-0		
Fluoranthene	206-44-0		
Fluorene	86-73-7		
Hexachlorobenzene	118-74-1		
Hexachlorobutadiene	87-68-3		
Hexachlorocyclopentadiene	77-47-4		
Hexachloroethane	67-72-1		
Indeno(1,2,3-cd)pyrene	193-39-5		
Isophorone	78-59-1		
Naphthalene	91-20-3		
Nitrobenzene	98-95-3		

QAPP Worksheet #15: Project Action Limits and Laboratory Specific Detection/Quantitation Limits (Continued)
Worksheet #15C: TAL SVOCs – Soil (Non-CLP Worksheet) (Concluded)

Matrix: Soil
Analytical Group: TAL SVOCs
Concentration Level: Low/Medium

Analyte	CAS Number	Action Level	Laboratory Method Detection/Quantitation Limits
N-Nitroso-di-n-propylamine	621-64-7	See Attachment C	See Attachment D
n-Nitrosodiphenylamine	86-30-6		
Pentachlorophenol	87-86-5		
Phenanthrene	85-01-8		
Phenol	108-95-2		
Pyrene	129-00-0		

QAPP Worksheet #15: Project Action Limits and Laboratory Specific Detection/Quantitation Limits
Worksheet #15D: PFAS (Non-CLP)

Matrix: Soil/Aqueous (Rinsate Blank)
Analytical Group: PFAS
Concentration Level: Low

Analyte	CAS Number	Project Quantification Limit*	NYSDEC RUSCO (PFAS) (ppb)	Achievable Laboratory	
				MDLs* µg/kg	RLs µg/kg
Perfluorobutanoic acid (PFBA)	375-22-4	Not Applicable	See Attachment B	0.0280	0.200
Perfluoropentanoic acid (PFPeA)	2706-90-3			0.0770	0.200
Perfluorohexanoic acid (PFHxA)	307-24-4			0.0420	0.200
Perfluoroheptanoic acid (PFHpA)	375-85-9			0.0290	0.200
Perfluorooctanoic acid (PFOA)	335-67-1			0.0860	0.200
Perfluorononanoic acid (PFNA)	375-95-1			0.0360	0.200
Perfluorodecanoic acid (PFDA)	335-76-2			0.0220	0.200
Perfluoroundecanoic acid (PFUnA)	2058-94-8			0.0360	0.200
Perfluorododecanoic acid (PFDoA)	307-55-1			0.0670	0.200
Perfluorotridecanoic acid (PFTriA)	72629-94-8			0.0510	0.200
Perfluorotetradecanoic acid (PFTeA)	376-06-7			0.0540	0.200
Perfluorobutanesulfonic acid (PFBS)	375-73-5			0.0250	0.200
Perfluorohexanesulfonic acid (PFHxS)	355-46-4			0.0310	0.200
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8			0.0350	0.200
Perfluorooctanesulfonic acid (PFOS)	1763-23-1			0.200	0.500
Perfluorodecanesulfonic acid (PFDS)	335-77-3			0.0390	0.200
Perfluorooctanesulfonamide (FOSA)	754-91-6			0.0820	0.200
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9			0.390	2.00
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6			0.370	2.00
6:2 FTS	27619-97-2			0.150	2.00
8:2 FTS	39108-34-4			0.250	2.00

Samples will be compared with New York State Department of Environmental Conservation (NYSDEC) guidance values for residential use documented in Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) NYSDEC Part 375 Remedial Program, October 2020. Refer to Attachment B.

QAPP Worksheet #15: Project Action Limits and Laboratory Specific Detection/Quantitation Limits (Continued)
Worksheet #15E: TAL Pesticides – Soil (Non-CLP Worksheet)

Matrix: Soil
Analytical Group: TAL Pesticides
Concentration Level: Low/Medium

Analyte	CAS Number	Action Level	Laboratory Method Detection/Quantitation Limits
4,4-DDD	72-54-8	See Attachment C	See Attachment D
4,4-DDE	72-55-9		
4,4-DDT	50-29-3		
Aldrin	309-00-2		
alpha-BHC	319-84-6		
alpha-Chlordane	5103-71-9		
beta-BHC	319-85-7		
delta-BHC	319-86-8		
Dieldrin	60-57-1		
Endosulfan I	959-98-8		
Endosulfan II	33213-65-9		
Endosulfan Sulfate	1031-07-8		
Endrin	72-20-8		
Endrin aldehyde	7421-93-4		
Endrin ketone	53494-70-5		
gamma-BHC (Lindane)	58-89-9		
gamma-Chlordane	5103-74-2		
Heptachlor	76-44-8		
Heptachlor epoxide	1024-57-3		
Methoxychlor	72-43-5		
Toxaphene	8001-35-2		

QAPP Worksheet #15: Project Action Limits and Laboratory Specific Detection/Quantitation Limits (Continued)
Worksheet #15F: PCBs – Soil (Non-CLP Worksheet)

Matrix: Soil
Analytical Group: TAL PCBs
Concentration Level: Low/Medium

Analyte	CAS Number	Action Level	Laboratory Method Detection/Quantitation Limits
Aroclor-1016	12674-11-2	See Attachment C	See Attachment D
Aroclor-1221	11104-28-2		
Aroclor-1232	11141-16-5		
Aroclor-1242	53469-21-9		
Aroclor-1248	12672-29-6		
Aroclor-1254	11097-69-1		
Aroclor-1260	11096-82-5		
Aroclor-1262	37324-23-5		
Aroclor-1268	11100-14-4		

QAPP Worksheet #15: Project Action Limits and Laboratory Specific Detection/Quantitation Limits (Continued)
Worksheet #15G: Herbicides – Soil (Non-CLP Worksheet)

Matrix: Soil
Analytical Group: Herbicides
Concentration Level: Low/Medium

Analyte	CAS Number	Action Level[1]	Laboratory Method Detection/Quantitation Limits
Dalapon	75-99-0	See Attachment C	See Attachment D
4-Nitrophenol	100-02-1		
Dicamba	1918-00-9		
Dichloroprop	120-36-5		
2,4-D	94-75-7		
Pentachlorophenol	87-86-5		
2,4,5-T-P (Silvex)	93-72-1		
2,4,5-T	93-76-5		
Dinoseb	88-85-7		
2,4-DB	94-82-6		

QAPP Worksheet #15: Project Action Limits and Laboratory Specific Detection/Quantitation Limits (Continued)
Worksheet #15H: TAL Metals including Hg and CN – Soil (Non-CLP Worksheet)

Matrix: Soil
Analytical Group: TAL Metals including Hg and CN
Concentration Level: Low/Medium

Analyte	CAS Number	Action Level	Laboratory Method Detection/Quantitation Limits
Aluminum	7429-90-5	See Attachment C	See Attachment D
Antimony	7440-36-0		
Arsenic	7440-38-2		
Barium	7440-39-3		
Beryllium	7440-41-7		
Cadmium	7440-43-9		
Calcium	7440-70-2		
Chromium	7440-47-3		
Cobalt	7440-48-4		
Copper	7440-50-8		
Iron	7439-89-6		
Lead	7439-92-1		
Magnesium	7439-95-4		
Manganese	7439-96-5		
Nickel	7440-02-0		
Potassium	7440-09-7		
Selenium	7782-49-2		
Silver	7440-22-4		
Sodium	7440-23-5		
Thallium	7440-28-0		
Vanadium	7440-62-2		
Zinc	7440-66-6		
Mercury	7439-97-6		
Cyanide	57-12-5		

QAPP Worksheet #17: Sampling Design and Rationale

All field sampling activities will be conducted in accordance with EPA's ERT/SERAS contractor's SOP No. 2001: *General Field Sampling Guidelines*.

Clean fill/Topsoil Sampling for TAL Analyses:

Clean fill and topsoil sampling for full TAL analyses will be performed in accordance with New York Codes, Rules and Regulations (NYCRR) Part 375 and NYSDEC *(DER)-10, Technical Guidance for Site Investigation and Remediation* (May 3, 2010), and MARSSIM. Clean fill/topsoil samples will be collected from stockpiles located on the fill material vendor's facility. Up to five grab samples each, including one field duplicate each, of clean fill and topsoil for TAL VOCs analysis will be collected directly from four sampling locations selected on each stockpile using three Encore™ samplers per sample. Subsequently, aliquots of each sample matrix will be collected from the four sampling locations selected on each stockpile using dedicated stainless-steel scoop. The aliquots of each sample matrix will be separately homogenized in aluminum pans, from which two composite samples, including one field duplicate, will be collected per matrix. New nitrile gloves will be donned at each stockpile location. The samples will be placed in appropriate sample containers for TAL: SVOCs, PCBs, pesticides, herbicides, metals including mercury, cyanide, and radiochemistry, analyses. For QC purposes, additional sample volumes designated for MS/MSD analyses will be collected. All sample information will be entered into the Site-Specific Scribe sample management database from which COC record and sample labels will be printed using the Scribe software.

Clean fill/Topsoil Sampling for PFAS Analyses:

Clean fill and topsoil sampling for PFAS analysis will be performed in accordance with the *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS)* protocol stipulated in the NYSDEC Part 375 Remedial Program, October 2020. Clean fill/topsoil samples will be collected from stockpiles located on the fill material vendor's facility. Aliquots of each sampling matrix will be collected from four sampling locations selected on each stockpile using dedicated stainless-steel scoop. The aliquots of each sample matrix will be separately homogenized in stainless-steel pans/bowl/container, from which two composite samples, including one field duplicate, will be collected per matrix. For QC purposes, additional sample volumes of each matrix designated for MS/MSD analyses will be collected. The number of samples to be collected will be in accordance with NYSDEC DER-10 and based on the volume of soil to be excavated/backfilled on-site, which is approximately 200 yd^3. Prior to sampling, the Weston PFAS sampling protocol checklist will be completed in order to prevent potential contamination of the samples with PFAS. New nitrile gloves will be donned at each stockpile location. The samples will be placed into sample containers to be provided by the assigned laboratory. In accordance with the PFAS sampling SOP, one equipment/rinsate blank will be collected for each sample matrix and submitted along with the clean fill/topsoil samples for PFAS analysis. All sample information will be entered into the Site-Specific Scribe sample management database from which chain of custody (COC) record and sample labels will be printed using the Scribe software.

QAPP Worksheet #17: Sampling Design and Rationale (Concluded)

Air Sampling:

Baseline air sampling will be conducted prior to initiating intrusive Site activities (excavation). Air sampling will be conducted at each air monitoring station using RADēCO (Model H-810) volumetric air samplers calibrated by the manufacturer and equipped with replaceable filter media. Each air sampler contains a 2-inch filter holder with a RADēCO (0750-37) glass fiber air filter. The air samplers will be set to collect air filter samples at a flow rate of 5 cubic feet per minute (cfm) for a target volume of 2,400 cubic feet (cf) over an approximately 8-hour period. Each day, the air samplers will be calibrated using the RADēCO Air Calibrator (Model D-828) prior to being deployed. Calibration readings will be recorded using the RADēCO Model H-810 Calibration Functional Check Form F001 or documented in the Site logbook. Calibration forms/information will be reviewed and maintained on-site by the EPA Health Physicist (HP) prior to air sampler being used in the field.

Each RADēCO unit will be mounted on a tripod stand, powered with an electric generator, and positioned in an opposing wind direction. Air filter samples will be collected from perimeter air monitoring locations. All air filter samples collected will be placed in a glassine envelop before being placed in a re-sealable plastic bag. Air sampling information, including date, start and stop time, start and ending flow rates, and total volume will be entered into the Site-Specific Scribe sample management database from which sample labels and COC record will be generated using the Scribe software. The sample label will be placed on the re-sealable plastic bag for each air sample, and documentation associated with the samples, including COCs, will be kept with the samples until relinquished to the field measurement personnel.

This sampling design is based on information currently available and may be modified on-site in light of field screening results and other acquired information.

The following laboratory will provide the analyses indicated:

Lab Name/Location	Sample Type	Parameters
Chemtech Consulting Group 284 Sheffield St Mountainside, NJ 07092 Contact: Kurt Hummler Call: (908) 728-3143	Soil	Full TAL: VOCs, SVOCS, Pesticides, PCBs, Metals + Mercury + Cyanide, and Herbicides
Eurofins TestAmerica Laboratories, Inc. 13715 Rider Trail North Earth City, MO 63045 Contact: Mike Franks Call: (314) 298-8566 RFP# 636	Soil	Gamma spectroscopy / Ra-226 homogenized for 21 days ingrowth Alpha spectroscopy U-233/234, U-235/236, U-238, Th-230, Th-232, and Th-228. PFAS
	Aqueous	PFAS

Refer to Worksheet #20 for QA/QC samples, sampling methods, and SOPs.

QAPP Worksheet #18: Sampling Locations and Methods/SOP Requirements Table

The following information is project-specific and will be included in the site-specific QAPP.

Sampling Location	Matrix	(Units)	Sample Type No. of Samples (identify field duplicates)	Analyte/Analytical Group(s)	Sampling SOP Reference[1]	Comments
8	Soil	pCi/g	Composite, 2 (2)	Gamma spectrometry, Alpha Spectrometry, and Isotopic Uranium/Thorium	SOP# 2001, SOP# 2012, MARSSIM[2]	To verify that the fill materials meet the regulatory requirements for use as backfill.
8	Soil	µg/kg mg/kg	Composite, 2 (2)	TAL: SVOCs, Pesticides, PCBs, Metals + Hg, CN, Herbicides	SOP# 2001, SOP# 2012	To verify that the fill materials meet the regulatory requirements for use as backfill.
8	Soil	µg/kg mg/kg	Composite, 2 (2)	TCLP: SVOCs, Pesticides, Metals, Herbicides	SOP# 2001, SOP# 2012	To verify that the fill materials meet the regulatory requirements for use as backfill.
8	Soil	µg/kg mg/kg	Grab, 8 (2)	TAL VOCs	SOP# 2001, SOP# 2012	To verify that the fill materials meet the regulatory requirements for use as backfill.
8	Soil	ppb	Composite, 2 (2)	PFAS	SOP# 2001, SOP# 2012	To verify that the fill materials meet the regulatory requirements for use as backfill.
NA	Aqueous (Rinsate Blank)	mg/L	Grab, 1	PFAS	SOP# 2001, SOP# 2012	To verify that cross contamination did not occur during sampling

[1]The website for EPA/ERT SOPs is: https://response.epa.gov/site/site_profile.aspx?site_id=2107
[2]The website for MARSSIM is: https://www.epa.gov/radiation/download-marssim-manual-and-resources

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference[1]	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Package Turnaround Time
Soil	Gamma Spec	EPA 901.1 / ST-RD-0102	1x16oz. plastic or glass	None	None	7days preliminary data 14 days final data
	Alpha Spec	HASL 300 A-01-R / ST-RD-0210	Included with Gamma spec	None	None	7days preliminary data 14 days final data
	TAL VOCs / Percent Moisture	SW-846 8260C	(3) 5-gram Encore samplers / (1) 4 oz. jar with septum	Cool to 4°C	48 hours (from time of sample collection)	7days preliminary data 14 days final data
	TAL SVOCs	SW-846 8270D	(1) 8 oz. clear glass jar w/ Teflon lined cap	Cool to 4°C	14 days extract; 40 days analyze	7days preliminary data 14 days final data
	TAL Pesticides	SW-846 8081B	(1) 8 oz. clear glass jar w/ Teflon lined cap	Cool to 4°C	14 days extract; 40 days analyze	7days preliminary data 14 days final data
	PCBs	SW-846 8082A	(1) 8 oz. clear glass jar w/ Teflon lined cap	Cool to 4°C	14 days extract; 40 days analyze	7days preliminary data 14 days final data
	Herbicides	SW-846 8151A	(1) 8 oz. clear glass jar w/ Teflon lined cap	Cool to 4°C	14 days extract; 40 days analyze	7days preliminary data 14 days final data
	TAL Metals, Hg, CN	SW-846 6010D	(1) 8 oz. clear glass jar w/ Teflon lined cap	Cool to 4°C	Metals - 180 days Hg - 28 days CN - 14 days	7days preliminary data 14 days final data
	PFAS	EPA537.1 modified	1 x 4-oz. HDPE Jar	Soil, Ice to 6°C	14/40 days	7days preliminary data 14 days final data
Aqueous	PFAS	EPA537.1 modified	1 x 4-oz. HDPE Jar	Trizma, Ice to 6°C	14/40 days	21 days preliminary data 42 days validated data

[1]The website for EPA's ERT/SERAS SOPs is: https://response.epa.gov/site/site_profile.aspx?site_id=2107
[2] The minimum sample size is based on analysis allowing for sufficient sample for reanalysis. Additional volume is needed for laboratory Matrix Spike/Matrix Spike Duplicate.
* No sample preservation is required, but sample containers should be completely filled and tightly sealed to preserve sample integrity.

QAPP Worksheet #20: Field Quality Control Sample Summary

Matrix	Analytical Group	No. of Field Samples	No. of Field Duplicates	No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples	No. of Field Blanks	No. of Equip. Blanks	No. of Trip. Blanks	No of others	Total No. of Samples to Lab
Soil	Gamma spectrometry/Ra-226 (21 days ingrowth) and Alpha Spectrometry	2	2	2	NR	NR	NR	NR	4
	TAL: VOCs	8	2	2	NR	NR	NR	NR	10
	TAL: SVOCs, Pesticides, Metals + Hg, CN, Herbicides	2	2	2	NR	NR	NR	NR	4
	PFAS	2	2	2	NR	NR	NR	NR	4
Aqueous	PFAS	0	0	0	NR	1	NR	NR	1

NR – Not Required

QAPP Worksheet #21: Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comment
SOP # 2001	General Field Sampling Guidelines Rev. 1.0, October 2020	EPA/ERT	Plastic scoops, re-sealable plastic bags, and glass sample jars	N	NA
SOP # 2012	Soil Sampling; Rev.01, July 2001	EPA/ERT	Plastic scoops, re-sealable plastic bags, and glass sample jars	N	NA
SOP # 2078	*Operation of the DustTrak Aerosol Monitor*, Desktop DRX Model 8533EP and Handheld DRX Model 8534. Rev. 1.1, June 2020	EPA/ERT	Aerosol Monitor	N	NA
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual, August 2000	NUREG/EPA/DOE	Plastic scoops, re-sealable plastic bags, and glass sample jars	N	NA

See Attachment B for EPA's ERT/SERAS SOP #s 2001, 2012, and MARSSIM.
The website for EPA's ERT/SERAS SOPs is: https://response.epa.gov/site/site_profile.aspx?site_id=2107
The website for MARSSIM is: https://www.epa.gov/radiation/download-marssim-manual-and-resources

QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Trimble® GeoXT™ handheld GPS	Factory-calibrated by Manufacturer	Charge battery when low	Confirm optimum satellite reception and battery status	Charge battery at least daily	For data accuracy, the unit should receive communication from at least 5 satellites	Charge battery when low or replace battery if it does not hold charge	EPA Equipment office	Not applicable
*Ludlum Model 2241 with 3x3 Gamma Scintillator	Factory-calibrated by Manufacturer	Replace battery when low	Turn on instrument to confirm sensitivity	As needed	Instrument reads background	EPA Equipment office	EPA Equipment office	Not applicable
DustTrak	NA	NA	Perform zero calibration	Before each use (refer to Section 7.2.3).	Pass	Repeat, clean instrument	Field Personnel	ERT/SERAS SOP 2078
DustTrak	NA	Clean inlet	Check Inlet	350 hr. at 1 mg/m^3	Pass	Repeat, clean instrument	Field Personnel	ERT/SERAS SOP 2078
DustTrak	NA	Clean 2.5 µm calibration impactor	Check impactor	Before every use.	Pass	Repeat, clean instrument	Field Personnel	ERT/SERAS SOP 2078
DustTrak	NA	Replace internal filters	Check Filter	350 hr. at 1 mg/m^3 or when indicated by the main screen filter error indicator.	Pass	Repeat, clean instrument	Field Personnel	ERT/SERAS SOP 2078
DustTrak	Annual Calibration	Return to factory for cleaning and calibration (TSI recommends that both the DustTrak monitor and the External Pump Module be returned to TSI)	NA	Annual	Manufacturer's Specifications	Recalibrate	Manufacturer or designated vendor	ERT/SERAS SOP 2078
DustTrak	Annual Calibration	Replace the internal HEPA filters in the External Pump module	NA	Annual	Manufacturer's Specifications	Replace the internal HEPA filters	Manufacturer or designated vendor	ERT/SERAS SOP 2078
Electronic Flow Meter	Calibrated by manufacturer	NA	NA	Annual	Manufacturer's Specifications	Recalibrate	Manufacturer or designated vendor	ERT/SERAS SOP 2130

*Equipment provided, calibrated, maintained, tested, and inspected by EPA.

QAPP Worksheet #23: Analytical SOPs

Reference Number	Title, Revision Date, and/or Number and URL (if available)	Definitive or Screening Data	Analytical Group	Instrument	Modified for Project Work? (Y/N) *
AP-011 AP-018AP-018	Gamma Spectroscopy Operation, Rev-20, 5/31/17 Operation of the Alpha Spectroscopy Systems Rev-19, 5/31/17	Definitive	Soil, Gamma Spectroscopy	Canberra	N
AP-002 & AP-005	Sample Preparation Rev21, 10/29/16 & Alpha Isotopic Analyses, Rev-20, 10/31/16	Definitive	Soil Alpha Spectroscopy	Canberra	N
SW-846 6010D	Inductively Coupled Plasma – Optical Emission Spectrometry, July 2018, Rev. 5	Definitive	Soil TAL Metals	ICP-AES	N
SW-846 3050B	Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique), January 1998, Rev. 2	Definitive	Soil TAL Mercury	CVAA	N
SW-846 9010C	Total and Amenable Cyanide: Distillation, November 2004, Rev. 2	Definitive	Soil TAL Cyanide	Colorimeter	N
SW-846 8260D	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), August 2006, Rev. 3	Definitive	Soil TAL Volatiles	GC/MS	N
SW-846 8270E	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), July 2014, Rev. 5	Definitive	TAL Soil TAL SemiVolatiles	GC/MS	N
SW-846 8081B	Organochlorine Pesticides by Gas Chromatography, February 2007, Rev. 2	Definitive	Soil TAL Pesticides	GC	N
SW-846 8082A	Polychlorinated Biphenyls (PCBs) by Gas Chromatography, February 20017, Rev. 1	Definitive	Soil TAL PCBs	GC	N
SW-846 8151A	Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzylation Derivatization, December 1996, Rev. 1	Definitive	Soil TAL Pesticide Herbicides	GC	N
NYSDEC PART 375 Remedial Programs	Sampling, analysis on assessment of per- And polyfluoroalkyl substances (PFAS) October 2020	Definitive	Soil/Aqueous PFAS	LC-MS/MS	N

ICP-AES = Inductively Coupled Plasma-Atomic Emission Spectrometer
CVAA = Cold Vapor Atomic Absorption
GC = Gas Chromatograph
GC/MS = Gas Chromatograph/Mass Spectrometer

QAPP Worksheet #24: Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectroscopy	Energy and efficiency calibrations	After initial installation, annually and following maintenance that would affect calibration	Gamma Spectroscopy Detector Resolution - within +0.4 Full Width at Half Maximum (FWHM) of the value during the initial calibration Energy – within +1 keV of the known energies Efficiency – 90-110% of the efficiency determined during the initial calibration	Correct problem, re-calibrate and re-analyze any affected samples	Assigned Laboratory Personnel	RTCA, New York Gamma Spectroscopy SOP
Gamma Spectrometer	Initial Calibration Verification (ICAL) for Energy, Efficiency, and FWHM peak resolution	Prior to initial use, following repair or loss of control and upon incorporation of new or changed instrument settings	Peak energy difference is within 0.1 keV of reference energy for all points. Peak FWHM < 2.5 keV at 1332 keV. Energy vs channel slope equation shall be linear and accurate to 0.5 keV	Correct problem, then repeat ICAL.	Lab Manager / Analyst	ST-RD-0102
Gamma Spectrometer	Initial Calibration Verification (ICV)	After ICAL for energy/efficiency and prior to analysis of samples.	Observed peaks of second source standard fall within ± 10% of initial calibration value relative to the true value.	Verify second source standard and repeat ICV to check for errors. If that fails, identify and correct problem and repeat ICV or ICAL and ICV as appropriate.	Lab Manager / Analyst	ST-RD-0102
Gamma Spectrometer	Continuing Calibration Verification (CCV) (Daily Check)	Daily or prior to use. When working with long count times or batch sequences that run more than a day, CCV is performed at the beginning and end of each analytical batch as long as it is not longer than a week.	Energy: ±0.5 keV at 60 keV; ± .75 keV at 1332 keV. FW HM: ±1.2x at 60 keV; ±1.8x at 662 keV; ±2.3x at 1332 keV. Activity Difference: %difference between the source activity and the reported activity ±5%	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Lab Manager / Analyst	ST-RD-0102
Gamma Spectrometer	Background Subtraction Count Measurement (BSC) (Long count for subtracting background from blanks or test sources)	Immediately after ICAL and then performed on at least a monthly basis.	Background count rate of the entire spectrum with ±3σ of the average.	Recount and check control chart for trends. Determine cause, correct problem, re-establish BSC. If background activity has changed, re-establish BSC and reanalyze or qualify all impacted samples since last acceptable BSC.	Lab Manager / Analyst	ST-RD-0102

QAPP Worksheet #24: Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer	Instrument Contamination Check (ICC) (Short count for controlling gross contamination)	Daily or when working with long count times before and after each analytical batch. Check after counting high activity samples.	No extraneous peaks identified (i.e., no new peaks in the short background spectrum compared to previous spectra); Background count rate of the entire spectrum with ±3σ of the average.	Recount the background. If still out of control, locate and correct problem; reanalyze or qualify all impacted samples since last acceptable ICC. If background activity has changed, re-establish BSC and reanalyze samples.	Lab Manager / Analyst	ST-RD-0102
Alpha Spectrometer	Initial Calibration (ICAL) (Energy, efficiency and FWHM peak resolution)	Prior to initial use, following repair or loss of control and upon incorporation of new or changed instrument settings.	3 isotopes within energy range of 3-6 MeV. Energy vs. channel slope equation <15 keV per channel. Full Width –Half Maximum (FWHM) <100 keV for each peak used for calibration. Minimum of 3,000 net counts in each peak.	Correct problem, then repeat ICAL.	Lab Manager / Analyst	ST-RD-0210
Alpha Spectrometer	Initial Calibration Verification (ICV)	After initial calibration.	FWHM ≤100 keV ; Each peak within ±40 keV of corresponding calibration peaks in initial energy calibration. Minimum 2000 net counts. Efficiency within 95% - 105% of initial calibration value.	Repeat ICV to check for error. If that fails, identify and correct problem and repeat ICV or ICAL and ICV, as appropriate.	Lab Manager / Analyst	ST-RD-0210
Alpha Spectrometer	Continuing Calibration Verification (CCV) (Pulser check)	Pulser verification daily, prior to analysis of samples.	Observed peak centroid falls ≤ 20 keV from reference energy.	Recount and check control chart for trends. Determine cause, correct problem, and repeat CCV and all associated samples since last successful CCV.	Lab Manager / Analyst	ST-RD-0210

QAPP Worksheet #24: Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Alpha Spectrometer	Continuing Calibration Verification (CCV) (Check source)	Weekly source check verification prior to analysis of samples.	FWHM ≤100 keV; Each peak within ±40 keV of corresponding calibration peaks in initial energy calibration. Minimum 2000 net counts. Efficiency within 95% - 105% of initial calibration value.	Recount and check control chart for trends. Determine cause, correct problem, and repeat CCV and all associated samples since last successful CCV.	Lab Manager / Analyst	ST-RD-0210
Alpha Spectrometer	Background Subtraction Count (BSC) Measurement	Prior to initial use or after initial calibration and monthly.	Use a statistical test to determine a change in the background count rate value.	Check control chart for trends and recount. Determine cause, correct problem, re-establish BSC. If background activity has changed, re-establish BSC and reanalyze all impacted samples since last acceptable BSC.	Lab Manager / Analyst	ST-RD-0210
Alpha Spectrometer	Instrument Contamination Check (ICC)	Performed weekly, at minimum, and after counting high activity samples.	Within ±3σ of mean activity of recent BSC's (minimum of 3 BSCs)	Check control chart for trends and recount. Determine cause and correct problem. Background activity has changed, re-establish BSC and reanalyze all infected samples.	Lab Manager / Analyst	ST-RD-0210
Electrometer	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory Electrometer Technician	SW-846 Methods

QAPP Worksheet #24: Analytical Instrument Calibration Table (Concluded)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP-AES	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory ICP-AES Technician	See SW-846 Methods
CVAA	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory CVAA Technician	SW-846 Methods
Colorimeter	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory Colorimeter Technician	SW-846 Methods
GC/MS	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory GC/MS Technician	SW-846 Methods
GC	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory GC Technician	SW-846 Methods
LC-MS-MS	See method 537.1 modified	See method 537.1 modified. The initial calibration should contain a minimum of five standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%. Linear fit calibration curves should have an R2 value greater than 0.990. The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.*	See method 537.1 modified	See method 537.1 modified	See method 537.1 modified	See method 537.1 modified

ICP-AES – Inductively Coupled Plasma-Atomic Emission Spectrometer
GC/MS – Gas Chromatograph/Mass Spectrometer
CVAA – Cold Vapor Atomic Absorption
GC – Gas Chromatograph
Also see, *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS)* protocol stipulated in NYSDEC's Part 375 Remedial Program, October 2020

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person for CA	SOP Reference[1]
Gamma Spectrometer	1. Clean cave; fill dewar with N2	1. Physical check	1. Physical check	1. Weekly	1. Acceptable background	Recalibrate	Eurofins TestAmerica/ Chemtech Analyst
Gamma Spectrometer	2. QA check	2. Background and source check	2. Check deviation	2. Daily	2. Within 3 sigma of measured population	Instrument maintenance and consult with Technical director	Eurofins TestAmerica/ Chemtech Analyst
Alpha Spectrometer	1. Clean planchette holders	1. Physical check	1. Physical check	1. Monthly	1. Acceptable background and calibration efficiencies	Recalibrate	Eurofins TestAmerica/ Chemtech Analyst
Alpha Spectrometer	2. Pulser check and background checks	2. Background and source check	2. Check deviation	2. Daily	2. Pulser energy, centroid peak, resolution area peak, calibration and background must pass statistical boundary out-of-range test.	Instrument maintenance and consult with Technical director	Eurofins TestAmerica/ Chemtech Analyst
Tandem Mass Spectrometer	See method 537.1	See method 537.1	See method 537.1	See method 537.1	See method 537.1	See method 537.1	See method 537.1

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Concluded)

Instrument/ Equipment	Maintenance Activity	Testing/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person for CA	SOP Reference[1]
ICP-AES	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory ICP-AES Technician	See SW-846 Methods
CVAA	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory CVAA Technician	See SW-846 Methods
Colorimeter	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory Colorimeter Technician	See SW-846 Methods
GC/MS	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory GC/MS Technician	See SW-846 Methods
GC	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory GC Technician	See SW-846 Methods
ICP-AES	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory ICP-AES Technician	See SW-846 Methods
CVAA	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	See SW-846 Methods	Non-CLP Laboratory CVAA Technician	See SW-846 Methods

[1] Specify the appropriate letter or number form the Analytical SOP References table (Worksheet #23).ICP-AES – Inductively Coupled Plasma-Atomic Emission Spectrometer
ICP-AES – Inductively Coupled Plasma-Atomic Emission Spectrometer
CVAA – Cold Vapor Atomic Absorption
GC/MS – Gas Chromatograph/Mass Spectrometer
GC – Gas Chromatograph
GC/ECD – Gas Chromatograph/Electron Capture Detector

QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal

Sampling Organization: Weston Solutions, Inc., START V.
Laboratories:
Eurofins TestAmerica, 13715 Rider Trail North, Earth City, MO 63045
Chemtech Consulting Group, 284 Sheffield St, Mountainside, NJ 07092
Method of sample delivery (shipper/carrier): FedEx
Number of days from reporting until sample disposal: 60 days

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference[1]
Sample Labeling	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Chain-of-Custody Form Completion	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Sample Packaging	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Shipping Coordination	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Sample Receipt, Inspection, & Log-in	Laboratory Sample Custodian	EPA-540-R-014-013, October 2014
Sample Custody and Storage	Laboratory Sample Custodian /Laboratory Analytical Personnel	EPA-540-R-014-013, October 2014
Sample Disposal	Field Personnel/Laboratory Sample Custodian /Laboratory Analytical Personnel	EPA-540-R-014-013, October 2014

Sample Identification Procedures: Each sample collected by START V will be designated by a code that will identify the sample in accordance with previous sampling (if applicable). An alpha-numeric code that identifies the site-specific property number will begin the sample nomenclature, followed by media type and location. Duplicate samples will be identified in the same manner as other samples and will be distinguished and documented in the field logbook.

Example sample naming for clean fill grab sample: HTCRV2-GRAB-CF01-01 / clean fill composite sample: HTCRV2-COMP-CF01-01 HTCRV2- Site Identification Number; HTC- Holy Trinity Cemetery; 0612- Clean Fill; 01- First Sample; Field Duplicate will be justify in the same manner, but will be the next sequential sample number (02)

Example sample naming for topsoil grab sample: HTCRV2-GRAB-TS01-01 / topsoil composite sample: HTCRV2-COMP-CF01-01 HTCRV2- Site Identification Number; HTC- Holy Trinity Cemetery; 0612- Clean Fill; 01- First Sample; Field Duplicate will be identified in the same manner, but will be the next sequential sample number (02)

QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal (Concluded)

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Each sample will be individually identified and labeled after collection, then sealed with custody seals and enclosed in a plastic cooler. The sample information will be COC forms, and the samples shipped to the appropriate laboratory via overnight delivery service or courier. Chain-of-custody records must be prepared in Scribe to accompany samples from the time of collection and throughout the shipping process. Each individual in possession of the samples must sign and date the sample COC Record. The chain-of-custody record will be considered completed upon receipt at the laboratory. A traffic report and chain-of-custody record will be maintained from the time the sample is taken to its final deposition. Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed. When samples are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. Specific information regarding custody of the samples projected to be collected on the weekend will be noted in the field logbook. The chain-of-custody record should include (at minimum) the following: 1) Sample identification number; 2) Sample information; 3) Sample location; 4) Sample date; 5) Sample Time; 6) Sample Type Matrix; 7) Sample Container Type; 8) Sample Analysis Requested; 9) Name(s) and signature(s) of sampler(s); and 10) Signature(s) of any individual(s) with custody of samples.

A separate chain-of-custody form must accompany each cooler for each daily shipment. The chain-of-custody form must address all samples in that cooler, but not address samples in any other cooler. This practice maintains the chain-of-custody for all samples in case of mis-shipment.

Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal): A sample custodian at the laboratory will accept custody of the shipped samples, and check them for discrepancies, proper preservation, integrity, etc. If noted, issues will be forwarded to the laboratory manager for corrective action. The sample custodian will relinquish custody to the appropriate department for analysis. At this time, no samples will be archived at the laboratory. Disposal of the samples will occur only after analyses and QA/QC checks are completed.

[1]Note: Refer to Contract Laboratory Program Guidance for Field Samplers, USEPA 540-R-20-005 November 2020 at: https://www.epa.gov/clp/contract-laboratory-program-guidance-field-samplers.

QAPP Worksheet #28: QC Samples Table
QAPP Worksheet #28A: Radiochemistry - Gamma Spectroscopy (non-CLP Worksheet)

Matrix	Soil
Analytical Group	Gamma Spectrometry
Concentration Level	Medium (pCi/g)
Sampling SOP(s)	EPA/ERT 2001, 2012
Analytical Method/SOP Reference	EPA Method 901.1
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Eurofins TestAmerica St. Louis
No. of Sample Locations	8

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No target analytes detected > target detection limit	Correct problem. If required, re-prepare and reanalyze MB and all samples processed with the contaminated blank.	Analyst, Supervisor	Accuracy/Bias/ Contamination	No target analytes detected > target detection limit
LCS	One per preparation batch	Recovery limits: 87-120% for Cs-137, 87-115% for Co-60, 87-116% for Am-241	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst, Supervisor	Accuracy/Bias	Target analytes must be within recovery limits
Duplicate	One per preparation batch	RPD limit of 40% or DER < 3	Correct problem, then re-prepare and reanalyze all samples in the associated preparatory batch, if not excursion not cuased by sample matrix.	Analyst, Supervisor	Precision/ Accuracy/Bias	The absolute value of the sample analyte result minus the duplicate analyte result divided by the square root of the sum of the squares of the sample and duplicate one-sigma analyte uncertainties must be less than 3.0

QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Continued)
Worksheet #28B: Radiochemistry - Alpha Spectroscopy (non-CLP Worksheet)

Matrix	Soil
Analytical Group	Alpha Spectroscopy
Concentration Level	Medium (pCi/g)
Sampling SOP(s)	EPA/ERT 2001, 2012
Analytical Method/SOP Reference	HASL-300/A-01-R
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Eurofins TestAmerica St. Louis
No. of Sample Locations	8

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No analytes detected > target detection limit	Correct problem. If required, re-prepare and reanalyze MB and all samples processed with the contaminated blank.	Analyst, Supervisor	Accuracy/Bias/ Contamination	No target analytes detected > target detection limit
LCS	One per preparation batch	Recovery limits: 84-120% for U-234 and 82-122% forU-238 Recovery limits: 81-118% for Th-230	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst, Supervisor	Accuracy/Bias	Target analytes must be within recovery limits
Duplicate	One per preparation batch	RPD limit of 40% or DER < 3	Correct problem, then re-prepare and reanalyze all samples in the associated preparatory batch, if not excursion not cuased by sample matrix.	Analyst, Supervisor	Precision/ Accuracy/Bias	The absolute value of the sample analyte result minus the duplicate analyte result divided by the square root of the sum of the squares of the sample and duplicate one-sigma analyte uncertainties must be less than 3.0

QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Continued)
Worksheet #28B: Radiochemistry - Alpha Spectroscopy (non-CLP Worksheet), Concluded

Matrix	Soil
Analytical Group	Alpha Spectroscopy
Concentration Level	Medium (pCi/g)
Sampling SOP(s)	EPA/ERT 2001, 2012
Analytical Method/SOP Reference	HASL-300/A-01-R
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Eurofins TestAmerica St. Louis
No. of Sample Locations	8

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective	Data Quality Indicator (DQI)	Measurement Performance Criteria
Tracer (U-232 and Th-229)	Every Sample	Recovery limits of 30-110%	Truncate tracers above 100% recovery to eliminate low biased results. Reprep and reanalyze sample if carrier is low (indicating high biased results) if there is activity in the sample above the reporting limit. No reanalysis if matrix interference is noticed during sample preparation.	Analyst, Supervisor	Accuracy/Bias	Tracer yield within recovery limits

Worksheet #28: QC Samples Table (Continued)
Worksheet # 28C: TAL Volatile - Soil (Non-CLP Worksheet)

Matrix	Soil
Analytical Group	TAL Volatile Organics
Concentration Level	Low/Medium/High (mg/kg)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 8260C
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Method Blank	1 every 12 hours	No analyte > CRQL*		Suspend analysis unit source recertified	Subcontracted RAS Laboratory GC/MS Technician	Accuracy	No analyte > CRQL*	
* Matrix Spike (Not Required)	1 per ≤ 20 samples; if requested	1,1-Dichloroethene	70-130 %R	Flag outliers, conjunction with other QC criteria.	Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Accuracy	1,1-Dichloroethene	70-130 %R
		Trichloroethene	70-130 %R				Trichloroethene	70-130 %R
		Benzene	70-130 %R				Benzene	70-130 %R
		Toluene	70-130 %R				Toluene	70-130 %R
* Matrix Spike Duplicate (Not Required)	1 per ≤ 20 samples; if requested	1,1-Dichloroethene	0-20 %RPD	Flag outliers, conjunction with other QC criteria.	Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Precision	1,1-Dichloroethene	0-20 %RPD
		Trichloroethene	0-20 %RPD				Trichloroethene	0-20 %RPD
		Benzene	0-20 %RPD				Benzene	0-20 %RPD
		Toluene	0-20 %RPD				Toluene	0-20 %RPD
Surrogate Recovery	All Samples	4-Bromofluorobenzene	70-130 %R	Check calculations and instruments, reanalyze affected samples; up to 3 DMCs per sample may fail to meet necessary limits (follow SOP: HW-24 for qualifications)	Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Accuracy	4-Bromofluorobenzene	70-130 %R
		Dibromofluoromethane	70-130 %R				Dibromofluoromethane	70-130 %R
		Toluene-d8	70-130 %R				Toluene-d8	70-130 %R
		Dichloroethane-d4	70-130 %R				Dichloroethane-d4	70-130 %R

* Laboratory spike entire list of compounds, but at the minimum, above compounds are require. For MS/MSD and LCS Laboratory can also use in house performance criteria

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28C: TAL Volatile - Soil (Non-CLP Worksheet) (Concluded)

Matrix	Soil
Analytical Group	TAL Volatile Organics
Concentration Level	Low/Medium/High (mg/kg)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 8260C
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards	all samples	50-100% of area, ± 30 sec retention time shift	Check calculations and instruments, reanalyze affected samples; up to 3 DMCs per sample may fail to meet necessary limits (Section 11.3.4, Page D45/VOC of SOM02.4)	Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Accuracy	50-100% of area, ± 30 sec retention time shift
LCS	1 per ≤ 20 samples; if requested	70-130 %R %RPD < 20	Flag outliers	Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Accuracy Precision	70-130 %R %RPD < 20
Field Duplicate	1 per ≤ 20 samples; if requested	%RPD < 20	Check calculation, and Flag outliers	Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Accuracy	% RPD < 20

* Laboratory spike entire list of compounds, but at the minimum, above compounds are require.
Laboratory may use in house performance criteria

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28D: TAL Semivolatile - Soil (Non-CLP Worksheet)

Matrix	Soil
Analytical Group	TAL Semivolatile Organics
Concentration Level	Low/Medium/High (mg/kg or mg/l)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 8270D
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Method Blank	1 per ≤ 20 samples or whenever samples extracted	No analyte > CRQL*		Suspend analysis unit source recertified	Weston Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Accuracy	No analyte > CRQL*	
Matrix Spike (Not Required)	1 per ≤ 20 samples; if requested	Phenol	In House MS/MSD Recovery Or (See SW 846 Method 8270D, Table 6)	No action is taken on MS/MSD data alone. Qualify data in conjunction with other QC criteria	Weston Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Accuracy	Phenol	In House MS/MSD Recovery Or (See SW 846 Method 8270D, Table 6
		2-Chlorophenol					2-Chlorophenol	
		N-Nitroso-di-n-propylamine					N-Nitroso-di-n-propylamine	
		4-Chloro-3-methylphenol					4-Chloro-3-methylphenol	
		Acenaphthene					Acenaphthene	
		4-Nitrophenol					4-Nitrophenol	
		2,4-Dinitrotoluene					2,4-Dinitrotoluene	
		Pentachloro-phenol					Pentachloro-phenol	
		1,2,4-Trichlorobenzene					1,2,4-Trichlorobenzene	
		1,4-Dichlorobenzene					1,4-Dichlorobenzene	
		2-Chlorophenol					2-Chlorophenol	
		Pyrene					Pyrene	
Matrix Spike Duplicate (Not Required)	1 per ≤ 20 samples; if requested	Phenol		Flag outliers	Weston Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Precision	Phenol	0-35 %RPD
		2-Chlorophenol					2-Chlorophenol	0-50 %RPD
		N-Nitroso-di-n-propylamine					N-Nitroso-di-n-propylamine	0-38 %RPD

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28D: TAL Semivolatile – Soil (Non-CLP Worksheet) (Concluded)

Matrix	Soil
Analytical Group	TAL Semivolatile Organics
Concentration Level	Low/Medium/High (mg/kg or mg/l)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 8270D
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Matrix Spike Duplicate (Not Required) [cont'd]	1 per ≤ 20 samples; if requested	4-Chloro-3-methylphenol	In House MS/MSD Recovery Or (See SW 846 Method 8270D, Table 6)	No anion is taken on MS/MSD data alone. Qualify data in conjunction with other QC criteria	Weston Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Precision	4-Chloro-3-methylphenol	0-33 %RPD
		Acenaphthene					Acenaphthene	0-19 %RPD
		4-Nitrophenol					4-Nitrophenol	0-50 %RPD
		2,4-Dinitrotoluene					2,4-Dinitrotoluene	0-47 %RPD
		Pentachloro-phenol					Pentachloro-phenol	0-47 %RPD
		1,2,4-Trichlorobenzene					Pyrene	0-36 %RPD
		1,4-Dichlorobenzene						
		2-Chlorophenol						
		Pyrene						
Surrogate Compounds	all samples	Phenol-d5 2-Fluorophenol	Lab In House recovery limit or SW 846 Method 8270B-43; 8000C-24	Check calculations and instruments, reanalyze affected samples; (follow SOP: HW-22 for qualifications)	Weston Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Accuracy	Phenol-d5 Bis(2-chloroethyl)ether-d8	17-103 %R 12-98 %R
		2-Fluorobiphenyl					2-Chlorophenol-d4	13-101 %R
		2,4,6-Tribromophenol					4-Methylphenol-d8	8-100 %R
		Nitrobenzene-d5					Nitrobenzene-d5 2-Nitrophenol-d4	16-103 %R 16-104 %R
		Terphenyl-d14						
Internal Standards	all samples	50-100% of area, ± 30 sec retention time shift	Check calculations and instruments, reanalyze affected samples	Weston Subcontracted RAS/non-RAS Laboratory GC/MS Technician	Accuracy	50-100% of area, ± 30 sec retention time shift	Internal Standards	all samples

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28E: TAL Pesticide - Soil (Non-CLP Worksheet)

Matrix	Soil
Analytical Group	TAL Pesticides
Concentration Level	Low/Medium (mg/kg)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 8081B
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Method Blank	1 per ≤ 20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis unit source recertified	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Accuracy	No analyte > CRQL	
Matrix Spike	1 per ≤ 20 samples	gamma-BHC (Lindane)	46-127 %R	Flag outliers	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Accuracy	gamma-BHC (Lindane)	46-127 %R
		Heptachlor	35-130 %R				Heptachlor	35-130 %R
		Aldrin	34-132 %R				Aldrin	34-132 %R
		Dieldrin	31-134 %R				Dieldrin	31-134 %R
		Endrin	42-139 %R				Endrin	42-139 %R
		4,4-DDT	23-134 %R				4,4-DDT	23-134 %R
Matrix Spike Duplicate	1 per ≤ 20 samples	gamma-BHC	0-50 %RPD	Flag outliers	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Precision	gamma-BHC	0-50 %RPD
		Heptachlor	0-31 %RPD				Heptachlor	0-31 %RPD
		Aldrin	0-43 %RPD				Aldrin	0-43 %RPD
		Dieldrin	0-38 %RPD				Dieldrin	0-38 %RPD
		Endrin	0-45 %RPD				Endrin	0-45 %RPD
		4,4-DDT	0-50 %RPD				4,4-DDT	0-50 %RPD

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28E: TAL Pesticide – Soil (Non-CLP Worksheet) (Continued)

Matrix	Soil
Analytical Group	TAL Pesticides
Concentration Level	Low/Medium (mg/kg)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 8081B
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Laboratory Control Sample	all samples	gamma-BHC	50-120 %R	Check calculations and instruments, reanalyze affected samples	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Accuracy	gamma-BHC	50-120 %R
		Heptachlor epoxide	50-150 %R				Heptachlor epoxide	50-150 %R
		Dieldrin	30-130 %R				Dieldrin	30-130 %R
		4,4'-DDE	50-150 %R				4,4'-DDE	50-150 %R
		Endrin	50-120 %R				Endrin	50-120 %R
		Endosulfan sulfate	50-120 %R				Endosulfan sulfate	50-120 %R
		gamma-Chlordane	30-130 %R				gamma-Chlordane	30-130 %R
Surrogate	all samples		30–150 %R	Check calculations and instruments, reanalyze affected samples	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Accuracy		30-150 %R

Laboratory may use in house performance criteria

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28E: TAL Pesticide – Soil (Non-CLP Worksheet) (Continued)

Matrix	Soil
Analytical Group	TAL Pesticides
Concentration Level	Low/Medium (mg/kg)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 8081B
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Method Blank	1 per ≤ 20 samples OR whenever samples extracted	No analyte > CRQL		Suspend analysis unit source recertified	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Accuracy	No analyte > CRQL	
Matrix Spike	1 per ≤ 20 samples; if requested	gamma-BHC (Lindane)	56-123 %R	Flag outliers	EPA non-CLP RAS Laboratory GC/ECD Technician	Accuracy	gamma-BHC (Lindane)	56-123 %R
		Heptachlor	40-131 %R				Heptachlor	40-131 %R
		Aldrin	40-120 %R				Aldrin	40-120 %R
		Dieldrin	52-126 %R				Dieldrin	52-126 %R
		Endrin	56-121 %R				Endrin	56-121 %R
		4,4'-DDT	38-127 %R				4,4'-DDT	38-127 %R
Matrix Spike Duplicate	1 per ≤ 20 samples; if requested	gamma-BHC	0-15 %RPD	Flag outliers	EPA non-CLP RAS Laboratory GC/ECD Technician	Precision	gamma-BHC	0-15 %RPD
		Heptachlor	0-20 %RPD				Helptachlor	0-20 %RPD
		Aldrin	0-22 %RPD				Aldrin	0-22 %RPD
		Dieldrin	0-18 %RPD				Dieldrin	0-18 %RPD
		Endrin	0-21 %RPD				Endrin	0-21 %RPD
		4,4'-DDT	0-27 %RPD				4,4'-DDT	0-27 %RPD
Laboratory Control Sample	1 per ≤ 20 samples	gamma-BHC	50-120 %R	Check calculations and instruments, reanalyze affected samples	EPA non-CLP RAS Laboratory GC/ECD Technician	Accuracy	gamma-BHC	50-120 %R

Laboratory may use in house performance criteria

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28E: TAL Pesticide – Soil (Non-CLP Worksheet) (Concluded)

Matrix	Soil
Analytical Group	TAL Pesticides
Concentration Level	Low/Medium (mg/kg)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 8081B
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Laboratory Control Sample [cont'd]	1 per ≤ 20 samples	Heptachlor epoxide	50-150 %R	Check calculations and instruments, reanalyze affected samples	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Accuracy	Helpachlor epoxide	50-150 %R
Laboratory Control Sample [cont'd]	1 per ≤ 20 samples	Dieldrin	30-130 %R	Check calculations and instruments, reanalyze affected samples	GC/ECD Technician	Accuracy	Dieldrin	30-130 %R
		4,4'-DDE	50-150 %R				4,4'-DDE	50-150 %R
		Endrin	50-120 %R				Endrin	50-120 %R
		Endosulfan sulfate	50-120 %R				Endosulfan sulfate	50-120 %R
		gamma-Chlordane	30-130 %R				gamma-Chlordane	30-130 %R
Surrogate	all samples		30-150 %R	Check calculations and instruments, reanalyze affected samples	GC/ECD Technician	Accuracy		30-150 %R

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28F: TAL PCBs – Soil (Non-CLP Worksheet)

Matrix	Soil
Analytical Group	TAL PCBs
Concentration Level	Low/Medium (mg/kg)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 8082A
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Method Blank	1 per ≤ 20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis unit source recertified	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Accuracy	No analyte > CRQL	
Matrix Spike	1 per ≤ 20 samples	Aroclor-1016	29-135 %R	EPA non-CLP RAS Laboratory GC/ECD Technician	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Accuracy	Aroclor-1016	29-135 %R
		Aroclor-1260	29-135 %R				Aroclor-1260	29-135 %R
Matrix Spike Duplicate	1 per ≤ 20 samples	Aroclor-1016	0-15 %RPD	EPA non-CLP RAS Laboratory GCECD Technician	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Precision	Aroclor-1016	0-15 %RPD
		Aroclor-1260	0-20 %RPD				Aroclor-1260	0-20 %RPD
Laboratory Control Sample	all samples	Aroclor-1016	50-150 %R	EPA non-CLP RAS Laboratory GC/ECD Technician	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Accuracy	Aroclor-1016	50-150 %R
		Aroclor-1260	50-150 %R				Aroclor-1260	50-150 %R
Surrogate	all samples		30-150%R	EPA non-CLP RAS Laboratory GC/ECD Technician	Weston Subcontracted RAS/non-RAS Laboratory GC/ECD Technician	Accuracy		30-150%R

Laboratory may use in house performance criteria

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28G: TAL Herbicides– Soil (Non-CLP Worksheet)

Matrix	Soil
Analytical Group	Herbicides
Concentration Level	Medium (mg/kg or mg/l)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 8151A
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per ≤ 20 samples OR whenever samples extracted	No analyte > CRQL	Suspend analysis unit source recertified	EPA CLP RAS Laboratory GC/ECD Technician	No analyte > CRQL
Matrix Spike	1 per ≤ 20 samples; if requested	70-130 %R	Flag outliers	EPA CLP RAS Laboratory GC/ECD Technician	70-130 %R
Matrix Spike Duplicate	1 per ≤ 20 samples; if requested	70-130 %R	Flag outliers	EPA CLP RAS Laboratory GC/ECD Technician	70-130 %R
Laboratory Control Sample	1 per ≤ 20 samples	70-130 %R	Check calculations and instruments, reanalyze affected samples	EPA CLP RAS Laboratory GC/ECD Technician	70-130 %R
Surrogate	all samples	70-130 %R		EPA CLP RAS Laboratory GC/ECD Technician	70-130 %R

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28H: TAL Metals– Soil (Non-CLP Worksheet)

Matrix	Soil
Analytical Group	TAL Metals
Concentration Level	Low/Medium (mg/kg or mg/l)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 6010C
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Preparation Blank	1 per ≤ 20 samples	No constituent > RL	Suspend analysis until source rectified; redigest and reanalyze affected samples	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Accuracy	No constituent > RL
Matrix Spike	1 per ≤ 20 samples	75-125%R*	Flag outliers		Accuracy	75-125%R*
Duplicate	1 per ≤ 20 samples	± 20% RPD**	Flag outliers	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Precision	± 20% RPD**
Post-Digestion Spike	after any analyte (except Ag and Hg) fails spike %R	80-120%R	Flag outliers	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Accuracy	80-120%R
ICP Serial Dilution	1 per ≤ 20 samples	< 10% D**	Flag outliers		Accuracy	< 10% D**
Interference Check Sample [ICP Analysis Only]	beginning, end and periodically during run (2 times every 8 hours)	Within ± 2 times CRQL of true value or ± 20% of true value, whichever is greater	Check calculations and instruments, reanalyze affected samples	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Sensitivity	Within ± 2 times CRQL of true value or ± 20% of true value, whichever is greater***

*except when the sample concentration is greater than 4 times the spike concentration, then disregard the recoveries; no data validation action taken
**Reference Principal outline in USEPA Region II SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP – (include absolute difference criteria)
ICP serial dilution required only when initial concentration is ≥ 50 X MDL
***except when the sample and/or duplicate concentration is less than 5 times the CRQL, then ± CRQL.
Laboratory may use in house performance criteria

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28H: TAL Metals– Soil (Non-CLP Worksheet) (Concluded)

Matrix	Soil
Analytical Group	TAL Metals
Concentration Level	Low/Medium (mg/kg or ug/L)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 6010C
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory Control Sample	1 per ≤ 20 samples	Control limits 80 - 120% R or established by EPA*	Suspend analysis until source rectified; redigest and reanalyze affected samples	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Accuracy	Control limits 80 - 120% R or established by EPA*

* If the EPA LCS is unavailable, other EPA QC samples or other certified materials may be used. In such cases, control limits for the LCS must be documented and provided.
Laboratory may use in house performance criteria

QAPP Worksheet #28: QC Samples Table (Continued)
Worksheet # 28I: Mercury – Soil (Non-CLP Worksheet)

Matrix	Soil
Analytical Group	TAL Mercury
Concentration Level	Low/Medium (ug/L or mg/kg)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 7471
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Preparation Blank (PB)	1 per ≤ 20 samples	No analyte > CRQL	Suspend analysis; redigest and reanalyze	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Accuracy	No analyte > CRQL
Duplicate Sample	1 per ≤ 20 samples	± 20% RPD*	Flag outliers	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Precision	± 20% RPD
Field Duplicate Sample	1 per ≤ 20 samples	± 20% RPD*	Flag outliers	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Precision	± 20% RPD
Spike Sample	1 per ≤ 20 samples	75 – 125 %R	Flag outliers	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Accuracy	75 – 125 %R

*Reference USEPA Region II SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)
Laboratory may use in house performance criteria.

QAPP Worksheet #28: QC Samples Table (Concluded)
Worksheet # 28J: Cyanide – Soil (Non-CLP Worksheet)

Matrix	Soil
Analytical Group	Cyanide
Concentration Level	Low/Medium (ug/L or mg/kg)
Sampling SOP(s)	EPA ERT/SERAS contractor SOP Nos. 2001 and 2012
Analytical Method/SOP Reference	SW-846 9012B
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Chemtech
No. of Sample Locations	8

Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Preparation Blank (PB)	1 per ≤ 20 samples	No analyte > CRQL	Suspend analysis; redistill and reanalyze	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Accuracy	No analyte > CRQL
Duplicate Sample	1 per ≤ 20 samples	± 20% RPD*	Flag outliers	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Precision	± 20% RPD
Spike Sample	1 per ≤ 20 samples	75 – 125 %R	Flag outliers	Weston Subcontracted RAS/non-RAS Laboratory ICP-AES/ICP-MS Technician	Accuracy	75 – 125 %R

*Reference USEPA Region II SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)
Laboratory may use in house performance criteria

QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Concluded)
Worksheet # 28K: PFAS– Organics/EPA 537.1 modified (Non-CLP Worksheet)

Matrix	Soil/Aqueous*
Analytical Group	PFAS
Concentration Level	Low (ug/kg)
Sampling SOP(s)	EPA/ERT 2001, 2012
Analytical Method/SOP Reference	EPA 537.1 modified, LC/MS/MS
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Eurofins TestAmerica Laboratory
No. of Sample Locations	8

REQUIREMENT	SPECIFICATION AND FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Initial Demonstration of Low System Background	Analyze LRB prior to any other IDC steps	Demonstrate that all method analytes are below 1/3 the MRL and that possible interferences from extraction media do not prevent the identification and quantification of method analytes.	Correct problem and then repeat requirement.
Initial Demonstration of Precision (IDP)	Analyze for to seven replicate LFBs fortified near the midrange calibration concentration	% RSD must be <20%	Correct problem and then repeat requirement.
Initial Demonstration of Accuracy (IDA)	Calculate average recovery for replicates used in IDP.	Mean recovery +/- 30% of true value	Correct problem and then repeat requirement.
Initial Demonstration of Peak Asymmetry Factor	Calculate the peak asymmetry factor using the equation in Section 9.3.9 for the first two eluting chromatographic peaks in a mid-level CAL standard.	Peak asymmetry factor 0.8-1.5	LC conditions require adjustment. Correct problem and then repeat requirement.
Minimum Reporting Limit (MRL) Confirmation	Fortify, extract and analyze seven replicate LFBs at the proposed MRL concentration. Calculate the Mean and the Half Range (HR). Confirm that the upper and lower limits for the Prediction Interval of Result (Upper PIR, and Lower PIR, Sect. 9.2.5.2) meet the recovery criteria.	Upper PIR ≤ 150% / Lower PIR ≥ 50%	If upper and lower PIR are outside the established range for any analyte the MRL is required to be tested at higher concentration until measured within range.
Quality Control Sample (QCS)	Analyze a standard from a second source, as part of IDC.	Results must be within 70-130% of true value	Correct problem and then repeat requirement or qualify data
Detection Limit (DL) Determination (optional)	Over a period of three days, prepare a minimum of seven replicate LFBs fortified at a concentration estimated to be near the DL. Analyze the replicates through all steps of the analysis. Calculate the DL using the equation in Sect. 9.2.7.1.	Data from DL replicates are not required to meet method precision and accuracy criteria. If the DL replicates are fortified at a low enough concentration, it is likely that they will not meet precision and accuracy criteria.	-

QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Continued)
Worksheet # 28K: PFAS– Organics/EPA 537.1 modified (Non-CLP Worksheet) - Continued

Matrix	Soil/Aqueous*
Analytical Group	PFAS
Concentration Level	Low (ug/kg)
Sampling SOP(s)	EPA/ERT 2001, 2012
Analytical Method/SOP Reference	EPA 537.1 modified, LC/MS/MS
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Eurofins TestAmerica
No. of Sample Locations	8

REQUIREMENT	SPECIFICATION AND FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Sample Holding Time	14 days with appropriate preservation and storage as described in Sections 8.1-8.5.	Sample results are valid only if samples are extracted within the sample holding time.	Recollect Samples
Extract Holding Time	28 days when stored at room temperature in polypropylene centrifuge tubes.	Extract results are valid only if extracts are analyzed within the extract holding time.	Re-extract Samples
Laboratory Reagent Blank (LRB)	Daily, or with each extraction batch of up to 20 samples, whichever is more frequent.	Demonstrate that all method analytes are below 1/3 the MRL, and confirm that possible interferences do not prevent quantification of method analytes. If targets exceed 1/3 the MRL or if interferences are present, results for these subject analytes in the extraction batch are invalid.	Correct problem. If require, reprepare and reanalyze MB and all samples processed with the contaminated blank and/or qualify affected analytes as estimated (J).
Laboratory Fortified Blank (LFB)	Analyze at least one LFB daily or one for each extraction batch of up to 20 Field Samples. Rotate the fortified concentrations between low, medium, and high amounts.	Results of LFB analyses must be 70-130% of the true value for each method analyte for all fortified concentrations except the lowest CAL point. Results of the LFBs corresponding to the lowest CAL point for each method analyte must be 50-150% of the true value.	Correct problem, then reprepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available and /or – if native compounds present recoveries below <50%, qualify the affected analytes (including non-detects) as biased low (L). If average recoveries >150% qualify hits as biased high (K). If %RSD>35 qualify hits as estimated (J).

QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Continued)
Worksheet # 28K: PFAS– Organics/ EPA 537.1 modified (Non-CLP Worksheet) - Continued

Matrix	Soil/Aqueous*
Analytical Group	PFAS
Concentration Level	Low (ug/kg)
Sampling SOP(s)	EPA/ERT 2001, 2012
Analytical Method/SOP Reference	EPA 537.1 modified, LC/MS/MS
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Eurofins TestAmerica
No. of Sample Locations	8

REQUIREMENT	SPECIFICATION AND FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Internal Standard (IS)	Internal standards, 13 C-PFOA (IS#1), 13CPFOS (IS#2), and d3-NMeFOSAA (IS#3), are added to all standards and sample extracts, including QC samples. Compare IS areas to the average IS area in the initial calibration and to the most recent CCC.	Peak area counts for all IS in all injections must be within +/- 50% of the average peak area calculated during the initial calibration and 70-140% from the most recent CCC. If IS do not meet this criterion, corresponding target results are invalid.	If recoveries are outside the acceptable range prepare a second vial using the backup aliquot. If the reinjected aliquot produces an acceptable IS response, the result can be reported and/or qualify the affected analytes as estimated (J).
Surrogate Standard (SUR)	Surrogate standards, 12C-PFHxA, 13C-PFDA, and d5-NEtFOSAA, are added to all CAL standards and samples, including QC samples. Calculate SUR recoveries.	SUR recoveries must be 70-130% of the true value. If a SUR fails this criteria, report all results for sample as suspect/SUR recovery.	If recoveries are outside the acceptable range correct the problem and reanalyze the extract. If the reinjected aliquot produces and acceptable ES response, the result can be reported. If the reinjected extract fails again, calibration must be checked by reanalyzing the most recently acceptable CCV standard and/or qualify affected samples as estimated (J).
Laboratory Fortified Sample Matrix (LFSM)	Analyze one LFSM per extraction batch (20 samples or less) fortified with method analytes at a concentration close to but greater than the native concentration, if known. Calculate LFSM recoveries.	Recoveries at mid and high levels should be within 70-130% and within 50-150% at the low-level fortified amount (near the MRL). If these criteria are not met, results are labeled suspect due to matrix effects.	If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference, i.e., matrix effect or analytical error. If the analyte is within control in the CCVs, the recovery is judged to be matrix biased and affected sample is qualified.

QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Continued)
Worksheet # 28K: PFAS– Organics/ EPA 537.1 modified (Non-CLP Worksheet) – Concluded)

Matrix	Soil/Aqueous*
Analytical Group	PFAS
Concentration Level	Low (ug/kg)
Sampling SOP(s)	EPA/ERT 2001, 2012
Analytical Method/SOP Reference	EPA 537.1 modified, LC/MS/MS
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	Eurofins TestAmerica
No. of Sample Locations	8

REQUIREMENT	SPECIFICATION AND FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Laboratory Fortified Sample Matrix Duplicate (LFSMD) or Field Duplicates (FD)	Extract and analyze at least one FD or LFSMD with each extraction batch (20 samples or less). A LFSMD may be substituted for a FD when the frequency of detects are low. Calculate RPDs.	Method analytes RPDs for the LFMD or FD should be ≤30% at mid and high levels of fortification and ≤50% near the MRL. If these criteria are not met, results are labeled suspect due to matrix effects.	If MSD/MD results are outside the limits, the data shall be evaluated to determine the source(s) of error, i.e. matrix effect or analytical error. If the analyte is within control in the CCVs, the recovery is judged to be matrix biased and sample qualified with a J to indicate and estimated value(s).
Field Reagent Blank (FRB)	Analysis of the FRB is required only if a Field Sample contains a method analyte or analytes at or above the MRL. The FRB is processed, extracted and analyzed in exactly the same manner as a Field Sample.	If the method analyte(s) found in the Field Sample is present in the FRB at a concentration greater than 1/3 the MRL, then all samples collected with that FRB are invalid and must be recollected and reanalyzed.	If the method analyte(s) found in the FS is present in the FB at concentration greater than 1/3 the MRL, then all samples collected with that FB are invalid and must be recollected and reanalyzed and/or results qualified as estimated (J).
Peak Asymmetry Factor	Calculate the peak asymmetry factor for the first two eluting chromatographic peaks in a mid-level CAL standard every time a calibration curve is generated.	Peak asymmetry factor 0.8-1.5	LC conditions require adjustment.
Quality Control Sample (QCS)	Analyze at least quarterly or when preparing new standards, as well as during the IDC.	Results must be within 70-130% of true value.	Correct problem, then reprepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available and/or qualify as estimated (J).

Aqueous sample is rinsate blank, MS/MSD and field duplicate samples will not be collected.

QAPP Worksheet #29: Project Documents and Records

Sample Collection and Field Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Field Logbook or Data Collection Sheets	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Chain-of-Custody Forms	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Custody Seals	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Air Bills	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Daily QC Reports	SPM	Group Leader or Operations Manager	Project File
Deviations	SPM/Field Scientist	Group Leader or Operations Manager	Project File
Corrective Action Reports	Delegated QA Manager	Operations Manager or Program Manager or designee	Project File
Correspondence	SPM	Delegated QA Manager	Project File
Field Sample Results/Measurements	SPM/Field Scientist	Delegated QA Manager	Project File
Tailgate Safety Meeting Items	SPM/Field Safety Officer	Delegated QA Manager	Project File

Project Assessments			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Data Verification Checklists	Data validator/Chemist QA/QC Specialist	Group Leader or Operations Manager	Project File
Data Validation Report	Data validator/Chemist QA/QC Specialist	Group Leader or Operations Manager	Project File
Data Usability Assessment Report	Site Project Manager	Group Leader or Operations Manager	Project File
Corrective Action Reports	Group Leader/HSO/Chemist QA/QC Specialist	Group Leader	Project File
Correspondence	Group Leader/HSO/Chemist QA/QC Specialist	Program Manager or designee	Project File

QAPP Worksheet #29: Project Documents and Records (Concluded)

Laboratory Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Sample Receipt, Custody, and Checklist	Laboratory Sample Receiving	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Equipment Calibration Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Standard Traceability Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Sample Prep Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Run Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Equipment Maintenance, Testing, and Inspection Logs	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory File
Corrective Action Reports	Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory File and Project File
Laboratory Analytical Results	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Laboratory QC Samples, Standards, and Checks	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Instrument Results (raw data) for Primary Samples, Standards, QC Checks, and QC Samples	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Sample Disposal Records	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory File

Laboratory Data Deliverables[1]							
Record	**VOCs**	**SVOCs**	**PCBs**	**Pesticides**	**Metals**	**Other[2]**	**Other[3]**
Narrative	Y	Y	Y	Y	Y	Y	Y
Chain of Custody	Y	Y	Y	Y	Y	Y	Y
Summary Results	Y	Y	Y	Y	Y	Y	Y
QC Results	Y	Y	Y	Y	Y	Y	Y
Chromatograms or raw data	Y	Y	Y	Y	Y	Y	Y
Tentatively Identified Compounds	Y	Y	NA	NA	NA	NA	NA

[1] The blank Laboratory Data Deliverables table is designed to be a checklist for use in supporting data completeness. The records and analytical groups in this table are not all inclusive of those that may be used on a specific project and should be modified and utilized by the delegated SPM as applicable.
[2] PFAS
[2] Gamma and alpha spectroscopy

Worksheet 31, 32 & 33: Assessments and Corrective Action

Assessments:

Assessment Type	Responsible Party & Organization	Number/ Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Field Sampling Technical Systems Audit (TSA)[1]	Chemist QA/QC Specialist (or designee) and Group Leader or Operations Manager WESTON	As needed, as determined by WESTON Chemist QA/QC Specialist (or designee) and Group Leader or Program Manager WESTON	To be completed near the beginning of field sample collection activities/TBD	TSA Memorandum and Checklist	48 to 72 hours following assessment
Laboratory TSA[2]	Laboratory QA Managers Regulatory Agency	Certified subcontract laboratories are routinely audited by accrediting authorities.	Every Year	Written Report	14 Days
Data Validation	Chemist QA/QC Specialist or Data Validator/CHP, WESTON	Each data package for which data validation was requested; varies by site	Within 42 days from sampling date	Data Validation Report	Varies by site
Management Review	Group Leader and/or Operations Manager, WESTON	Varies; as determined by WESTON Program Manager	Within 42 days from sampling date	Quality Management Report (memo/e-mail to file)	1-2 weeks following assessment

[1] Field sampling TSAs may include, but are not limited to the following: sample collection records; sample handling, preservation, packaging, shipping, and custody records; equipment operation, maintenance, and calibration records.

[2] Laboratory TSAs may include, but are not limited to the following: sample log-in, identification, storage, tracking, and custody procedures; sample and standards preparation procedures; availability of analytical instruments; analytical instrument operation, maintenance, and calibration records; laboratory security procedures; qualifications of analysts; case file organization and data handling procedures.

Worksheet 31, 32 & 33: Assessments and Corrective Action (Concluded)

Assessment Response and Corrective Action:

Assessment Type	Responsibility for Responding to Assessment Findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for Monitoring Corrective Action Implementation
Field Sampling Technical Systems Audit (TSA)[1]	SPM, WESTON	Findings of field audit.	24 hours of receipt of audit report	Operations Manager, WESTON	SPM or Operations Manager, WESTON
Laboratory TSA[2]	Non-CLP Laboratory: TestAmerica QA manager: Mike Franks Chemtech QA manager: Kurt Hummler Chemist QA/QC Specialist (or designee) WESTON	Written response to EPA Region II to address deficiencies	1 week of receipt of request from EPA Region II (or START V on behalf of EPA)	Laboratory Manager	Quality Manager (or designee) and/or Chemist, WESTON
Data Validation	Chemist QA/QC Specialist (or designee) WESTON	Validation Report	Within 48 hours of receipt of validation inquiry	Laboratory QA Manager and/or Chemist	Chemist, WESTON
Management Review	Program Manager WESTON	Quality Management Response	48 hours of receipt of Quality Management report	Program Manager, WESTON	Chemist QA/QC Specialist (or designee) and Program Manager, WESTON

[1] Field sampling TSAs may include, but are not limited to the following: sample collection records; sample handling, preservation, packaging, shipping, and custody records; equipment operation, maintenance, and calibration records.

[2] Laboratory TSAs may include, but are not limited to the following: sample log-in, identification, storage, tracking, and custody procedures; sample and standards preparation procedures; availability of analytical instruments; analytical instrument operation, maintenance, and calibration records; laboratory security procedures; qualifications of analysts; case file organization and data handling procedures.

QAPP Worksheet #34: Data Verification and Validation Inputs

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
3	Field SOPs	X	
4	Laboratory SOPs	X	
5	Laboratory QA Manual	NA	
6	Laboratory Certifications	X	
Field Records			
7	Field Logbooks	X	X
8	Equipment Calibration Records	X	X
9	Chain of Custody Forms	X	X
10	Sampling Diagrams/Surveys	X	X
11	Drilling Logs	NA	NA
12	Geophysics Reports	NA	NA
13	Relevant Correspondence	X	X
14	Change Orders/Deviations	X	X
15	Field Audit Reports	X	X
16	Field Corrective Action Reports	X	X
17	Sample Location Verification (Worksheet 18)	X	X
Analytical Data Package and Other Laboratory Deliverables			
18	Cover Sheet (laboratory identifying information)	X	X
19	Case Narrative	X	X
20	Internal Laboratory Chain of Custody	X	X
21	Sample Receipt Records	X	X
22	Sample Chronology (i.e. dates and times of receipt, preparation, & analysis)	X	X
23	Communication Records	X	X
24	Project-specific PT Sample Results	NA	NA
25	RL/MDL Establishment and Verification	X	X
26	Standards Traceability	NA	NA
27	Instrument Calibration Records	X	X
28	Definition of Laboratory Qualifiers	X	X
29	Results Reporting Forms	X	X
30	QC Sample Results	X	X
31	Corrective Action Reports	X	X
32	Raw Data	X	X
33	Electronic Data Deliverable	X	X

QAPP Worksheet #35: Data Verification Procedures

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
Contract QAPP	Contract, EPA and UFP-QAPP Guidance documents	Verify completeness, correctness, and contractual compliance of all program QA/QC against the methods, SOPs, and contract requirements.	Timothy Benton WESTON Program Manager Smita Sumbaly, WESTON Chemist QA/QC Specialist
Site-specific QAPP	Contract QAPP, Work Scope in TDD	Verify sampling and analytical methods specified in site-specific QAPP are correct and all contract QAPP protocols are followed and required QC samples will be collected in the correct bottles and properly preserved.	Bernard Nwosu WESTON Operations Manager Smita Sumbaly, WESTON Chemist QA/QC Specialist
Field Logs and SOPs	Contract and site-specific QAPP, SOPs	Ensure that all field sampling SOPs specified in site-specific QAPP were followed.	WESTON SPM and Data Validation Personnel
Analytical SOPs	Analytical Method and Contract QAPP	Ensure that laboratory analytical SOPs comply with the published method.	Mike Franks/TestAmerica, non-CLP Laboratories QA Managers. Kurt Hummler/Chemtech, non-CLP Laboratories QA Managers. Smita Sumbaly, WESTON Chemist QA/QC Specialist /Data validation Personnel
Laboratory QA Manual	EPA Guidance Documents	Verify that best practices specified in EPA Guidance Documents are incorporated into the Laboratory QA Manual.	Mike Franks/TestAmerica, non-CLP Laboratories QA Managers. Kurt Hummler/Chemtech, non-CLP Laboratories QA Managers. Smita Sumbaly, WESTON Chemist QA/QC Specialist /Data validation Personnel
Laboratory Certifications	Generic and site-specific QAPP	Ensure that laboratory performing analytical sample analyses has current State, National Environmental Laboratory Accreditation Program, National Voluntary Laboratory Accreditation Program, or American Industrial Hygiene Association certifications as required by the project.	Mike Franks/TestAmerica, non-CLP Laboratories QA Managers. Kurt Hummler/Chemtech, non-CLP Laboratories QA Managers. Smita Sumbaly, WESTON Chemist QA/QC Specialist /Data validation Personnel
Laboratory Deliverables	Contract and site-specific QAPP	Verify that the laboratory deliverable contains all records specified in the contract QAPP. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported. Compare the data package with Chains of custody to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. If Stage 2B or higher validation is required, verify that analytical instrumentation met calibration requirements. Check for evidence that any required notifications were provided to project personnel. Verify that necessary signatures and dates are present.	Laboratory QA Managers: TestAmerica/Mike Franks Kurt Hummler/Chemtech Non-CLP Data: Data Validators, WESTON, Smita Sumbaly, Chemist QA/QC Specialist

* Site-specific QAPP may contain additional data validation inputs as required by the project objectives.

QAPP Worksheet #35: Data Verification Procedures (Concluded)

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
WESTON Data Validation Deliverables	Laboratory Report, Analytical Method and Laboratory SOPs	Verify that the report consists of the following for all field samples submitted to the laboratory: 1) Data validation report (pdf), 2) Sample Summary Report with data validation qualifiers, and 3) Excel EDD file with data validation qualifiers	WESTON Data Validator Smita Sumbaly, WESTON Chemist QA/QC Specialist
Field Logbook, Field Sheets, Sample Diagrams/ Surveys	Contract and site-specific QAPP	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	WESTON SPM and Operations Manager
Field Equipment Calibration Records	Contract and site-specific QAPP, SOPs, field logbook	Ensure that all field analytical instrumentation SOPs for equipment calibration were followed.	WESTON SPM and Operations Manager
Chain of Custody Forms	Site-specific QAPP; Field Logbook; and other sampling records (e.g., boring logs, etc.)	Verify the completeness of Chain-of-Custody records. Examine entries for consistency with the field logbook. Check that appropriate methods were requested and sample preservation was recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for Laboratory QC samples (e.g., MS/MSD and S/D). Verify that all required signatures and dates are present. Check for transcription errors.	WESTON SPM, WESTON Chemist QA/QC Specialist, and Laboratory PMs: TestAmerica, Chemtech
Relevant reports and correspondence	Contract and site-specific QAPP	Verify that reports are present and complete for each day of field activities. Verify that correspondence is documented and was reported in accordance with requirements.	WESTON Operations Manager and SPM
Audit Reports, Corrective Action Reports	Generic and site-specific QAPP	Verify that all planned audits were conducted. Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	Smita Sumbaly, WESTON Chemist QA/QC Specialist Laboratory PMs: TestAmerica, Chemtech

Worksheet 36 — Data Validation Procedures

The following information is project-specific and will be identified in the site-specific or QAPP.

Data Validator: WESTON

Analytical Group/ Method	Data Deliverable Requirements	Analytical Specifications	MPC	Percent of Data Packages to be Validated	Percent of Raw Data Reviewed	Percent of Results to be Recalculated	Validation Procedure	Validation Code	Electronic Validation Program/Version
Radiochemistry – EPA 901.1/HASL-300-A-01-R	SEDD Stage IIa/IIb	SEDD Stage IIa/IIb	Worksheets 12, 24, 28	100%	100%	10%	As per lab SOPs and Analytical Methods	Validated Manually (VM)	Excel EDD
TAL VOC-SW-846 8260C	SEDD Stage IIa/IIb	SEDD Stage IIa/IIb	Worksheets 12, 24, 28	100%	100%	10%	Region 2 SOP No. HW-24, Revision 4, October 2014	Validated Manually (VM)	Excel EDD
TAL SVOC-SW-846 8270D	SEDD Stage IIa/IIb	SEDD Stage IIa/IIb	Worksheets 12, 24, 28	100%	100%	10%	Region 2 SOP No. HW-22, Revision 5, December 2010	Validated Manually (VM)	Excel EDD
TAL Pesticides SW-846 8081B	SEDD Stage IIa/IIb	SEDD Stage IIa/IIb	Worksheets 12, 24, 28	100%	100%	10%	Region 2 SOP No. HW-44, Revision 1.1, December 2010	Validated Manually (VM)	Excel EDD
TAL PCBs-SW-846 8081B	SEDD Stage IIa/IIb	SEDD Stage IIa/IIb	Worksheets 12, 24, 28	100%	100%	10%	Region 2 SOP No. HW-37A, Revision 0, June 2015	Validated Manually (VM)	Excel EDD
TAL Metals +Hg +CN SW-846 6010D/7471B/901C	SEDD Stage IIa/IIb	SEDD Stage IIa/IIb	Worksheets 12, 24, 28	100%	100%	10%	EPA Region 2 SOP No. HW-3a/3c, Revision 1, September 2016	Validated Manually (VM)	Excel EDD
PFAS EPA Method 537.1	SEDD Stage IIa/IIb	EPA 537.1 Modified	Worksheets 12, 24, 28	100%	100%	10%	As per lab SOPs and Analytical Methods	Validated Manually (VM)	Excel EDD
Herbicides SW-846 8151A	SEDD Stage IIa	SEDD Stage IIa	Worksheets 12, 24, 28	100%	100%	10%	Region 2 SOP No. HW-17, Revision 3.11, December 2010	Validated Manually (VM)	Excel EDD

QAPP Worksheet #37: Usability Assessment

Data usability assessments (DUA) will be performed as directed by EPA. This worksheet documents procedures that will be used to perform the DUA. The DUA is performed at the conclusion of data collection activities using the outputs from data verification and data validation (i.e., data of known and documented quality). It is the data interpretation phase, which involves a qualitative and quantitative evaluation of environmental data to determine whether the Site data are of the right type, quality, and quantity to support the decisions that need to be made. It involves a retrospective evaluation of the systematic planning process, and involves participation by key members of the project team. The DUA evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence.

Data, whether generated in the field or by the laboratory, are tabulated and reviewed for PARCCS by the SPM for field data or the data validator for laboratory data. The review of the PARCC Data Quality Indicators (DQI) will compare with the Data Quality Objectives (DQO) detailed in the site-specific QAPP, the analytical methods used and impact of any qualitative and quantitative trends will be examined to determine if bias exists. A hard copy of field data is maintained in a designated field or site logbook. Laboratory data packages are validated, and final data reports are generated. All documents and logbooks are assigned unique and specific control numbers to allow tracking and management.

Where applicable, the following documents will be followed to evaluate data for fitness in decision making: EPA QA/G-4, Guidance on Systematic Planning using the Data Quality Objectives Process, EPA/240/B-06/001, February 2006, and EPA QA/G-9R, Guidance for Data Quality Assessment, A reviewer's Guide EPA/240/B-06/002, February 2006.

Personnel (organization and position/title) responsible for participating in the data usability assessment may include, but not be limited to:

- START V Operations Manager;
- START V Quality Manager (or designee);
- START V Risk Assessor;
- START V SPM;
- START V Chemist QA/QC Specialist;
- START V Statistician.

Based on project-specific oversight responsibilities and analytical scopes, this DUA worksheet outlines the approach that will be taken as the analytical scope expands on a project-specific basis.

The following general steps will be followed to assure that the data usability assessment evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence:

QAPP Worksheet #37: Usability Assessment (Concluded)

Step 1 – Review the project's objectives and sampling design: This includes reviewing the DQOs and MPC to make sure they are still applicable. The sampling design will be consistent with stated DQOs.

Step 2 – Review the data verification and data validation outputs: Graphs, maps, and tables can be prepared to summarize the data. Deviations from activities planned in the Project QAPP should be considered, including samples not collected (potential data gaps), holding time exceedances, damaged samples, impact of non-compliant PE sample results, and SOP deviations. The implications of unacceptable QC sample results will be assessed.

Step 3 – Verify the assumptions of the selected statistical method: The underlying assumptions for the selected statistical methods (if specified in the QAPP) will be verified for validity. Common assumptions include the distributional form of the data, independence of the data, dispersion characteristics, homogeneity, etc. Depending on the robustness of the statistical method, minor deviations from assumptions usually are not critical to statistical analysis and data interpretation. If serious deviations from assumptions are discovered, then another statistical method may be selected.

Step 4 - Implement the statistical method: If specified in the site-specific QAPP, statistical procedures will be implemented for analyzing the data and reviewing underlying assumptions. For a decision project that involves hypothesis testing (e.g., "concentrations of lead in groundwater are below the action level") the consequences of selecting the incorrect alternative will be considered; for estimation projects (e.g., establishing a boundary for surface soil contamination), the tolerance for uncertainty in measurements will be considered.

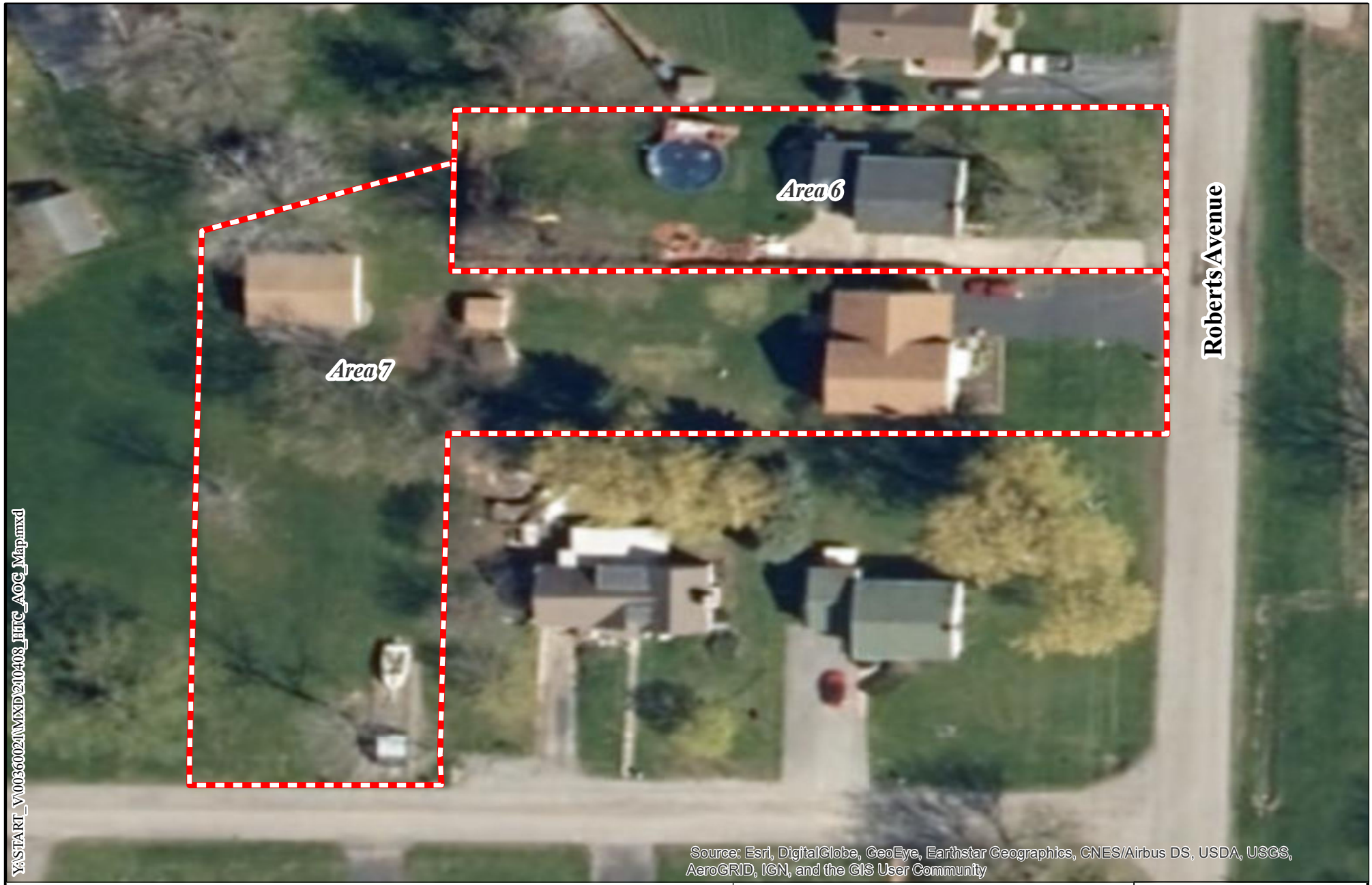
Step 5 – Document data usability and draw conclusions:

The DUA considered the final step in the data evaluation process. All data will be assessed for usability regardless of data evaluation/validation process implementation. Data usability goes beyond validation in that it evaluates the achievement of the DQOs based on the comparison of the project DQIs and site-specific QAPP with the obtained results. The results of the DUA, and particularly any changes to the DQOs necessitated by the data not meeting usability criteria, will be communicated in accordance with Worksheet 6.

The usability of the data as intended will be determined. Achievable DQOs, based on comparison with the Site DQIs, will be discussed. The performance of the sampling design will be assessed and limitations of the data use identified. The conceptual site model will be updated and conclusions documented. A DUA report (in the form of text/or table) will be prepared or a data usability summary will be included in the final report.

ATTACHMENT A

Figure 1: Site Location Map



Y:\START_V\0036002\MXD\210408_HTC_AOC_Map.mxd

Legend

Area of Concern

0 20 40 80 120 160 Feet

N

Weston Solutions, Inc.
Federal East Division

In Association With
Eco-Risk; Avatar Environmental, LLC;
Pro-West & Associates, Inc.;
On-Site Environmental, Inc.;
and Sovereign Consulting, Inc.

Figure 1: Area of Concern Map

HOLY TRINITY CEMETERY
LEWISTON, NEW YORK

U.S. ENVIRONMENTAL PROTECTION AGENCY
SUPERFUND TECHNICAL ASSESSMENT
& RESPONSE TEAM V
CONTRACT # 68HE0319D0004

DATE MODIFIED: 4/8/2021

GIS ANALYST:	M. LANG
EPA OSC:	P. LISICHENKO
START V SPM:	B. NWOSU
FILENAME:	210408_HTC_AOC_Map.mxd

ATTACHMENT B

Sampling SOPs

EPA ERT/SERAS SOP # 2001
EPA ERT/SERAS SOP # 2006
EPA ERT/SERAS SOP # 2012
MARSSIM Website

GENERAL FIELD SAMPLING GUIDELINES

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4.0 RESPONSIBILITIES

- 4.1 ERT Work Assignment Manager
- 4.2 ERT Quality Control Coordinator
- 4.3 ERT Contractor Task Leaders
- 4.2 ERT Contractor Field Personnel
- 4.3 ERT Contractor QA/QC Officer
- 4.5 ERT Contractor Health and Safety Officer

5.0 REFERENCES

6.0 APPENDICES

The policies and procedures established in this document are intended solely for the guidance of OLEM employees of the U.S. Environmental Protection Agency (EPA). They are not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. EPA reserves the right to act at variance with these policies and procedures, and to change them at any time without public notice. EPA strongly encourages all readers to verify the validity of the information contained in this document by consulting the most recent Code of Federal Regulations (CFR) and updated guidance documents.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to describe the general field sampling techniques and guidelines that will assist in planning, choosing sampling strategies and sampling locations, and frequency of Quality Control (QC) samples for proper assessment of site characteristics. The ultimate goal is to ensure data quality during field collection activities.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure the methods used are adequate to satisfy the data quality objectives (DQOs).

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

2.0 APPLICABILITY

This SOP applies to the collection of aqueous and non-aqueous samples for subsequent laboratory analysis to determine the presence, type, and extent of contamination at a site.

3.0 DESCRIPTION

Representative sampling ensures that a sample or a group of samples accurately reflect the target population from which the sample(s) are intended to draw conclusions about. Depending on the contaminant of concern and matrix, several environmental and logistical variables may contribute to uncertainty in sampling design, which may affect the representativeness of the samples and subsequent measurements. Environmental variability can occur due to non-uniform distribution of the pollutant due to topographic, meteorological and hydrogeological factors, changes in species, and dispersion of contaminants and flow rates. Logistical variables including restricted or limited access to areas for sampling due to health and safety concerns, physical obstructions, or inability to obtain access agreements may affect the spatial representativeness of the sampling design and/or preclude samples from being collected in areas of interest.

Determining the sampling approach depends on what is known about the site from prior sampling (if any) and the site history, variation of the contaminant concentrations throughout a site, potential migration pathways, and human and environmental receptors. The objectives of an investigation determine the appropriate sampling design.

The frequency of sampling and the specific sample locations that are required must be defined in the site-specific QAPP.

3.1 Planning Stage

The objectives of an investigation are established and documented in the site-specific QAPP. The technical approach including the media/matrix to be sampled, sampling equipment to be used, sampling design and rationale, and SOPs or descriptions of the procedure to be implemented are included in the QAPP. Refer to the matrix-specific SOPs for sampling techniques which include the equipment required for sampling.

During the planning stage, the DQOs will be determined. In turn, the project's DQOs will determine the need for screening data or definitive data. Screening data supports an intermediate or preliminary decision but eventually is supported by definitive data before the project is complete (i.e., placement

of monitor wells, estimation of extent of contamination). Definitive data is suitable for final decision making, has defined precision and accuracy requirements and is legally defensible (i.e., risk assessments, site closures).

3.2. Sampling Design

A sample design specifies the number of samples to be collected for each matrix of concern, the measurements which will be conducted on those samples, where the samples will be collected (downstream of the contaminant release, along a grid, etc.) and how the samples will be collected (discrete or composite samples, seasonally, etc.). The DQOs for a Site assist in selecting the appropriate sampling design for the population of concern (e.g., lead concentrations in residential soil, contaminant uptake in plants, polychlorinated biphenyl [PCB] levels in a specific reach of a river). Other factors may include logistical, measurement and budgetary constraints, such as accessibility to the sampling area, analytical instrument sensitivity or manpower availability. EPA QA/G-5S, *Guidance on Choosing a Sampling Design for Environmental Data Collection*, provides detailed guidance on the selection of a representative sampling design.

There are two main categories of environmental sampling designs:

1. Judgmental, also known as biased or targeted sampling; and
2. Probability-based sampling, which includes, but is not limited to, simple random, systematic, ranked set, stratified and cluster sampling.

Judgmental sampling is based on expert/technical knowledge of the site, known contaminant pathways and the chemical/physical processes associated with the contaminants of concern (COCs). It can be less expensive than probability-based sampling as it is typically quicker to implement. It is often used to target sampling in areas where there have been known chemical spills or visible staining of the matrix of concern. Because it is based on professional judgment, the reliability and precision of the results cannot be quantified using statistical assessments. The interpretation of the sampling results is dependent on personal interpretation.

Although probabilistic sampling is often more costly in time and implementation, this type of design allows for the assessment of the uncertainty associated with the sampling results and provides reproducible results, if performed accurately. Probability-based sampling includes a random/unbiased component for locating samples. Inferential statistics can be used to extend the measured results of the sampling efforts to the larger population of concern and statistical limits can be computed assessing the variability of the measurements. Probabilistic sampling is used when DQOs include the need to obtain the mean or median concentration across an area of concern, establish variability of the COC(s), perform trend analyses, determine the probability of exceeding an actionable level, locate hot spot(s) within a designated area, compare reference and on-site COCs, and establish background levels of COCs. There are many more applications of probabilistic-sampling. Simple random, systematic and stratified random sampling are the most commonly applied sampling designs in assessing environmental sites.

3.2.1 Judgmental Sampling

Judgmental sampling is the subjective selection of sampling locations based on the professional judgment of the field team. This method is useful to locate and to identify potential sources of contamination when there is reliable historical and physical knowledge about a relatively small feature or condition. It may not be representative of the full site and is used to document worst case scenarios. For example, groundwater sampling points

are typically chosen based on professional judgment, whether permanently installed wells or temporary well points. Judgmental sampling may also be implemented at a site when there are schedule and budget limitations, or to determine if there are contaminant "hotspots" that require further investigation using an extensive probability-based sampling design. For example, judgmental sampling may be used to identify multiple areas of contaminated soil, and a subsequent probability-based sampling design can be used to fully delineate the extent of the contaminated soil in each area within a specified level of uncertainty.

3.2.2 Simple Random Sampling

In simple random sampling, sample locations are selected randomly. For example, random pairs of coordinates could be selected from an area where soil sampling is planned. The simple random sampling approach is applied when there are many sample locations and the concentrations are assumed to be homogeneous across a site with respect to the parameter(s) that are going to be analyzed or monitored for. Simple random sampling can also be used to select an initial sample location in a systematic and stratified sampling design.

3.2.3 Systematic Sampling

Systematic grid sampling involves the collection of samples at fixed intervals when the contamination is assumed to be randomly distributed. A random point is chosen as the origin for the placement of the grid. A grid is constructed over a site and samples are collected from the nodes (where the grid lines intersect). Depending on the number of samples that are required to be collected, the distance between the sampling locations can be adjusted. The representativeness of the sampling may be improved by shortening the distance between sample locations.

Systematic random sampling is used for estimating contaminant concentrations within grid cells. Instead of sampling at each node, a random location is chosen within each grid cell. The systematic grid and random sampling approaches are useful for delineating the extent of contamination, documenting the attainment of clean-up goals, and evaluating and determining treatment and disposal options.

Transect sampling involves one or more transect lines established across the site. Samples are collected at systematic intervals along the transect lines. The number of samples to be collected and the length of the transect line determines the spacing between the sampling points. This type of sampling design is useful for delineating the extent of contamination at a particular site, for documenting the attainment of clean-up goals, and for evaluating and determining treatment and disposal options.

3.2.4 Stratified Sampling

Stratified sampling involves separating a site with heterogenous conditions into multiple homogenous strata. It is useful when a heterogeneous population or area can be broken down into regions with less variability within the boundaries of a stratum then between the strata. Professional judgement, historical information, site observations, exposure to ecological and human receptors, soil type, fate and transport mechanisms, and other site-specific factors can be used to separate a sampling area into multiple strata. Additionally, strata can be defined based on the decisions that will be made. Sampling locations can be

selected from each stratum using professional judgment, random sampling, or systematic sampling. Using a systematic sampling design within each stratum, with varying sample densities between different strata, ensures that areas of the site thought to have higher variability in contaminant concentrations and/or thought to be within the boundaries of uncertainty surrounding decision levels are sampled at a higher spatial resolution. This method still maintains a representative and unbiased sample design within each stratum.

3.3 Sampling Techniques

Sampling is the selection of a representative portion of a larger population or body (i.e. target population). The primary objective of all sampling activities is to characterize a site accurately in a way that the impact on human health and the environment can be evaluated appropriately.

3.3.1 Sample Collection Techniques

Sample collection techniques may be either grab or composite. A grab sample is a discrete aliquot representative of a specific location at a given time and collected all at once from one location. The representativeness of such samples is defined by the nature of the materials that are sampled. Samples collected for volatile organic compounds (VOCs) are always grab samples and are never homogenized. Composite samples are non-discrete samples composed of more than one specific aliquot collected at selected sampling locations. Composite samples must be homogenized by mixing prior to putting the sample into containers. Composite samples can, in certain instances, be used as an alternative to analyzing a number of individual grab samples and calculating an average value. Incremental sampling conducted over a grid is a special case of composite sampling and is detailed in U.S. EPA Environmental Response Team (ERT) SOP, *Incremental Soil Sampling.* Choice of collecting discrete or composite samples is based on project's DQOs.

3.3.2 Homogenization

Mixing of soil and sediment samples is critical to obtain a representative sample. An adequate volume/weight of sample is collected and placed in a stainless steel or Teflon® container, and is thoroughly mixed using a spatula or spoon made of an inert material. Once the sample is thoroughly mixed the sample is placed into sample containers specific for an analysis. Avoid the use of equipment made of plastic or polyvinyl chloride (PVC) when sampling for organic compounds when the reporting limit (RL) is in the parts per billion (ppb) or parts per trillion (ppt) ranges. Refer to ERT SOP, *Soil Sampling*, for more details on homogenization.

3.3.3 Filtration

In-line filters are used specifically for collecting groundwater samples for dissolved metals analysis and for filtering large volumes of turbid groundwater. Groundwater samples collected for VOCs are typically not filtered due to potential VOC losses. Filtering groundwater is performed to remove silt particulates from samples to prevent interference with the laboratory analysis. The filters used in groundwater sampling are either cartridge type filters inserted into a reusable housing, or are self-contained and disposable. Filter chambers are usually made of polypropylene housing an inert filtering material that removes particles larger than 0.45 micrometers (µm). Refer to ERT SOP, *Groundwater Well Sampling* and ERT SOP, *Surface Water Sampling*, for more details on filtration techniques.

3.4 Quality Assurance /Quality Control Samples

QA/QC samples provide an evaluation of both the laboratory's and the field sampling team's performance. Including QA/QC samples in a sampling design allows for identifying and measuring sources of error potentially introduced from the time of sample collection through analysis. The most common QA/QC samples collected in the field are collocated field duplicates, field replicates, equipment blanks and field blanks. Trip blanks are typically added for each matrix in each cooler used to ship VOC samples and are prepared prior to going into the field preferably by the laboratory that will be performing the analyses. Extra volume/mass is collected for a matrix spike/matrix spike duplicate (MS/MSD) at a frequency of 5 percent (%; one in 20 samples). Spiking is performed in the laboratory. For additional information or other QA/QC samples pertinent to sample analysis, refer to ERT SOP, *Quality Assurance/Quality Control Samples*.

Collocated field duplicates may be collected based on site objectives and used to measure variability and precision associated with the sampling process including sample heterogeneity, sampling methodology, and analytical procedures. Field replicates are field samples obtained from one location, homogenized, and divided into separate containers. This is useful for determining whether the sample has been homogenized properly. Equipment blanks (also known as rinsate blanks) are typically collected at a rate of one per day. The equipment blank is used to evaluate the relative cleanliness and the decontamination methods of non-dedicated equipment. Refer to ERT SOP, *Sampling Equipment Decontamination,* for more details regarding decontaminating non-dedicated equipment.

3.5 Sample Containers, Preservation, Storage and Holding Times

The amount of sample to be collected, the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix sampled and the analyses to be conducted. This information is provided in ERT SOP, *Sample Storage, Preservation, and Handling*. Field personnel need to be cognizant of any short holding times that warrant immediate shipment/transfer to the laboratory.

3.6 Documentation

Field conditions and site activities must be documented. Scribe will be used to document sample information and generate chain of custody records. Other field measurements not typically entered into Scribe will be documented in a site-specific logbook or in a personal logbook. All sample documentation will be maintained in accordance with ERT SOP, *Sample Documentation* and ERT SOP, *Chain of Custody Procedures.*

4.0 RESPONSIBILITIES

4.1 ERT Work Assignment Manager

The ERT WAM is responsible for providing technical expertise and technical direction to the contractor, preparing task orders/work assignments, reviewing deliverables, interacting with the Regional customers and monitoring the financial and administrative management of the project.

4.2 ERT Quality Control Coordinator

The ERT Quality Coordinator provides quality assurance oversight for all projects and implements/maintains the ERT Quality Assurance Program.

4.3 ERT Contractor Task Leaders

Task Leaders (TLs) are responsible for the overall management of the project. Task Leader responsibilities include ensuring that field personnel are well informed of the sampling requirements for a specific project and that SOP and QA/QC procedures stated in the site-specific QAPP are adhered to, issuing a Field Change Form that documents any changes to sampling activities after the QAPP has been approved and maintaining sample documentation.

4.4 ERT Contractor Field Personnel

Field personnel are responsible for reading the QAPP prior to site activities and performing sample collection activities as written. They are responsible for notifying the TL of deviations from sample collection protocols which occurred during the execution of sampling activities. Field staff will collect samples and prepare documentation in accordance with ERT SOP, *Sample Documentation*. In addition, field personnel are responsible for reading and conforming to the approved site-specific Health and Safety Plan (HASP).

4.5 ERT Contractor QA/QC Officer

The contractor's QA/QC Officer is responsible for reviewing this SOP and ensuring that the information in this SOP is updated on a timely basis. Compliance to this SOP may be monitored by either conducting a field audit or reviewing deliverables prepared by the contractor's TL.

4.6 ERT Contractor Health and Safety Officer

Based on OSHA requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's ERT should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

The contractor's Health and Safety Officer (HSO) is responsible for ensuring that a HASP has been written and approved prior to field activities. Additionally, the contractor's HSO is responsible for ensuring that the contractor's site personnel H&S training and that their medical monitoring is current.

5.0 REFERENCES

U.S. EPA. 2006. Guidance on Systematic Planning using the Data Quality Objectives Process (QA/G-4), EPA/240/B-06/001, February 2006.

U.S. EPA. 2002. Guidance on Choosing a Sampling Design for Environmental Data Collection (QA/G-5S), EPA/240/R-02/005, December 2002.

6.0 APPENDICES

This section is not applicable to this SOP.

SOIL SAMPLING

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3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE*

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*These sections affected by Revision 1.0.

SUPERCEDES: SOP #2012; Revision 0.0; 2/18/00; U.S. EPA Contract 68-C99-223.

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe procedures for the collection of representative surface soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push technology, or other mechanized equipment (except for a back-hoe). Sample depths typically extend up to 1-foot below ground surface. Analysis of soil samples may define the extent of contamination, determine whether concentrations of specific contaminants exceed established action levels, or if the concentrations of contaminants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with a final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Surface soil samples can be used to investigate contaminants that are persistent in the near surface environment. Contaminants that are detected in the near surface environment may extend to considerable depths, may migrate to the groundwater, surface water, the atmosphere, or may enter biological systems.

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (discrete or composite), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and/or scoop. Sampling at greater depths may be performed using a hand auger, continuous-flight auger, trier, split-spoon sampler, or, if required, a backhoe.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples must be cooled and maintained at 4°C and protected from sunlight immediately upon collection to minimize any potential reaction. The amount of sample to be collected, proper sample container type and handling requirements are discussed in the Scientific, Engineering, Response Analytical Services (SERAS) SOP #2003, *Sample Storage, Preservation and Handling.*

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary problems associated with soil sampling: 1) cross contamination of samples, and 2) improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, decontamination of sampling equipment is necessary. The guidelines for preventing, minimizing and limiting cross contamination of samples are discussed in the Environmental Response Team (ERT)/SERAS SOP #2006, *Sampling Equipment Decontamination*. Improper sample collection procedures can disturb the sample matrix, resulting in volatilization of contaminants, compaction of the sample, or inadequate homogenization of the samples (when required), resulting in variable, non-representative results.

5.0 EQUIPMENT/APPARATUS

Soil sampling equipment includes the following:

- Site maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan (HASP)
- Traditional survey equipment or global positioning system (GPS)
- Tape measure
- Survey stakes or flags
- Camera and image collection media
- Stainless steel, plastic*, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Site logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Plastic sheeting
- Spade or shovel
- Spatula(s)
- Scoop(s)
- Plastic* or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoon sampler
- Soil core sampler
  - Tubes, points, drive head, drop hammer, puller jack and grip
- Photoionization detector (PID), Flame ionization detector (FID) and/or Respirable Aerosol Monitor (RAM)
- Backhoe (as required)
- En Core® samplers

* Not used when sampling for semivolatile compounds.

6.0 REAGENTS

Decontamination solutions are specified in ERT/SERAS SOP #2006, *Sampling Equipment Decontamination*, and the site specific work plan.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the analytes to be determined, the sampling methods to be employed, and the types and amounts of equipment and supplies required to accomplish the assignment.

2. Obtain the necessary sampling and air monitoring equipment.

3. Prepare schedules and coordinate with staff, client, and regulatory agencies, as appropriate.

4. Perform a general site reconnaissance survey prior to site entry in accordance with the site specific HASP.

5. Use stakes or flags to identify and mark all sampling locations. Specific site factors, including extent and nature of contamination, should be considered when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared prior to soil sampling; utility clearances must be confirmed before beginning intrusive work.

6. Pre-clean and decontaminate equipment in accordance with the site specific work plan, and ensure that it is in working order.

7.2 Sample Collection

7.2.1 Surface Soil Samples

The collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. The over-burden or over-lying surface material is removed to the required depth and a stainless steel or plastic scoop is used to collect the sample. Plastic utensils are not to be used when sampling for semivolatile compounds.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected by this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials must not be used.

The following procedure is used to collect surface soil samples:

1. If volatile organic compound (VOC) contamination is suspected, use a PID to monitor the sampler's breathing zone during soil sampling activities.

2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard sticks, rocks, vegetation and other debris from the sampling area.

3. Accumulate an adequate volume of soil, based on the type(s) of analyses to be performed, in

a stainless, plastic or other appropriate container.

4. If volatile organic analysis is to be performed, immediately transfer the sample directly into an appropriate, labeled sample container with a stainless steel spoon, or equivalent, and secure the cap tightly to ensure that the volatile fraction is not compromised. Thoroughly mix the remainder of the soil to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly, or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, head, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger head. If additional sample volume is required, multiple grabs at the same depth are made. If a core sample is to be collected, the auger head is then replaced with a tube auger. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected.

Several types of augers are available; these include bucket or tube type, and continuous flight (screw) or post-hole augers. Bucket or tube type augers are better for direct sample recovery because a large volume of sample can be collected from a discrete area in a short period of time. When continuous flight or post-hole augers are used, the sample can be collected directly from the flights or from the borehole cuttings. The continuous flight or post-hole augers are satisfactory when a composite of the complete soil column is desired, but have limited utility for sample collection as they cannot be used to sample a discrete depth.

The following procedure is used for collecting soil samples with an auger:

1. Attach the auger head to an extension rod and attach the "T" handle.

2. Clear the area to be sampled of surface debris (e.g., twigs, rocks, litter). It may be advisable to remove a thin layer of surface soil for an area approximately six inches in radius around the sampling location.

3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents the accidental brushing of loose material back down the borehole when removing the auger or adding extension rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger head, proceed to Step 10.

5. Remove auger tip from the extension rods and replace with a tube sampler. Install the

proper cutting tip.

6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.

7. Remove the tube sampler and unscrew the extension rods.

8. Remove the cutting tip and the core from the device.

9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the core or a discrete portion of the core into the appropriate labeled sample container using a clean, decontaminated stainless steel spoon. If required, homogenize the sample as described in Step 10.

10. If VOC analysis is to be performed, transfer the sample directly from the auger head into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly.

11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger head to the drill assembly, and follow steps 3 through 11, making sure to decontaminate the auger head and tube sampler between samples.

12. Abandon the hole according to applicable state regulations.

7.2.3 Sampling at Depth with a Trier

The system consists of a trier and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a zero degree to forty-five degree (0° to 45°) angle from the soil surface plane. This orientation minimizes the spillage of sample.

2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure that the slot is facing upward.

4. If VOC analyses are required, transfer the sample directly from the trier into an appropriate, labeled sample container with a stainless steel spoon, or equivalent device and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; if composite samples are to be collected, place a sample from another sampling interval into the

homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18- or 24- inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should be performed in accordance with American Society for Testing and Materials (ASTM) D1586-99, "*Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*".

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of the barrel and then screwing the drive shoe on the bottom and the head piece on top.

2. Place the sampler at a 90 degree (90°) angle to the sample material.

3. Using a well ring, drive the sampler. Do not drive past the bottom of the head piece or compression of the sample will result.

4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain the sample.

5. Withdraw the sampler, and open it by unscrewing the bit and head, and then splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2- and 3.5-inch diameter tubes. A larger barrel (diameter and/or length) may be necessary to obtain the required sample volume.

6. Without disturbing the core, transfer it to the appropriately labeled sample container(s) and seal tightly. Place the remainder of the sample into a stainless steel, plastic, or appropriate homogenization container, and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into the appropriate, labeled containers and secure the caps tightly, or if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.

7. Abandon the hole according to applicable state regulations.

7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil when a detailed examination of stratigraphy and soil characteristics is required. The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is imperative to ensure that all sampling locations are clear of overhead and buried utilities.

2. Review the site specific HASP and ensure that all safety precautions including appropriate monitoring equipment are installed as required.

3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by Occupational Safety and Health Administration (OSHA) regulations.

4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.

5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.

6. If VOC analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.

7. Abandon the pit or excavation according to applicable state regulations.

7.2.6 Sampling for VOCs in Soil Using an En Core® Sampler

An En Core® sampler is a single-use device designed to collect and transport samples to the laboratory. The En Core® sampler is made of an inert composite polymer and reduces the open-air handling of soil samples in the field and in the laboratory; thereby, minimizing losses of VOCs.

1. Assemble the coring body, plunger rod and T-handle according to the instructions provided with the En Core® sampler.

2. Turn the T-handle with the T-up and the coring body down and push the sampler into the soil until the coring body is completely full. Remove the sampler from the soil. Wipe excess soil from the coring body exterior.

3. Cap the coring body while it is still on the T-handle. Push the cap over the flat area of the ridge. Be sure that the cap is seated properly to seal the sampler. Push and cap to lock arm in place.

4. Remove the capped sampler by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.

5. Attach the label to the coring body cap, place in a plastic zippered bag, seal and put on ice.

Generally, three En Core® samplers are required for each sample location. These samplers are shipped to the laboratory where the cap is removed and the soil samples are preserved with methanol or sodium bisulfate.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

2. All data must be documented in site logbooks or on field data sheets. At a minimum, the following data is recorded:

   Sampler's name and affiliation with project
   Sample number
   Sample location
   Sample depth
   Approximate volume of sample collected
   Type of analyses to be performed
   Sample description
   Date and time of sample collection
   Weather conditions at time of sampling
   Method of sample collection
   Sketch of sample location

2. All instrumentation must be operated in accordance with applicable SOPs and/or the manufacturer's operating instructions, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and must be documented.

3. The types of quality control (QC) samples to be collected in the field shall be documented in the site-specific Work Plan.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures, in addition to the procedures specified in the site specific HASP.

12.0 REFERENCES

Mason, B.J. 1983. *Preparation of Soil Sampling Protocol: Technique and Strategies*. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1989. *Soil Sampling Quality Assurance User's Guide*. EPA-600/8-89-046.

U.S. Environmental Protection Agency. 1984. *Characterization of Hazardous Waste Sites - A Methods Manual: Volume II.* Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, ER, B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. *Samplers and Sampling Procedures for Hazardous Waste Streams*. EPA-600/2-80-018.

American Society for Testing and Materials. *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*. Method D 1586-99.

En Novative Technologies, Inc. 2001. *En Core® Sampler Sampling Procedures*. Web site access. March 13, 2001.

APPENDIX A
Figures
SOP #2012
July 2001

FIGURE 1. Sampling Augers

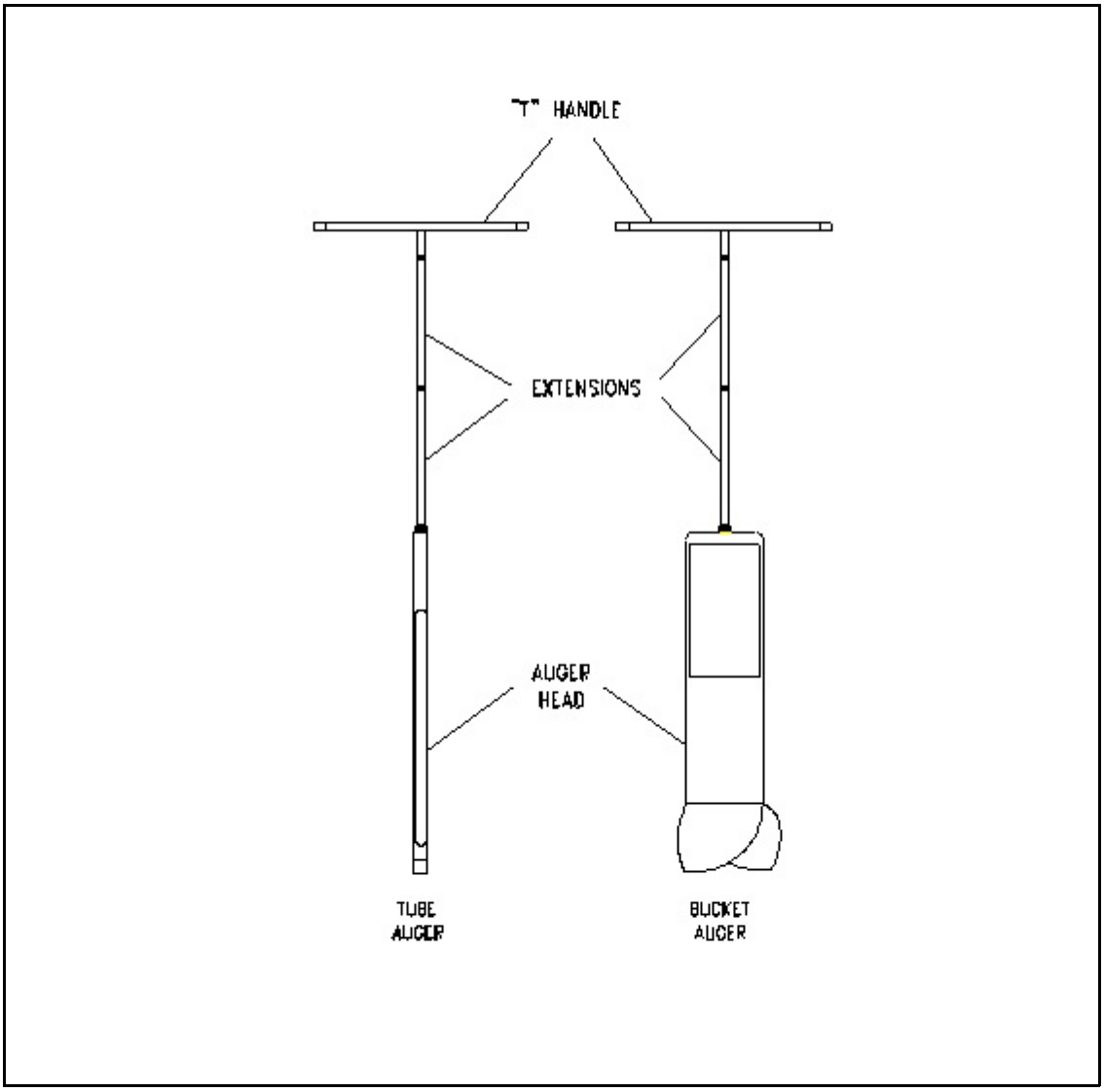
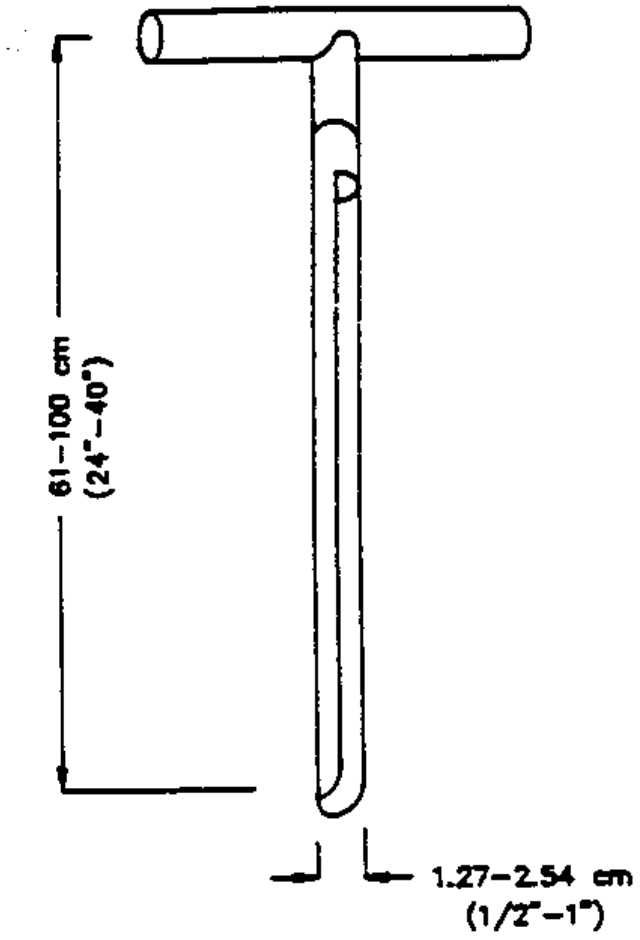


FIGURE 2. Sampling Trier


61–100 cm
(24"–40")
1.27–2.54 cm
(1/2"–1")

OPERATION OF THE DUSTTRAK AEROSOL MONITORS; DESKTOP DRX MODEL 8533EP AND HANDHELD DRX MODEL 8534

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Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

OPERATION OF THE DUSTTRAK AEROSOL MONITORS; DESKTOP DRX MODEL 8533EP AND HANDHELD DRX MODEL 8534

1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) describes the start-up, check out, operation, calibration and routine use of the TSI, Inc. DustTrak DRX Model 8533EP aerosol monitor. The procedures and figures contained in this SOP are taken from the copyrighted *DUSTTRAK DRX MODEL 8533/8534/8533EP OPERATION AND SERVICE MANUAL* (2017). Some material is excerpted without change from this manual. This SOP will be used for educational and training purposes only.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives listed in the UFP-QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the UFP-QAPP. These changes must be documented in the final deliverable.

2.0 METHOD SUMMARY

The TSI DustTrak DRX is a light-scattering laser photometer which produces size-segregated mass fraction concentration measurements of particulates with diameters of 10 microns (µm) [PM_{10}], 2.5 µm ($PM_{2.5}$), 1 µm (PM_1), respirable particulates (Resp), and total suspended particulates (TSP), simultaneously. The DustTrak DRX provides real-time continuous monitoring and electronic recording of particulate concentration data. Refer to the *DustTrak DRX Aerosol Monitor Operation and Service Manual* for detailed operating procedures. Instrument specifications are presented in Appendix A, *Specifications*. Advanced users should consult Appendix B, *Theory of Operation,* for a more detailed explanation of the principle of operation.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

This section is not applicable to this SOP.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

- Good measurement accuracy is dependent on the measured aerosol having a wide particle size distribution, that is, the more monodisperse the aerosol, the lower the accuracy.
- Measurement accuracy may be affected due to differential light scattering by particles with equivalent aerodynamic diameters, but with different optical characteristics, such as density, refractive index, size, shape, and composition.
- High humidity or the presence of fog, especially frozen water droplets, may cause elevated readings. Through the use of the Heated Inlet Sample Conditioning module, a constant sample inlet stream relative humidity level can be maintained.

WARNING: The DustTrak DRX must be protected from all forms of precipitation. If there is a potential for exposure, operation should be conducted using the appropriate outdoor enclosure.

5.0 EQUIPMENT/APPARATUS

The following equipment is provided for the operation and transport of the DustTrak DRX aerosol monitor:

- DustTrak DRX 8533EP (desktop) or DustTrak DRX 8534 (Handheld) unit
- Inlet cap
- External pump, including power cable, air hose and exhaust adapter (8533EP Model only)
- Outdoor enclosure, including omni-directional sampling inlet, condensation catch and tripod (8533EP Model only)
- Heated inlet (8533EP Model only)
- Auto-zero module (8533EP Model only) and/or zero filter for manual zeroing
- Instruction Manual
- TrakPro communications software
- Digital output cable
- Charger/power supply (Desktop 8533EP; Part# 801692 or Handheld 8534; Part# 801694)
- External batteries and wiring harness (8533EP Model only)
- External battery charger (Desktop 8533EP; Part# 801685 or Handheld 8534; Part# 801686)
- Spare internal filters (Desktop 8533EP; Part# 801673 or Handheld 8534; Part# 801666)
- 37-millimeter (mm) filter (8533EP Model only)
- 37-mm filter cartridge opening tool (8533EP Model only)
- Filter removal tool (8533EP Model only)
- Stylus
- $PM_{2.5}$ calibration impactor kit (impactor top, impactor bottom and impaction plate)
- Impactor oil
- Pelican storage and transport cases (8533EP Model only)
- Viper network data management (Optional)

6.0 REAGENTS

This section is not applicable to this SOP.

7.0 PROCEDURES

7.1 Air Monitoring Guidelines

For typical short-term area monitoring applications, such as fires, construction or remediation activities, the DustTrak DRX 8533EP units should be operated within their enclosures and placed in strategic fixed locations around the area of concern, away from localized air currents such as those caused by fans, blowers, ventilation intakes or exhausts. This is to ensure representative results for protection of local sensitive receptors. The handheld DustTrak DRX Model 8534 units are more suitable to mobile monitoring or situations where the monitoring locations may be moved frequently. The following siting and set-up conditions are recommended for the DustTrak DRX Model 8533EP:

- The inlet should be away and above any obstructions whose wake may affect sampling representativeness.
- The inlet should be at least 1 meter (m) above the ground or any major horizontal surface, such as, a roof.
- The Omni-directional Inlet should be used under typically horizontal and variable wind conditions to prevent loss of particles with aerodynamic diameters larger than 1 µm.

- At ambient relative humidity above 65 percent (%) to 70%, airborne particles are likely to grow by accumulation of water. If only the solid portion of the particulates is to be measured, the heated inlet should be used, especially when monitoring under fog or water mist conditions.
- When the heated inlet is utilized, federal reference methods dictate what the setting should be. As most SERAS mobilizations will perform either $PM_{2.5}$ or PM_{10} monitoring, the Heated Inlet Sample Conditioning module should be set to 40%. See Appendix C, *Relative Humidity Setting on the Heated Inlet*.
- To operate the DustTrak DRX Model 8533EP outdoors, provisions must be made to protect the external pump from any form of precipitation. The DustTrak Model 8533EP-specific outdoor enclosure should always be used for outdoor monitoring activities. If environmental extremes are a possibility, such as temperatures beyond the specified operational range (32-120 degrees Fahrenheit [°F]), a small shelter or roof may be required with a heating source that does not create any perturbation in airborne particulate levels. Heating sources with fan motors can be an issue (i.e. move particulates into the air column).

NOTE: At freezing temperatures, the DustTrak DRX cannot differentiate between solid particulates and frozen water droplets. A heated inlet (applicable to Desktop DRX 8533EP) may be used if the temperatures are below freezing and the instrument is functioning properly.

NOTE: Wood or coal-burning stoves can produce airborne particulate matter both indoors and outdoors.

7.2 Operation

7.2.1 Instrument Set-Up

1. Before powering on the unit, it must be properly set up.
   - Model 8533EP; Open the battery door in the back of the unit and ensure that there are two internal batteries installed. If not, or if the batteries need to be replaced, install new batteries by sliding each battery into the slot with the label side facing upwards. Use only the rechargeable batteries supplied by TSI.
   - Model 8534; Open the bottom door of the unit to install handheld model specific battery secured by a screw. Use only the rechargeable batteries supplied by TSI.

     NOTE: Units are supplied with only one battery. Operating the unit with only one internal battery will provide up to 6 hours run time; therefore, two internal batteries are typically used.

2. This setup pertains to Model 8533EP only. Attach the external pump to the DustTrak DRX unit. The pump draws power from the DustTrak DRX and pulls air through for analysis via connection to the unit's exhaust port.
   - There are two ports on the pump module; the top (silver) port is the air intake and the bottom (black) is a power connector. First, attach one end of the air hose quick-connect to the silver air intake port of the pump.
   - Connect one end of the power cable to the black power connector on the pump, turning the locking connector to ensure that it stays in place.
   - Attach the opposite end of the power cable to the appropriate port on the back of the DustTrak DRX. There is only one port where it will seat properly.

- Connect the exhaust adaptor to the exhaust port of the DustTrak DRX. Attach the opposite end of the air hose quick-connect to the exhaust adaptor.
- Model 8534 setup requires only the inlet cap firmly secured onto the units inlet.

3. If the instrument is being operated outdoors, set up the outdoor enclosure (below setup procedures pertain to Model 8533EP only):
   - Set up the tripod to the desired height.
   - Remove the nut from the bottom of the enclosure with an Allen wrench. Center the enclosure on top of the tripod so that the screw threads are visible from below. Secure onto the tripod using the attached bolt.
   - Open the enclosure, undo the Velcro and insert the DustTrak DRX, external pump and external batteries (if required) into the appropriate spaces, as shown below.

- Secure with Velcro. Note: External batteries and line power cannot be used simultaneously; only one power source may be connected at a time.
- With the inlet cap removed from the DustTrak inlet, press the auto-zero module onto the inlet and connect the power cable to the appropriate port on the back of the DustTrak unit.
- Press the heated inlet module onto the inlet of the auto-zero module. Use the thumbscrews to secure the module to the metal plate behind the DustTrak. Refer to Appendix D, *Heated Inlet for Environmental Enclosure*, for additional information.
- Press the black tubing into the recessed port on the left side of the heated inlet module. Attached the opposite end of the tubing onto the barb on the inlet on the

ceiling of the enclosure.

- Attach the water catch to the bottom of the inlet on the ceiling of the enclosure.
- Loosen the gray cord grip fitting on the left side of the enclosure. Remove the metal protector from the temperature/relative humidity probe. Insert the bare (uncorded) end of the sensor through the cord grip fitting so that it is protruding to the outside of the enclosure. Tighten the fitting and clip the protector onto the probe. Plug the end of the cord into the appropriate port on the front of the heated inlet module.
- Plug the power wires into the DustTrak unit and the heated inlet. Attach the opposite end to the power source (either line power or the external batteries).
- Remove the plug from the black fitting in the outside back left corner of the enclosure to allow exhaust.
- Attach the omni-directional inlet to the top of the enclosure.

Refer to the *DustTrak Aerosol Monitor Environmental Enclosure Model 8535 Operation and Maintenance Manual* for additional information.

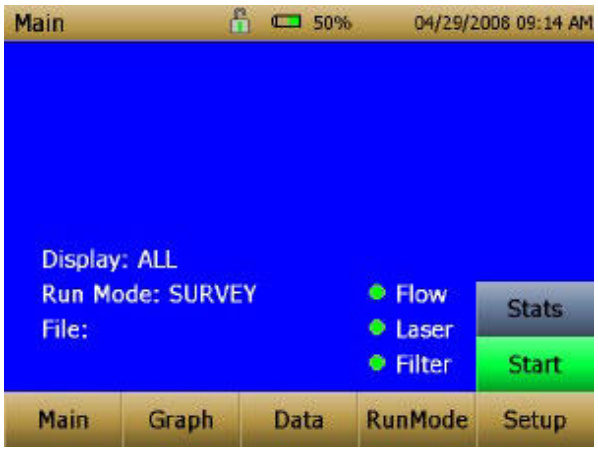
Note: With an exception of single 'Analog Out' port and menu option on Model DRX 8533, remaining firmware menus are identical with the Model 8534).

7.2.2 Battery Charging

This instrument will charge the Lithium Ion battery packs. Insert the battery/batteries into the battery compartment, plug the instrument into alternating current (AC) power, and turn the instrument on, typically this happens automatically. Batteries will charge only when the instrument is on and in stand-by mode. Batteries will not charge if the instrument is turned off or is actively taking measurements. Charging will stop when the batteries are fully charged. Note that when charging the battery the ambient temperature must **not** exceed 107°F.

7.2.3 Start-Up

1. <u>Ensure that the external pump (Model 8533EP only) and internal batteries are installed in the DustTrak DRX before powering on the unit</u> by pressing the gray power button on the front of the instrument. The **START UP** screen is displayed initially when the instrument is turned on, following the initial TSI logo splash screen.



Using a stylus or fingertip, touch the "buttons" on the screen to activate different menus. If "No pump is connected" is displayed on the screen, power off the unit, then power on.

2. Pressing **Setup** (located in the bottom right corner of the screen) activates the Setup Menu touchscreen buttons along the left edge of the screen. Setup is not accessible when the instrument is sampling. The main screen of the **Setup** screen displays the following information:

Serial Number	The instruments serial number.
Model Number	The instruments model number.
Firmware Version	Instruments current version of firmware.
Calibration Date	Date of the last factory calibration.
Pump Run Time	Pump running time in hours.
Cum Mass Conc	Amount of mass run through instrument over life.
Cum Filter Conc	Amount of mass run through instrument since last filter change.
Filter Time	Date of last filter change.

3. To zero, attach the zero filter to the DustTrak DRX inlet and select **Zero Cal** from the top left corner of the screen within the Setup menu. Press the **Start** button to begin the zeroing process. A count-down clock will appear, indicating the time remaining. The screen will indicate "Zero Cal Complete" when done. Remove the zero filter when finished.

   Alternatively, the auto-zero module may be used if the unit is setup within the outdoor enclosure (see Section 7.2.4 for programming instructions). The module remains in place during sampling and will zero automatically at user-defines intervals over the course of the sample period. The initial zero should still be performed with the zero filter.

   Note: Never perform a zero cal without attaching a zero filter or using an auto-zero module. Run Zero Cal the first time the instrument is used and repeat prior to

redeployment and/or when specified by manufactures recommended maintenance interval. Zero Cal must also be performed if the unit is reading negative concentrations, as it is not possible for the DustTrak monitor to read negative concentrations and this a symptom of zero drift.

4. The **Flow Cal** option in the Setup menu allows for calibration of air flow to the factory set point of 3.0 liters per minute (L/min). Flow calibration should be performed when tubing in excess of normal lengths (i.e. longer than what is normally used in the outdoor enclosure) is attached to the DustTrak inlet or when the unit is utilized to collect a sample; these are not typical SERAS applications. Calibration is necessary as the unit requires a predetermined volume of air to accurately measure particulate concentrations; adding resistance to the inlet may alter the amount of air flow and skew concentration measurements.

The flow set point is factory set to 3 L/min total flow. Two (2) L/min of the total flow is measured aerosol flow. One (1) L/min of total flow is split off, filtered, and used for sheath flow. There is an internal flowmeter in the DustTrak DRX instrument that controls flow rate to plus or minus (±) 5% of factory set point. TSI recommends checking the flows with an external flow reference meter, especially when collecting data. The pump will automatically start when entering the Flow Cal screen.

- Attach a flow calibrator (reference flow meter) to inlet port. You may use a bubble buret, mass flow meter, dry piston or rotameter as flow measurement devices.
- Move the arrows up or down to achieve desired flow on the reference flowmeter. Each up or down arrow will change the flow about 1%. Allow time between button presses to let pump change to the new flow rate.
- Select **Save** once the desired flow rate is achieved. Select **Undo** to return to the factory set point.

5. Make sure that the correct date and time are set prior to use. Select **Settings** from the bottom right corner of the Setup menu, and then select Date Time from the drop-down menu that appears. Select the desired parameter and use the arrows to adjust to the correct value.

7.2.4 Starting a Run

From the main screen, select the **RunMode** option from the bottom of the screen. The RunMode tab brings up sampling options, including Survey Mode, Manual Log and Log Mode 1-5. Preprogrammed tests are set in the Log Modes. The modes are described below. Select the desired mode from the pull-down list. After selecting the appropriate mode and parameters, Press **Main** to return to the main screen, then press the green **Start** button to begin the run.

Survey	Survey Mode runs a real-time, continuous active sample, but does not log data.
Manual	Manual Log sets the instrument to log data for a specified run time
Log Modes	Log Mode starts and stops the instrument at specified times, runs for a specified test length, and perform multiple tests of the same length with a specified time period between tests. Use of the auto-zero module requires this function.

When a mode is selected, a pull-down list of parameters will appear below it. Parameters (as shown below) may be changed by selecting each from the menu; the screen will display set options for the parameter after selection.

Survey Mode

Time Constant	Time Constant can be set from 1 to 60 seconds. This will control the update rate of the main screen. It is the rolling average of data displayed on the main screen and is not linked to logged data in either Manual or Program Log modes.
Auto Start on Power Up	When set to "Yes", unit will start a measurement upon being powered on, if the unit was set to "Survey" when it was turned off. When set to "No", the unit will be in idle when it is powered on.

Manual Mode

Test Length	Test length can be set from 1 minute to the limit of the data storage.
Log Interval	The log interval can be set from 1 second to 60 minutes. It is the amount of time between logged data points.
Time Constant	Time Constant can be set from 1 to 60 seconds. This will control the update rate of the main screen. It is the rolling average of data displayed on the main screen and is not linked to logged data in either Manual or Program Log modes.

Log Mode (1-5) (Test 1-5, able to be renamed)

Log Name	Log Name, brings up a virtual keypad to name the Logged Data file.
Test Length	From 1 minute to the limit of the data storage.
Log Interval	The log interval can be set from 1 second to 60 minutes. It is the amount of time between logged data points.
Number of Tests	Number of tests, 1 to 999.
Time between Tests	Time between tests, 1 minute to 30 days.
Time Constant	Time Constant can be set from 1 to 60 seconds. This will control the update rate of the main screen. It is the rolling average of data displayed on the main screen and is not linked to logged data in either Manual or Program Log modes.
Use Start Date	Use Start Date, option to use programmed start date or by pass programmed start date.
Start Date	Start Date, select the date the test will start.
Use Start Time	Use Start Time, option to use programmed start time or bypass programmed start time.
Start Time	Start Time, select the time the test will start.
Use Auto Zero	Use Auto Zero, Option to use the Auto-Zero accessory

Auto Zero Interval	Interval between re-zeroing the instrument using the Auto-Zero accessory. Model 8533 desktop only.

Note: The auto-zero module can only be used in the Log Modes. To set this function, select one of the log modes and scroll down to "Use Auto-Zero". Select this line (live key) and use the displayed arrows to select yes or no. The Auto Zero Interval, or the period of time between auto zero readings, must then be set from the Log Mode pull-down menu. In addition, the log interval for data logging must be set to 2 minutes or greater, as data will not be recorded when the zero module is activated.

Refer to Appendix E, *Troubleshooting*, for troubleshooting instructions.

7.2.5 Data Logging Management Using Viper (Optional)

VIPER= Instrument (Unit) + Telemetry (Viper) + Data Translation (Data)

VIPER is a wireless network based communication system designed to enable real-time transmission of data from the field to a local computer or remote computer. VIPER allows direct wireless data transfer from DustTrak DRX unit without having to download data.

Individual LINCs communicate with each DustTrak DRX unit. Data is transferred from the DustTrak's Universal Serial Bus (USB) port to the LINC via a null-modem RS232-to-USB cable. Communication is at a baud rate of 9600. LINCs may be operated within the outdoor enclosure.

The LINC(s) connect to a Gateway (hardware that provides telemetry from the LINC to the instrument specific Meter Apps and Survey Controller software) Survey Controller is the primary software component of VIPER which allows real-time viewing of individual instrument readings instead of waiting to download from a data logger software.

Refer to Appendix F, *Viper Guide for DustTrak DRX8533*, for LINC and Meter App information.

NOTE: For more VIPER information please refer to the latest user guide and software available at https://response.epa.gov/viper

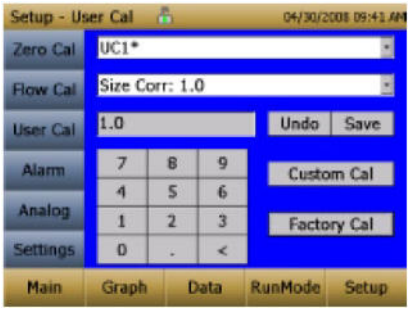
7.2.6 Size Correction Factor

Under typical operating conditions, either the **Factory Cal**, for indoor workplace aerosol monitoring, or the **Ambient Cal**, for outdoor dust or fugitive dust monitoring, should be selected. However, the user can create and save up to 10 additional calibrations.

Size correction is used to improve the relative accuracy between the five mass channels (PM_1, $PM_{2.5}$, Resp, PM_{10} and TSP) in response to the aerosol of interest. Size correction changes the factory calibration of the particle distribution based on Arizona Road Dust to that of the aerosol being measured. The process uses the $PM_{2.5}$ Calibration Impactor which must be cleaned before each use (refer to Section 7.3.3). Attach Impactor to Inlet Flow Tube and Inlet Fitting inside lid of Enclosure.

To conduct the Standard Size Correction, select **User Cal** from **Setup** Menu; select **Size**

Corr from drop down list, press **Custom Cal** and follow on-screen directions. A full calibration will take over 40 minutes and should be performed at or near operating temperatures and humidity. Save calculated value to User Profiles.



Note: Photometric calibration and advanced size correction are covered in the manual, and are beyond the scope of this SOP.

7.3 Maintenance

7.3.1 Maintenance Schedule

There are no user-serviceable parts inside the DustTrak DRX. The instrument should only be opened by TSI or a TSI-approved service technician. Basic maintenance and cleaning should be performed according to the schedule below to keep the instrument functioning properly.

Item	Frequency
Perform zero check	Before each use (refer to Section 7.2.3).
Clean inlet	350 hr. at 1 mg/m^3
Clean 2.5 µm calibration impactor	Before every use.
Replace internal filters	350 hr. at 1 mg/m^3 or when indicated by the main screen filter error indicator.
Return to factory for cleaning and calibration (TSI recommends that both the DustTrak monitor and the External Pump Module be returned to TSI)	Annually
Replace the internal HEPA filters in the External Pump module	Annually

Instruments will be checked on a monthly basis to ensure satisfactory operation. The Contractor's maintenance checklist is presented in Appendix G, *Maintenance Worksheet.*

7.3.2 Cleaning the Inlet

The inlet should be cleaned based on the schedule in Section 7.3.2. Clean the inlet only with the instrument powered off.

To clean, unscrew the inlet nozzle from the instrument.

Use a cotton swab to clean the outside of the inlet port. The swab can be dampened with water or a light solvent (such as isopropanol). Clean the inside of the sample tube by using a small brush along with a light solvent. Dry the tube by letting it air-dry thoroughly. Do not blow air directly into the inlet port. Screw (hand-tighten) the inlet back into the instrument.

7.3.3 Cleaning the 2.5µm Calibration Impactor

The Calibration impactor should be cleaned prior to every use when using it to perform a Standard Calibration (size correction) on the instrument (refer to Section 7.2.6).

- Unscrew the impactor and check the O-ring on the impactor base.
- Clean the outside and inside of the impactor and the impactor plate using a clean brush and a light solvent. Dry impactor parts by blowing with compressed air or let it air dry thoroughly.
- Apply two drops of impactor oil to the impactor plate. Do not over-fill the impaction plate.
- Screw (hand-tighten) the impactor plate back together.

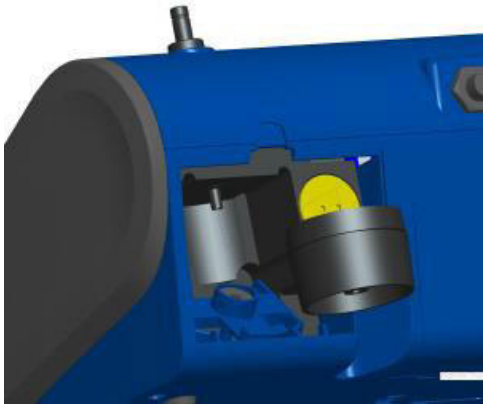
7.3.4 Replacing the Internal Filters

Replace the internal filters based on the schedule in Section 7.3.1 or when the filter indicator on the main screen turns to red.

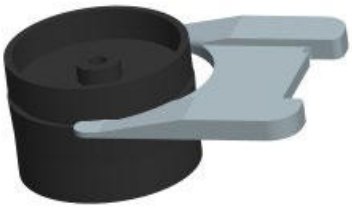
- Turn the instrument off.
- To remove the old filters from the instrument, open the filter access door on the back of the instrument.
- Use the filter removal tool to unscrew the filter cap.
- Pull out the single cylindrical filter from the filter well. If the filter well is visibly dirty, blow out with compressed air.

- Insert a new filter into the filter well and screw the filter cap back in place.
- Open the blue retention clip (to the left of the filter cap) by pinching the ends inward and pushing down.

- Remove the 37-mm cassette by pulling downward and outward.



- Open the filter cassette using the filter tool.



- Remove the screen mesh from the filter cassette and blow out using compressed air. Blow in reverse direction to remove captured particulate.
- Replace mesh in filter and press halves together. Ensure the filter has been fully closed by rotating the flat end of the filter opening tool around the cassette edges.

- Place the filter cassette back into position and close the blue retaining clip. Make sure the retaining clip snaps back into place.

It is important to reset the instrument's filter counter after replacing internal filters. Resetting the counter will clear the filter error condition shown on the main screen.

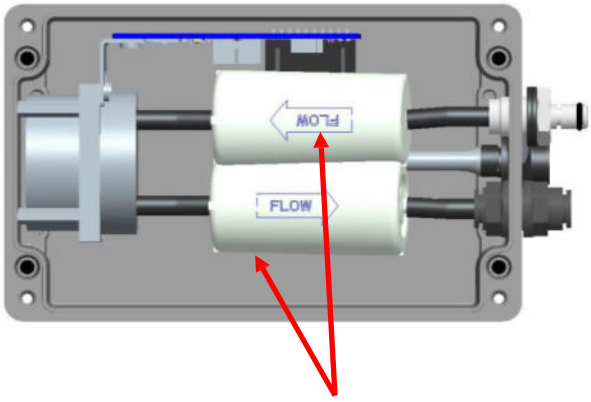
- Turn on the instrument.

- Press the Setup button to open the Setup screen.
- Touch the Cum Filter Conc: (live key) to reset the aerosol mass.
- "*Replace user serviceable filters?*" dialog will appear. Press OK.
- "*Reset filter concentration?*" dialog will appear. Press Yes to reset the cumulative filter concentration to zero.
- The Setup screen will now show zero for the Cum Filter Concentration and the current date for the Filter Time.

7.3.5 Replacing the Filters in the External Pump Module

The external pump module provided with Model 8533EP is designed to run continuously for about a year (8760 hours). There are two HEPA filters that protect the pump from contamination - one on the suction side of the pump and the other on the discharge side of the pump. The discharge side of the pump collects particles shedding from the vanes of the pump and will turn black over time. The HEPA filters will have to be replaced once a year.

To access the filters, open the top cover of the pump module. The two HEPA filters are identified in the figure below. The two filters can be replaced by disconnecting the soft tubing between the filters, pump, and the casing connectors.



8.0 CALCULATIONS

The DustTrak DRX is a direct reading instrument requiring no calculations.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

9.1 General QA/QC Procedures

- All data must be documented on field data sheets (Appendix H *Particulate Monitoring Worksheet*), logbooks or as per requirements dictated by field activities.
- The instrument must be operated and maintained according to the instructions supplied by the manufacturer, unless otherwise specified in the UFP-QAPP. Compliance will be documented on Maintenance Worksheets (Appendix G).
- Instrument calibration and maintenance records are maintained by the Contractor's staff and are located in Edison, New Jersey (NJ) and Las Vegas, Nevada (NV).

- Records must be maintained, documenting the training of the operators that use instrumentation and equipment for the collection of environmental information.

9.2 Annual Calibration

DustTrak DRX units should be returned to TSI for factory calibration once per year during normal operation. Instruments may require additional factory calibrations if malfunctions occur and repairs are necessary.

The DustTrak DRX monitor is calibrated with Arizona Road Dust at TSI against a reference photometer that is gravimetrically calibrated (also with Arizona Road Dust). This specific dust has a wide size distribution covering the entire size range of the DustTrak DRX and is representative of a wide variety of ambient aerosols. Because the instrument combines photometry with single particle sizing for mass measurement, both photometry and size need to be calibrated.

10.0 DATA VALIDATION

The user will ensure that the particulate monitor was operated in accordance with this SOP, within instrument specifications (Appendix A) and all operational checks have been completed and are within the criteria specified in the site-specific UFP-QAPP. The Contractor's Task Leader is responsible for completing the UFP-QAPP verification checklist prior to each project.

11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's Environmental Response Team (ERT) should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

Safety concerns specific to the operation of the DustTrak DRX include:

- Do not operate when highly corrosive aerosols or solvent fumes are present.
- Do not attempt to disassemble the instrument.
- The DustTrak DRX should be operated only from the type of power sources described in this SOP.
- Never operate the DustTrak DRX without the internal filters in place.

12.0 REFERENCES

TSI, Inc., DustTrak DRX Aerosol Monitor Model 8533/8534/8533EP Operation and Service Manual, P/N 6001898, Revision M, January 2017.

TSI, Inc., DustTrak DRX Aerosol Monitor Theory of Operation Application Note, EXPMN-002, Revision B, 2012.

TSI, Inc., DustTrak Aerosol Monitor Environmental Enclosure Model 8535 Operation and Maintenance Manual, P/N 6002097, Revision J, February 2017.

TSI, Inc., DustTrak DRX Aerosol Monitor Specifications, P/N 6001981, Revision G, 2014.

TSI, Inc., Quick Start Guide, Heated Inlet for Environmental Enclosure Models 8535 and 8537, P/N6007667, Revision C, 2014.

13.0 APPENDICES

A- Specifications
B- Theory of Operation
C- Relative Humidity Setting on the Heated Inlet
D- Heated Inlet for Environmental Enclosure
E- Troubleshooting
F- Viper Guide for DustTrak DRX8533
G- Maintenance Worksheet
H- Particulate Monitoring Worksheet

APPENDICES
Operation of the DustTrak DRX Model 8533EP Aerosol Monitor
SOP: ERT-PROC-2078-20
June 2020

APPENDIX A
Specifications
SOP: ERT-PROC-2078-20
June 2020

DUSTTRAK™ DRX AEROSOL MONITORS MODELS 8533, 8533EP AND 8534

REAL-TIME DUST AND AEROSOL MONITORING FOR ANY ENVIRONMENT, ANY APPLICATION

Only DustTrak™ DRX Aerosol Monitors can simultaneously measure both mass and size fraction – no other monitor can do both. DustTrak DRX models are battery-operated, data-logging, light-scattering laser photometers that give you real-time aerosol mass readings. They use a patent air system that isolates the aerosol in the optics chamber to keep the optics clean for improved reliability and low maintenance. From desktop with external pump models to a handheld model, the DustTrak DRX offers a suitable solution for heavy industrial workplaces, construction and environmental sites and other outdoor applications, as well as clean office settings. DustTrak DRX monitors measure aerosol contaminants such as dust, smoke, fumes and mists.

Features and Benefits

All Models
- Real-time mass concentration and size fraction readings, as well as data-logging allow for data analysis during and after sampling.
- Simultaneously measure size-segregated mass fraction concentrations corresponding to PM1, PM2.5, Respirable, PM10, and Total PM size fractions
- Easy-to-use graphical user interface with color touch-screen for effortless operation

Handheld Model (8534)
- Long life internal pump for continuous sampling
- Single-point data collection for walk through surveys
- Lightweight design with ergonomic handle for portable applications

Desktop Models (8533 and 8533EP)
- Energy-efficient, long lasting external pump for continuous, unattended, 24/7, outdoor monitoring applications (Model 8533EP only)
- Long life internal pump for shorter work-shift or IAQ sampling applications (Model 8533)
- Gravimetric reference sampling capability for custom reference calibrations
- Automatic zeroing (with optional zero module) to minimize the effect of zero drift
- STEL alarm setpoint for tracking 15-minute average mass concentrations
- Standard and advanced calibration capabilities for consistent accuracy
- Environmental protected and tamper-proof secure (with an optional environmental enclosure)
- Inlet sample conditioning (with optional heated inlet sample conditioner) to reduce the effect of humidity on photometric mass measurements (for use with an environmental enclosure)
- Cloud Data Management System hosted by Netronix*

TSI® UNDERSTANDING, ACCELERATED

Unsurpassed Technology and Performance

DustTrak DRX monitors are laser photometers that simultaneously measure five size segregated mass fraction concentrations at once–something no other monitor can do. The desktop, desktop with external pump and handheld monitors are continuous, real-time, 90°, light-scattering laser photometers that simultaneously measure size-segregated mass fraction concentrations corresponding to PM1, PM2.5, Respirable, PM10, and Total PM fractions. They combine both particle cloud (total area of scattered light) and single particle detection to achieve mass fraction measurements.

This size-segregated mass fraction measurement technique is superior to either a basic photometer or optical particle counter (OPC). It delivers the mass concentration of a photometer and the size resolution of an OPC. Typically, photometers can be used at high mass concentration, but they do not give any size information (unless used with size selective inlet conditioners) and significantly underestimate large particle mass concentrations. OPC's provide size and count information; however, they do not provide any mass concentration information and cannot be used in high mass concentration environments. The DustTrak DRX can do both.

Handheld Models: Perfect for Walk-Through Surveys and Single-Point Data Collection Applications

The DustTrak DRX handheld Model 8534 is lightweight and portable. It is perfect for industrial hygiene surveys, point source location monitoring, indoor air quality investigations, engineering control evaluations/validation, and for baseline trending and screening. Like the desktop models, it has manual and programmable data logging functions. In addition, the handheld model also has a single-point data logging capability for walk-through industrial hygiene surveys and indoor air quality investigations.

Desktop Models: Ideal for Long-Term Surveys and Remote Monitoring Applications

The DustTrak DRX is also offered as a standard desktop (Model 8533), as well as a desktop with external pump (Model 8533EP.) Both models have manual and programmable data logging functions, making them ideal for unattended applications. The standard desktop model is most suitable for indoor, continuous monitoring, while the desktop with external pump is designed for 24/7 unattended, remote monitoring outdoors.

The DustTrak DRX desktop models come with USB (device and host), Ethernet, and analog and alarm outputs allowing remote access to data. User adjustable alarm setpoints for instantaneous or 15-minute short-term excursion limit (STEL) are also available on desktop models. The alarm output with user-defined setpoint alerts you when upset or changing conditions occur.

The DustTrak DRX Desktop Monitors have several unique features:

+ External pump (Model 8533EP) with low power consumption for continuous, unattended monitoring in remote outdoor locations.
+ Gravimetric sampling capability using a 37-mm filter cassette which can be inserted in-line with the aerosol stream allowing you to perform an integral gravimetric analysis for custom reference calibrations.
+ Zeros automatically using the external zeroing module. This optional accessory is used when sampling over extended periods of time. By zeroing the monitor during sampling, the effect of zero drift is minimized.
+ STEL alarm feature for tracking 15-minute average mass concentrations when alarm setpoint has been reached for applications like monitoring fugitive emissions at hazardous waste sites.
+ Provide for environmental protection and tamper-proof security using an environmental enclosure. This optional accessory encloses the instrument within a waterproof, lockable, custom-designed case.
+ Condition the sample air stream before entering the instrument optics using a heated inlet sample conditioner (designed for use with the environmental enclosure.) This optional accessory is used in humid environments. By conditioning the sample, the humidity and water vapor are minimized.
+ Standard and advanced calibration capabilities. The DustTrak DRX Aerosol Monitor has two calibration factors: a photometric calibration factor (PCF) and a size calibration factor (SCF). The PCF accounts for the photometric response difference between A1 Test Dust and the aerosol under measurement, while the SCF accounts for the aerodynamic size difference.
  - The primary goal of the standard calibration is to obtain the SCF for the aerosol of interest. The standard calibration process is very easy and does not require comparison to gravimetric samples. Measure with and without a PM2.5 impactor, and the instrument takes the ratio of these two size distributions and compares this reading to the PM2.5 impactor transmission efficiency curve to calculate the SCF. However, the absolute mass concentration may not be as accurate as the advanced calibration.
  - The advanced calibration method yields high size segregated mass concentration accuracy. It involves two separate gravimetric measurements to obtain PCF and SCF in sequence. The advanced calibration will accurately measure size segregated mass concentrations.

Applications	Desktop	Handheld
Aerosol research studies	+	+
Baseline trending and screening	+	+
Engineering control evaluations		+
Engineering studies		+
Epidemiology studies	+	+
Indoor air quality investigations	+	+
Industrial/occupational hygiene surveys	+	+
Point source monitoring		+
Outdoor environmental monitoring	+	
Process monitoring	+	+
Remote monitoring	+	

DustTrak DRX Aerosol Monitor Features

All Models
+ Li-Ion rechargeable batteries
+ Internal and external battery charging capabilities
+ Outlet port for isokinetic sampling applications
+ User serviceable sheath flow and pump filters
+ Logged test pause and restart feature
+ Logged test programming
  - Color touch screen—either manual mode or program mode
  - TRAKPRO™ Data Analysis Software via a PC
+ User adjustable custom calibration settings
+ Instantaneous alarm settings with visual and audible warnings
+ Real-time graph display
+ View statistical information during and after sampling
+ On-screen instrument status indicators: FLOW, LASER and FILTER
+ Filter service indicator for user preventative maintenance

Desktop Models (8533 and 8533EP)
+ Long life external pump (8533EP)
+ Internal pump (8533)
+ Hot swappable batteries
+ Gravimetric reference sample capability
+ STEL alarm setpoint

Optional Accessories
+ Auto zeroing module
+ Protective environmental enclosure (8535 and 8537)
+ Heated inlet sample conditioner (for use with an environmental enclosure)
+ Cloud Data Management System as hosted by Netronix™

Handheld Model (8534)
+ Long life internal pump
+ Single-point data collection for walk through surveys

Easy to Program and Operate

The graphical user interface with color touch-screen puts everything at your fingertips. The easy-to-read display shows real-time mass concentration and graphical data, as well as other statistical information along with instrument pump, laser and flow status, and much more. Perform quick walk-through surveys or program the instrument's advanced logging modes for long-term sampling investigations. Program start times, total sampling times, logging intervals, alarm setpoints and many other parameters. You can even set up the instrument for continuous unattended operation.

TRAKPRO™ Software Makes Monitoring Easier than Ever

TrakPro™ Data Analysis Software allows you to set up and program directly from a PC. It even features the ability for remote programming and data acquisition from your PC via wireless communication options or over an Ethernet network. As always, you can print graphs, raw data tables, and statistical and comprehensive reports for recordkeeping purposes

Battery Performance		
Models 8533 and 8533EP (Typical) 6600 mAH Li-Ion Battery Pack (P/N 801680)	1 Battery	2 Batteries
Battery runtime (hours)	Up to 6	Up to 12
Charge time* (hours) in DustTrak	4	8
Charge time* (hours) in external battery charger (P/N 801685)	4	8

Model 8534 (Typical) 3600 mAH Li-Ion Battery Pack (P/N 801681)	Battery
Battery runtime (hours)	Up to 6
Charge time* (hours) in DustTrak	4
Charge time* (hours) in external battery charger (P/N 801686)	4

* Of a fully depleted battery

SPECIFICATIONS

DUSTTRAK™ DRX AEROSOL MONITORS
MODELS 8533, 8533EP AND 8534

Sensor Type
90° light scattering

Particle Size Range
0.1 to 15 µm

Aerosol Concentration Range

8533 Desktop	0.001 to 150 mg/m³
8533EP Desktop with External Pump	0.001 to 150 mg/m³
8534 Handheld	0.001 to 150 mg/m³

Display
Size Segregated Mass Fractions for PM1, PM2.5, Respirable, PM10 and Total. All displayed

Resolution
±0.1% of reading or 0.001 mg/m³, whichever is greater

Zero Stability
±0.002 mg/m³ per 24 hours at 10 sec time constant

Flow Rate
3.0 L/min

Flow Accuracy
±5% of factory set point, internal flow controlled

Temperature Coefficient
+0.001 mg/m³ per °C

Operational Temp
32 to 120°F (0 to 50°C)

Storage Temp
-4 to 140°F (-20 to 60°C)

Operational Humidity
0 to 95% RH, non-condensing

Time Constant
User adjustable, 1 to 60 seconds

Data Logging
5 MB of on-board memory (>60,000 data points)
45 days at 1 minute logging interval

Log Interval
User adjustable, 1 second to 1 hour

Physical Size (H x W x D)

Handheld	4.9 x 4.8 x 12.5 in. (12.5 x 12.1 x 31.6 cm)
Desktop	5.3 x 8.5 x 8.8 in. (13.5 x 21.6 x 22.4 cm)
External Pump	4.0 x 7.0 x 3.5 in. (10.0 x 18.0 x 9.0 cm)

Weight

Handheld	2.9 lb (1.3 kg), 3.3 lb (1.5 kg) with battery
Desktop	3.5 lb (1.6 kg), 4.5 lb (2.0 kg) - 1 battery, 5.5 lb (2.5 kg) - 2 batteries
External Pump	3.0 lb (1.4 kg)

Communications

8533	USB (host and device) and Ethernet. Stored data accessible using flash memory drive
8533EP	USB (host and device) and Ethernet. Stored data accessible using flash memory drive plus cable assembly for external pump
8534	USB (host and device). Stored data accessible using flash memory drive

Power-AC
Switching AC power adapter with universal line cord included.
115-240 VAC

Analog Out

8533/8533EP	User selectable output, 0 to 5 V or 4 to 20 mA. User selectable scaling range

Alarm Out

8533/8533EP	Relay or audible buzzer Relay Non-latching MOSFET switch + User selectable set point + ~5% deadband + Connector 4 pin, Mini-DIN connectors
8534	Audible buzzer

Screen

8533/8533EP	5.7 in. VGA color touchscreen
8534	3.5 in. VGA color touchscreen

Gravimetric Sampling

8533/8533EP	Removable 37 mm cartridge (user supplied)

CE Rating

Immunity	EN61236-1:2006
Emissions	EN61236-1:2006

Specifications are subject to change without notice

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P/N 60019B1 Rev G

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APPENDIX B
Theory of Operation
SOP: ERT-PROC-2078-20
June 2020

DUSTTRAK™ DRX AEROSOL MONITOR THEORY OF OPERATION

APPLICATION NOTE EXPMN-002

The Models 8533 and 8534 are not versions of the basic DUSTTRAK™ II Aerosol Monitor, they are advanced versions known as the DRX models. The DUSTTRAK Model 8533 is a desktop instrument while the Model 8534 is a handheld. The primary difference between the basic single-channel DUSTTRAK II photometer and the Advanced DRX models are in the ability of the DRX advanced models to measure size fractions of the sampled aerosol in addition to making a mass based photometric measurement. This employs a **patent pending** method to simultaneously measure size segregated mass fraction concentrations (PM_1, $PM_{2.5}$, Respirable/PM_4, PM_{10}/Thoracic, and TPM) over a wide concentration range (0.001–150 mg/m^3) in real time. This method combines a photometric measurement to cover the mass concentration range and a single particle detection measurement to be able to size discriminate the sampled aerosol.

The schematic is very similar to that of the basic DUSTTRAK II Aerosol Monitor. Aerosol is drawn in to the sensing chamber in a continuous stream using a diaphragm pump. Part of the aerosol stream is split ahead of the sensing chamber and passed through a HEPA filter and injected back in to the chamber around the inlet nozzle as sheath flow. The remaining flow, called the sample flow passes through the inlet entering the sensing chamber. Here, it is illuminated by a sheet of laser light. This sheet of laser light is formed from a laser diode. First, the light emitted from the laser diode passes through a collimating lens and then through a cylindrical lens to create a thin sheet of light. A gold coated spherical mirror captures a significant fraction of the light scattered by the particles and focuses it on to a photodetector.

The signal processing is however very different from a typical photometer. Although the voltage across the photodetector, which is proportional to the mass concentration, is used to determine the concentration of the aerosol, the individual pulses from the photometer are also used to make single particle measurements. As shown in the schematic below, the photodiode signal is separated in to two components: the photometric signal and the single particle pulses. The voltage across the photodetector is proportional to the $PM_{2.5}$ fraction of the total sampled aerosol over a wide range of concentrations. The voltage is then multiplied by a calibration constant which is determined from the ratio of a known $PM_{2.5}$ mass concentration of the test aerosol to the voltage response of the DUSTTRAK DRX Aerosol Monitor. Typically, the test aerosol is Arizona Test Dust (or ISO 12103-1, A1 test Dust). The single particle pulses are calibrated to measure the aerodynamic size of the A1 test dust. To reduce coincidence error, only particles greater than 1 µm are recorded. The particle mass is calculated and recorded in one of the four size segregated mass fractions (PM_1, $PM_{2.5}$, Respirable/PM_4, PM_{10}/Thoracic, and TPM). The size segregated mass concentration is obtained as follows:

$PM_1 = PM_{2.5} - PM_{1-2.5}$
$PM_{2.5}$ = Photometric signal × calibration factor
Respirable / $PM_4 = PM_{2.5} + PM_{2.5-4}$
PM_{10} / Thoracic = $PM_4 + PM_{4-10}$
$TPM = PM_{10} + PM_{>10}$

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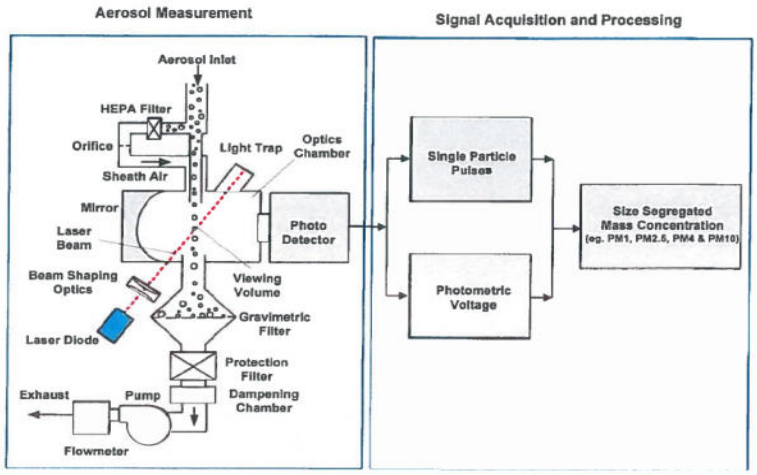

The algorithms used by the DUSTTRAK DRX Aerosol Monitor yield a mass measurement technique that is superior to either a basic photometer or Optical Particle Counter (OPC). While photometers can be used at high mass concentrations, they do not give any size information (unless used with size selective inlet conditioners) and significantly underestimate particle mass contributed by large particles. On the other hand, OPCs provide size information, however they cannot be used at high mass concentration. The DUSTTRAK DRX Aerosol Monitor is able to combine the advantages of both the measurement techniques to improve the overall accuracy of the mass measurement.

The DUSTTRAK DRX Aerosol Monitor is able to measure mass concentrations with greater accuracy because of its ability to measure single particles >1 µm, since the photometric signal is less sensitive to large particles. In addition, the DUSTTRAK DRX compensates for coincidence error using a dead-time correction algorithm. Furthermore, the DUSTTRAK DRX Aerosol Monitor converts the single particle pulses to aerodynamic size by proprietary factory or custom calibrations, significantly reducing mass calculation errors due to particle density, refractive index and shape on the calculated mass concentration. As a result, the DUSTTRAK DRX Aerosol Monitor size segregated mass fraction measurement has the size resolution of an OPC along with a much higher mass concentration range like a typical photometer.

Although the DUSTTRAK DRX monitor comes with a couple of calibration impactors, they are recommended for use only during custom calibrations. The greatest advantage of using the DUSTTRAK DRX Aerosol Monitor over other photometers in the market including the DUSTTRAK II Aerosol Monitor basic is the lack of need for a size-selective inlet conditioner. PM_1, $PM_{2.5}$, Respirable/PM_4, PM_{10}/Thoracic and TPM fractions can all be measured simultaneously without the use of any size-selective inlet conditioners.

To improve the accuracy of the mass measurement, the unit can be calibrated with gravimetric sample(s) by conducting side-by-side comparisons with the DUSTTRAK DRX Aerosol Monitor readings to gravimetric samples. On the Desktop Model 8533, a 37-mm filter cassette sampler can be inserted in-line with the aerosol stream at the outlet of the optics chamber allowing the user to perform a gravimetric analysis without the need for using an external pump and filter holder.

At TSI, the DUSTTRAK DRX Aerosol Monitor is calibrated against a reference photometer (Model 8587) that is gravimetrically calibrated to ISO 12103-1, A1 test dust (Arizona Test Dust). This test dust has a wide size distribution covering the entire size range of the DUSTTRAK DRX Aerosol Monitor and is representative of a wide variety of ambient aerosols.

The optics inside the DUSTTRAK DRX Aerosol Monitor is kept clean by surrounding the aerosol stream with a sheath of clean filtered air. This sheath air confines the aerosol to a narrow stream and prevents particles from circulating around the optics chamber and depositing on the optics. It reduces coincidence errors in the single particle measurements and make the pulse height more uniform by retaining the particles within the Gaussian profile of the laser beam that produces more uniform pulse widths regardless of where the particles enter the inlet nozzle. Sheath flow also improves the response time of the instrument. The user can also access the sheath and main flow filters that need to be changed periodically to maintain the flow ratio between the sample flow and sheath flow a constant. The DUSTTRAK DRX's firmware will automatically detect the life of those filters and warn the user to change them before the pressure drop across those filters become excessive.

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APPENDIX C
Relative Humidity Setting on the Heated Inlet
SOP: ERT-PROC-2078-20
June 2020

WHAT RELATIVE HUMIDITY SETTING DO I USE WITH THE HEATED INLET

APPLICATION NOTE ENVDT-001 (US)

Introduction

The Heated Inlet Sample Conditioning module is designed to maintain a constant relative humidity level in the sample air stream before entering the Environmental DustTrak optics. The module uses a Relative Humidity/Temperature sensor to measure the atmospheric conditions. The module is programmed to maintain the necessary temperature to control the Rh to the selected set point during the aerosol capture time through the module.

The TSI Heated Inlet Sample Conditioning Module can be set to condition the sample to 30%, 40% and 50% relative humidity.

Setting Selection

What setting do I choose? This question goes back to the approved federal reference method and analytical methods for measuring ambient aerosol in the region.

- In the US, the EPA requires humidity control to 30-40% for PM10 particle sampling, and 35% for PM2.5 particle sampling.
- In the UK, EN12341 requires humidity control to 50% ± 5% for PM10 particulates, and 30-40% for PM2.5 particulates.
- *The NIOSH Analytical Method 0600 for Particulates, not otherwise classified, Respirable, specifies the* sample filter media be equilibrated in an environmental chamber at 20°± 1° C and 50±5% Relative Humidity.

Summary

US	Outdoor environmental sampling for PM2.5	35% Rh
	Outdoor environmental sampling for PM10	30–40% Rh
	Occupational Exposure sampling for respirable dust	50% Rh
UK	Outdoor environmental sampling for PM2.5	30–40% Rh
	Outdoor environmental sampling PM10	50% Rh

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APPENDIX D
Heated Inlet for Environmental Enclosure
SOP: ERT-PROC-2078-20
June 2020

QUICK START GUIDE

HEATED INLET FOR ENVIRONMENTAL ENCLOSURE

MODELS 8535 AND 8537

Thank you for purchasing a DustTrak™ Aerosol Monitor Heated Inlet Accessory. This guide will help you quickly begin using your Heated Inlet.

Unpacking

1. Carefully unpack the Heated inlet shipping container and verify that all the items listed in the following table are present.
2. Contact TSI immediately if items are missing or broken.
3. Additional items may be included if you ordered accessories or spare parts.

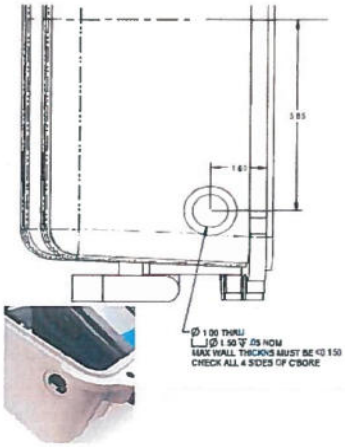
Qty.	Item Description	Reference Picture
1	Heated Inlet Column	
1	Temp/RH Probe	
1	Temp/RH Grommet	
1	Power Cable – Model 8535	
1	Power Cable – Model 8537	
1	90º Inlet	
1	Mounting Bracket Model 8535	
1	Mounting Bracket Model 8537	

Qty.	Item Description	Reference Picture
1	AutoZero Module*	
1	Cover – Sun Shield for Temp-Humidity Probe	

PN 801850 ships with AutoZero Module
PN 801851 does not ship with AutoZero Module
Heated inlet to be operated with the AutoZero Module

Preparation of Environmental Enclosure (8535) for Heated Inlet

1. The Environmental Enclosure may need a hole feature added, if purchased prior to ordering the Heated Inlet.



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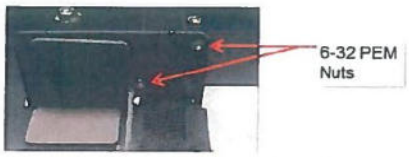
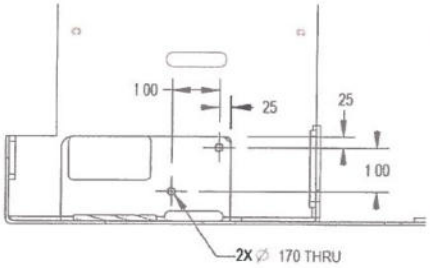
2. The Environmental Enclosure Bracket may need two holes added. Check the back left section of the large black sheet metal bracket for the installed 6-32 PEM nuts.



3. If they are present, no modification is needed.
4. If there are no 6-32 PEM nuts installed in the bracket, drill two Ø.189 holes as indicated in the drawing below.



5. Then use two 6-32 locking nuts on the back side of the flange when attaching the "Mounting Bracket."

Installing Heated Inlet- Model 8535

1. Install the 90° Inlet next to the water trap.

2. Mount the impactor (optional) and inlet tubing.

3. Install the Heated Inlet on top of the Auto-Zero Module.

4. If the Enclosure has the 6-32 PEM nuts, install the "Mounting Bracket" as shown—do ***not*** tighten.

5. If the Environmental Enclosure does *not* have the PEM nuts, install the "Mounting Bracket" using the 6-32 nuts—do ***not*** tighten.

6. Attach the Mounting Bracket to the Heated Inlet with 8-32 thumbscrews—do ***not*** tighten.

7. Approximately level the Heated Inlet and tighten all screws.

8. Attach inlet tube to Heated Inlet.

9. Attach Temp/RH Grommet to Case.

10. Push Temp/RH Probe through grommet and attach cable. Tighten grommet to secure probe with the sintered cover extending ¼" (13mm) past the grommet.

11. Attach Power Cable for Model 8535 to incoming power, DustTrak monitor, and Heated Inlet.

Installing Heated Inlet- Model 8537

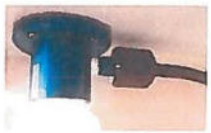
1. Connect the Power Cable for Model 8537 to back panel.

2. Insert the DustTrak monitor with Zero Module into its tray.

3. Attach the Dustrak monitor to the tray with the Velcro® strap.

4. Cut black inlet tubing to 7" length.

5. Mount the impactor (optional), the inlet fitting and connect the tubing.



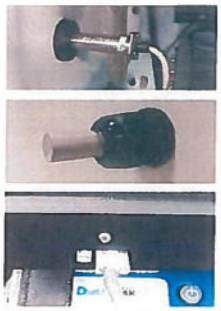
6. Attach the bracket-8537 to the Heated Inlet Assy.

7. Place the Heated Inlet on the Zero Module. Guide hole into tube of Zero Module.

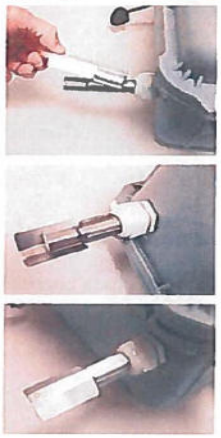
8. Align slots of bracket to holes in back panel and insert thumbscrews. .

9. Check that Heated Inlet sits horizontal and tighten mounting thumbscrews.

10. Push Temp/RH Probe through grommet and attach cable. Tighten grommet to secure probe with the sintered cover extending 1/8" (3 mm) past the grommet.



11. In areas with intense sun it may be necessary to use the "Temp-Humidity-Screen" to obtain correct ambient temperature and humidity measurements. The screen easily clamps on the temperature humidity probe as shown. Make sure the "clamp" portion of the screen is in contact with the solid stainless steel part of the probe and is not touching the sintered part (see pictures of probe).



12. Attach the power cable to the Heated Inlet.

Operating Instructions

1. When powered and attached to the DustTrak monitor, the Heated Inlet will automatically function.
2. Select RH set point that will be controlled at the entrance to DustTrak monitor to be 30, 40 or 50% RH via the DIP switches. Heated inlet will then power heaters to heat incoming air and thereby decrease RH to the targeted level.

The **LED** describes the status of the heated inlet:

Solid Green	Inlet temp. is > 1°C below set point and controlling to maintain set point.
Blinking Green	Inlet temp. is between -1 to -5°C of set point and controlling to improve.
Blinking Red	Inlet temp. is more than 5°C below set point and controlling to improve. This will occur when unit is first turned on and coming to temperature.
Solid Red	Sensor unplugged or has issue.

Warning Labels

	Warns that the instrument could be hot to the touch or a burn hazard.

Specifications

Power	12 Volts DC; 13 Watts
Dimensions	7.6" x 3.5" x 2.3"
Weight	1 lb.
Temp Range	0 to 50°C
RH Range	0 to 95%
RH Set Points	30% RH, 40%RH, 50% RH
Warm-up Time	17 minutes
CE	IEC 61326 & IEC 61010-1

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APPENDIX E
Troubleshooting
SOP: ERT-PROC-2078-20
June 2020

Symptom	Possible Cause	Corrective Action
Erratic zero reading	Leak	Check connections for leaks. Replace zero filter.
	Dirty inlet port and/or sample tube	Clean inlet port. Clean or replace tubing.
	Internal filter(s) not installed properly (leaking)	Inspect internal filter wells to make certain the filters and O-rings are seated properly. Replace internal filters if necessary.
DustTrak reading negative concentrations	Zero Drift	Perform Zero Cal.
	Zero Cal was performed without the Zero Filter in-line	Perform Zero Cal again and make sure the Zero Filter is attached to the DustTrak inlet.
Error completing Zero Cal	Too much light scatter in the optics chamber due to dust deposits	Clean the inlet nozzle. Attach the zero filter and sample for about 2 minutes. During sampling, pulse the flow going into the DustTrak monitor by intermittently plugging the zero filter. Any dust in the optics chamber will break loose during flow pulsations and will be cleared out by the pump. Perform Zero Cal again. If the Zero Cal still cannot be performed, factory service may be required.
Run Mode Error: The start time has passed	The selected Run Mode program has “Use Start Date” selected, but the start date is prior to the current date	Correct or change the run mode program
Run Mode Error: The selected log mode will exceed the allowed number of samples	The selected Run Mode program is programmed to save more samples then is room in memory	Reduce the number of samples by reducing the test length or increasing the logging interval.
Instrument runs slow	Large amount of data in memory	Large data files or many small data files will cause instrument to slow, due to need to read and display large amounts of data.
No display	Unit not switched on	Switch unit on.
	Low or dead batteries	Recharge the batteries or plug in the AC adapter.

Symptom	Possible Cause	Corrective Action
No touch -screen response	Instrument currently busy	The instrument will take time to open large data files and save configuration information. During this time, the instrument will not respond to additional touch-screen touches
	Instrument Touchscreen is locked	If the lock in the title bar is red, unlock the instrument following the instructions in Appendix A, DustTrak DRX User's Manual (Chapter 3, Operation: Title Bar section).
Analog output does not work	Cable/connector not correctly installed	Make sure cable connector is fully seated.
	Output wired with reverse polarity	Make sure analog out (+) and analog ground (-) are wired correctly to data-logger.
Analog output is not in proportion to display	Analog output range in DustTrak monitor may be set incorrectly	Check analog output setting in the Setup->Analog screen. Make sure the channel of interest is selected. Make sure that the correct output (0 to 5V, 4 to 20 mA) is selected.
	Data logger scaling factor may be set incorrectly	Review the scaling factor set in the Setup-Analog screen.
Alarm output does not work	Alarm does not turn on correctly	Turn the alarm function on in the Settings->Alarm screen.
	Alarm function not turned on	Check the alarm settings in the Settings->Alarm screen.
	Alarm setting incorrect	Make sure the logging interval and time constant are set as short. as possible (30 seconds or lower)
	Alarm output wired with reverse polarity	Alarm wires are polarized. Voltage input must be wired to alarm input (+).
Instrument does not store new data	Memory is full	Delete or transfer historic data.
	Instrument is in Survey mode	The instrument does not store data in survey mode. Can to manual or program log mode.

Symptom	Possible Cause	Corrective Action
Flow Error is indicated on front screen	If sampling from a duct, instrument may have problems overcoming pressure differences	Attach both the input and the exhaust port into the duct.
	Flow obstruction	Remove obstruction if still present. Press any key to bypass.
	Internal pump failing, indicated by inability to adjust flow rate to full range	Factory service may be required.
	Filter Cassette clogged or has mass loading	Replace the filter cassette. See Section 7.3.4.
	External pump module (for Model 8533EP only) is not connected to the DustTrak monitor	Make sure both the External Pump cable and the flow tubing connector are connected to the DustTrak monitor and the External pump module. Lock the External Pump Cable in place by rotating the connector clockwise until you hear it snap in place. Make sure the tubing between the DustTrak monitor and the External pump module is not kinked and is free of any sharp bends. Make sure the exhaust adapter is connected to the exhaust of the DustTrak monitor. Make sure the External Pump module filters are not clogged. If found dirty, replace the two HEPA filters.
Laser Error indicated on front screen	Laser background is too high	Remove and clean inlet nozzle. Pay close attention to the tip of the nozzle that is inserted into the instrument to ensure it is clear of any contamination.
	Laser is failing	Factory service may be required.

Symptom	Possible Cause	Corrective Action
Filter Error indicated on front screen	Filters need to be replaced	Replaced the filters per instructions in the maintenance section of this manual. Make sure to reset the filter mass and date once the filters have been changed. Note: This is only a warning. The unit will continue to operate normally until the increase in pressure drop across the filter is so high that the pump can no longer maintain the set flow rate.
System Error has Occurred!	The processor did not receive the input it expected. This can also happen if the optics chamber is saturated with light, or the External Pump Cable is accidentally disconnected during the middle of sampling.	Reboot the instrument. If the error does not go away, factory service is required.

APPENDIX F
Viper Guide for DustTrak DRX8533
SOP: ERT-PROC-2078-20
June 2020

ERT

USER MANUAL for DUSTTRAK DRX8533

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CONFIGURING THE DUSTTRAK DRX 8533

Background

The DustTrak DRX8533 can work with Viper using either a Gen 2 LINC or Gen 3 LINC. The Gen 3 LINC can receive power from the DustTrak USB Port. The following guide addresses both configurations and what parts are needed for both.

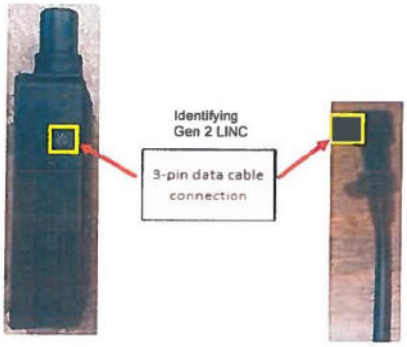
SETUP WITHOUT EXTERNAL POWER TO THE LINC

Part Needed

To connect the DustTrak to a Gen 2 LINC (internal battery power only), the following part is necessary:

- USB to SERIAL Adapter. ***NOTE:*** *Although there may be many USB to Serial Adapters on the market, ERT has tested and recommends the* ***CHIPI-X USB*** *to Serial (USB-DB9 to RS232) with the DustTrak setup.*

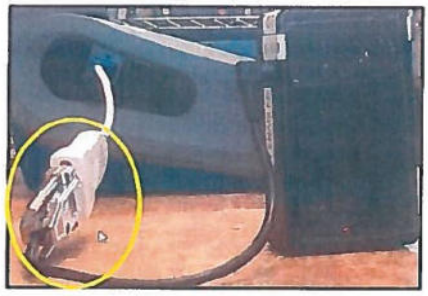
USB to Serial Adapter



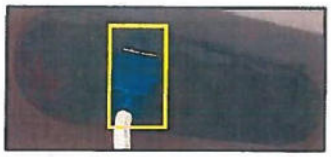
Example: Gen 2 LINC - 3-Pin Data Cable Connection – INTERNAL Battery Power Only

Hardware Connections

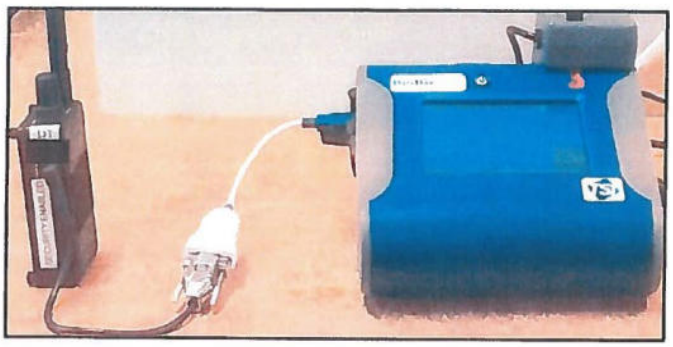
1. Connect the LINC Cable (Gen 2 – 3-Pin Data Cable Connection) to the USB to Serial Adapter.



2. Plug the USB connection into the left side of the Instrument, behind the rubber protective plug-- second (2nd) port-- on the DustTrak instrument.



USB Connection 2nd port on DustTrak



Setup without Power to LINC (Gen 2 LINC – Battery Power Only)

Once VIPER Survey Controller is running, data streams from the instrument to the LINC, without modification to the DustTrak while it is in **Run Mode.**

SETUP WITH EXTERNAL POWER TO LINC

Parts Needed

Both internal (battery source) and external power sources can be configured on the Gen 3 (7-pin) LINC through the mini-USB on the bottom of the Gen 3 LINC.

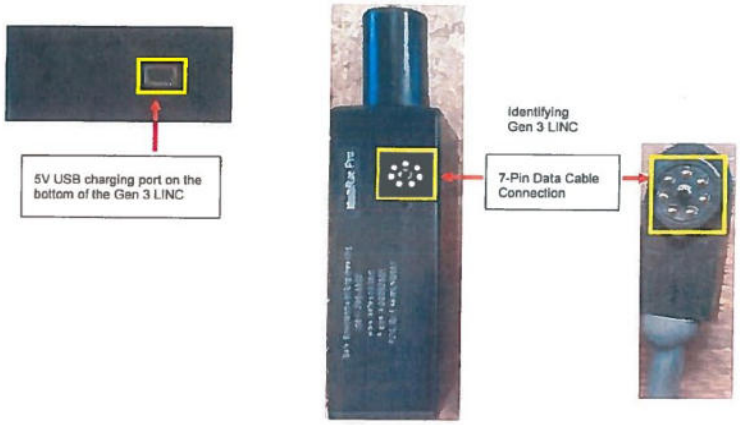
To connect the DustTrak to a Gen 3 LINC (internal/external power), the following parts are necessary:

- USB A to USB Mini 5 Pin Cable. ***Note:*** *ERT has tested and recommends cables from www.firefold.com , 3ft USB to USB Mini Cable – 5 pin.*

USB A to USB Mini 5 Pin Cable

- USB A to USB A multiport splitter Hub. ***Note:*** *This equipment is only needed when external power to the LINC is needed from the instrument. ERT has tested and recommends the* ***Sabrent SA HB-UMLS 4-port hub with individual switches*** *available from www.bhphotovideo.com).*

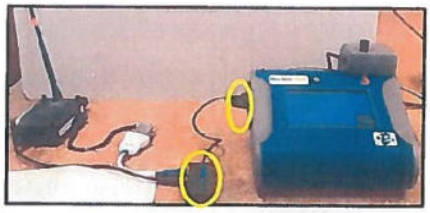
USB A to USB A Multiport Splitter



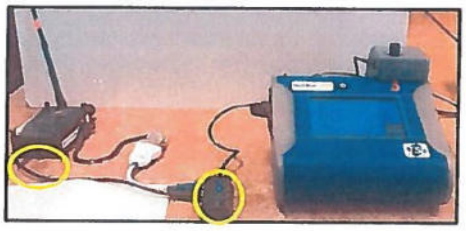
Example: Gen 3 LINC – 5V USB charging port on the Gen 3 LINC with 7-Pin Data Cable Connection

Hardware Connections

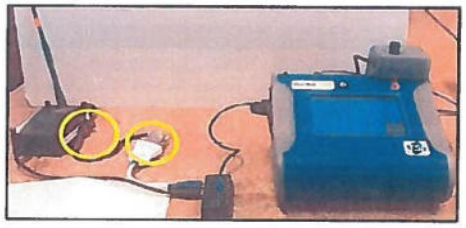
1. Connect the 4-port USB Multiport Splitter (Hub) to the 2nd Port on the DustTrak.

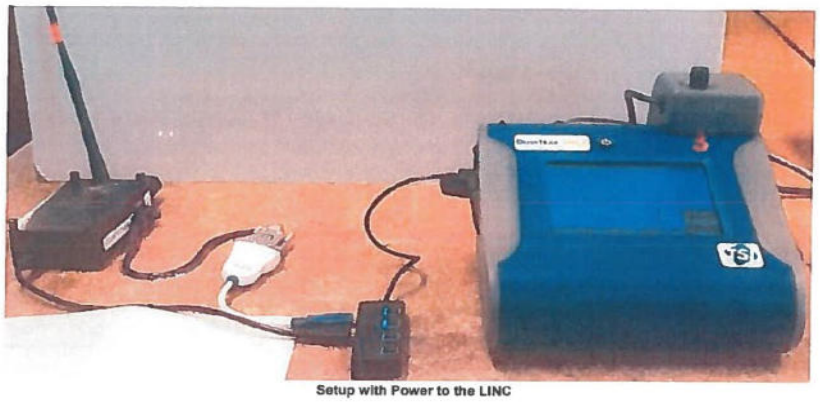


2. Connect the USB A to USB mini-5 Pin Cable from the Gen 3 LINC (mini USB) to the USB Port Splitter (Hub). This provides power to the Gen 3 LINC.



3. Connect the LINC Cable (7-Pin) to the USB to Serial Connector and plug into the USB Port Splitter.



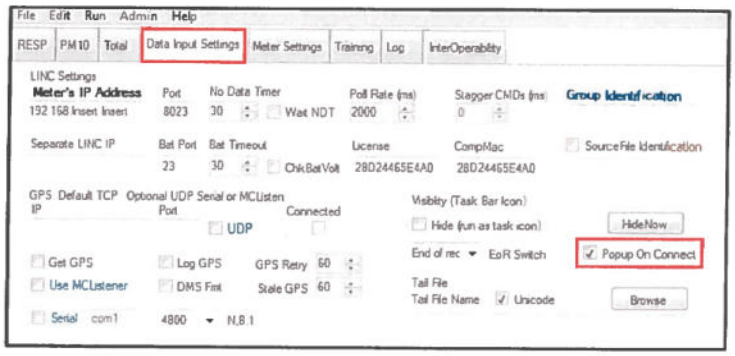


Setup with Power to the LINC

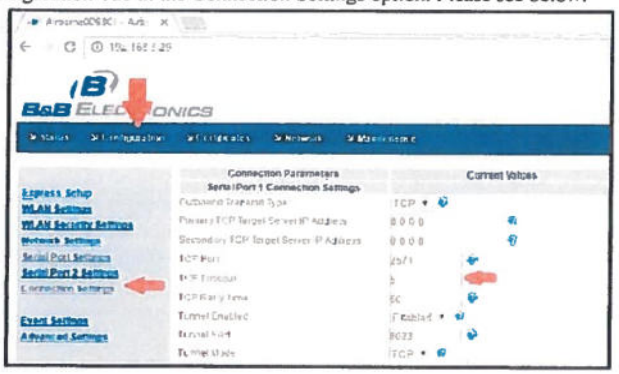
Once VIPER Survey Controller is running, data streams from the instrument to the LINC, without modification to the DustTrak while it is in **Run Mode.**

Helpful tips

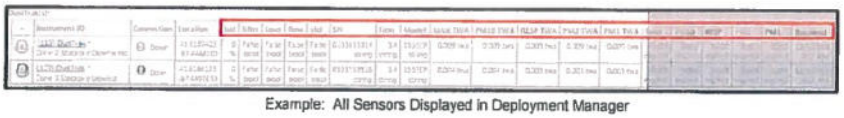
- The LINC Baud rate must be set to 9600.
- Only Gen 3 LINCs can be powered through the mini USB port on the bottom.
- If Survey Controller turns green and then immediately greys out, there is a problem with one of the cables (either LINC Cable or the USB A to USB Mini 5 pin cable.
- By default, the DustTrak MeterApp will not launch full screen. To have the MeterApp launch full screen automatically, unlock the MeterApp. On the Data Input Settings tab, put a checkmark in the 'Popup on Connect'. The MeterApp will launch full screen on the next run.



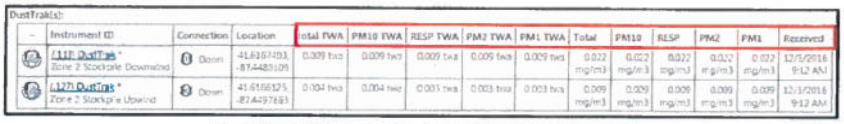
- To help maintain better connectivity, we suggest that the TCP Timeout timer for the LINCs connected to the DustTraks be changed from 5 seconds to 0 (zero). The TCP Timeout setting for Serial Port 1 can be found under the Configuration Tab in the Connection Settings option. Please see below.



- The DustTrak instruments display numerous sensors in Deployment Manager. Sensors that do not need to be displayed (i.e., SN, Firm, Model, etc.) can be turned off in Deployment Manager and will not view in Deployment Manager. Below are example screen shots showing all sensors being displayed and sensors being turned off and not displayed. Please call 1-800-999-6990 or email crtsupport@epa.gov to modify how your sensors are displayed in Deployment Manager.

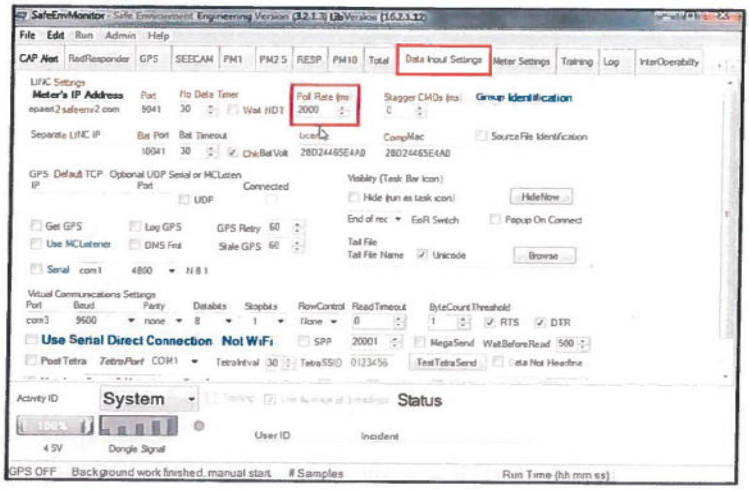


Example: All Sensors Displayed in Deployment Manager



Example: Sensors turned off and not Displayed in Deployment Manager

- Recommend running the MeterApp at a 2 second polling rate. Running it at a 1 second polling rate does not allow the TSI's com port buffer to completely empty before asking for another reading. To change the polling rate, unlock the MeterApp. Under the Data Input Settings, change the Poll Rate (ms) to 2000 as the default. ***NOTE:* This is only an issue with the serial I/O (900 MHz) not using IP packet Lincs.**



APPENDIX G
Maintenance Worksheet
SOP: ERT-PROC-2078-20
June 2020

NOTE: To charge battery, Unit must be plugged in, turned on and in standby mode. Battery will not charge when unit is off or when pump is running.

MONTHLY DUSTTRAK DRX CALIBRATION CHECKLIST
(New 11/16)

Name:_____ Date: _____

EPA NUMBER _____ S/N: _____

Last Annual Cal. Date: _____ Next Annual Cal. Date: _____

Out on WA# / Name:_____

Maintenance Schedule

Item	Frequency
Perform Zero Check	Monthly. And: Before Each Use or When negative values are displayed.
Clean 2.5 µm calibration impactor	Before each use of impactor (not regular part of maintenance)
Clean inlet	Quarterly, if unit has been used. Or, every 350 hours at 1 mg/m^3 concentration (Equals 2 weeks of 24-hour operation or 30 12-hour days). This is concentration dependent, i.e. 700 hours at 0.5 mg/m^3.
Replace internal filters	350 hours at 1 mg/m^3, or when filter error light indicates
Return to factory for cleaning and calibration – send both the DustTrak AND the External Pump	Annually
Replace the internal HEPA filters in the External Pump Module	Annually-have done during annual cal

Maintenance

Zero Instrument.

1. Set up instrument with external pump
2. Attach zero filter to inlet
3. Press Zero Cal button from Setup menu
4. Press Start
5. Wait for countdown, screen should indicate "Zero Cal Complete" when finished

Zero Calibration completed (Monthly)? YES/NO

Time and Date Verified/Set? YES/NO

Internal Filters Replaced (As Necessary)? YES/NO
IF "YES", was filter count re-set? YES/NO
_____mg
(Click on "Cum Filter Mass:" in Setup and follow directions)
_____(date)

From Setup Screen:
Cum Filter Mass: _____
Filter Last changed: _____

Inlet Cleaned (As Necessary)? YES/NO
Unit Discharged (Once per Quarter)? YES/NO
External Batteries Charged (Monthly)? YES/NO

APPENDIX H
Particulate Monitoring Worksheet
SOP: ERT-PROC-2078-20
June 2020

Page ____of____

EPA/Environmental Response Team
Scientific, Engineering, Response and Analytical Services
Leidos, Inc., Edison, NJ
U.S. EPA Contract No. EP-W-09-031

Air Monitoring Work Sheet

Site: _____ WA# _____

Sampler: _____ U.S. EPA/ERT WAM:_____

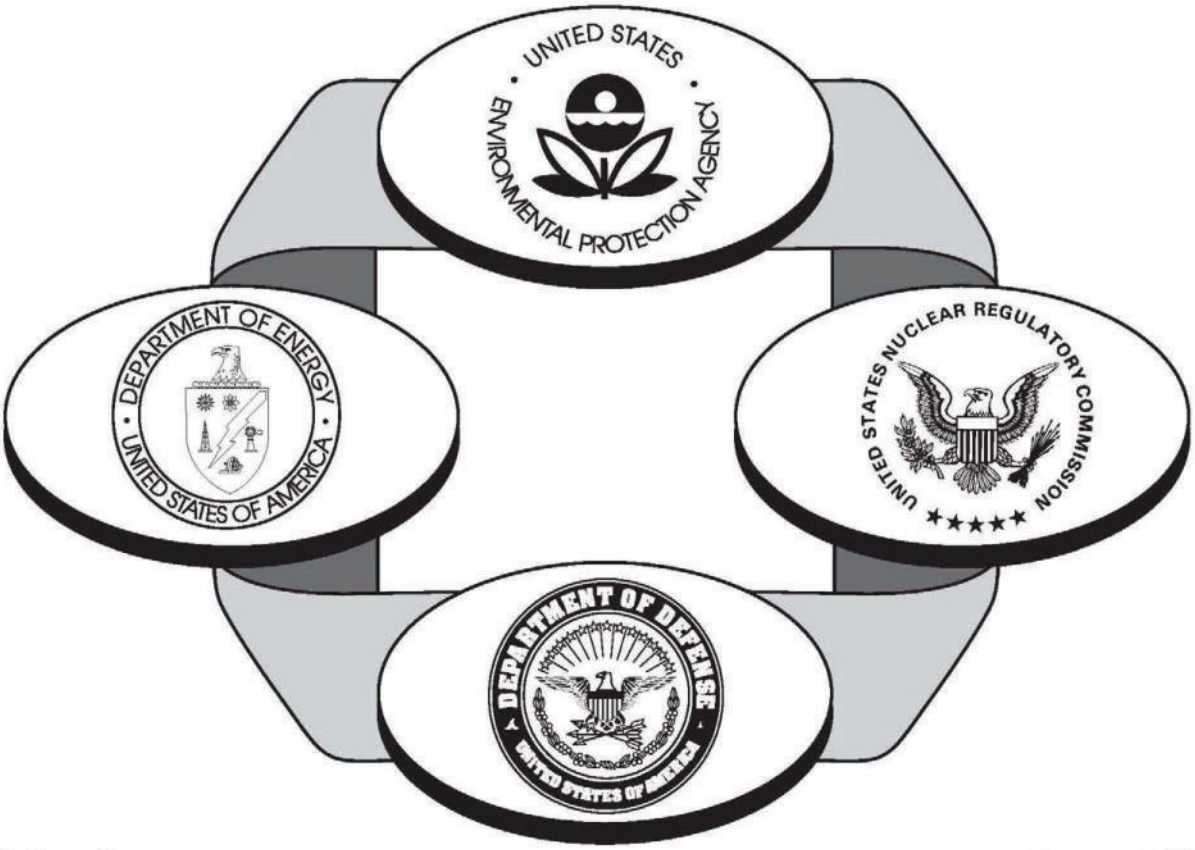
Date: _____ SERAS Task Leader:_____

Instrument	EPA #	Location/Description	Reading	Time

General Comments:

NUREG-1575, Rev. 1
EPA 402-R-97-016, Rev. 1
DOE/EH-0624, Rev. 1

MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION MANUAL (MARSSIM)



Revision 1

August 2000

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Submit written comments arising from the review or use of MARSSIM to EITHER the U.S. Environmental Protection Agency, ATTN: Air and Radiation Docket, Mail Stop 6102, Air Docket No. A-96-44, First Floor Waterside Mall (geographic address at 401 M Street, SW.), mailing address 1200 Pennsylvania Ave., NW., Washington D.C. 20460-2001 or the Chief, Rules and Directives Branch, Division of Administrative Services, U.S. Nuclear Regulatory Commission, Washington DC 20555-0001. As appropriate, revised pages of MARSSIM will be posted on the Internet at: http://www.epa.gov/radiation/marssim.

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NRCM 1102,
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U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER
(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers. if anv.)

NUREG-1575, Rev.1;
EPA-402-R-97-016, Rev. 1;
DOE/EH-0624, Rev. 1

2. TITLE AND SUBTITLE

Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)
Revision 1

3. DATE REPORT PUBLISHED

MONTH	YEAR
August	2000

4. FIN OR GRANT NUMBER

5. AUTHOR(S)

6. TYPE OF REPORT

Technical

7. PERIOD COVERED *(Inclusive Dates)*

8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Department of Defense, Washington, DC 20301-3400
Department of Energy, Washington, DC 20585-0119
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Nuclear Regulatory Commission, Washington, DC 20555-0001

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Department of Defense, Washington, DC 20301-3400
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Environmental Protection Agency, Washington, DC 20460-0001
Nuclear Regulatory Commission, Washington, DC 20555-0001

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

The MARSSIM provides information on planning, conducting, evaluating, and documenting building and surface soil final status radiological surveys for demonstrating compliance with dose or risk-based regulations or standards. The MARSSIM is a multi-agency consensus document that was developed collaboratively by four Federal agencies having authority and control over radioactive materials: Department of Defense (DOD), Department of Energy (DOE), Environmental Protection Agency (EPA), and Nuclear Regulatory Commission (NRC). The MARSSIM's objective is to describe a consistent approach for building and surface soil final status surveys to meet established dose or risk-based release criteria, while at the same time encouraging an effective use of resources.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

Measurement, Planning, Data Quality Objectives, Survey(s), Decommissioning, Clean-up, Statistics, Quality Assurance

13. AVAILABILITY STATEMENT

unlimited

14. SECURITY CLASSIFICATION

(This Page)
unclassified

(This Report)
unclassified

15. NUMBER OF PAGES

16. PRICE

This form was electronically produced by Elite Federal Forms, Inc.

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FIELD SAMPLING PROTOCOLS TO AVOID CROSS-CONTAMINATION AT PERFLUORINATED CHEMICAL (PFC) SITES

The following are procedures/considerations to be made during field activities at potential perfluorinated chemical (PFC) release sites. A summary of the prohibited and acceptable items for PFC sites is included in Table 1. A checklist for field use is provided as Attachment 1.

These procedures apply to all personnel and subcontractors who collect or otherwise handle samples of soil, sediment, surface water, ground water, or drinking water for analysis of PFCs. These procedures should be reviewed by all on-site personnel prior to implementation of field activities. Given the low detection limits associated with PFC analysis and the many potential sources of trace levels of PFCs, field personnel shall act on the side of caution by strictly following these protocols, frequently replacing nitrile gloves, and rinsing field equipment to help mitigate the potential for false detections of PFCs. Specific items related to field sampling are discussed below.

Field Equipment

- **Do not use Teflon®-containing materials** (e.g., Teflon® tubing, bailers, tape, plumbing paste, or other Teflon® materials) since Teflon® contains fluorinated compounds.
- **Do not use low-density polyethylene (LDPE) materials** during sampling. High-density polyethylene (HDPE) and silicon materials are acceptable.
- When using liners to collect soil samples during direct-push technology (DPT) or conventional drilling methodologies, **acetate liners are to be used**.
- To avoid plastic coating or glue materials, **do not use waterproof field books**. Field reports will be documented on loose paper on masonite or aluminum clipboards (i.e. plastic clipboards, binders, or spiral hard cover notebooks are not acceptable) using a pen or pencil. Sharpies®/markers may be used.
- **Post-It Notes are not allowed** on project sites.
- **Do not use markers other than Sharpies®markers.** Pens will be used when documenting field activities in the field log and on field forms as well as labeling sample containers and preparing the Chain of Custody.
- **Do not use chemical (blue) ice packs** during the sampling program. This includes the use of ice packs for the storage of food and/or samples.

Field Clothing and Personal Protective Equipment

- **Do not wear synthetic water resistant, waterproof, or stain-treated clothing** during the field program. Field clothing to be worn on-site should be restricted to natural fibers (preferably cotton) and not synthetic. Field clothing should be laundered avoiding the

use of fabric softener. Preferably, field gear should be cotton construction and well laundered (a minimum of 6 times from time of purchase). New cotton clothing may contain PFC related treatments. **Do not use new clothing** while sampling or sample handling.

- **Do not wear clothing or boots containing Gore-Tex™** during the sampling program as it consists of a PFC membrane.
- All safety footwear will consist of steel-toed boots made with polyurethane and polyvinyl chloride (PVC).
- **Do not wear Tyvek® clothing** on-site since it contains fluorinated compounds.
- Disposable nitrile gloves must be worn at all times. Further, a new pair of nitrile gloves shall be donned prior to the following activities at each sample location:
  - Decontamination of re-usable sampling equipment;
  - Prior to contact with sample bottles or water containers;
  - Handling of any quality assurance/quality control samples including field blanks and equipment blanks; and,
  - After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.

Sample Containers

- Different laboratories may supply sample collection containers of varying sizes dependent on the type of media to be sampled (e.g., soil, groundwater, etc.). However, all samples should be collected in polypropylene or HDPE bottles fitted with an unlined (no Teflon®), polypropylene or HDPE screw cap.
- Container labels will be completed using pen after the caps have been placed back on each bottle.
- Glass containers should also be avoided due to potential loss of analyte through adsorption.

Wet Weather

- Field sampling occurring during wet weather (e.g., rainfall and snowfall) should be conducted while wearing appropriate clothing that will not pose a risk for cross-contamination. Teams will avoid synthetic gear that has been treated with water- repellant finishes containing PFCs. Use rain gear made from polyurethane and wax-coated materials.
- Teams should consider the use of a gazebo tent, which can be erected over the sample location and provide shelter from the rain. It should be noted that the canopy material is likely a treated surface and should be treated as such; therefore, gloves should be worn when moving the tent, changed immediately afterwards and further contact with the tent

should be avoided until all sampling activities have been finished and the team is ready to move on to the next sample location.

Equipment Decontamination

Field sampling equipment, such as trowels and augers, that are utilized at each sample location will require cleaning between uses. Alconox® and Liquinox® soaps are acceptable for use since the Material Safety Data Sheets do not list fluoro-surfactants as an ingredient. However, **Decon 90 will not be used** during decontamination activities. Water used for the final rinse during decontamination of sampling equipment will be laboratory certified PFC-free water.

For larger equipment (e.g., drill rigs), decontamination will be conducted with potable water using a high-pressure washer and then rinsed using potable water. Details regarding the decontamination of drilling equipment and other heavy equipment are presented below under the heading "Decontamination Procedures for Drilling Equipment and Other Heavy Equipment at PFC Sites".

Personnel Hygiene

- Field personnel will not use cosmetics, moisturizers, hand cream, or other related products as part of their personal cleaning/showering routine on the morning of a sampling event, as these products may contain surfactants and represent a potential source of PFCs.
- Many manufactured sunblock and insect repellants contain PFCs and should not be brought or used on-site. Sunblock and insect repellants that are used on-site should consist of 100% natural ingredients. A list of acceptable sunscreens and insect repellents are listed in Table 1.
- For washroom breaks, field personnel will leave the exclusion zone and then remove gloves and overalls. Field personnel should wash as normal with extra time for rinsing with water after soap use. When finished washing, the use of a mechanical dryer is preferred and the use of paper towel for drying is to be avoided (if possible).

Food Considerations

- No food or drink shall be brought on-site, with the exception of bottled water and hydration drinks (i.e., Gatorade® and Powerade®), which will only be allowed to be brought and consumed within the staging area.

Visitors

- Visitors to the site are asked to remain outside of the exclusion zone during sampling activities.

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

Prohibited	Acceptable
Field	
Teflon® containing materials	High-density polyethylene (HDPE) materials
Low density polyethylene (LDPE) materials	Acetate liners
	Silicon tubing
Waterproof field books	Loose paper (non-waterproof)
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
	Sharpies®, pens
Post-It Notes	
Chemical (blue) ice packs	Regular ice
Field Clothing and	
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing made of natural fibers (preferable cotton)
Clothing laundered using fabric softener	No fabric
Boots containing Gore-Tex™	Boots made with polyurethane and PVC
Tyvek®	Cotton Clothing
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	**Sunscreens** - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are "free" or "natural" **Insect Repellents** - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics **Sunscreen and insect repellant -** Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion
Sample	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Unlined polypropylene caps
Rain	
Waterproof or resistant rain gear	Gazebo tent that is only touched or moved prior to and following sampling activities
Equipment	
Decon 90	Alconox® and/or Liquinox®
Water from an on-site well	Potable water from remote drinking water supply
Food	
All food and drink, with exceptions noted on the right	Bottled water and hydration drinks (i.e. Gatorade® and Powerade®) to be brought and consumed only in the staging area

Attachment 1
Daily PFC Protocol Checklist

Date: _____ Installation Name: _____

Weather (*temp./precipitation*): _____ Site Name: _____

Field Clothing and PPE:

- ☐ No clothing or boots containing Gore-Tex™
- ☐ All safety boots made from polyurethane and PVC
- ☐ No materials containing Tyvek®
- ☐ Field crew has not used fabric softener on clothing
- ☐ Field crew has not used cosmetics, moisturizers, hand cream, or other related products this morning
- ☐ Field crew has not applied unauthorized sunscreen or insect repellant

Field Equipment:

- ☐ No Teflon® or LDPE containing materials on-site
- ☐ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☐ No waterproof field books on-site
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☐ No adhesives (Post-It Notes) on-site
- ☐ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

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.
- ☐ Alconox and Liquinox to 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

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the site or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the site.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

_____

_____

_____

Field Manager Name: _____

Field Manager Signature: _____ Time: _____

DECONTAMINATION PROCEDURES FOR DRILLING EQUIPMENT AND OTHER HEAVY EQUIPMENT AT PFC SITES

These procedures establish guidelines for use by field personnel in the decontamination of drilling equipment and other heavy equipment when conducting PFC environmental assessments. The details are applicable as general requirements for drilling and heavy equipment decontamination, and should also be used in conjunction with the project QAPP.

Compliance with this procedure is the responsibility of project management and field personnel. These procedures and the project QAPP should be reviewed before implementing drilling, development, and heavy equipment decontamination at the project site.

This section provides requirements for the construction of a temporary decontamination facility for drilling, development, and heavy equipment and the decontamination procedures to be followed. The project QAPP provides specific information regarding:

- Types of equipment requiring decontamination under these procedures;
- Location of the decontamination station;
- Types and/or specifications on materials to be used in the fabrication of the decontamination station; and,
- Types of materials and additional details on the procedures to be used in the decontamination process.

Field personnel associated with construction of the decontamination station or decontamination of drilling or heavy equipment must read these procedures and the project QAPP prior to implementation of related decontamination activities.

Decontamination Facility

A decontamination facility will be set up in an area exclusively for decontamination of drilling equipment and other heavy equipment. Decontamination of drilling equipment and other heavy equipment will be conducted within the station.

At a minimum, the station will be constructed such that all rinsates, liquid spray, soil, debris, and other decontamination wastes are fully contained and may be collected for appropriate waste management and disposal. The facility may be as simple as a bermed pad lined with approved PFC-free, high density polyethylene (HDPE) sheeting with an impermeable sump for collecting rinse water. More sophisticated designs involving self-contained metal decontamination pads in combination with bermed HDPE sheeting may also be used, depending on project-specific requirements. These requirements along with specific equipment and construction specifications for the decontamination facility will be provided in the project QAPP.

Decontamination of Downhole Equipment

Downhole drilling and development equipment (including but not limited to drill pipe, drive casing, drill rods, bits, tools, nondisposable bailers, etc.) will be thoroughly decontaminated before mobilization to each site and between borings or wells at each site or as required in the project QAPP. The standard procedure will be performed as described below. Decontamination will be performed in accordance with these procedures and the project QAPP.

- Appropriate personal protective equipment (as specified in the project QAPP) must be worn by all personnel involved with the task to limit personal exposure.
- Equipment caked with drill cuttings, soil, or other material will initially be scraped or brushed. The scrapings will be staged and appropriately handled.
- Equipment will then be sprayed with potable water using a high-pressure washer.
- Washed equipment that will be used to collect the samples or will come into contact with the sampled media (such as the direct-push cutting shoe) will then be final rinsed with certified PFC-free water.
- Decontaminated downhole equipment (such as drill pipe, drive casing, bits, tools, bailers, etc.) will be placed on clean PFC-free, HDPE plastic sheeting to prevent contact with contaminated soil and allowed to air dry. If equipment is not used immediately, it will be covered or wrapped in PFC-free plastic sheeting to minimize airborne contamination.
- Decontamination activities will be documented by field personnel in the field log and/or appropriate form(s), as specified in the project QAPP.

Decontamination of Heavy Equipment

Heavy equipment (e.g., drill rigs, development rigs, backhoes, trucks, and other earthmoving equipment) will be decontaminated between drilling sites or inside the contaminant reduction area prior to entering and leaving an exclusion zone. Decontamination will be performed in accordance with the project work plans. The standard procedure will be performed as described below.

- Appropriate personal protective equipment will be worn by all personnel involved in the task, in order to limit personal exposure.
- Heavy equipment caked with drill cuttings, soil, or other material will be initially scraped or brushed to remove bulk soil.
- Heavy equipment will then be moved to the decontamination pad and sprayed with potable water using a high pressure washer.
- Those portions of the heavy equipment that will potentially contact the sample will be rinsed in a final rinse with lab provided “PFC-free” water.
- During the decontamination effort, fluid systems should be inspected for any leaks or problems, which might potentially result in an inadvertent release at the site, thereby

contributing to the volume of waste or contamination. Decontamination of heavy equipment should be performed before moving equipment between sites or before leaving the site.

- Decontamination activities will be documented in the field log and appropriate form(s), as specified in the project QAPP.

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SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Under NYSDEC's Part 375 Remedial Programs

October 2020

www.dec.ny.gov

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ERRATA SHEET for

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) Under NYSDEC's Part 375 Remedial Programs Issued January 17, 2020

Citation and Page Number	Current Text	Corrected Text	Date
Title of Appendix I, page 32	Appendix H	Appendix I	2/25/2020
Document Cover, page 1	Guidelines for Sampling and Analysis of PFAS	Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs	9/15/2020
Routine Analysis, page 9	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1 or ISO 25101."	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533."	9/15/2020
Additional Analysis, page 9, new paragraph regarding soil parameters	None	"In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils."	9/15/2020
Data Assessment and Application to Site Cleanup Page 10	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Target levels for cleanup of PFAS in other media, including biota and sediment, have not yet been established by the DEC.	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.	9/15/2020
Water Sample Results Page 10	PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water (…) If PFAS are identified as a contaminant of concern for a site, they should be assessed as	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water (…) If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
	part of the remedy selection process in accordance with Part 375 and DER-10.		
Soil Sample Results, page 10	"The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase."	"Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values. " [Guidance Value Table] "PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP. As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf. "	9/15/2020
Testing for Imported Soil Page 11	Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the PFAS Analyte List (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs.	Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
	If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	
Footnotes	None	[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. [2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the soil cleanup objective for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	9/15/2020

Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, DER has developed this document which summarizes currently accepted procedures and updates previous DER technical guidance pertaining to PFAS.

Applicability

All work plans submitted to DEC pursuant to one of the remedial programs under Part 375 shall include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected.

Equipment blanks should be collected at a minimum frequency of one per day per site or one per twenty samples, whichever is more frequent.

Analysis and Reporting

As of October 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a *PFAS Analyte List* (Appendix F) for remedial programs to understand the nature of contamination at sites. 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 analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP) does not offer certification for PFAS in matrices other than finished drinking water. However, laboratories analyzing environmental samples for PFAS (e.g., soil, sediments, and groundwater) under DER's Part 375 remedial programs need to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533. Laboratories should adhere to the guidelines and criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids). Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist.

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay).

In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.[1]

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Data Assessment and Application to Site Cleanup

Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.

Water Sample Results

PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt) and is determined to be attributable to the site, either by a comparison of upgradient and downgradient levels, or the presence of soil source areas, as defined below. In addition, further assessment of water may be warranted if either of the following screening levels are met:

a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or
b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L

If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values.

[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Guidance Values for Anticipated Site Use	PFOA (ppb)	PFOS (ppb)
Unrestricted	0.66	0.88
Residential	6.6	8.8
Restricted Residential	33	44
Commercial	500	440
Industrial	600	440
Protection of Groundwater[2]	1.1	3.7

PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf.

Testing for Imported Soil

Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.

PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

[2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
    - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP-approved lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an "Analytical Methods/Quality Assurance Summary Table" specifying:
    - Matrix type
    - Number or frequency of samples to be collected per matrix
    - Number of field and trip blanks per matrix
    - Analytical parameters to be measured per matrix
    - Analytical methods to be used per matrix with minimum reporting limits
    - Number and type of matrix spike and matrix spike duplicate samples to be collected
    - Number and type of duplicate samples to be collected
    - Sample preservation to be used per analytical method and sample matrix
    - Sample container volume and type to be used per analytical method and sample matrix
    - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by LC-MS/MS for PFAS using methodologies based on EPA Method 537.1
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
    - Reporting Limits should be less than or equal to:
        - Aqueous – 2 ng/L (ppt)
        - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
- Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, EPA Method 533, or ISO 25101
- Include detailed sampling procedures
    - Precautions to be taken
    - Pump and equipment types
    - Decontamination procedures
    - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment

- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per site for each matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the

middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., washroom sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank per day per site and a minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers.
- A field reagent blank (FRB) should be collected at a rate of one per 20 samples. The lab will provide a FRB bottle containing PFAS free water and one empty FRB bottle. In the field, pour the water from the one bottle into the empty FRB bottle and label appropriately.
- Request appropriate data deliverable (Category B) and an electronic data deliverable
- For sampling events where multiple private wells (homes or sites) are to be sampled per day, it is acceptable to collect QC samples at a rate of one per 20 across multiple sites or days.

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the latest guidelines developed by the Division of Fish and Wildlife (DFW) entitled "General Fish Handling Procedures for Contaminant Analysis" (Ver. 8).

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

   1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

   2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.

   3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.

B. The following data are required on each **Fish Collection Record** form:

   1. Project and Site Name.

   2. DEC Region.

   3. All personnel (and affiliation) involved in the collection.

   4. Method of collection (gill net, hook and line, etc.)

   5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:

   1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

   2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

   3. Date collected.

   4. Sample location (waterway and nearest prominent identifiable landmark).

   5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate "Age" column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish's tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **The Bureau of Ecosystem Health will supply the bags.** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with

the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:

No materials containing Teflon.
No Post-it notes.
No ice packs; only water ice or dry ice.
Any gloves worn must be powder free nitrile.
No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
Wash hands after handling any food containers or packages as these may contain PFCs.
Keep pre-wrapped food containers and wrappers isolated from fish handling.
Wear clothing washed at least six times since purchase.
Wear clothing washed without fabric softener.
Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with "fluor" in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

Project and Site Name _____ DEC Region _____

Collections made by (include all crew) _____

Sampling Method: ☐Electrofishing ☐Gill netting ☐Trap netting ☐Trawling ☐Seining ☐Angling ☐Other _____

Preservation Method: ☐Freezing ☐Other _____ Notes (SWFDB survey number): _____

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ( )	WEIGHT ( )	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CHAIN OF CUSTODY

I, _____, of _____ collected the
(Print Name) (Print Business Address)

following on _____, 20____ from _____
(Date) (Water Body)

in the vicinity of _____
(Landmark, Village, Road, etc.)

Town of _____, in _____ County.

Item(s) _____

_____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on _____, 20_____.

_____ _____
Signature Date

I, _____, received the above mentioned sample(s) on the date specified and assigned identification number(s) _____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

_____ _____
Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelops, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – 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

Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) developed the following guidelines for laboratories analyzing environmental samples for PFAS under DER programs. If laboratories cannot adhere to the following guidelines, they should contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov prior to analysis of samples.

Isotope Dilution

Isotope dilution techniques should be utilized for the analysis of PFAS in all media.

Extraction

For water samples, the entire sample bottle should be extracted, and the sample bottle rinsed with appropriate solvent to remove any residual PFAS.

For samples with high particulates, the samples should be handled in one of the following ways:

1. Spike the entire sample bottle with isotope dilution analytes (IDAs) prior to any sample manipulation. The sample can be passed through the SPE and if it clogs, record the volume that passed through.
2. If the sample contains too much sediment to attempt passing it through the SPE cartridge, the sample should be spiked with isotope dilution analytes, centrifuged and decanted.
3. If higher reporting limits are acceptable for the project, the sample can be diluted by taking a representative aliquot of the sample. If isotope dilution analytes will be diluted out of the sample, they can be added after the dilution. The sample should be homogenized prior to taking an aliquot.

If alternate sample extraction procedures are used, please contact the DER remedial program chemist prior to employing. Any deviations in sample preparation procedures should be clearly noted in the case narrative.

Signal to Noise Ratio

For all target analyte ions used for quantification, signal to noise ratio should be 3:1 or greater.

Blanks

There should be no detections in the method blanks above the reporting limits.

Ion Transitions

The ion transitions listed below should be used for the following PFAS:

PFOA	413 > 369
PFOS	499 > 80
PFHxS	399 > 80
PFBS	299 > 80
6:2 FTS	427 > 407
8:2 FTS	527 > 507
N-EtFOSAA	584 > 419
N-MeFOSAA	570 > 419

Branched and Linear Isomers

Standards containing both branched and linear isomers should be used when standards are commercially available. Currently, quantitative standards are available for PFHxS, PFOS, NMeFOSAA, and NEtFOSAA. As more standards become available, they should be incorporated in to the method. All isomer peaks present in the standard should be integrated and the areas summed. Samples should be integrated in the same manner as the standards.

Since a quantitative standard does not exist for branched isomers of PFOA, the instrument should be calibrated using just the linear isomer and a technical (qualitative) PFOA standard should be used to identify the retention time of the branched PFOA isomers in the sample. The total response of PFOA branched and linear isomers should be integrated in the samples and quantitated using the calibration curve of the linear standard.

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated for each target analyte and the ratio compared to standards. Lab derived criteria should be used to determine if the ratios are acceptable.

Reporting

Detections below the reporting limit should be reported and qualified with a J qualifier.

The acid form of PFAS analytes should be reported. If the salt form of the PFAS was used as a stock standard, the measured mass should be corrected to report the acid form of the analyte.

Appendix I - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report. Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 14 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6ºC upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of five standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%. Linear fit calibration curves should have an R^2 value greater than 0.990.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects
R^2 >0.990	J flag detects and UJ non detects
Low-level calibration check <50% or >150%	J flag detects and UJ non detects
Mid-level calibration check <70% or >130%	J flag detects and UJ non detects

Initial Calibration Verification

An initial calibration verification (ICV) standard should be from a second source (if available). The ICV should be at the same concentration as the mid-level standard of the calibration curve.

ICV recovery <70% or >130%	J flag detects and non-detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated from the standards for each target analyte. Lab derived criteria should be used to determine if the ratios are acceptable. If the ratios fall outside of the laboratory criteria, qualify results as an estimated maximum concentration.

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Branched and Linear Isomers

Observed branched isomers in the sample that do not have a qualitative or quantitative standard should be noted and the analyte should be qualified as biased low in the final data review summary report. Note: The branched isomer peak should also be present in the secondary ion transition.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.

ATTACHMENT C

Action Levels

Appendix 5
Allowable Constituent Levels for Imported Fill or Soil
Subdivision 5.4(e)

Source: This table is derived from soil cleanup objective (SCO) tables in 6 NYCRR 375. Table 375-6.8(a) is the source for unrestricted use and Table 375-6.8(b) is the source for restricted use.

Note: For constituents not included in this table, refer to the contaminant for supplemental soil cleanup objectives (SSCOs) in the Commissioner Policy on *Soil Cleanup Guidance*. If an SSCO is not provided for a constituent, contact the DER PM to determine a site-specific level.

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Metals					
Arsenic	13	16	16	16	13
Barium	350	350	400	400	433
Beryllium	7.2	14	47	47	10
Cadmium	2.5	2.5	4.3	7.5	4
Chromium, Hexavalent[1]	1 [3]	19	19	19	1 [3]
Chromium, Trivalent[1]	30	36	180	1500	41
Copper	50	270	270	270	50
Cyanide	27	27	27	27	NS
Lead	63	400	400	450	63
Manganese	1600	2000	2000	2000	1600
Mercury (total)	0.18	0.73	0.73	0.73	0.18
Nickel	30	130	130	130	30
Selenium	3.9	4	4	4	3.9
Silver	2	8.3	8.3	8.3	2
Zinc	109	2200	2480	2480	109
PCBs/Pesticides					
2,4,5-TP Acid (Silvex)	3.8	3.8	3.8	3.8	NS
4,4'-DDE	0.0033 [3]	1.8	8.9	17	0.0033 [3]
4,4'-DDT	0.0033 [3]	1.7	7.9	47	0.0033 [3]
4,4'-DDD	0.0033 [3]	2.6	13	14	0.0033 [3]
Aldrin	0.005	0.019	0.097	0.19	0.14
Alpha-BHC	0.02	0.02	0.02	0.02	0.04 [4]
Beta-BHC	0.036	0.072	0.09	0.09	0.6
Chlordane (alpha)	0.094	0.91	2.9	2.9	1.3
Delta-BHC	0.04	0.25	0.25	0.25	0.04 [4]
Dibenzofuran	7	14	59	210	NS
Dieldrin	0.005	0.039	0.1	0.1	0.006
Endosulfan I	2.4[2]	4.8	24	102	NS
Endosulfan II	2.4[2]	4.8	24	102	NS
Endosulfan sulfate	2.4[2]	4.8	24	200	NS
Endrin	0.014	0.06	0.06	0.06	0.014
Heptachlor	0.042	0.38	0.38	0.38	0.14
Lindane	0.1	0.1	0.1	0.1	6
Polychlorinated biphenyls	0.1	1	1	1	1

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Semi-volatile Organic Compounds					
Acenaphthene	20	98	98	98	20
Acenaphthylene	100	100	100	107	NS
Anthracene	100	100	100	500	NS
Benzo(a)anthracene	1	1	1	1	NS
Benzo(a)pyrene	1	1	1	1	2.6
Benzo(b)fluoranthene	1	1	1	1.7	NS
Benzo(g,h,i)perylene	100	100	100	500	NS
Benzo(k)fluoranthene	0.8	1	1.7	1.7	NS
Chrysene	1	1	1	1	NS
Dibenz(a,h)anthracene	0.33 [3]	0.33 [3]	0.33 [3]	0.56	NS
Fluoranthene	100	100	100	500	NS
Fluorene	30	100	100	386	30
Indeno(1,2,3-cd)pyrene	0.5	0.5	0.5	5.6	NS
m-Cresol(s)	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	NS
Naphthalene	12	12	12	12	NS
o-Cresol(s)	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	NS
p-Cresol(s)	0.33	0.33	0.33	0.33	NS
Pentachlorophenol	0.8 [3]	0.8 [3]	0.8 [3]	0.8 [3]	0.8 [3]
Phenanthrene	100	100	100	500	NS
Phenol	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	30
Pyrene	100	100	100	500	NS
Volatile Organic Compounds					
1,1,1-Trichloroethane	0.68	0.68	0.68	0.68	NS
1,1-Dichloroethane	0.27	0.27	0.27	0.27	NS
1,1-Dichloroethene	0.33	0.33	0.33	0.33	NS
1,2-Dichlorobenzene	1.1	1.1	1.1	1.1	NS
1,2-Dichloroethane	0.02	0.02	0.02	0.02	10
1,2-Dichloroethene(cis)	0.25	0.25	0.25	0.25	NS
1,2-Dichloroethene(trans)	0.19	0.19	0.19	0.19	NS
1,3-Dichlorobenzene	2.4	2.4	2.4	2.4	NS
1,4-Dichlorobenzene	1.8	1.8	1.8	1.8	20
1,4-Dioxane	0.1 [3]	0.1 [3]	0.1 [3]	0.1 [3]	0.1
Acetone	0.05	0.05	0.05	0.05	2.2
Benzene	0.06	0.06	0.06	0.06	70
Butylbenzene	12	12	12	12	NS
Carbon tetrachloride	0.76	0.76	0.76	0.76	NS
Chlorobenzene	1.1	1.1	1.1	1.1	40
Chloroform	0.37	0.37	0.37	0.37	12
Ethylbenzene	1	1	1	1	NS
Hexachlorobenzene	0.33 [3]	0.33 [3]	1.2	3.2	NS
Methyl ethyl ketone	0.12	0.12	0.12	0.12	100
Methyl tert-butyl ether	0.93	0.93	0.93	0.93	NS
Methylene chloride	0.05	0.05	0.05	0.05	12

Volatile Organic Compounds (continued)					
Propylbenzene-n	3.9	3.9	3.9	3.9	NS
Sec-Butylbenzene	11	11	11	11	NS
Tert-Butylbenzene	5.9	5.9	5.9	5.9	NS
Tetrachloroethene	1.3	1.3	1.3	1.3	2
Toluene	0.7	0.7	0.7	0.7	36
Trichloroethene	0.47	0.47	0.47	0.47	2
Trimethylbenzene-1,2,4	3.6	3.6	3.6	3.6	NS
Trimethylbenzene-1,3,5	8.4	8.4	8.4	8.4	NS
Vinyl chloride	0.02	0.02	0.02	0.02	NS
Xylene (mixed)	0.26	1.6	1.6	1.6	0.26

All concentrations are in parts per million (ppm)
NS = Not Specified

Footnotes:
[1] The SCO for Hexavalent or Trivalent Chromium is considered to be met if the analysis for the total species of this contaminant is below the specific SCO for Hexavalent Chromium.
[2] The SCO is the sum of endosulfan I, endosulfan II and endosulfan sulfate.
[3] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the Track 1 SCO value.
[4] This SCO is derived from data on mixed isomers of BHC.

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)
				1.2E-03	O						1.36E+09		1	0.1	Acephate	30560-19-1					9.4E+01	4.0E+02		7.6E+01
		2.2E-06	I			9.0E-03	I	V		1.07E+05	1.36E+09	8.72E+03	1		Acetaldehyde	75-07-0			1.1E+03	1.1E+03			8.2E+01	8.2E+01
				2.0E-02	I						1.36E+09		1	0.1	Acetochlor	34256-82-1					1.6E+03	6.6E+03		1.3E+03
				9.0E-01	I	3.1E+01	A	V		1.14E+05	1.36E+09	1.37E+04	1		Acetone	67-64-1					7.0E+04		4.4E+05	6.1E+04
						2.0E-03	X				1.36E+09		1	0.1	Acetone Cyanohydrin	75-86-5							2.8E+06	2.8E+06
						6.0E-02	I	V		1.28E+05	1.36E+09	1.30E+04	1		Acetonitrile	75-05-8							8.1E+02	8.1E+02
				1.0E-01	I			V		2.52E+03	1.36E+09	5.97E+04	1		Acetophenone	98-86-2					7.8E+03			7.8E+03
3.8E+00	C	1.3E-03	C								1.36E+09		1	0.1	Acetylaminofluorene, 2-	53-96-3	1.8E+01	6.5E+01	2.9E+05	1.4E+01				
				5.0E-04	I	2.0E-05	I	V		2.27E+04	1.36E+09	6.91E+03	1		Acrolein	107-02-8					3.9E+01		1.4E-01	1.4E-01
5.0E-01	I	1.0E-04	I	2.0E-03	I	6.0E-03	I		M		1.36E+09		1	0.1	Acrylamide	79-06-1	3.1E+01	1.2E+02	1.4E+06	2.4E+01	1.6E+02	6.6E+02	8.5E+06	1.3E+02
				5.0E-01	I	1.0E-03	I	V		1.09E+05	1.36E+09	9.53E+04	1		Acrylic Acid	79-10-7					3.9E+04		9.9E+01	9.9E+01
5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V		1.13E+04	1.36E+09	7.69E+03	1		Acrylonitrile	107-13-1	1.3E+02		3.2E+01	2.5E+01	3.1E+03		1.6E+01	1.6E+01
						6.0E-03	P				1.36E+09		1	0.1	Adiponitrile	111-69-3							8.5E+06	8.5E+06
5.6E-02	C			1.0E-02	I						1.36E+09		1	0.1	Alachlor	15972-60-8	1.2E+03	4.4E+03		9.7E+02	7.8E+02	3.3E+03		6.3E+02
				1.0E-03	I						1.36E+09		1	0.1	Aldicarb	116-06-3					7.8E+01	3.3E+02		6.3E+01
				1.0E-03	I						1.36E+09		1	0.1	Aldicarb Sulfone	1646-88-4					7.8E+01	3.3E+02		6.3E+01
											1.36E+09		1	0.1	Aldicarb sulfoxide	1646-87-3								
1.7E+01	I	4.9E-03	I	3.0E-05	I			V			1.36E+09	1.72E+06	1		Aldrin	309-00-2	4.1E+00		9.8E+01	3.9E+00	2.3E+00			2.3E+00
				5.0E-03	I	1.0E-04	X	V		1.11E+05	1.36E+09	3.42E+04	1		Allyl Alcohol	107-18-6					3.9E+02		3.6E+00	3.5E+00
2.1E-02	C	6.0E-06	C			1.0E-03	I	V		1.42E+03	1.36E+09	1.58E+03	1		Allyl Chloride	107-05-1	3.3E+03		7.4E+01	7.2E+01			1.7E+00	1.7E+00
				1.0E+00	P	5.0E-03	P				1.36E+09		1		Aluminum	7429-90-5					7.8E+04		7.1E+06	7.7E+04
				4.0E-04	I						1.36E+09		1		Aluminum Phosphide	20859-73-8					3.1E+01			3.1E+01
				9.0E-03	I						1.36E+09		1	0.1	Ametryn	834-12-8					7.0E+02	3.0E+03		5.7E+02
2.1E+01	C	6.0E-03	C								1.36E+09		1	0.1	Aminobiphenyl, 4-	92-67-1	3.3E+00	1.2E+01	6.4E+04	2.6E+00				
				8.0E-02	P						1.36E+09		1	0.1	Aminophenol, m-	591-27-5					6.3E+03	2.6E+04		5.1E+03
				4.0E-03	X						1.36E+09		1	0.1	Aminophenol, o-	95-55-6					3.1E+02	1.3E+03		2.5E+02
				2.0E-02	P						1.36E+09		1	0.1	Aminophenol, p-	123-30-8					1.6E+03	6.6E+03		1.3E+03
				2.5E-03	I						1.36E+09		1	0.1	Amitraz	33089-61-1					2.0E+02	8.2E+02		1.6E+02
						5.0E-01	I	V					1		Ammonia	7664-41-7								
				2.0E-03	X						1.36E+09		1	0.1	Ammonium Picrate	131-74-8					1.6E+02	6.6E+02		1.3E+02
				2.0E-01	I						1.36E+09		1		Ammonium Sulfamate	7773-06-0					1.6E+04			1.6E+04
						3.0E-03	X	V		1.37E+04	1.36E+09	2.62E+04	1		Amyl Alcohol, tert-	75-85-4							8.2E+01	8.2E+01
5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I				1.36E+09		1	0.1	Aniline	62-53-3	1.2E+04	4.3E+04	2.4E+08	9.5E+03	5.5E+02	2.3E+03	1.4E+06	4.4E+02
4.0E-02	P			2.0E-03	X						1.36E+09		1	0.1	Anthraquinone, 9,10-	84-65-1	1.7E+03	6.2E+03		1.4E+03	1.6E+02	6.6E+02		1.3E+02
				4.0E-04	I	3.0E-04	A				1.36E+09		0.15		Antimony (metallic)	7440-36-0					3.1E+01		4.3E+05	3.1E+01
				5.0E-04	H						1.36E+09		0.15		Antimony Pentoxide	1314-60-9					3.9E+01			3.9E+01
				4.0E-04	H						1.36E+09		0.15		Antimony Tetroxide	1332-81-6					3.1E+01			3.1E+01
						2.0E-04	I				1.36E+09		0.15		Antimony Trioxide	1309-64-4							2.8E+05	2.8E+05
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C				1.36E+09		1	0.03	Arsenic, Inorganic	7440-38-2	7.7E+01	5.5E+02	8.9E+04	6.8E+01	3.9E+01	3.3E+02	2.1E+04	3.5E+01
				3.5E-06	C	5.0E-05	I				1.36E+09		1		Arsine	7784-42-1					2.7E-01		7.1E+04	2.7E-01
													1		Asbestos (units in fibers)	1332-21-4								
				3.6E-02	O						1.36E+09		1	0.1	Asulam	3337-71-1					2.8E+03	1.2E+04		2.3E+03
2.3E-01	C			3.5E-02	I						1.36E+09		1	0.1	Atrazine	1912-24-9	3.0E+02	1.1E+03		2.4E+02	2.7E+03	1.2E+04		2.2E+03
8.8E-01	C	2.5E-04	C								1.36E+09		1	0.1	Auramine	492-80-8	7.9E+01	2.8E+02	1.5E+06	6.2E+01				
				4.0E-04	I						1.36E+09		1	0.1	Avermectin B1	65195-55-3					3.1E+01	1.3E+02		2.5E+01
				3.0E-03	A	1.0E-02	A				1.36E+09		1	0.1	Azinphos-methyl	86-50-0					2.3E+02	9.9E+02	1.4E+07	1.9E+02
1.1E-01	I	3.1E-05	I					V			1.36E+09	5.23E+05	1		Azobenzene	103-33-3	6.3E+02		4.7E+03	5.6E+02				
				1.0E+00	P	7.0E-06	P				1.36E+09		1	0.1	Azodicarbonamide	123-77-3					7.8E+04	3.3E+05	9.9E+03	8.6E+03
				2.0E-01	I	5.0E-04	H				1.36E+09		0.07		Barium	7440-39-3					1.6E+04		7.1E+05	1.5E+04
				5.0E-03	O			V			1.36E+09	3.07E+05	1		Benfluralin	1861-40-1					3.9E+02			3.9E+02
				5.0E-02	I						1.36E+09		1	0.1	Benomyl	17804-35-2					3.9E+03	1.6E+04		3.2E+03
				2.0E-01	I						1.36E+09		1	0.1	Bensulfuron-methyl	83055-99-6					1.6E+04	6.6E+04		1.3E+04
				3.0E-02	I						1.36E+09		1	0.1	Bentazon	25057-89-0					2.3E+03	9.9E+03		1.9E+03
4.0E-03	P			1.0E-01	I			V		1.16E+03	1.36E+09	2.25E+04	1		Benzaldehyde	100-52-7	1.7E+04			1.7E+04	7.8E+03			7.8E+03
5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	V		1.82E+03	1.36E+09	3.54E+03	1		Benzene	71-43-2	1.3E+03		1.3E+02	1.2E+02	3.1E+02		1.1E+02	8.2E+01
1.0E-01	X			3.0E-04	X						1.36E+09		1	0.1	Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1	7.0E+02	2.5E+03		5.4E+02	2.3E+01	9.9E+01		1.9E+01
				1.0E-03	P			V		1.26E+03	1.36E+09	1.94E+04	1		Benzenethiol	108-98-5					7.8E+01			7.8E+01
2.3E+02	I	6.7E-02	I	3.0E-03	I				M		1.36E+09		1	0.1	Benzidine	92-87-5	6.7E-02	2.6E-01	2.1E+03	5.3E-02	2.3E+02	9.9E+02		1.9E+02
				4.0E+00	I						1.36E+09		1	0.1	Benzoic Acid	65-85-0					3.1E+05	1.3E+06		2.5E+05
1.3E+01	I							V		3.24E+02	1.36E+09	6.76E+04	1		Benzotrichloride	98-07-7	5.3E+00			5.3E+00				
				1.0E-01	P						1.36E+09		1	0.1	Benzyl Alcohol	100-51-6					7.8E+03	3.3E+04		6.3E+03
1.7E-01	I	4.9E-05	C	2.0E-03	P	1.0E-03	P	V		1.46E+03	1.36E+09	2.55E+04	1		Benzyl Chloride	100-44-7	4.1E+02		1.5E+02	1.1E+02	1.6E+02		2.7E+01	2.3E+01
		2.4E-03	I	2.0E-03	I	2.0E-05	I				1.36E+09		0.007		Beryllium and compounds	7440-41-7			1.6E+05	1.6E+05	1.6E+02		2.8E+04	1.6E+02
				9.0E-03	P						1.36E+09		1	0.1	Bifenox	42576-02-3					7.0E+02	3.0E+03		5.7E+02
				1.5E-02	I						1.36E+09		1	0.1	Biphenthrin	82657-04-3					1.2E+03	4.9E+03		9.5E+02
8.0E-03	I			5.0E-01	I	4.0E-04	X	V			1.36E+09	1.14E+05	1		Biphenyl, 1,1'-	92-52-4	8.7E+03			8.7E+03	3.9E+04		4.8E+01	4.7E+01
				4.0E-02	I			V		1.02E+03	1.36E+09	3.50E+04	1		Bis(2-chloro-1-methylethyl) ether	108-60-1					3.1E+03			3.1E+03
				3.0E-03	P						1.36E+09		1	0.1	Bis(2-chloroethoxy)methane	111-91-1					2.3E+02	9.9E+02		1.9E+02
1.1E+00	I	3.3E-04	I					V		5.05E+03	1.36E+09	4.25E+04	1		Bis(2-chloroethyl)ether	111-44-4	6.3E+01		3.6E+01	2.3E+01				
2.2E+02	I	6.2E-02	I					V		4.22E+03	1.36E+09	1.88E+03	1		Bis(chloromethyl)ether	542-88-1	3.2E-01		8.5E-03	8.3E-03				
				5.0E-02	I						1.36E+09		1	0.1	Bisphenol A	80-05-7					3.9E+03	1.6E+04		3.2E+03
				2.0E-01	I	2.0E-02	H				1.36E+09		1		Boron And Borates Only	7440-42-8					1.6E+04		2.8E+07	1.6E+04
				2.0E+00	P	2.0E-02	P	V			1.36E+09		1		Boron Trichloride	10294-34-5					1.6E+05		2.8E+07	1.6E+05
				4.0E-02	C	1.3E-02	C	V			1.36E+09		1		Boron Trifluoride	7637-07-2					3.1E+03		1.8E+07	3.1E+03
7.0E-01	I			4.0E-03	I						1.36E+09		1		Bromate	15541-45-4	9.9E+01			9.9E+01	3.1E+02			3.1E+02
2.0E+00	X	6.0E-04	X					V		2.38E+03	1.36E+09	5.92E+03	1		Bromo-2-chloroethane, 1-	107-04-0	3.5E+01		2.8E+00	2.6E+00				
				3.0E-04	X			V		8.96E+02	1.36E+09	1.12E+04	1		Bromo-3-fluorobenzene, 1-	1073-06-9					2.3E+01			2.3E+01
				3.0E-04	X			V		3.23E+02	1.36E+09	1.14E+04	1		Bromo-4-fluorobenzene, 1-	460-00-4					2.3E+01			2.3E+01

RMLs
TR=1E-04
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)
											1.36E+09		1	0.1	Bromoacetic acid	79-08-3								
				8.0E-03	I	6.0E-02	I	V		6.79E+02	1.36E+09	8.37E+03	1		Bromobenzene	108-86-1					6.3E+02		5.2E+02	2.9E+02
						4.0E-02	X	V		4.04E+03	1.36E+09	3.58E+03	1		Bromochloromethane	74-97-5							1.5E+02	1.5E+02
6.2E-02	I	3.7E-05	C	2.0E-02	I			V		9.32E+02	1.36E+09	3.97E+03	1		Bromodichloromethane	75-27-4	1.1E+03		3.0E+01	2.9E+01	1.6E+03			1.6E+03
7.9E-03	I	1.1E-06	I	2.0E-02	I			V		9.15E+02	1.36E+09	9.70E+03	1		Bromoform	75-25-2	8.8E+03		2.5E+03	1.9E+03	1.6E+03			1.6E+03
				1.4E-03	I	5.0E-03	I	V		3.59E+03	1.36E+09	1.40E+03	1		Bromomethane	74-83-9					1.1E+02		7.3E+00	6.8E+00
				5.0E-03	H			V			1.36E+09	1.24E+05	1		Bromophos	2104-96-3					3.9E+02			3.9E+02
						1.0E-01	A	V		9.66E+02	1.36E+09	2.14E+03	1		Bromopropane, 1-	106-94-5							2.2E+02	2.2E+02
1.0E-01	O			1.5E-02	O						1.36E+09		1	0.1	Bromoxynil	1689-84-5	6.7E+02	2.4E+03		5.3E+02	1.2E+03	4.9E+03		9.5E+02
1.0E-01	O			1.5E-02	O			V			1.36E+09	4.74E+05	1		Bromoxynil Octanoate	1689-99-2	6.7E+02			6.7E+02	1.2E+03			1.2E+03
6.0E-01	C	3.0E-05	I			2.0E-03	I	V		6.67E+02	1.36E+09	8.66E+02	1		Butadiene, 1,3-	106-99-0	1.2E+02		8.1E+00	7.6E+00			1.8E+00	1.8E+00
				3.0E-02	O						1.36E+09		1	0.1	Butanoic acid, 4-(2,4-dichlorophenoxy)-	94-82-6					2.3E+03	9.9E+03		1.9E+03
				1.0E-01	I			V		7.64E+03	1.36E+09	3.00E+04	1		Butanol, N-	71-36-3					7.8E+03			7.8E+03
				2.0E+00	P	3.0E+01	P	V		2.13E+04	1.36E+09	2.92E+04	1		Butyl alcohol, sec-	78-92-2					1.6E+05		9.1E+05	1.3E+05
				5.0E-02	I			V			1.36E+09	8.63E+04	1		Butylate	2008-41-5					3.9E+03			3.9E+03
2.0E-04	C	5.7E-08	C								1.36E+09		1	0.1	Butylated hydroxyanisole	25013-16-5	3.5E+05	1.2E+06	6.7E+09	2.7E+05				
3.6E-03	P			3.0E-01	P						1.36E+09		1	0.1	Butylated hydroxytoluene	128-37-0	1.9E+04	6.9E+04		1.5E+04	2.3E+04	9.9E+04		1.9E+04
				5.0E-02	P			V		1.08E+02	1.36E+09	8.14E+03	1		Butylbenzene, n-	104-51-8					3.9E+03			3.9E+03
				1.0E-01	X			V		1.45E+02	1.36E+09	7.35E+03	1		Butylbenzene, sec-	135-98-8					7.8E+03			7.8E+03
				1.0E-01	X			V		1.83E+02	1.36E+09	7.36E+03	1		Butylbenzene, tert-	98-06-6					7.8E+03			7.8E+03
				2.0E-02	A						1.36E+09		1	0.1	Cacodylic Acid	75-60-5					1.6E+03	6.6E+03		1.3E+03
		1.8E-03	I	1.0E-03	I	1.0E-05	A				1.36E+09		0.025	0.001	Cadmium (Diet)	7440-43-9			2.1E+05	2.1E+05	7.8E+01	8.2E+02	1.4E+04	7.1E+01
		1.8E-03	I	5.0E-04	I	1.0E-05	A						0.05	0.001	Cadmium (Water)	7440-43-9								
				5.0E-01	I	2.2E-03	C				1.36E+09		1	0.1	Caprolactam	105-60-2					3.9E+04	1.6E+05	3.1E+06	3.1E+04
1.5E-01	C	4.3E-05	C	2.0E-03	I						1.36E+09		1	0.1	Captafol	2425-06-1	4.6E+02	1.6E+03	8.9E+06	3.6E+02	1.6E+02	6.6E+02		1.3E+02
2.3E-03	C	6.6E-07	C	1.3E-01	I						1.36E+09		1	0.1	Captan	133-06-2	3.0E+04	1.1E+05	5.8E+08	2.4E+04	1.0E+04	4.3E+04		8.2E+03
				1.0E-01	I						1.36E+09		1	0.1	Carbaryl	63-25-2					7.8E+03	3.3E+04		6.3E+03
				5.0E-03	I						1.36E+09		1	0.1	Carbofuran	1563-66-2					3.9E+02	1.6E+03		3.2E+02
				1.0E-01	I	7.0E-01	I	V		7.38E+02	1.36E+09	1.17E+03	1		Carbon Disulfide	75-15-0					7.8E+03		8.5E+02	7.7E+02
7.0E-02	I	6.0E-06	I	4.0E-03	I	1.0E-01	I	V		4.58E+02	1.36E+09	1.49E+03	1		Carbon Tetrachloride	56-23-5	9.9E+02		7.0E+01	6.5E+01	3.1E+02		1.6E+02	1.0E+02
						1.0E-01	P	V		5.89E+03	1.36E+09	6.46E+02	1		Carbonyl Sulfide	463-58-1							6.7E+01	6.7E+01
				1.0E-02	I						1.36E+09		1	0.1	Carbosulfan	55285-14-8					7.8E+02	3.3E+03		6.3E+02
				1.0E-01	I						1.36E+09		1	0.1	Carboxin	5234-68-4					7.8E+03	3.3E+04		6.3E+03
						9.0E-04	I				1.36E+09		1		Ceric oxide	1306-38-3							1.3E+06	1.3E+06
				1.0E-01	I			V			1.36E+09	1.45E+05	1		Chloral Hydrate	302-17-0					7.8E+03			7.8E+03
				1.5E-02	I						1.36E+09		1	0.1	Chloramben	133-90-4					1.2E+03	4.9E+03		9.5E+02
											1.36E+09				Chloramines, Organic	E701235								
4.0E-01	H										1.36E+09		1	0.1	Chloranil	118-75-2	1.7E+02	6.1E+02		1.3E+02				
3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I	V			1.36E+09	1.53E+06	1	0.04	Chlordane (technical mixture)	12789-03-6	2.0E+02	1.8E+03	4.3E+03	1.7E+02	3.9E+01	4.1E+02	1.1E+03	3.5E+01
1.0E+01	I	4.6E-03	C	3.0E-04	I						1.36E+09		1	0.1	Chlordecone (Kepone)	143-50-0	7.0E+00	2.5E+01	8.3E+04	5.4E+00	2.3E+01	9.9E+01		1.9E+01
				7.0E-04	A						1.36E+09		1	0.1	Chlorfenvinphos	470-90-6					5.5E+01	2.3E+02		4.4E+01
				9.0E-02	O						1.36E+09		1	0.1	Chlorimuron, Ethyl-	90982-32-4					7.0E+03	3.0E+04		5.7E+03
				1.0E-01	I	1.5E-04	A	V		2.78E+03	1.36E+09	1.22E+03	1		Chlorine	7782-50-5					7.8E+03		1.8E-01	1.8E-01
				3.0E-02	I	2.0E-04	I	V			1.36E+09		1		Chlorine Dioxide	10049-04-4					2.3E+03		2.8E+05	2.3E+03
				3.0E-02	I						1.36E+09		1		Chlorite (Sodium Salt)	7758-19-2					2.3E+03			2.3E+03
						5.0E+01	I	V		1.15E+03	1.36E+09	1.03E+03	1		Chloro-1,1-difluoroethane, 1-	75-68-3							5.4E+04	5.4E+04
		3.0E-04	I	2.0E-02	H	2.0E-02	I	V		7.86E+02	1.36E+09	1.08E+03	1		Chloro-1,3-butadiene, 2-	126-99-8			1.0E+00	1.0E+00	1.6E+03		2.2E+01	2.2E+01
4.6E-01	H										1.36E+09		1	0.1	Chloro-2-methylaniline HCl, 4-	3165-93-3	1.5E+02	5.4E+02		1.2E+02				
1.0E-01	P	7.7E-05	C	3.0E-03	X						1.36E+09		1	0.1	Chloro-2-methylaniline, 4-	95-69-2	7.0E+02	2.5E+03	5.0E+06	5.4E+02	2.3E+02	9.9E+02		1.9E+02
2.7E-01	X							V		1.18E+04	1.36E+09	1.62E+04	1		Chloroacetaldehyde, 2-	107-20-0	2.6E+02			2.6E+02				
											1.36E+09		1	0.1	Chloroacetic Acid	79-11-8								
						3.0E-05	I				1.36E+09		1	0.1	Chloroacetophenone, 2-	532-27-4							4.3E+04	4.3E+04
2.0E-01	P			4.0E-03	I						1.36E+09		1	0.1	Chloroaniline, p-	106-47-8	3.5E+02	1.2E+03		2.7E+02	3.1E+02	1.3E+03		2.5E+02
				2.0E-02	I	5.0E-02	P	V		7.61E+02	1.36E+09	6.45E+03	1		Chlorobenzene	108-90-7					1.6E+03		3.4E+02	2.8E+02
				1.0E-01	X						1.36E+09		1	0.1	Chlorobenzene sulfonic acid, p-	98-66-8					7.8E+03	3.3E+04		6.3E+03
1.1E-01	C	3.1E-05	C	2.0E-02	I						1.36E+09		1	0.1	Chlorobenzilate	510-15-6	6.3E+02	2.2E+03	1.2E+07	4.9E+02	1.6E+03	6.6E+03		1.3E+03
				3.0E-02	X						1.36E+09		1	0.1	Chlorobenzoic Acid, p-	74-11-3					2.3E+03	9.9E+03		1.9E+03
		8.6E-06	C	3.0E-03	P	3.0E-01	P	V		2.90E+02	1.36E+09	6.76E+03	1		Chlorobenzotrifluoride, 4-	98-56-6			2.2E+02	2.2E+02	2.3E+02		2.1E+03	2.1E+02
				4.0E-02	P			V		7.28E+02	1.36E+09	1.76E+03	1		Chlorobutane, 1-	109-69-3					3.1E+03			3.1E+03
						5.0E+01	I	V		1.68E+03	1.36E+09	9.38E+02	1		Chlorodifluoromethane	75-45-6							4.9E+04	4.9E+04
				2.0E-02	P			V		1.11E+05	1.36E+09	7.81E+04	1		Chloroethanol, 2-	107-07-3					1.6E+03			1.6E+03
3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V		2.54E+03	1.36E+09	2.63E+03	1		Chloroform	67-66-3	2.2E+03		3.2E+01	3.2E+01	7.8E+02		2.7E+02	2.0E+02
						9.0E-02	I	V		1.32E+03	1.36E+09	1.18E+03	1		Chloromethane	74-87-3							1.1E+02	1.1E+02
2.4E+00	C	6.9E-04	C					V		9.32E+03	1.36E+09	5.33E+03	1		Chloromethyl Methyl Ether	107-30-2	2.9E+01		2.2E+00	2.0E+00				
3.0E-01	P			3.0E-03	P	1.0E-05	X				1.36E+09		1	0.1	Chloronitrobenzene, o-	88-73-3	2.3E+02	8.2E+02		1.8E+02	2.3E+02	9.9E+02	1.4E+04	1.9E+02
6.0E-02	P			7.0E-04	P	2.0E-03	P				1.36E+09		1	0.1	Chloronitrobenzene, p-	100-00-5	1.2E+03	4.1E+03		9.0E+02	5.5E+01	2.3E+02	2.8E+06	4.4E+01
				5.0E-03	I			V		2.74E+04	1.36E+09	1.39E+05	1		Chlorophenol, 2-	95-57-8					3.9E+02			3.9E+02
						4.0E-04	C	V		6.17E+02	1.36E+09	4.68E+03	1		Chloropicrin	76-06-2							2.0E+00	2.0E+00
1.7E-02	C			1.5E-02	I						1.36E+09		1	0.1	Chlorothalonil	1897-45-6	4.1E+03	1.5E+04		3.2E+03	1.2E+03	4.9E+03		9.5E+02
				2.0E-02	I			V		9.07E+02	1.36E+09	8.12E+03	1		Chlorotoluene, o-	95-49-8					1.6E+03			1.6E+03
				2.0E-02	X			V		2.53E+02	1.36E+09	7.29E+03	1		Chlorotoluene, p-	106-43-4					1.6E+03			1.6E+03
2.4E+02	C	6.9E-02	C								1.36E+09		1	0.1	Chlorozotocin	54749-90-5	2.9E-01	1.0E+00	5.5E+03	2.3E-01				
				5.0E-02	O						1.36E+09		1	0.1	Chlorpropham	101-21-3					3.9E+03	1.6E+04		3.2E+03
				1.0E-03	A						1.36E+09		1	0.1	Chlorpyrifos	2921-88-2					7.8E+01	3.3E+02		6.3E+01
				1.0E-02	H						1.36E+09		1	0.1	Chlorpyrifos Methyl	5598-13-0					7.8E+02	3.3E+03		6.3E+02
				5.0E-02	O						1.36E+09		1	0.1	Chlorsulfuron	64902-72-3					3.9E+03	1.6E+04		3.2E+03
				1.0E-02	I						1.36E+09		1	0.1	Chlorthal-dimethyl	1861-32-1					7.8E+02	3.3E+03		6.3E+02
				8.0E-04	H						1.36E+09		1	0.1	Chlorthiophos	60238-56-4					6.3E+01	2.6E+02		5.1E+01

RMLs
TR=1E-04
HQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)
				1.5E+00	I						1.36E+09		0.013		Chromium(III), Insoluble Salts	16065-83-1					1.2E+05			1.2E+05
5.0E-01	C	8.4E-02	G	3.0E-03	I	1.0E-04	I		M		1.36E+09		0.025		Chromium(VI)	18540-29-9	3.1E+01		1.6E+03	3.0E+01	2.3E+02		1.4E+05	2.3E+02
											1.36E+09		0.013		Chromium, Total	7440-47-3								
				1.3E-02	I						1.36E+09		1	0.1	Clofentezine	74115-24-5					1.0E+03	4.3E+03		8.2E+02
		9.0E-03	P	3.0E-04	P	6.0E-06	P				1.36E+09		1		Cobalt	7440-48-4			4.2E+04	4.2E+04	2.3E+01		8.5E+03	2.3E+01
		6.2E-04	I					V	M				1		Coke Oven Emissions	E649830								
				4.0E-02	H						1.36E+09		1		Copper	7440-50-8					3.1E+03			3.1E+03
				5.0E-02	I	6.0E-01	C				1.36E+09		1	0.1	Cresol, m-	108-39-4					3.9E+03	1.6E+04	8.5E+08	3.2E+03
				5.0E-02	I	6.0E-01	C				1.36E+09		1	0.1	Cresol, o-	95-48-7					3.9E+03	1.6E+04	8.5E+08	3.2E+03
				1.0E-01	A	6.0E-01	C				1.36E+09		1	0.1	Cresol, p-	106-44-5					7.8E+03	3.3E+04	8.5E+08	6.3E+03
				1.0E-01	A						1.36E+09		1	0.1	Cresol, p-chloro-m-	59-50-7					7.8E+03	3.3E+04		6.3E+03
				1.0E-01	A	6.0E-01	C				1.36E+09		1	0.1	Cresols	1319-77-3					7.8E+03	3.3E+04	8.5E+08	6.3E+03
1.9E+00	H			1.0E-03	P			V		1.66E+04	1.36E+09	1.89E+04	1		Crotonaldehyde, trans-	123-73-9	3.7E+01			3.7E+01	7.8E+01			7.8E+01
				1.0E-01	I	4.0E-01	I	V		2.68E+02	1.36E+09	6.21E+03	1		Cumene	98-82-8					7.8E+03		2.6E+03	1.9E+03
2.2E-01	C	6.3E-05	C								1.36E+09		1	0.1	Cupferron	135-20-6	3.2E+02	1.1E+03	6.1E+06	2.5E+02				
8.4E-01	H			2.0E-03	H						1.36E+09		1	0.1	Cyanazine	21725-46-2	8.3E+01	2.9E+02		6.5E+01	1.6E+02	6.6E+02		1.3E+02
															Cyanides									
				1.0E-03	I						1.36E+09		1		~Calcium Cyanide	592-01-8					7.8E+01			7.8E+01
				5.0E-03	I						1.36E+09		1		~Copper Cyanide	544-92-3					3.9E+02			3.9E+02
				6.0E-04	I	8.0E-04	G	V		9.54E+05	1.36E+09	5.33E+04	1		~Cyanide (CN-)	57-12-5					4.7E+01		4.4E+01	2.3E+01
				1.0E-03	I			V			1.36E+09		1		~Cyanogen	460-19-5					7.8E+01			7.8E+01
				9.0E-02	I			V			1.36E+09		1		~Cyanogen Bromide	506-68-3					7.0E+03			7.0E+03
				5.0E-02	I			V			1.36E+09		1		~Cyanogen Chloride	506-77-4					3.9E+03			3.9E+03
				6.0E-04	I	8.0E-04	I	V		1.00E+07	1.36E+09	5.22E+04	1		~Hydrogen Cyanide	74-90-8					4.7E+01		4.4E+01	2.3E+01
				2.0E-03	I						1.36E+09		1		~Potassium Cyanide	151-50-8					1.6E+02			1.6E+02
				5.0E-03	I						1.36E+09		0.04		~Potassium Silver Cyanide	506-61-6					3.9E+02			3.9E+02
				1.0E-01	I						1.36E+09		0.04		~Silver Cyanide	506-64-9					7.8E+03			7.8E+03
				1.0E-03	I						1.36E+09		1		~Sodium Cyanide	143-33-9					7.8E+01			7.8E+01
				2.0E-04	P						1.36E+09		1		~Thiocyanates	E1790664					1.6E+01			1.6E+01
				2.0E-04	X			V			1.36E+09		1		~Thiocyanic Acid	463-56-9					1.6E+01			1.6E+01
				5.0E-02	I						1.36E+09		1		~Zinc Cyanide	557-21-1					3.9E+03			3.9E+03
						6.0E+00	I	V		1.17E+02	1.36E+09	1.04E+03	1		Cyclohexane	110-82-7							6.5E+03	6.5E+03
2.0E-02	X			2.0E-02	X						1.36E+09		1	0.1	Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	3.5E+03	1.2E+04		2.7E+03	1.6E+03	6.6E+03		1.3E+03
				5.0E+00	I	7.0E-01	P	V		5.11E+03	1.36E+09	4.17E+04	1		Cyclohexanone	108-94-1					3.9E+05		3.0E+04	2.8E+04
				5.0E-03	P	1.0E+00	X	V		2.83E+02	1.36E+09	1.46E+03	1		Cyclohexene	110-83-8					3.9E+02		1.5E+03	3.1E+02
				2.0E-01	I			V		2.93E+05	1.36E+09	7.46E+04	1		Cyclohexylamine	108-91-8					1.6E+04			1.6E+04
				2.5E-02	I						1.36E+09		1	0.1	Cyfluthrin	68359-37-5					2.0E+03	8.2E+03		1.6E+03
				1.0E-03	O						1.36E+09		1	0.1	Cyhalothrin	68085-85-8					7.8E+01	3.3E+02		6.3E+01
				5.0E-01	O						1.36E+09		1	0.1	Cyromazine	66215-27-8					3.9E+04	1.6E+05		3.2E+04
2.4E-01	I	6.9E-05	C	3.0E-05	X						1.36E+09		1	0.1	DDD, p,p'- (DDD)	72-54-8	2.9E+02	1.0E+03	5.5E+06	2.3E+02	2.3E+00	9.9E+00		1.9E+00
3.4E-01	I	9.7E-05	C	3.0E-04	X			V			1.36E+09	2.10E+06	1		DDE, p,p'-	72-55-9	2.0E+02		6.1E+03	2.0E+02	2.3E+01			2.3E+01
3.4E-01	I	9.7E-05	I	5.0E-04	I						1.36E+09		1	0.03	DDT	50-29-3	2.0E+02	2.4E+03	3.9E+06	1.9E+02	3.9E+01	5.5E+02		3.7E+01
				3.0E-02	I						1.36E+09		1	0.1	Dalapon	75-99-0					2.3E+03	9.9E+03		1.9E+03
1.8E-02	C	5.1E-06	C	1.5E-01	I						1.36E+09		1	0.1	Daminozide	1596-84-5	3.9E+03	1.4E+04	7.5E+07	3.0E+03	1.2E+04	4.9E+04		9.5E+03
7.0E-04	I			7.0E-03	I						1.36E+09		1	0.1	Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	9.9E+04	3.5E+05		7.8E+04	5.5E+02	2.3E+03		4.4E+02
				4.0E-05	I						1.36E+09		1	0.1	Demeton	8065-48-3					3.1E+00	1.3E+01		2.5E+00
1.2E-03	I			6.0E-01	I						1.36E+09		1	0.1	Di(2-ethylhexyl)adipate	103-23-1	5.8E+04	2.1E+05		4.5E+04	4.7E+04	2.0E+05		3.8E+04
6.1E-02	H										1.36E+09		1	0.1	Diallate	2303-16-4	1.1E+03	4.1E+03		8.9E+02				
				7.0E-04	A						1.36E+09		1	0.1	Diazinon	333-41-5					5.5E+01	2.3E+02		4.4E+01
				1.0E-02	X			V			1.36E+09	5.24E+05	1		Dibenzothiophene	132-65-0					7.8E+02			7.8E+02
8.0E-01	P	6.0E-03	P	2.0E-04	P	2.0E-04	I	V	M	9.79E+02	1.36E+09	3.20E+04	1		Dibromo-3-chloropropane, 1,2-	96-12-8	1.9E+01		5.4E-01	5.3E-01	1.6E+01		6.7E+00	4.7E+00
											1.36E+09		1	0.1	Dibromoacetic acid	631-64-1								
				4.0E-04	X			V		1.59E+02	1.36E+09	1.93E+04	1		Dibromobenzene, 1,3-	108-36-1					3.1E+01			3.1E+01
				1.0E-02	I			V			1.36E+09	2.20E+04	1		Dibromobenzene, 1,4-	106-37-6					7.8E+02			7.8E+02
8.4E-02	I			2.0E-02	I			V		8.02E+02	1.36E+09	7.95E+03	1		Dibromochloromethane	124-48-1	8.3E+02			8.3E+02	1.6E+03			1.6E+03
2.0E+00	I	6.0E-04	I	9.0E-03	I	9.0E-03	I	V		1.34E+03	1.36E+09	8.64E+03	1		Dibromoethane, 1,2-	106-93-4	3.5E+01		4.0E+00	3.6E+00	7.0E+02		8.1E+01	7.3E+01
						4.0E-03	X	V		2.82E+03	1.36E+09	5.64E+03	1		Dibromomethane (Methylene Bromide)	74-95-3							2.4E+01	2.4E+01
				3.0E-04	P						1.36E+09		1	0.1	Dibutyltin Compounds	E1790660					2.3E+01	9.9E+01		1.9E+01
				3.0E-02	I						1.36E+09		1	0.1	Dicamba	1918-00-9					2.3E+03	9.9E+03		1.9E+03
											1.36E+09				Dichloramine	3400-09-7								
		4.2E-03	P					V		5.54E+02	1.36E+09	3.21E+03	1		Dichloro-2-butene, 1,4-	764-41-0			2.1E-01	2.1E-01				
		4.2E-03	P					V		5.19E+02	1.36E+09	1.11E+04	1		Dichloro-2-butene, cis-1,4-	1476-11-5			7.4E-01	7.4E-01				
		4.2E-03	P					V		7.60E+02	1.36E+09	1.11E+04	1		Dichloro-2-butene, trans-1,4-	110-57-6			7.4E-01	7.4E-01				
5.0E-02	I			4.0E-03	I						1.36E+09		1	0.1	Dichloroacetic Acid	79-43-6	1.4E+03	4.9E+03		1.1E+03	3.1E+02	1.3E+03		2.5E+02
				9.0E-02	I	2.0E-01	H	V		3.76E+02	1.36E+09	1.17E+04	1		Dichlorobenzene, 1,2-	95-50-1					7.0E+03		2.4E+03	1.8E+03
5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I	V			1.36E+09	1.04E+04	1		Dichlorobenzene, 1,4-	106-46-7	1.3E+04		2.7E+02	2.6E+02	5.5E+03		8.7E+03	3.4E+03
4.5E-01	I	3.4E-04	C								1.36E+09		1	0.1	Dichlorobenzidine, 3,3'-	91-94-1	1.5E+02	5.5E+02	1.1E+06	1.2E+02				
				9.0E-03	X						1.36E+09		1	0.1	Dichlorobenzophenone, 4,4'-	90-98-2					7.0E+02	3.0E+03		5.7E+02
				2.0E-01	I	1.0E-01	X	V		8.45E+02	1.36E+09	8.41E+02	1		Dichlorodifluoromethane	75-71-8					1.6E+04		8.8E+01	8.7E+01
5.7E-03	C	1.6E-06	C	2.0E-01	P			V		1.69E+03	1.36E+09	2.08E+03	1		Dichloroethane, 1,1-	75-34-3	1.2E+04		3.7E+02	3.6E+02	1.6E+04			1.6E+04
9.1E-02	I	2.6E-05	I	6.0E-03	X	7.0E-03	P	V		2.98E+03	1.36E+09	4.57E+03	1		Dichloroethane, 1,2-	107-06-2	7.6E+02		4.9E+01	4.6E+01	4.7E+02		3.3E+01	3.1E+01
				5.0E-02	I	2.0E-01	I	V		1.19E+03	1.36E+09	1.16E+03	1		Dichloroethylene, 1,1-	75-35-4					3.9E+03		2.4E+02	2.3E+02
				2.0E-03	I			V		2.37E+03	1.36E+09	2.50E+03	1		Dichloroethylene, cis-1,2-	156-59-2					1.6E+02			1.6E+02
				2.0E-02	I	4.0E-02	X	V		1.85E+03	1.36E+09	1.75E+03	1		Dichloroethylene, trans-1,2-	156-60-5					1.6E+03		7.3E+01	7.0E+01
				3.0E-03	I						1.36E+09		1	0.1	Dichlorophenol, 2,4-	120-83-2					2.3E+02	9.9E+02		1.9E+02
				1.0E-02	I						1.36E+09		1	0.05	Dichlorophenoxy Acetic Acid, 2,4-	94-75-7					7.8E+02	6.6E+03		7.0E+02
3.7E-02	P	3.7E-06	P	4.0E-02	P	4.0E-03	I	V		1.36E+03	1.36E+09	3.79E+03	1		Dichloropropane, 1,2-	78-87-5	1.9E+03		2.9E+02	2.5E+02	3.1E+03		1.6E+01	1.6E+01
				2.0E-02	P			V		1.49E+03	1.36E+09	6.76E+03	1		Dichloropropane, 1,3-	142-28-9					1.6E+03			1.6E+03

RMLs
TR=1E-04
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)
				3.0E-03	I						1.36E+09		1	0.1	Dichloropropanol, 2,3-	616-23-9					2.3E+02	9.9E+02		1.9E+02
1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	V		1.57E+03	1.36E+09	3.55E+03	1		Dichloropropene, 1,3-	542-75-6	7.0E+02		2.5E+02	1.8E+02	2.3E+03		7.4E+01	7.2E+01
2.9E-01	I	8.3E-05	C	5.0E-04	I	5.0E-04	I				1.36E+09		1	0.1	Dichlorvos	62-73-7	2.4E+02	8.5E+02	4.6E+06	1.9E+02	3.9E+01	1.6E+02	7.1E+05	3.2E+01
				3.0E-05	O						1.36E+09		1	0.1	Dicrotophos	141-66-2					2.3E+00	9.9E+00		1.9E+00
				8.0E-02	P	3.0E-04	X	V		2.56E+02	1.36E+09	4.11E+03	1		Dicyclopentadiene	77-73-6					6.3E+03		1.3E+00	1.3E+00
1.6E+01	I	4.6E-03	I	5.0E-05	I						1.36E+09		1	0.1	Dieldrin	60-57-1	4.3E+00	1.5E+01	8.3E+04	3.4E+00	3.9E+00	1.6E+01		3.2E+00
		3.0E-04	C			5.0E-03	I						1	0.1	Diesel Engine Exhaust	E17136615								
				2.0E-03	P	2.0E-04	P				1.36E+09		1	0.1	Diethanolamine	111-42-2					1.6E+02	6.6E+02	2.8E+05	1.3E+02
				3.0E-02	P	1.0E-04	P				1.36E+09		1	0.1	Diethylene Glycol Monobutyl Ether	112-34-5					2.3E+03	9.9E+03	1.4E+05	1.9E+03
				6.0E-02	P	3.0E-04	P				1.36E+09		1	0.1	Diethylene Glycol Monoethyl Ether	111-90-0					4.7E+03	2.0E+04	4.3E+05	3.8E+03
				1.0E-03	P			V		1.12E+05	1.36E+09	1.39E+05	1		Diethylformamide	617-84-5					7.8E+01			7.8E+01
3.5E+02	C	1.0E-01	C								1.36E+09		1	0.1	Diethylstilbestrol	56-53-1	2.0E-01	7.1E-01	3.8E+03	1.6E-01				
				8.3E-02	O						1.36E+09		1	0.1	Difenzoquat	43222-48-6					6.5E+03	2.7E+04		5.2E+03
				2.0E-02	I						1.36E+09		1	0.1	Diflubenzuron	35367-38-5					1.6E+03	6.6E+03		1.3E+03
						4.0E-01	I	V		1.43E+03	1.36E+09	1.15E+03	1		Difluoroethane, 1,1-	75-37-6							4.8E+04	4.8E+04
						3.0E+01	X	V		6.91E+02	1.36E+09	7.58E+02	1		Difluoropropane, 2,2-	420-45-1							2.4E+04	2.4E+04
4.4E-02	C	1.3E-05	C					V			1.36E+09	1.23E+05	1		Dihydrosafrole	94-58-6	1.6E+03		2.7E+03	9.9E+02				
						7.0E-01	P	V		2.26E+03	1.36E+09	3.06E+03	1		Diisopropyl Ether	108-20-3							2.2E+03	2.2E+03
				8.0E-02	I			V		5.30E+02	1.36E+09	3.81E+04	1		Diisopropyl Methylphosphonate	1445-75-6					6.3E+03			6.3E+03
				2.2E-02	O						1.36E+09		1	0.1	Dimethipin	55290-64-7					1.7E+03	7.2E+03		1.4E+03
				2.2E-03	O						1.36E+09		1	0.1	Dimethoate	60-51-5					1.7E+02	7.3E+02		1.4E+02
1.6E+00	P										1.36E+09		1	0.1	Dimethoxybenzidine, 3,3'-	119-90-4	4.3E+01	1.5E+02		3.4E+01				
1.7E-03	P			6.0E-02	P						1.36E+09		1	0.1	Dimethyl methylphosphonate	756-79-6	4.1E+04	1.5E+05		3.2E+04	4.7E+03	2.0E+04		3.8E+03
4.6E+00	C	1.3E-03	C								1.36E+09		1	0.1	Dimethylamino azobenzene [p-]	60-11-7	1.5E+01	5.4E+01	2.9E+05	1.2E+01				
5.8E-01	H										1.36E+09		1	0.1	Dimethylaniline HCl, 2,4-	21436-96-4	1.2E+02	4.3E+02		9.4E+01				
2.0E-01	P			2.0E-03	X						1.36E+09		1	0.1	Dimethylaniline, 2,4-	95-68-1	3.5E+02	1.2E+03		2.7E+02	1.6E+02	6.6E+02		1.3E+02
2.7E-02	P			2.0E-03	I			V		8.30E+02	1.36E+09	3.13E+04	1		Dimethylaniline, N,N-	121-69-7	2.6E+03			2.6E+03	1.6E+02			1.6E+02
1.1E+01	P										1.36E+09		1	0.1	Dimethylbenzidine, 3,3'-	119-93-7	6.3E+00	2.2E+01		4.9E+00				
				1.0E-01	P	3.0E-02	I	V		1.06E+05	1.36E+09	1.28E+05	1		Dimethylformamide	68-12-2					7.8E+03		4.0E+03	2.6E+03
				1.0E-04	X	2.0E-06	X	V		1.72E+05	1.36E+09	2.77E+04	1		Dimethylhydrazine, 1,1-	57-14-7					7.8E+00		5.8E-02	5.7E-02
5.5E+02	C	1.6E-01	C					V		1.89E+05	1.36E+09	1.68E+05	1		Dimethylhydrazine, 1,2-	540-73-8	1.3E-01		2.9E-01	8.8E-02				
				2.0E-02	I						1.36E+09		1	0.1	Dimethylphenol, 2,4-	105-67-9					1.6E+03	6.6E+03		1.3E+03
				6.0E-04	I						1.36E+09		1	0.1	Dimethylphenol, 2,6-	576-26-1					4.7E+01	2.0E+02		3.8E+01
				1.0E-03	I						1.36E+09		1	0.1	Dimethylphenol, 3,4-	95-65-8					7.8E+01	3.3E+02		6.3E+01
4.5E-02	C	1.3E-05	C					V		4.73E+02	1.36E+09	5.48E+03	1		Dimethylvinylchloride	513-37-1	1.5E+03		1.2E+02	1.1E+02				
				8.0E-05	X						1.36E+09		1	0.1	Dinitro-o-cresol, 4,6-	534-52-1					6.3E+00	2.6E+01		5.1E+00
				2.0E-03	I						1.36E+09		1	0.1	Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5					1.6E+02	6.6E+02		1.3E+02
				1.0E-04	P						1.36E+09		1	0.1	Dinitrobenzene, 1,2-	528-29-0					7.8E+00	3.3E+01		6.3E+00
				1.0E-04	I						1.36E+09		1	0.1	Dinitrobenzene, 1,3-	99-65-0					7.8E+00	3.3E+01		6.3E+00
				1.0E-04	P						1.36E+09		1	0.1	Dinitrobenzene, 1,4-	100-25-4					7.8E+00	3.3E+01		6.3E+00
				2.0E-03	I						1.36E+09		1	0.1	Dinitrophenol, 2,4-	51-28-5					1.6E+02	6.6E+02		1.3E+02
6.8E-01	I										1.36E+09		1	0.1	Dinitrotoluene Mixture, 2,4/2,6-	E1615210	1.0E+02	3.6E+02		8.0E+01				
3.1E-01	C	8.9E-05	C	2.0E-03	I						1.36E+09		1	0.102	Dinitrotoluene, 2,4-	121-14-2	2.2E+02	7.8E+02	4.3E+06	1.7E+02	1.6E+02	6.5E+02		1.3E+02
1.5E+00	P			3.0E-04	X						1.36E+09		1	0.099	Dinitrotoluene, 2,6-	606-20-2	4.6E+01	1.7E+02		3.6E+01	2.3E+01	1.0E+02		1.9E+01
				1.0E-04	X						1.36E+09		1	0.006	Dinitrotoluene, 2-Amino-4,6-	35572-78-2					7.8E+00	5.5E+02		7.7E+00
				1.0E-04	X						1.36E+09		1	0.009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0					7.8E+00	3.7E+02		7.7E+00
4.5E-01	X			9.0E-04	X						1.36E+09		1	0.1	Dinitrotoluene, Technical grade	25321-14-6	1.5E+02	5.5E+02		1.2E+02	7.0E+01	3.0E+02		5.7E+01
				1.0E-03	I						1.36E+09		1	0.1	Dinoseb	88-85-7					7.8E+01	3.3E+02		6.3E+01
1.0E-01	I	5.0E-06	I	3.0E-02	I	3.0E-02	I	V		1.16E+05	1.36E+09	3.96E+04	1		Dioxane, 1,4-	123-91-1	7.0E+02		2.2E+03	5.3E+02	2.3E+03		1.2E+03	8.1E+02
															Dioxins									
6.2E+03	I	1.3E+00	I								1.36E+09		1	0.03	~Hexachlorodibenzo-p-dioxin, Mixture	34465-46-8	1.1E-02	1.3E-01	2.9E+02	1.0E-02				
1.3E+05	C	3.8E+01	C	7.0E-10	I	4.0E-08	C	V			1.36E+09	1.96E+06	1	0.03	~TCDD, 2,3,7,8-	1746-01-6	5.3E-04	6.3E-03	1.4E-02	4.8E-04	5.5E-05	7.7E-04	8.2E-02	5.1E-05
				3.0E-02	I						1.36E+09		1	0.1	Diphenamid	957-51-7					2.3E+03	9.9E+03		1.9E+03
						4.0E-04	X	V			1.36E+09	8.06E+04	1		Diphenyl Ether	101-84-8							3.4E+01	3.4E+01
				8.0E-04	X						1.36E+09		1	0.1	Diphenyl Sulfone	127-63-9					6.3E+01	2.6E+02		5.1E+01
				1.0E-01	O						1.36E+09		1	0.1	Diphenylamine	122-39-4					7.8E+03	3.3E+04		6.3E+03
8.0E-01	I	2.2E-04	I								1.36E+09		1	0.1	Diphenylhydrazine, 1,2-	122-66-7	8.7E+01	3.1E+02	1.7E+06	6.8E+01				
				2.2E-03	I						1.36E+09		1	0.1	Diquat	2764-72-9					1.7E+02	7.3E+02		1.4E+02
7.4E+00	C	2.1E-03	C								1.36E+09		1	0.1	Direct Black 38	1937-37-7	9.4E+00	3.3E+01	1.8E+05	7.3E+00				
7.4E+00	C	2.1E-03	C								1.36E+09		1	0.1	Direct Blue 6	2602-46-2	9.4E+00	3.3E+01	1.8E+05	7.3E+00				
6.7E+00	C	1.9E-03	C								1.36E+09		1	0.1	Direct Brown 95	16071-86-6	1.0E+01	3.7E+01	2.0E+05	8.1E+00				
				4.0E-05	I						1.36E+09		1	0.1	Disulfoton	298-04-4					3.1E+00	1.3E+01		2.5E+00
				1.0E-02	I			V			1.36E+09	4.54E+04	1		Dithiane, 1,4-	505-29-3					7.8E+02			7.8E+02
				2.0E-03	I						1.36E+09		1	0.1	Diuron	330-54-1					1.6E+02	6.6E+02		1.3E+02
				2.0E-02	O						1.36E+09		1	0.1	Dodine	2439-10-3					1.6E+03	6.6E+03		1.3E+03
				5.0E-02	O			V			1.36E+09	1.17E+05	1		EPTC	759-94-4					3.9E+03			3.9E+03
				6.0E-03	I			V			1.36E+09	4.10E+05	1		Endosulfan	115-29-7					4.7E+02			4.7E+02
				6.0E-03	P						1.36E+09		1	0.1	Endosulfan Sulfate	1031-07-8					4.7E+02	2.0E+03		3.8E+02
				2.0E-02	I						1.36E+09		1	0.1	Endothall	145-73-3					1.6E+03	6.6E+03		1.3E+03
				3.0E-04	I						1.36E+09		1	0.1	Endrin	72-20-8					2.3E+01	9.9E+01		1.9E+01
9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V		1.05E+04	1.36E+09	1.89E+04	1		Epichlorohydrin	106-89-8	7.0E+03		4.4E+03	2.7E+03	4.7E+02		2.0E+01	1.9E+01
						2.0E-02	I	V		1.53E+04	1.36E+09	7.66E+03	1		Epoxybutane, 1,2-	106-88-7							1.6E+02	1.6E+02
				4.0E-02	P						1.36E+09		1	0.1	Ethanol, 2-(2-methoxyethoxy)-	111-77-3					3.1E+03	1.3E+04		2.5E+03
				5.0E-03	I						1.36E+09		1	0.1	Ethephon	16672-87-0					3.9E+02	1.6E+03		3.2E+02
				5.0E-04	I						1.36E+09		1	0.1	Ethion	563-12-2					3.9E+01	1.6E+02		3.2E+01
				1.0E-01	P	6.0E-02	P	V		2.38E+04	1.36E+09	6.15E+04	1		Ethoxyethanol Acetate, 2-	111-15-9					7.8E+03		3.8E+03	2.6E+03
				9.0E-02	P	2.0E-01	I	V		1.06E+05	1.36E+09	9.84E+04	1		Ethoxyethanol, 2-	110-80-5					7.0E+03		2.1E+04	5.2E+03
				9.0E-01	I	7.0E-02	P	V		1.08E+04	1.36E+09	8.62E+03	1		Ethyl Acetate	141-78-6					7.0E+04		6.3E+02	6.2E+02

RMLs
TR=1E-04
HQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)
				5.0E-03	P	8.0E-03	P	V		2.50E+03	1.36E+09	6.34E+03	1		Ethyl Acrylate	140-88-5					3.9E+02		5.3E+01	4.7E+01
						1.0E+01	I	V		2.12E+03	1.36E+09	1.29E+03	1		Ethyl Chloride (Chloroethane)	75-00-3							1.4E+04	1.4E+04
				2.0E-01	I			V		1.01E+04	1.36E+09	3.12E+03	1		Ethyl Ether	60-29-7					1.6E+04			1.6E+04
						3.0E-01	P	V		1.10E+03	1.36E+09	5.77E+03	1		Ethyl Methacrylate	97-63-2							1.8E+03	1.8E+03
				1.0E-05	I						1.36E+09		1	0.1	Ethyl-p-nitrophenyl Phosphonate	2104-64-5					7.8E-01	3.3E+00		6.3E-01
1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V		4.80E+02	1.36E+09	5.67E+03	1		Ethylbenzene	100-41-4	6.3E+03		6.4E+02	5.8E+02	7.8E+03		5.9E+03	3.4E+03
				7.0E-02	P						1.36E+09		1	0.1	Ethylene Cyanohydrin	109-78-4					5.5E+03	2.3E+04		4.4E+03
				9.0E-02	P			V		1.89E+05	1.36E+09	1.80E+05	1		Ethylene Diamine	107-15-3					7.0E+03			7.0E+03
				2.0E+00	I	4.0E-01	C				1.36E+09		1	0.1	Ethylene Glycol	107-21-1					1.6E+05	6.6E+05	5.7E+08	1.3E+05
				1.0E-01	I	1.6E+00	I				1.36E+09		1	0.1	Ethylene Glycol Monobutyl Ether	111-76-2					7.8E+03	3.3E+04	2.3E+09	6.3E+03
3.1E-01	C	3.0E-03	I			3.0E-02	C	V	M	1.21E+05	1.36E+09	6.09E+03	1		Ethylene Oxide	75-21-8	4.9E+01		2.1E-01	2.0E-01			1.9E+02	1.9E+02
4.5E-02	C	1.3E-05	C	8.0E-05	I						1.36E+09		1	0.1	Ethylene Thiourea	96-45-7	1.5E+03	5.5E+03	2.9E+07	1.2E+03	6.3E+00	2.6E+01		5.1E+00
6.5E+01	C	1.9E-02	C					V		1.54E+05	1.36E+09	2.39E+04	1		Ethyleneimine	151-56-4	1.1E+00		3.5E-01	2.7E-01				
				3.0E+00	I						1.36E+09		1	0.1	Ethylphthalyl Ethyl Glycolate	84-72-0					2.3E+05	9.9E+05		1.9E+05
				2.5E-04	I						1.36E+09		1	0.1	Fenamiphos	22224-92-6					2.0E+01	8.2E+01		1.6E+01
				2.5E-02	I						1.36E+09		1	0.1	Fenpropathrin	39515-41-8					2.0E+03	8.2E+03		1.6E+03
				2.5E-02	I						1.36E+09		1	0.1	Fenvalerate	51630-58-1					2.0E+03	8.2E+03		1.6E+03
				1.3E-02	I						1.36E+09		1	0.1	Fluometuron	2164-17-2					1.0E+03	4.3E+03		8.2E+02
				4.0E-02	C	1.3E-02	C				1.36E+09		1		Fluoride	16984-48-8					3.1E+03		1.8E+07	3.1E+03
				6.0E-02	I	1.3E-02	C				1.36E+09		1		Fluorine (Soluble Fluoride)	7782-41-4					4.7E+03		1.8E+07	4.7E+03
				8.0E-02	I						1.36E+09		1	0.1	Fluridone	59756-60-4					6.3E+03	2.6E+04		5.1E+03
				4.0E-02	O						1.36E+09		1	0.1	Flurprimidol	56425-91-3					3.1E+03	1.3E+04		2.5E+03
				2.0E-03	O						1.36E+09		1	0.1	Flusilazole	85509-19-9					1.6E+02	6.6E+02		1.3E+02
				5.0E-01	O						1.36E+09		1	0.1	Flutolanil	66332-96-5					3.9E+04	1.6E+05		3.2E+04
				1.0E-02	I						1.36E+09		1	0.1	Fluvalinate	69409-94-5					7.8E+02	3.3E+03		6.3E+02
				9.0E-02	O						1.36E+09		1	0.1	Folpet	133-07-3					7.0E+03	3.0E+04		5.7E+03
				2.5E-03	O						1.36E+09		1	0.1	Fomesafen	72178-02-0					2.0E+02	8.2E+02		1.6E+02
				2.0E-03	I						1.36E+09		1	0.1	Fonofos	944-22-9					1.6E+02	6.6E+02		1.3E+02
2.1E-02	C	1.3E-05	I	2.0E-01	I	9.8E-03	A	V		4.24E+04	1.36E+09	7.77E+04	1		Formaldehyde	50-00-0	3.3E+03		1.7E+03	1.1E+03	1.6E+04		8.0E+02	7.6E+02
				9.0E-01	P	3.0E-04	X	V		1.06E+05	1.36E+09	9.30E+04	1		Formic Acid	64-18-6					7.0E+04		2.9E+01	2.9E+01
				2.5E+00	O						1.36E+09		1	0.1	Fosetyl-AL	39148-24-8					2.0E+05	8.2E+05		1.6E+05
															Furans									
				1.0E-03	X			V			1.36E+09	1.56E+05	1		~Dibenzofuran	132-64-9					7.8E+01			7.8E+01
				1.0E-03	I			V		6.22E+03	1.36E+09	2.62E+03	1		~Furan	110-00-9					7.8E+01			7.8E+01
				9.0E-01	I	2.0E+00	I	V		1.65E+05	1.36E+09	1.20E+04	1		~Tetrahydrofuran	109-99-9					7.0E+04		2.5E+04	1.8E+04
3.8E+00	H										1.36E+09		1	0.1	Furazolidone	67-45-8	1.8E+01	6.5E+01		1.4E+01				
				3.0E-03	I	5.0E-02	H	V		1.01E+04	1.36E+09	4.86E+04	1		Furfural	98-01-1					2.3E+02		2.5E+03	2.1E+02
1.5E+00	C	4.3E-04	C								1.36E+09		1	0.1	Furium	531-82-8	4.6E+01	1.6E+02	8.9E+05	3.6E+01				
3.0E-02	I	8.6E-06	C								1.36E+09		1	0.1	Furmecyclox	60568-05-0	2.3E+03	8.2E+03	4.4E+07	1.8E+03				
				6.0E-03	O						1.36E+09		1	0.1	Glufosinate, Ammonium	77182-82-2					4.7E+02	2.0E+03		3.8E+02
				1.0E-01	A	8.0E-05	C				1.36E+09		1	0.1	Glutaraldehyde	111-30-8					7.8E+03	3.3E+04	1.1E+05	6.0E+03
				4.0E-04	I	1.0E-03	X	V		1.06E+05	1.36E+09	8.43E+04	1		Glycidaldehyde	765-34-4					3.1E+01		8.8E+01	2.3E+01
				1.0E-01	I						1.36E+09		1	0.1	Glyphosate	1071-83-6					7.8E+03	3.3E+04		6.3E+03
				1.0E-02	X			V			1.36E+09	1.45E+05	1		Guanidine	113-00-8					7.8E+02			7.8E+02
				2.0E-02	P						1.36E+09		1	0.1	Guanidine Chloride	50-01-1					1.6E+03	6.6E+03		1.3E+03
				3.0E-02	X						1.36E+09		1	0.1	Guanidine Nitrate	506-93-4					2.3E+03	9.9E+03		1.9E+03
				5.0E-05	I						1.36E+09		1	0.1	Haloxyfop, Methyl	69806-40-2					3.9E+00	1.6E+01		3.2E+00
4.5E+00	I	1.3E-03	I	5.0E-04	I			V			1.36E+09	4.79E+05	1		Heptachlor	76-44-8	1.5E+01		1.0E+02	1.3E+01	3.9E+01			3.9E+01
9.1E+00	I	2.6E-03	I	1.3E-05	I			V			1.36E+09	8.43E+05	1		Heptachlor Epoxide	1024-57-3	7.6E+00		9.1E+01	7.0E+00	1.0E+00			1.0E+00
						3.0E-03	X	V		2.09E+02	1.36E+09	7.80E+03	1		Heptanal, n-	111-71-7							2.4E+01	2.4E+01
				3.0E-04	X	4.0E-01	P	V		5.79E+01	1.36E+09	8.95E+02	1		Heptane, N-	142-82-5					2.3E+01		3.7E+02	2.2E+01
				2.0E-03	I			V			1.36E+09	3.80E+05	1		Hexabromobenzene	87-82-1					1.6E+02			1.6E+02
				2.0E-04	I						1.36E+09		1	0.1	Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2					1.6E+01	6.6E+01		1.3E+01
1.6E+00	I	4.6E-04	I	8.0E-04	I			V			1.36E+09	6.80E+04	1		Hexachlorobenzene	118-74-1	4.3E+01		4.1E+01	2.1E+01	6.3E+01			6.3E+01
7.8E-02	I	2.2E-05	I	1.0E-03	P			V		1.68E+01	1.36E+09	1.08E+04	1		Hexachlorobutadiene	87-68-3	8.9E+02		1.4E+02	1.2E+02	7.8E+01			7.8E+01
6.3E+00	I	1.8E-03	I	8.0E-03	A						1.36E+09		1	0.1	Hexachlorocyclohexane, Alpha-	319-84-6	1.1E+01	3.9E+01	2.1E+05	8.6E+00	6.3E+02	2.6E+03		5.1E+02
1.8E+00	I	5.3E-04	I								1.36E+09		1	0.1	Hexachlorocyclohexane, Beta-	319-85-7	3.9E+01	1.4E+02	7.2E+05	3.0E+01				
1.1E+00	C	3.1E-04	C	3.0E-04	I						1.36E+09		1	0.04	Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	6.3E+01	5.6E+02	1.2E+06	5.7E+01	2.3E+01	2.5E+02		2.1E+01
1.8E+00	I	5.1E-04	I								1.36E+09		1	0.1	Hexachlorocyclohexane, Technical	608-73-1	3.9E+01	1.4E+02	7.5E+05	3.0E+01				
				6.0E-03	I	2.0E-04	I	V		1.57E+01	1.36E+09	8.51E+03	1		Hexachlorocyclopentadiene	77-47-4					4.7E+02		1.8E+00	1.8E+00
4.0E-02	I	1.1E-05	C	7.0E-04	I	3.0E-02	I	V			1.36E+09	8.01E+03	1		Hexachloroethane	67-72-1	1.7E+03		2.0E+02	1.8E+02	5.5E+01		2.5E+02	4.5E+01
				3.0E-04	I						1.36E+09		1	0.1	Hexachlorophene	70-30-4					2.3E+01	9.9E+01		1.9E+01
8.0E-02	I			4.0E-03	I						1.36E+09		1	0.015	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	8.7E+02	2.1E+04		8.3E+02	3.1E+02	8.8E+03		3.0E+02
						1.0E-05	I	V		3.39E+03	1.36E+09	3.00E+05	1		Hexamethylene Diisocyanate, 1,6-	822-06-0							3.1E+00	3.1E+00
						4.0E-04	C				1.36E+09		1	0.1	Hexamethylene diisocyanate biuret	4035-89-6							5.7E+05	5.7E+05
						4.0E-04	C				1.36E+09		1	0.1	Hexamethylene diisocyanate isocyanurate	3779-63-3							5.7E+05	5.7E+05
				4.0E-04	P						1.36E+09		1	0.1	Hexamethylphosphoramide	680-31-9					3.1E+01	1.3E+02		2.5E+01
		2.0E-07	X			6.0E-01	P	V		1.41E+02	1.36E+09	8.29E+02	1		Hexane, Commercial	E5241997			1.2E+03	1.2E+03			5.2E+02	5.2E+02
						7.0E-01	I	V		1.41E+02	1.36E+09	8.29E+02	1		Hexane, N-	110-54-3							6.1E+02	6.1E+02
				2.0E+00	P						1.36E+09		1	0.1	Hexanedioic Acid	124-04-9					1.6E+05	6.6E+05		1.3E+05
9.5E-03	P			7.0E-02	P	4.0E-04	P	V		2.74E+02	1.36E+09	3.62E+04	1		Hexanol, 1-,2-ethyl- (2-Ethyl-1-hexanol)	104-76-7	7.3E+03			7.3E+03	5.5E+03		1.5E+01	1.5E+01
				5.0E-03	I	3.0E-02	I	V		3.28E+03	1.36E+09	1.33E+04	1		Hexanone, 2-	591-78-6					3.9E+02		4.2E+02	2.0E+02
				3.3E-02	I						1.36E+09		1	0.1	Hexazinone	51235-04-2					2.6E+03	1.1E+04		2.1E+03
				2.5E-02	I						1.36E+09		1	0.1	Hexythiazox	78587-05-0					2.0E+03	8.2E+03		1.6E+03
				1.7E-02	O						1.36E+09		1	0.1	Hydramethylnon	67485-29-4					1.3E+03	5.6E+03		1.1E+03
3.0E+00	I	4.9E-03	I			3.0E-05	P	V		1.12E+05	1.36E+09	6.52E+04	1		Hydrazine	302-01-2	2.3E+01		3.7E+00	3.2E+00			2.0E+00	2.0E+00
3.0E+00	I	4.9E-03	I								1.36E+09		1		Hydrazine Sulfate	10034-93-2	2.3E+01		7.8E+04	2.3E+01				
						2.0E-02	I	V			1.36E+09		1		Hydrogen Chloride	7647-01-0							2.8E+07	2.8E+07

RMLs
TR=1E-04
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)
				4.0E-02	C	1.4E-02	C	V			1.36E+09		1		Hydrogen Fluoride	7664-39-3					3.1E+03		2.0E+07	3.1E+03
						2.0E-03	I	V			1.36E+09		1		Hydrogen Sulfide	7783-06-4							2.8E+06	2.8E+06
6.0E-02	P			4.0E-02	P						1.36E+09		1	0.1	Hydroquinone	123-31-9	1.2E+03	4.1E+03		9.0E+02	3.1E+03	1.3E+04		2.5E+03
6.1E-02	O			2.5E-03	O						1.36E+09		1	0.1	Imazalil	35554-44-0	1.1E+03	4.0E+03		8.9E+02	2.0E+02	8.2E+02		1.6E+02
				2.5E-01	I						1.36E+09		1	0.1	Imazaquin	81335-37-7					2.0E+04	8.2E+04		1.6E+04
				2.5E+00	O						1.36E+09		1	0.1	Imazethapyr	81335-77-5					2.0E+05	8.2E+05		1.6E+05
				1.0E-02	A						1.36E+09		1		Iodine	7553-56-2					7.8E+02			7.8E+02
				4.0E-02	I						1.36E+09		1	0.1	Iprodione	36734-19-7					3.1E+03	1.3E+04		2.5E+03
				7.0E-01	P						1.36E+09		1		Iron	7439-89-6					5.5E+04			5.5E+04
				3.0E-01	I			V		1.00E+04	1.36E+09	2.81E+04	1		Isobutyl Alcohol	78-83-1					2.3E+04			2.3E+04
9.5E-04	I			2.0E-01	I	2.0E+00	C				1.36E+09		1	0.1	Isophorone	78-59-1	7.3E+04	2.6E+05		5.7E+04	1.6E+04	6.6E+04	2.8E+09	1.3E+04
				1.5E-02	I			V			1.36E+09	4.20E+05	1		Isopropalin	33820-53-0					1.2E+03			1.2E+03
				2.0E+00	P	2.0E-01	P	V		1.09E+05	1.36E+09	2.77E+04	1		Isopropanol	67-63-0					1.6E+05		5.8E+03	5.6E+03
				1.0E-01	I						1.36E+09		1	0.1	Isopropyl Methyl Phosphonic Acid	1832-54-8					7.8E+03	3.3E+04		6.3E+03
				5.0E-02	I						1.36E+09		1	0.1	Isoxaben	82558-50-7					3.9E+03	1.6E+04		3.2E+03
						3.0E-01	A	V			1.36E+09		1		JP-7	E1737665							4.3E+08	4.3E+08
				8.0E-03	O						1.36E+09		1	0.1	Lactofen	77501-63-4					6.3E+02	2.6E+03		5.1E+02
				2.0E-04	X						1.36E+09		1	0.1	Lactonitrile	78-97-7					1.6E+01	6.6E+01		1.3E+01
				5.0E-05	P						1.36E+09		1		Lanthanum	7439-91-0					3.9E+00			3.9E+00
				2.1E-05	P						1.36E+09		1	0.1	Lanthanum Acetate Hydrate	100587-90-4					1.6E+00	6.9E+00		1.3E+00
				1.9E-05	P						1.36E+09		1		Lanthanum Chloride Heptahydrate	10025-84-0					1.5E+00			1.5E+00
				2.8E-05	P						1.36E+09		1		Lanthanum Chloride, Anhydrous	10099-58-8					2.2E+00			2.2E+00
				1.6E-05	P						1.36E+09		1		Lanthanum Nitrate Hexahydrate	10277-43-7					1.3E+00			1.3E+00
															Lead Compounds									
8.5E-03	C	1.2E-05	C								1.36E+09		1		~Lead Phosphate	7446-27-7	8.2E+03		3.2E+07	8.2E+03				
2.1E-01	C	8.0E-05	C								1.36E+09		1	0.1	~Lead acetate	301-04-2	3.3E+02	1.2E+03	4.8E+06	2.6E+02				
											1.36E+09		1		~Lead and Compounds	7439-92-1								4.0E+02
3.8E-02	C	1.1E-05	C								1.36E+09		1	0.1	~Lead subacetate	1335-32-6	1.8E+03	6.5E+03	3.5E+07	1.4E+03				
				1.0E-07	I			V		2.43E+00	1.36E+09	1.91E+03	1		~Tetraethyl Lead	78-00-2					7.8E-03			7.8E-03
				5.0E-06	P			V		3.83E+02	1.36E+09	2.55E+04	1		Lewisite	541-25-3					3.9E-01			3.9E-01
				7.7E-03	O						1.36E+09		1	0.1	Linuron	330-55-2					6.0E+02	2.5E+03		4.9E+02
				2.0E-03	P						1.36E+09		1		Lithium	7439-93-2					1.6E+02			1.6E+02
				5.0E-04	I						1.36E+09		1	0.1	MCPA	94-74-6					3.9E+01	1.6E+02		3.2E+01
				4.4E-03	O						1.36E+09		1	0.1	MCPB	94-81-5					3.4E+02	1.5E+03		2.8E+02
				1.0E-03	I						1.36E+09		1	0.1	MCPP	93-65-2					7.8E+01	3.3E+02		6.3E+01
				2.0E-02	I						1.36E+09		1	0.1	Malathion	121-75-5					1.6E+03	6.6E+03		1.3E+03
				1.0E-01	I	7.0E-04	C				1.36E+09		1	0.1	Maleic Anhydride	108-31-6					7.8E+03	3.3E+04	9.9E+05	6.3E+03
				5.0E-01	I						1.36E+09		1	0.1	Maleic Hydrazide	123-33-1					3.9E+04	1.6E+05		3.2E+04
				1.0E-04	P						1.36E+09		1	0.1	Malononitrile	109-77-3					7.8E+00	3.3E+01		6.3E+00
				3.0E-02	H						1.36E+09		1	0.1	Mancozeb	8018-01-7					2.3E+03	9.9E+03		1.9E+03
				5.0E-03	I						1.36E+09		1	0.1	Maneb	12427-38-2					3.9E+02	1.6E+03		3.2E+02
				1.4E-01	I	5.0E-05	I						1		Manganese (Diet)	7439-96-5								
				2.4E-02	G	5.0E-05	I				1.36E+09		0.04		Manganese (Non-diet)	7439-96-5					1.9E+03		7.1E+04	1.8E+03
				9.0E-05	H						1.36E+09		1	0.1	Mephosfolan	950-10-7					7.0E+00	3.0E+01		5.7E+00
				3.0E-02	I						1.36E+09		1	0.1	Mepiquat Chloride	24307-26-4					2.3E+03	9.9E+03		1.9E+03
1.1E-02	P			4.0E-03	P						1.36E+09		1	0.1	Mercaptobenzothiazole, 2-	149-30-4	6.3E+03	2.2E+04		4.9E+03	3.1E+02	1.3E+03		2.5E+02
															Mercury Compounds									
				3.0E-04	I	3.0E-04	G				1.36E+09		0.07		~Mercuric Chloride (and other Mercury salts)	7487-94-7					2.3E+01		4.3E+05	2.3E+01
						3.0E-04	I	V		3.13E+00	1.36E+09	3.47E+04	1		~Mercury (elemental)	7439-97-6							1.1E+01	1.1E+01
				1.0E-04	I						1.36E+09		1		~Methyl Mercury	22967-92-6					7.8E+00			7.8E+00
				8.0E-05	I						1.36E+09		1	0.1	~Phenylmercuric Acetate	62-38-4					6.3E+00	2.6E+01		5.1E+00
				3.0E-05	I			V			1.36E+09	1.94E+06	1		Merphos	150-50-5					2.3E+00			2.3E+00
				6.0E-02	I						1.36E+09		1	0.1	Metalaxyl	57837-19-1					4.7E+03	2.0E+04		3.8E+03
				1.0E-04	I	3.0E-02	P	V		4.58E+03	1.36E+09	6.79E+03	1		Methacrylonitrile	126-98-7					7.8E+00		2.1E+02	7.5E+00
				5.0E-05	I						1.36E+09		1	0.1	Methamidophos	10265-92-6					3.9E+00	1.6E+01		3.2E+00
				2.0E+00	I	2.0E+01	I	V		1.06E+05	1.36E+09	2.90E+04	1		Methanol	67-56-1					1.6E+05		6.1E+05	1.2E+05
				1.5E-03	O						1.36E+09		1	0.1	Methidathion	950-37-8					1.2E+02	4.9E+02		9.5E+01
				2.5E-02	I						1.36E+09		1	0.1	Methomyl	16752-77-5					2.0E+03	8.2E+03		1.6E+03
4.9E-02	C										1.36E+09		1	0.1	Methoxy-5-nitroaniline, 2-	99-59-2	1.4E+03	5.0E+03		1.1E+03				
				5.0E-03	I						1.36E+09		1	0.1	Methoxychlor	72-43-5					3.9E+02	1.6E+03		3.2E+02
				8.0E-03	P	1.0E-03	P	V		1.15E+05	1.36E+09	1.24E+05	1		Methoxyethanol Acetate, 2-	110-49-6					6.3E+02		1.3E+02	1.1E+02
				5.0E-03	P	2.0E-02	I	V		1.06E+05	1.36E+09	1.01E+05	1		Methoxyethanol, 2-	109-86-4					3.9E+02		2.1E+03	3.3E+02
				1.0E+00	X			V		2.90E+04	1.36E+09	8.12E+03	1		Methyl Acetate	79-20-9					7.8E+04			7.8E+04
						2.0E-02	P	V		6.75E+03	1.36E+09	6.97E+03	1		Methyl Acrylate	96-33-3							1.5E+02	1.5E+02
				6.0E-01	I	5.0E+00	I	V		2.84E+04	1.36E+09	1.22E+04	1		Methyl Ethyl Ketone (2-Butanone)	78-93-3					4.7E+04		6.4E+04	2.7E+04
		1.0E-03	X	1.0E-03	P	2.0E-05	X	V		1.80E+05	1.36E+09	5.04E+04	1		Methyl Hydrazine	60-34-4			1.4E+01	1.4E+01	7.8E+01		1.1E+00	1.0E+00
						3.0E+00	I	V		3.36E+03	1.36E+09	1.06E+04	1		Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1							3.3E+04	3.3E+04
						1.0E-03	C	V		1.01E+04	1.36E+09	4.42E+03	1		Methyl Isocyanate	624-83-9							4.6E+00	4.6E+00
				1.4E+00	I	7.0E-01	I	V		2.36E+03	1.36E+09	6.33E+03	1		Methyl Methacrylate	80-62-6					1.1E+05		4.6E+03	4.4E+03
				2.5E-04	I						1.36E+09		1	0.1	Methyl Parathion	298-00-0					2.0E+01	8.2E+01		1.6E+01
				6.0E-02	X						1.36E+09		1	0.1	Methyl Phosphonic Acid	993-13-5					4.7E+03	2.0E+04		3.8E+03
				6.0E-03	H	4.0E-02	H	V		3.93E+02	1.36E+09	2.43E+04	1		Methyl Styrene (Mixed Isomers)	25013-15-4					4.7E+02		1.0E+03	3.2E+02
9.9E-02	C	2.8E-05	C								1.36E+09		1	0.1	Methyl methanesulfonate	66-27-3	7.0E+02	2.5E+03	1.4E+07	5.5E+02				
1.8E-03	C	2.6E-07	C			3.0E+00	I	V		8.87E+03	1.36E+09	4.90E+03	1		Methyl tert-Butyl Ether (MTBE)	1634-04-4	3.9E+04		5.3E+03	4.7E+03			1.5E+04	1.5E+04
				3.0E-04	X						1.36E+09		1	0.1	Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2					2.3E+01	9.9E+01		1.9E+01
						3.0E+00	X	V		2.45E+03	1.36E+09	1.72E+04	1		Methyl-2-Pentanol, 4-	108-11-2							5.4E+04	5.4E+04
9.0E-03	P			2.0E-02	X						1.36E+09		1	0.1	Methyl-5-Nitroaniline, 2-	99-55-8	7.7E+03	2.7E+04		6.0E+03	1.6E+03	6.6E+03		1.3E+03
8.3E+00	C	2.4E-03	C								1.36E+09		1	0.1	Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	8.4E+00	3.0E+01	1.6E+05	6.5E+00				

RMLs
TR=1E-04
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)
1.3E-01	C	3.7E-05	C								1.36E+09		1	0.1	Methylaniline Hydrochloride, 2-	636-21-5	5.3E+02	1.9E+03	1.0E+07	4.2E+02				
				1.0E-02	A						1.36E+09		1	0.1	Methylarsonic acid	124-58-3					7.8E+02	3.3E+03		6.3E+02
				2.0E-04	X						1.36E+09		1	0.1	Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7					1.6E+01	6.6E+01		1.3E+01
1.0E-01	X			3.0E-04	X						1.36E+09		1	0.1	Methylbenzene-1,4-diamine sulfate, 2-	615-50-9	7.0E+02	2.5E+03		5.4E+02	2.3E+01	9.9E+01		1.9E+01
2.2E+01	C	6.3E-03	C						M		1.36E+09		1	0.1	Methylcholanthrene, 3-	56-49-5	7.0E-01	2.7E+00	2.2E+04	5.5E-01				
2.0E-03	I	1.0E-08	I	6.0E-03	I	6.0E-01	I	V	M	3.32E+03	1.36E+09	2.19E+03	1		Methylene Chloride	75-09-2	7.7E+03		2.2E+04	5.7E+03	4.7E+02		1.4E+03	3.5E+02
1.0E-01	P	4.3E-04	C	2.0E-03	P				M		1.36E+09		1	0.1	Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	1.5E+02	6.0E+02	3.2E+05	1.2E+02	1.6E+02	6.6E+02		1.3E+02
4.6E-02	I	1.3E-05	C								1.36E+09		1	0.1	Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	1.5E+03	5.4E+03	2.9E+07	1.2E+03				
1.6E+00	C	4.6E-04	C			2.0E-02	C				1.36E+09		1	0.1	Methylenebisbenzenamine, 4,4'-	101-77-9	4.3E+01	1.5E+02	8.3E+05	3.4E+01			2.8E+07	2.8E+07
						6.0E-04	I				1.36E+09		1	0.1	Methylenediphenyl Diisocyanate	101-68-8							8.5E+05	8.5E+05
				7.0E-02	H			V		5.00E+02	1.36E+09	1.28E+04	1		Methylstyrene, Alpha-	98-83-9					5.5E+03			5.5E+03
				1.5E-01	I						1.36E+09		1	0.1	Metolachlor	51218-45-2					1.2E+04	4.9E+04		9.5E+03
				2.5E-02	I						1.36E+09		1	0.1	Metribuzin	21087-64-9					2.0E+03	8.2E+03		1.6E+03
				2.5E-01	I						1.36E+09		1	0.1	Metsulfuron-methyl	74223-64-6					2.0E+04	8.2E+04		1.6E+04
		4.5E-06	X	1.0E-02	X	1.0E-01	P	V		6.86E+00	1.36E+09	1.04E+03	1		Midrange Aliphatic Hydrocarbon Streams	E1790669			6.5E+01	6.5E+01	7.8E+02		1.1E+02	9.6E+01
				3.0E+00	P			V		3.42E-01	1.36E+09	1.38E+03	1		Mineral oils	8012-95-1					2.3E+05			2.3E+05
1.8E+01	C	5.1E-03	C	2.0E-04	I			V			1.36E+09	8.58E+05	1		Mirex	2385-85-5	3.9E+00		4.7E+01	3.6E+00	1.6E+01			1.6E+01
				2.0E-03	I						1.36E+09		1	0.1	Molinate	2212-67-1					1.6E+02	6.6E+02		1.3E+02
				5.0E-03	I	2.0E-03	A				1.36E+09		1		Molybdenum	7439-98-7					3.9E+02		2.8E+06	3.9E+02
				1.0E-01	I						1.36E+09		1		Monochloramine	10599-90-3					7.8E+03			7.8E+03
				2.0E-03	P						1.36E+09		1	0.1	Monomethylaniline	100-61-8					1.6E+02	6.6E+02		1.3E+02
				2.5E-02	I						1.36E+09		1	0.1	Myclobutanil	88671-89-0					2.0E+03	8.2E+03		1.6E+03
				3.0E-04	X						1.36E+09		1	0.1	N,N'-Diphenyl-1,4-benzenediamine	74-31-7					2.3E+01	9.9E+01		1.9E+01
				2.0E-03	I			V			1.36E+09	5.70E+04	1		Naled	300-76-5					1.6E+02			1.6E+02
				3.0E-02	X	1.0E-01	P	V			1.36E+09		1		Naphtha, High Flash Aromatic (HFAN)	64742-95-6					2.3E+03		1.4E+08	2.3E+03
1.8E+00	C	0.0E+00	C								1.36E+09		1	0.1	Naphthylamine, 2-	91-59-8	3.9E+01	1.4E+02		3.0E+01				
				1.2E-01	O						1.36E+09		1	0.1	Napropamide	15299-99-7					9.4E+03	4.0E+04		7.6E+03
9.1E-01	C	2.6E-04	C	1.1E-02	C	1.4E-05	C				1.36E+09		1	0.1	Nickel Acetate	373-02-4	7.6E+01	2.7E+02	1.5E+06	6.0E+01	8.6E+02	3.6E+03	2.0E+04	6.7E+02
9.1E-01	C	2.6E-04	C	1.1E-02	C	1.4E-05	C				1.36E+09		1	0.1	Nickel Carbonate	3333-67-3	7.6E+01	2.7E+02	1.5E+06	6.0E+01	8.6E+02	3.6E+03	2.0E+04	6.7E+02
9.1E-01	C	2.6E-04	C	1.1E-02	C	1.4E-05	C	V			1.36E+09		1		Nickel Carbonyl	13463-39-3	7.6E+01		1.5E+06	7.6E+01	8.6E+02		2.0E+04	8.2E+02
9.1E-01	C	2.6E-04	C	1.1E-02	C	1.4E-05	C				1.36E+09			0.04	Nickel Hydroxide	12054-48-7	7.6E+01		1.5E+06	7.6E+01	8.6E+02		2.0E+04	8.2E+02
9.1E-01	C	2.6E-04	C	1.1E-02	C	2.0E-05	C				1.36E+09			0.04	Nickel Oxide	1313-99-1	7.6E+01		1.5E+06	7.6E+01	8.6E+02		2.8E+04	8.4E+02
9.1E-01	C	2.4E-04	I	1.1E-02	C	1.4E-05	C				1.36E+09			0.04	Nickel Refinery Dust	E715532	7.6E+01		1.6E+06	7.6E+01	8.6E+02		2.0E+04	8.2E+02
		2.6E-04	C	2.0E-02	I	9.0E-05	A				1.36E+09			0.04	Nickel Soluble Salts	7440-02-0			1.5E+06	1.5E+06	1.6E+03		1.3E+05	1.5E+03
1.7E+00	C	4.8E-04	I	1.1E-02	C	1.4E-05	C				1.36E+09			0.04	Nickel Subsulfide	12035-72-2	4.1E+01		8.0E+05	4.1E+01	8.6E+02		2.0E+04	8.2E+02
9.1E-01	C	2.6E-04	C	1.1E-02	C	1.4E-05	C				1.36E+09		1	0.1	Nickelocene	1271-28-9	7.6E+01	2.7E+02	1.5E+06	6.0E+01	8.6E+02	3.6E+03	2.0E+04	6.7E+02
				1.6E+00	I						1.36E+09		1		Nitrate (measured as nitrogen)	14797-55-8					1.3E+05			1.3E+05
											1.36E+09		1		Nitrate + Nitrite (measured as nitrogen)	E701177								
				1.0E-01	I						1.36E+09		1		Nitrite (measured as nitrogen)	14797-65-0					7.8E+03			7.8E+03
				1.0E-02	X	5.0E-05	X				1.36E+09		1	0.1	Nitroaniline, 2-	88-74-4					7.8E+02	3.3E+03	7.1E+04	6.3E+02
2.0E-02	P			4.0E-03	P	6.0E-03	P				1.36E+09		1	0.1	Nitroaniline, 4-	100-01-6	3.5E+03	1.2E+04		2.7E+03	3.1E+02	1.3E+03	8.5E+06	2.5E+02
		4.0E-05	I	2.0E-03	I	9.0E-03	I	V		3.05E+03	1.36E+09	7.32E+04	1		Nitrobenzene	98-95-3			5.1E+02	5.1E+02	1.6E+02		6.9E+02	1.3E+02
				3.0E+03	P						1.36E+09		1	0.1	Nitrocellulose	9004-70-0					2.3E+08	9.9E+08		1.9E+08
				7.0E-02	H						1.36E+09		1	0.1	Nitrofurantoin	67-20-9					5.5E+03	2.3E+04		4.4E+03
1.3E+00	C	3.7E-04	C								1.36E+09		1	0.1	Nitrofurazone	59-87-0	5.3E+01	1.9E+02	1.0E+06	4.2E+01				
1.7E-02	P			1.0E-04	P						1.36E+09		1	0.1	Nitroglycerin	55-63-0	4.1E+03	1.5E+04		3.2E+03	7.8E+00	3.3E+01		6.3E+00
				1.0E-01	I						1.36E+09		1	0.1	Nitroguanidine	556-88-7					7.8E+03	3.3E+04		6.3E+03
		8.8E-06	P			5.0E-03	P	V		1.80E+04	1.36E+09	1.69E+04	1		Nitromethane	75-52-5			5.4E+02	5.4E+02			8.8E+01	8.8E+01
		5.8E-04	X			2.0E-02	I	V		4.86E+03	1.36E+09	1.31E+04	1		Nitropropane, 2-	79-46-9			6.4E+00	6.4E+00			2.7E+02	2.7E+02
2.7E+01	C	7.7E-03	C						M		1.36E+09		1	0.1	Nitroso-N-ethylurea, N-	759-73-9	5.7E-01	2.2E+00	1.8E+04	4.5E-01				
1.2E+02	C	3.4E-02	C						M		1.36E+09		1	0.1	Nitroso-N-methylurea, N-	684-93-5	1.3E-01	5.0E-01	4.1E+03	1.0E-01				
5.4E+00	I	1.6E-03	I					V			1.36E+09	2.43E+05	1		Nitroso-di-N-butylamine, N-	924-16-3	1.3E+01		4.3E+01	9.9E+00				
7.0E+00	I	2.0E-03	C								1.36E+09		1	0.1	Nitroso-di-N-propylamine, N-	621-64-7	9.9E+00	3.5E+01	1.9E+05	7.8E+00				
2.8E+00	I	8.0E-04	C								1.36E+09		1	0.1	Nitrosodiethanolamine, N-	1116-54-7	2.5E+01	8.8E+01	4.8E+05	1.9E+01				
1.5E+02	I	4.3E-02	I						M		1.36E+09		1	0.1	Nitrosodiethylamine, N-	55-18-5	1.0E-01	4.0E-01	3.2E+03	8.1E-02				
5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X	V	M	2.37E+05	1.36E+09	8.23E+04	1		Nitrosodimethylamine, N-	62-75-9	3.0E-01		6.0E-01	2.0E-01	6.3E-01		3.4E+00	5.3E-01
4.9E-03	I	2.6E-06	C								1.36E+09		1	0.1	Nitrosodiphenylamine, N-	86-30-6	1.4E+04	5.0E+04	1.5E+08	1.1E+04				
2.2E+01	I	6.3E-03	C					V		1.08E+05	1.36E+09	1.21E+05	1		Nitrosomethylethylamine, N-	10595-95-6	3.2E+00		5.4E+00	2.0E+00				
6.7E+00	C	1.9E-03	C								1.36E+09		1	0.1	Nitrosomorpholine [N-]	59-89-2	1.0E+01	3.7E+01	2.0E+05	8.1E+00				
9.4E+00	C	2.7E-03	C								1.36E+09		1	0.1	Nitrosopiperidine [N-]	100-75-4	7.4E+00	2.6E+01	1.4E+05	5.8E+00				
2.1E+00	I	6.1E-04	I								1.36E+09		1	0.1	Nitrosopyrrolidine, N-	930-55-2	3.3E+01	1.2E+02	6.3E+05	2.6E+01				
				1.0E-04	X						1.36E+09		1	0.1	Nitrotoluene, m-	99-08-1					7.8E+00	3.3E+01		6.3E+00
2.2E-01	P			9.0E-04	P			V		1.51E+03	1.36E+09	1.37E+05	1		Nitrotoluene, o-	88-72-2	3.2E+02			3.2E+02	7.0E+01			7.0E+01
1.6E-02	P			4.0E-03	P						1.36E+09		1	0.1	Nitrotoluene, p-	99-99-0	4.3E+03	1.5E+04		3.4E+03	3.1E+02	1.3E+03		2.5E+02
				3.0E-04	X	2.0E-02	P	V		6.86E+00	1.36E+09	1.04E+03	1		Nonane, n-	111-84-2					2.3E+01		2.2E+01	1.1E+01
				1.5E-02	O						1.36E+09		1	0.1	Norflurazon	27314-13-2					1.2E+03	4.9E+03		9.5E+02
				3.0E-03	I						1.36E+09		1	0.1	Octabromodiphenyl Ether	32536-52-0					2.3E+02	9.9E+02		1.9E+02
				5.0E-02	I						1.36E+09		1	0.006	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0					3.9E+03	2.7E+05		3.9E+03
				2.0E-03	H						1.36E+09		1	0.1	Octamethylpyrophosphoramide	152-16-9					1.6E+02	6.6E+02		1.3E+02
7.8E-03	O			1.4E-01	O						1.36E+09		1	0.1	Oryzalin	19044-88-3	8.9E+03	3.2E+04		7.0E+03	1.1E+04	4.6E+04		8.8E+03
				5.0E-03	I						1.36E+09		1	0.1	Oxadiazon	19666-30-9					3.9E+02	1.6E+03		3.2E+02
				2.5E-02	I						1.36E+09		1	0.1	Oxamyl	23135-22-0					2.0E+03	8.2E+03		1.6E+03
7.3E-02	O			3.0E-02	O						1.36E+09		1	0.1	Oxyfluorfen	42874-03-3	9.5E+02	3.4E+03		7.4E+02	2.3E+03	9.9E+03		1.9E+03
				1.3E-02	I						1.36E+09		1	0.1	Paclobutrazol	76738-62-0					1.0E+03	4.3E+03		8.2E+02
				4.5E-03	I						1.36E+09		1	0.1	Paraquat Dichloride	1910-42-5					3.5E+02	1.5E+03		2.8E+02
				6.0E-03	H						1.36E+09		1	0.1	Parathion	56-38-2					4.7E+02	2.0E+03		3.8E+02
				5.0E-02	H			V			1.36E+09	4.49E+04	1		Pebulate	1114-71-2					3.9E+03			3.9E+03
				3.0E-01	O						1.36E+09		1	0.1	Pendimethalin	40487-42-1					2.3E+04	9.9E+04		1.9E+04

RMLs
TR=1E-04
HQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)
				2.0E-03	I			V		3.12E-01	1.36E+09	5.13E+05	1		Pentabromodiphenyl Ether	32534-81-9					1.6E+02			1.6E+02
				1.0E-04	I						1.36E+09		1	0.1	Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9					7.8E+00	3.3E+01		6.3E+00
				8.0E-04	I			V			1.36E+09	8.12E+04	1		Pentachlorobenzene	608-93-5					6.3E+01			6.3E+01
9.0E-02	P							V		4.57E+02	1.36E+09	9.65E+03	1		Pentachloroethane	76-01-7	7.7E+02			7.7E+02				
2.6E-01	H			3.0E-03	I			V			1.36E+09	4.32E+05	1		Pentachloronitrobenzene	82-68-8	2.7E+02			2.7E+02	2.3E+02			2.3E+02
4.0E-01	I	5.1E-06	C	5.0E-03	I						1.36E+09		1	0.25	Pentachlorophenol	87-86-5	1.7E+02	2.5E+02	7.5E+07	1.0E+02	3.9E+02	6.6E+02		2.5E+02
4.0E-03	X			2.0E-03	P						1.36E+09		1	0.1	Pentaerythritol tetranitrate (PETN)	78-11-5	1.7E+04	6.2E+04		1.4E+04	1.6E+02	6.6E+02		1.3E+02
				1.0E-04	X						1.36E+09		1	0.1	Pentamethylphosphoramide (PMPA)	10159-46-3					7.8E+00	3.3E+01		6.3E+00
						1.0E+00	P	V		3.88E+02	1.36E+09	7.79E+02	1		Pentane, n-	109-66-0							8.1E+02	8.1E+02
															Perchlorates									
				7.0E-04	I						1.36E+09		1		~Ammonium Perchlorate	7790-98-9					5.5E+01			5.5E+01
				7.0E-04	I						1.36E+09		1		~Lithium Perchlorate	7791-03-9					5.5E+01			5.5E+01
				7.0E-04	I						1.36E+09		1		~Perchlorate and Perchlorate Salts	14797-73-0					5.5E+01			5.5E+01
				7.0E-04	I						1.36E+09		1		~Potassium Perchlorate	7778-74-7					5.5E+01			5.5E+01
				7.0E-04	I						1.36E+09		1		~Sodium Perchlorate	7601-89-0					5.5E+01			5.5E+01
				2.0E-02	P						1.36E+09		1	0.1	Perfluorobutane sulfonic acid (PFBS)	375-73-5					1.6E+03	6.6E+03		1.3E+03
				2.0E-02	P						1.36E+09		1	0.1	Perfluorobutanesulfonate	45187-15-3					1.6E+03	6.6E+03		1.3E+03
				5.0E-02	I						1.36E+09		1	0.1	Permethrin	52645-53-1					3.9E+03	1.6E+04		3.2E+03
2.2E-03	C	6.3E-07	C								1.36E+09		1	0.1	Phenacetin	62-44-2	3.2E+04	1.1E+05	6.1E+08	2.5E+04				
				2.4E-01	O						1.36E+09		1	0.1	Phenmedipham	13684-63-4					1.9E+04	7.9E+04		1.5E+04
				3.0E-01	I	2.0E-01	C				1.36E+09		1	0.1	Phenol	108-95-2					2.3E+04	9.9E+04	2.8E+08	1.9E+04
				4.0E-03	I						1.36E+09		1	0.1	Phenol, 2-(1-methylethoxy)-, methylcarbamate	114-26-1					3.1E+02	1.3E+03		2.5E+02
				5.0E-04	X						1.36E+09		1	0.1	Phenothiazine	92-84-2					3.9E+01	1.6E+02		3.2E+01
				2.0E-04	X			V		1.29E+02	1.36E+09	7.06E+03	1		Phenyl Isothiocyanate	103-72-0					1.6E+01			1.6E+01
				6.0E-03	I						1.36E+09		1	0.1	Phenylenediamine, m-	108-45-2					4.7E+02	2.0E+03		3.8E+02
1.2E-01	P			4.0E-03	P						1.36E+09		1	0.1	Phenylenediamine, o-	95-54-5	5.8E+02	2.1E+03		4.5E+02	3.1E+02	1.3E+03		2.5E+02
				1.0E-03	X						1.36E+09		1	0.1	Phenylenediamine, p-	106-50-3					7.8E+01	3.3E+02		6.3E+01
1.9E-03	H										1.36E+09		1	0.1	Phenylphenol, 2-	90-43-7	3.6E+04	1.3E+05		2.8E+04				
				2.0E-04	H						1.36E+09		1	0.1	Phorate	298-02-2					1.6E+01	6.6E+01		1.3E+01
						3.0E-04	I	V		1.61E+03	1.36E+09	9.81E+02	1		Phosgene	75-44-5							3.1E-01	3.1E-01
				2.0E-02	I						1.36E+09		1	0.1	Phosmet	732-11-6					1.6E+03	6.6E+03		1.3E+03
															Phosphates, Inorganic									
				4.9E+01	P						1.36E+09		1		~Aluminum metaphosphate	13776-88-0					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Ammonium polyphosphate	68333-79-9					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Calcium pyrophosphate	7790-76-3					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Diammonium phosphate	7783-28-0					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Dicalcium phosphate	7757-93-9					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Dimagnesium phosphate	7782-75-4					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Dipotassium phosphate	7758-11-4					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Disodium phosphate	7558-79-4					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Monoaluminum phosphate	13530-50-2					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Monoammonium phosphate	7722-76-1					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Monocalcium phosphate	7758-23-8					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Monomagnesium phosphate	7757-86-0					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Monopotassium phosphate	7778-77-0					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Monosodium phosphate	7558-80-7					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Polyphosphoric acid	8017-16-1					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Potassium tripolyphosphate	13845-36-8					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Sodium acid pyrophosphate	7758-16-9					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Sodium aluminum phosphate (acidic)	7785-88-8					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Sodium aluminum phosphate (anhydrous)	10279-59-1					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Sodium aluminum phosphate (tetrahydrate)	10305-76-7					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Sodium hexametaphosphate	10124-56-8					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Sodium polyphosphate	68915-31-1					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Sodium trimetaphosphate	7785-84-4					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Sodium tripolyphosphate	7758-29-4					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Tetrapotassium phosphate	7320-34-5					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Tetrasodium pyrophosphate	7722-88-5					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Tricalcium phosphate	7758-87-4					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Trimagnesium phosphate	7757-87-1					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Tripotassium phosphate	7778-53-2					3.8E+06			3.8E+06
				4.9E+01	P						1.36E+09		1		~Trisodium phosphate	7601-54-9					3.8E+06			3.8E+06
				3.0E-04	I	3.0E-04	I	V			1.36E+09		1		Phosphine	7803-51-2					2.3E+01		4.3E+05	2.3E+01
				4.9E+01	P	1.0E-02	I				1.36E+09		1		Phosphoric Acid	7664-38-2					3.8E+06		1.4E+07	3.0E+06
				2.0E-05	I			V			1.36E+09	6.92E+03	1		Phosphorus, White	7723-14-0					1.6E+00			1.6E+00
															Phthalates									
1.4E-02	I	2.4E-06	C	2.0E-02	I						1.36E+09		1	0.1	~Bis(2-ethylhexyl)phthalate	117-81-7	5.0E+03	1.8E+04	1.6E+08	3.9E+03	1.6E+03	6.6E+03		1.3E+03
1.9E-03	P			2.0E-01	I						1.36E+09		1	0.1	~Butyl Benzyl Phthalate	85-68-7	3.7E+04	1.3E+05		2.9E+04	1.6E+04	6.6E+04		1.3E+04
				1.0E+00	I						1.36E+09		1	0.1	~Butylphthalyl Butylglycolate	85-70-1					7.8E+04	3.3E+05		6.3E+04
				1.0E-01	I						1.36E+09		1	0.1	~Dibutyl Phthalate	84-74-2					7.8E+03	3.3E+04		6.3E+03
				8.0E-01	I						1.36E+09		1	0.1	~Diethyl Phthalate	84-66-2					6.3E+04	2.6E+05		5.1E+04
				1.0E-01	I			V			1.36E+09	2.13E+04	1		~Dimethylterephthalate	120-61-6					7.8E+03			7.8E+03
				1.0E-02	P						1.36E+09		1	0.1	~Octyl Phthalate, di-N-	117-84-0					7.8E+02	3.3E+03		6.3E+02
				5.0E-01	X						1.36E+09		1	0.1	~Phthalic Acid, p-	100-21-0					3.9E+04	1.6E+05		3.2E+04
				2.0E+00	I	2.0E-02	C				1.36E+09		1	0.1	~Phthalic Anhydride	85-44-9					1.6E+05	6.6E+05	2.8E+07	1.3E+05
				7.0E-02	I						1.36E+09		1	0.1	Picloram	1918-02-1					5.5E+03	2.3E+04		4.4E+03
				1.0E-04	X						1.36E+09		1	0.1	Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3					7.8E+00	3.3E+01		6.3E+00

RMLs
TR=1E-04
HQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)
				2.0E-03	X						1.36E+09		1	0.1	Picric Acid (2,4,6-Trinitrophenol)	88-89-1					1.6E+02	6.6E+02		1.3E+02
				7.0E-05	O						1.36E+09		1	0.1	Pirimiphos, Methyl	29232-93-7					5.5E+00	2.3E+01		4.4E+00
3.0E+01	C	8.6E-03	C	7.0E-06	H						1.36E+09		1	0.1	Polybrominated Biphenyls	36355-01-8	2.3E+00	8.2E+00	4.4E+04	1.8E+00	5.5E-01	2.3E+00		4.4E-01
															Polychlorinated Biphenyls (PCBs)									
7.0E-02	G	2.0E-05	G	7.0E-05	I			V			1.36E+09	5.86E+05	1	0.14	~Aroclor 1016	12674-11-2	9.9E+02	2.5E+03	8.2E+03	6.6E+02	5.5E+00	1.6E+01		4.1E+00
2.0E+00	G	5.7E-04	G					V			1.36E+09	2.04E+05	1	0.14	~Aroclor 1221	11104-28-2	3.5E+01	8.8E+01	1.0E+02	2.0E+01				
2.0E+00	G	5.7E-04	G					V			1.36E+09	1.12E+05	1	0.14	~Aroclor 1232	11141-16-5	3.5E+01	8.8E+01	5.5E+01	1.7E+01				
2.0E+00	G	5.7E-04	G					V			1.36E+09	5.91E+05	1	0.14	~Aroclor 1242	53469-21-9	3.5E+01	8.8E+01	2.9E+02	2.3E+01				
2.0E+00	G	5.7E-04	G					V			1.36E+09	5.14E+05	1	0.14	~Aroclor 1248	12672-29-6	3.5E+01	8.8E+01	2.5E+02	2.3E+01				
2.0E+00	G	5.7E-04	G	2.0E-05	I			V			1.36E+09	8.43E+05	1	0.14	~Aroclor 1254	11097-69-1	3.5E+01	8.8E+01	4.1E+02	2.4E+01	1.6E+00	4.7E+00		1.2E+00
2.0E+00	G	5.7E-04	G					V			1.36E+09	1.31E+06	1	0.14	~Aroclor 1260	11096-82-5	3.5E+01	8.8E+01	6.5E+02	2.4E+01				
				6.0E-04	X			V			1.36E+09	1.15E+06	1	0.14	~Aroclor 5460	11126-42-4					4.7E+01	1.4E+02		3.5E+01
3.9E+00	W	1.1E-03	W	2.3E-05	W	1.3E-03	W	V			1.36E+09	2.43E+06	1	0.14	~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.8E+01	4.5E+01	6.0E+02	1.3E+01	1.8E+00	5.5E+00	3.4E+03	1.4E+00
3.9E+00	W	1.1E-03	W	2.3E-05	W	1.3E-03	W	V			1.36E+09	1.58E+06	1	0.14	~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.8E+01	4.5E+01	3.9E+02	1.2E+01	1.8E+00	5.5E+00	2.2E+03	1.4E+00
3.9E+00	W	1.1E-03	W	2.3E-05	W	1.3E-03	W	V			1.36E+09	1.04E+06	1	0.14	~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	1.8E+01	4.5E+01	2.6E+02	1.2E+01	1.8E+00	5.5E+00	1.4E+03	1.4E+00
3.9E+00	W	1.1E-03	W	2.3E-05	W	1.3E-03	W	V			1.36E+09	1.11E+06	1	0.14	~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	1.8E+01	4.5E+01	2.7E+02	1.2E+01	1.8E+00	5.5E+00	1.5E+03	1.4E+00
3.9E+03	W	1.1E+00	W	2.3E-08	W	1.3E-06	W	V			1.36E+09	1.58E+06	1	0.14	~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	1.8E-02	4.5E-02	3.9E-01	1.2E-02	1.8E-03	5.5E-03	2.2E+00	1.4E-03
3.9E+00	W	1.1E-03	W	2.3E-05	W	1.3E-03	W	V			1.36E+09	7.33E+05	1	0.14	~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	1.8E+01	4.5E+01	1.8E+02	1.2E+01	1.8E+00	5.5E+00	1.0E+03	1.4E+00
3.9E+00	W	1.1E-03	W	2.3E-05	W	1.3E-03	W	V			1.36E+09	5.90E+05	1	0.14	~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	1.8E+01	4.5E+01	1.5E+02	1.2E+01	1.8E+00	5.5E+00	8.2E+02	1.4E+00
3.9E+00	W	1.1E-03	W	2.3E-05	W	1.3E-03	W	V			1.36E+09	6.01E+05	1	0.14	~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	1.8E+01	4.5E+01	1.5E+02	1.2E+01	1.8E+00	5.5E+00	8.4E+02	1.4E+00
3.9E+00	W	1.1E-03	W	2.3E-05	W	1.3E-03	W	V			1.36E+09	1.05E+06	1	0.14	~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	1.8E+01	4.5E+01	2.6E+02	1.2E+01	1.8E+00	5.5E+00	1.5E+03	1.4E+00
1.3E+04	W	3.8E+00	W	7.0E-09	W	4.0E-07	W	V			1.36E+09	7.26E+05	1	0.14	~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	5.3E-03	1.4E-02	5.4E-02	3.6E-03	5.5E-04	1.6E-03	3.0E-01	4.1E-04
2.0E+00	I	5.7E-04	I					V			1.36E+09	5.32E+05	1	0.14	~Polychlorinated Biphenyls (high risk)	1336-36-3	3.5E+01	8.8E+01	2.6E+02	2.3E+01				
4.0E-01	I	1.0E-04	I					V					1	0.14	~Polychlorinated Biphenyls (low risk)	1336-36-3								
7.0E-02	I	2.0E-05	I					V					1	0.14	~Polychlorinated Biphenyls (lowest risk)	1336-36-3								
1.3E+01	W	3.8E-03	W	7.0E-06	W	4.0E-04	W				1.36E+09		1	0.14	~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	5.3E+00	1.4E+01	1.0E+05	3.8E+00	5.5E-01	1.6E+00	5.7E+05	4.1E-01
3.9E+01	W	1.1E-02	W	2.3E-06	W	1.3E-04	W	V			1.36E+09	5.09E+05	1	0.14	~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	1.8E+00	4.5E+00	1.3E+01	1.2E+00	1.8E-01	5.5E-01	7.1E+01	1.4E-01
						6.0E-04	I				1.36E+09		1	0.1	Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9							8.5E+05	8.5E+05
															Polynuclear Aromatic Hydrocarbons (PAHs)									
				6.0E-02	I			V			1.36E+09	1.41E+05	1	0.13	~Acenaphthene	83-32-9					4.7E+03	1.5E+04		3.6E+03
				3.0E-01	I			V			1.36E+09	5.23E+05	1	0.13	~Anthracene	120-12-7					2.3E+04	7.6E+04		1.8E+04
1.0E-01	E	6.0E-05	E					V	M		1.36E+09	4.41E+06	1	0.13	~Benz[a]anthracene	56-55-3	1.5E+02	4.6E+02	7.4E+03	1.1E+02				
1.2E+00	C	1.1E-04	C								1.36E+09		1	0.13	~Benzo(j)fluoranthene	205-82-3	5.8E+01	1.6E+02	3.5E+06	4.2E+01				
1.0E+00	I	6.0E-04	I	3.0E-04	I	2.0E-06	I		M		1.36E+09		1	0.13	~Benzo[a]pyrene	50-32-8	1.5E+01	4.6E+01	2.3E+05	1.1E+01	2.3E+01	7.6E+01	2.8E+03	1.8E+01
1.0E-01	E	6.0E-05	E						M		1.36E+09		1	0.13	~Benzo[b]fluoranthene	205-99-2	1.5E+02	4.6E+02	2.3E+06	1.1E+02				
1.0E-02	E	6.0E-06	E						M		1.36E+09		1	0.13	~Benzo[k]fluoranthene	207-08-9	1.5E+03	4.6E+03	2.3E+07	1.1E+03				
				8.0E-02	I			V			1.36E+09	7.99E+04	1	0.13	~Chloronaphthalene, Beta-	91-58-7					6.3E+03	2.0E+04		4.8E+03
1.0E-03	E	6.0E-07	E						M		1.36E+09		1	0.13	~Chrysene	218-01-9	1.5E+04	4.6E+04	2.3E+08	1.1E+04				
1.0E+00	E	6.0E-04	E						M		1.36E+09		1	0.13	~Dibenz[a,h]anthracene	53-70-3	1.5E+01	4.6E+01	2.3E+05	1.1E+01				
1.2E+01	C	1.1E-03	C								1.36E+09		1	0.13	~Dibenzo(a,e)pyrene	192-65-4	5.8E+00	1.6E+01	3.5E+05	4.2E+00				
2.5E+02	C	7.1E-02	C						M		1.36E+09		1	0.13	~Dimethylbenz(a)anthracene, 7,12-	57-97-6	6.1E-02	1.8E-01	1.9E+03	4.6E-02				
				4.0E-02	I						1.36E+09		1	0.13	~Fluoranthene	206-44-0					3.1E+03	1.0E+04		2.4E+03
				4.0E-02	I			V			1.36E+09	2.81E+05	1	0.13	~Fluorene	86-73-7					3.1E+03	1.0E+04		2.4E+03
1.0E-01	E	6.0E-05	E						M		1.36E+09		1	0.13	~Indeno[1,2,3-cd]pyrene	193-39-5	1.5E+02	4.6E+02	2.3E+06	1.1E+02				
2.9E-02	P			7.0E-02	A			V		3.94E+02	1.36E+09	5.86E+04	1	0.13	~Methylnaphthalene, 1-	90-12-0	2.4E+03	6.6E+03		1.8E+03	5.5E+03	1.8E+04		4.2E+03
				4.0E-03	I			V			1.36E+09	5.80E+04	1	0.13	~Methylnaphthalene, 2-	91-57-6					3.1E+02	1.0E+03		2.4E+02
1.2E-01	C	3.4E-05	C	2.0E-02	I	3.0E-03	I	V			1.36E+09	4.63E+04	1	0.13	~Naphthalene	91-20-3	5.8E+02	1.6E+03	3.8E+02	2.0E+02	1.6E+03	5.1E+03	1.4E+02	1.3E+02
1.2E+00	C	1.1E-04	C								1.36E+09		1	0.13	~Nitropyrene, 4-	57835-92-4	5.8E+01	1.6E+02	3.5E+06	4.2E+01				
				3.0E-02	I			V			1.36E+09	2.38E+06	1	0.13	~Pyrene	129-00-0					2.3E+03	7.6E+03		1.8E+03
				2.0E-02	P						1.36E+09		1	0.1	Potassium Perfluorobutane Sulfonate	29420-49-3					1.6E+03	6.6E+03		1.3E+03
1.5E-01	I			9.0E-03	I						1.36E+09		1	0.1	Prochloraz	67747-09-5	4.6E+02	1.6E+03		3.6E+02	7.0E+02	3.0E+03		5.7E+02
				6.0E-03	H			V			1.36E+09	4.20E+05	1		Profluralin	26399-36-0					4.7E+02			4.7E+02
				1.5E-02	I						1.36E+09		1	0.1	Prometon	1610-18-0					1.2E+03	4.9E+03		9.5E+02
				4.0E-02	O						1.36E+09		1	0.1	Prometryn	7287-19-6					3.1E+03	1.3E+04		2.5E+03
				7.5E-02	I						1.36E+09		1	0.1	Pronamide	23950-58-5					5.9E+03	2.5E+04		4.7E+03
				1.3E-02	I						1.36E+09		1	0.1	Propachlor	1918-16-7					1.0E+03	4.3E+03		8.2E+02
				5.0E-03	I						1.36E+09		1	0.1	Propanil	709-98-8					3.9E+02	1.6E+03		3.2E+02
1.9E-01	O			4.0E-02	O						1.36E+09		1	0.1	Propargite	2312-35-8	3.6E+02	1.3E+03		2.8E+02	3.1E+03	1.3E+04		2.5E+03
				2.0E-03	I			V		1.11E+05	1.36E+09	6.27E+04	1		Propargyl Alcohol	107-19-7					1.6E+02			1.6E+02
				2.0E-02	I						1.36E+09		1	0.1	Propazine	139-40-2					1.6E+03	6.6E+03		1.3E+03
				2.0E-02	I						1.36E+09		1	0.1	Propham	122-42-9					1.6E+03	6.6E+03		1.3E+03
				1.0E-01	O						1.36E+09		1	0.1	Propiconazole	60207-90-1					7.8E+03	3.3E+04		6.3E+03
						8.0E-03	I	V		3.26E+04	1.36E+09	8.94E+03	1		Propionaldehyde	123-38-6							7.5E+01	7.5E+01
				1.0E-01	X	1.0E+00	X	V		2.64E+02	1.36E+09	6.99E+03	1		Propyl benzene	103-65-1					7.8E+03		7.3E+03	3.8E+03
						3.0E+00	C	V		3.49E+02	1.36E+09	7.04E+02	1		Propylene	115-07-1							2.2E+03	2.2E+03
				2.0E+01	P						1.36E+09		1	0.1	Propylene Glycol	57-55-6					1.6E+06	6.6E+06		1.3E+06
						2.7E-04	A				1.36E+09		1	0.1	Propylene Glycol Dinitrate	6423-43-4							3.9E+05	3.9E+05
				7.0E-01	H	2.0E+00	I	V		1.06E+05	1.36E+09	7.83E+04	1		Propylene Glycol Monomethyl Ether	107-98-2					5.5E+04		1.6E+05	4.1E+04
2.4E-01	I	3.7E-06	I			3.0E-02	I	V		7.77E+04	1.36E+09	1.03E+04	1		Propylene Oxide	75-56-9	2.9E+02		7.8E+02	2.1E+02			3.2E+02	3.2E+02
				1.0E-03	I			V		5.30E+05	1.36E+09	5.54E+04	1		Pyridine	110-86-1					7.8E+01			7.8E+01
				5.0E-04	I						1.36E+09		1	0.1	Quinalphos	13593-03-8					3.9E+01	1.6E+02		3.2E+01
3.0E+00	I										1.36E+09		1	0.1	Quinoline	91-22-5	2.3E+01	8.2E+01		1.8E+01				
				9.0E-03	I						1.36E+09		1	0.1	Quizalofop-ethyl	76578-14-8					7.0E+02	3.0E+03		5.7E+02
						3.0E+04	A						1		Refractory Ceramic Fibers (units in fibers)	E715557								
				3.0E-02	I						1.36E+09		1	0.1	Resmethrin	10453-86-8					2.3E+03	9.9E+03		1.9E+03
				5.0E-02	H			V			1.36E+09	4.65E+05	1		Ronnel	299-84-3					3.9E+03			3.9E+03
				4.0E-03	I						1.36E+09		1	0.1	Rotenone	83-79-4					3.1E+02	1.3E+03		2.5E+02
2.2E-01	C	6.3E-05	C						M		1.36E+09		1	0.1	Safrole	94-59-7	7.0E+01	2.7E+02	2.2E+06	5.5E+01				

TRMLs
TR=1E-04
HQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)
				5.0E-03	I						1.36E+09		1		Selenious Acid	7783-00-8					3.9E+02			3.9E+02
				5.0E-03	I	2.0E-02	C				1.36E+09		1		Selenium	7782-49-2					3.9E+02		2.8E+07	3.9E+02
				5.0E-03	C	2.0E-02	C				1.36E+09		1		Selenium Sulfide	7446-34-6					3.9E+02		2.8E+07	3.9E+02
				1.4E-01	O						1.36E+09		1	0.1	Sethoxydim	74051-80-2					1.1E+04	4.6E+04		8.8E+03
						3.0E-03	C				1.36E+09		1		Silica (crystalline, respirable)	7631-86-9							4.3E+06	4.3E+06
				5.0E-03	I						1.36E+09		0.04		Silver	7440-22-4					3.9E+02			3.9E+02
1.2E-01	H			5.0E-03	I						1.36E+09		1	0.1	Simazine	122-34-9	5.8E+02	2.1E+03		4.5E+02	3.9E+02	1.6E+03		3.2E+02
				1.3E-02	I						1.36E+09		1	0.1	Sodium Acifluorfen	62476-59-9					1.0E+03	4.3E+03		8.2E+02
				4.0E-03	I						1.36E+09		1		Sodium Azide	26628-22-8					3.1E+02			3.1E+02
2.7E-01	H			3.0E-02	I						1.36E+09		1	0.1	Sodium Diethyldithiocarbamate	148-18-5	2.6E+02	9.2E+02		2.0E+02	2.3E+03	9.9E+03		1.9E+03
				5.0E-02	A	1.3E-02	C				1.36E+09		1		Sodium Fluoride	7681-49-4					3.9E+03		1.8E+07	3.9E+03
				2.0E-05	I						1.36E+09		1	0.1	Sodium Fluoroacetate	62-74-8					1.6E+00	6.6E+00		1.3E+00
				1.0E-03	H						1.36E+09		1		Sodium Metavanadate	13718-26-8					7.8E+01			7.8E+01
				8.0E-04	P						1.36E+09		1		Sodium Tungstate	13472-45-2					6.3E+01			6.3E+01
				8.0E-04	P						1.36E+09		1		Sodium Tungstate Dihydrate	10213-10-2					6.3E+01			6.3E+01
2.4E-02	H			3.0E-02	I						1.36E+09		1	0.1	Stirofos (Tetrachlorovinphos)	961-11-5	2.9E+03	1.0E+04		2.3E+03	2.3E+03	9.9E+03		1.9E+03
				6.0E-01	I						1.36E+09		1		Strontium, Stable	7440-24-6					4.7E+04			4.7E+04
				3.0E-04	I						1.36E+09		1	0.1	Strychnine	57-24-9					2.3E+01	9.9E+01		1.9E+01
				2.0E-01	I	1.0E+00	I	V		8.67E+02	1.36E+09	9.35E+03	1		Styrene	100-42-5					1.6E+04		9.7E+03	6.0E+03
				3.0E-03	P						1.36E+09		1	0.1	Styrene-Acrylonitrile (SAN) Trimer (THNA isomer)	57964-39-3					2.3E+02	9.9E+02		1.9E+02
				3.0E-03	P						1.36E+09		1	0.1	Styrene-Acrylonitrile (SAN) Trimer (THNP isomer)	57964-40-6					2.3E+02	9.9E+02		1.9E+02
				1.0E-03	P	2.0E-03	X				1.36E+09		1	0.1	Sulfolane	126-33-0					7.8E+01	3.3E+02	2.8E+06	6.3E+01
				8.0E-04	P						1.36E+09		1	0.1	Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9					6.3E+01	2.6E+02		5.1E+01
						1.0E-03	C	V			1.36E+09		1		Sulfur Trioxide	7446-11-9							1.4E+06	1.4E+06
						1.0E-03	C				1.36E+09		1		Sulfuric Acid	7664-93-9							1.4E+06	1.4E+06
2.5E-02	I	7.1E-06	I	5.0E-02	H						1.36E+09		1	0.1	Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8	2.8E+03	9.9E+03	5.4E+07	2.2E+03	3.9E+03	1.6E+04		3.2E+03
				3.0E-02	H						1.36E+09		1	0.1	TCMTB	21564-17-0					2.3E+03	9.9E+03		1.9E+03
				7.0E-02	I						1.36E+09		1	0.1	Tebuthiuron	34014-18-1					5.5E+03	2.3E+04		4.4E+03
				2.0E-02	H						1.36E+09		1	0.1	Temephos	3383-96-8					1.6E+03	6.6E+03		1.3E+03
				1.3E-02	I						1.36E+09		1	0.1	Terbacil	5902-51-2					1.0E+03	4.3E+03		8.2E+02
				2.5E-05	H			V		3.09E+01	1.36E+09	2.64E+05	1		Terbufos	13071-79-9					2.0E+00			2.0E+00
				1.0E-03	I						1.36E+09		1	0.1	Terbutryn	886-50-0					7.8E+01	3.3E+02		6.3E+01
5.0E-03	C	1.3E-06	C					V			1.36E+09	3.99E+03	1		Tert-Butyl Acetate	540-88-5	1.4E+04		8.6E+02	8.1E+02				
				1.0E-04	I						1.36E+09		1	0.1	Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1					7.8E+00	3.3E+01		6.3E+00
				3.0E-04	I			V			1.36E+09	5.07E+04	1		Tetrachlorobenzene, 1,2,4,5-	95-94-3					2.3E+01			2.3E+01
2.6E-02	I	7.4E-06	I	3.0E-02	I			V		6.80E+02	1.36E+09	5.68E+03	1		Tetrachloroethane, 1,1,1,2-	630-20-6	2.7E+03		2.2E+02	2.0E+02	2.3E+03			2.3E+03
2.0E-01	I	5.8E-05	C	2.0E-02	I			V		1.90E+03	1.36E+09	1.51E+04	1		Tetrachloroethane, 1,1,2,2-	79-34-5	3.5E+02		7.3E+01	6.0E+01	1.6E+03			1.6E+03
2.1E-03	I	2.6E-07	I	6.0E-03	I	4.0E-02	I	V		1.66E+02	1.36E+09	2.35E+03	1		Tetrachloroethylene	127-18-4	3.3E+04		2.5E+03	2.4E+03	4.7E+02		9.8E+01	8.1E+01
				3.0E-02	I						1.36E+09		1	0.1	Tetrachlorophenol, 2,3,4,6-	58-90-2					2.3E+03	9.9E+03		1.9E+03
1.6E+01	X			6.0E-05	X			V			1.36E+09	1.05E+05	1		Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	4.3E+00			4.3E+00	4.7E+00			4.7E+00
				5.0E-04	I						1.36E+09		1	0.1	Tetraethyl Dithiopyrophosphate	3689-24-5					3.9E+01	1.6E+02		3.2E+01
						8.0E+01	I	V		2.05E+03	1.36E+09	1.22E+03	1		Tetrafluoroethane, 1,1,1,2-	811-97-2							1.0E+05	1.0E+05
				1.0E-04	X						1.36E+09		1	0.1	Tetramethylphosphoramide, -N,N,N',N" (TMPA)	16853-36-4					7.8E+00	3.3E+01		6.3E+00
				2.0E-03	P						1.36E+09		1	0.00065	Tetryl (Trinitrophenylmethylnitramine)	479-45-8					1.6E+02	1.0E+05		1.6E+02
				2.0E-05	G						1.36E+09		1		Thallic Oxide	1314-32-5					1.6E+00			1.6E+00
				1.0E-05	X						1.36E+09		1		Thallium (I) Nitrate	10102-45-1					7.8E-01			7.8E-01
				1.0E-05	X						1.36E+09		1		Thallium (Soluble Salts)	7440-28-0					7.8E-01			7.8E-01
				1.0E-05	X			V			1.36E+09		1		Thallium Acetate	563-68-8					7.8E-01			7.8E-01
				2.0E-05	X			V			1.36E+09		1		Thallium Carbonate	6533-73-9					1.6E+00			1.6E+00
				1.0E-05	X						1.36E+09		1		Thallium Chloride	7791-12-0					7.8E-01			7.8E-01
				1.0E-05	G						1.36E+09		1		Thallium Selenite	12039-52-0					7.8E-01			7.8E-01
				2.0E-05	X						1.36E+09		1		Thallium Sulfate	7446-18-6					1.6E+00			1.6E+00
				4.3E-02	O						1.36E+09		1	0.1	Thifensulfuron-methyl	79277-27-3					3.4E+03	1.4E+04		2.7E+03
				1.0E-02	I						1.36E+09		1	0.1	Thiobencarb	28249-77-6					7.8E+02	3.3E+03		6.3E+02
				7.0E-02	X						1.36E+09		1	0.0075	Thiodiglycol	111-48-8					5.5E+03	3.1E+05		5.4E+03
				3.0E-04	H						1.36E+09		1	0.1	Thiofanox	39196-18-4					2.3E+01	9.9E+01		1.9E+01
1.2E-02	O			2.7E-02	O						1.36E+09		1	0.1	Thiophanate, Methyl	23564-05-8	6.0E+03	2.1E+04		4.7E+03	2.1E+03	8.9E+03		1.7E+03
				1.5E-02	O						1.36E+09		1	0.1	Thiram	137-26-8					1.2E+03	4.9E+03		9.5E+02
				6.0E-01	H						1.36E+09		1		Tin	7440-31-5					4.7E+04			4.7E+04
						1.0E-04	A	V			1.36E+09		1		Titanium Tetrachloride	7550-45-0							1.4E+05	1.4E+05
				8.0E-02	I	5.0E+00	I	V		8.18E+02	1.36E+09	4.29E+03	1		Toluene	108-88-3					6.3E+03		2.2E+04	4.9E+03
3.9E-02	C	1.1E-05	C			8.0E-06	C	V			1.36E+09	7.62E+05	1		Toluene-2,4-diisocyanate	584-84-9	1.8E+03		1.9E+04	1.6E+03			6.4E+00	6.4E+00
1.8E-01	X			2.0E-04	X						1.36E+09		1	0.1	Toluene-2,5-diamine	95-70-5	3.9E+02	1.4E+03		3.0E+02	1.6E+01	6.6E+01		1.3E+01
3.9E-02	C	1.1E-05	C			8.0E-06	C	V		1.71E+03	1.36E+09	6.32E+05	1		Toluene-2,6-diisocyanate	91-08-7	1.8E+03		1.6E+04	1.6E+03			5.3E+00	5.3E+00
				5.0E-03	P						1.36E+09		1	0.1	Toluic Acid, p-	99-94-5					3.9E+02	1.6E+03		3.2E+02
1.6E-02	P	5.1E-05	C								1.36E+09		1	0.1	Toluidine, o- (Methylaniline, 2-)	95-53-4	4.3E+03	1.5E+04	7.5E+06	3.4E+03				
3.0E-02	P			4.0E-03	X						1.36E+09		1	0.1	Toluidine, p-	106-49-0	2.3E+03	8.2E+03		1.8E+03	3.1E+02	1.3E+03		2.5E+02
				3.0E+00	P			V		3.42E-01	1.36E+09	1.38E+03	1		Total Petroleum Hydrocarbons (Aliphatic High)	E1790670					2.3E+05			2.3E+05
						6.0E-01	P	V		1.41E+02	1.36E+09	8.29E+02	1		Total Petroleum Hydrocarbons (Aliphatic Low)	E1790666							5.2E+02	5.2E+02
				1.0E-02	X	1.0E-01	P	V		6.86E+00	1.36E+09	1.04E+03	1		Total Petroleum Hydrocarbons (Aliphatic Medium)	E1790668					7.8E+02		1.1E+02	9.6E+01
				4.0E-02	P						1.36E+09		1	0.13	Total Petroleum Hydrocarbons (Aromatic High)	E1790676					3.1E+03	1.0E+04		2.4E+03
				4.0E-03	P	3.0E-02	P	V		1.82E+03	1.36E+09	3.54E+03	1		Total Petroleum Hydrocarbons (Aromatic Low)	E1790672					3.1E+02		1.1E+02	8.2E+01
				4.0E-03	P	3.0E-03	P	V			1.36E+09	5.24E+04	1	0.13	Total Petroleum Hydrocarbons (Aromatic Medium)	E1790674					3.1E+02	1.0E+03	1.6E+02	9.7E+01
1.1E+00	I	3.2E-04	I	9.0E-05	P						1.36E+09		1	0.1	Toxaphene	8001-35-2	6.3E+01	2.2E+02	1.2E+06	4.9E+01	7.0E+00	3.0E+01		5.7E+00
				3.0E-05	X						1.36E+09		1	0.1	Toxaphene, Weathered	E1841606					2.3E+00	9.9E+00		1.9E+00
				7.5E-03	I						1.36E+09		1	0.1	Tralomethrin	66841-25-6					5.9E+02	2.5E+03		4.7E+02
				3.0E-04	A			V			1.36E+09	3.36E+03	1		Tri-n-butyltin	688-73-3					2.3E+01			2.3E+01
				8.0E+01	X						1.36E+09		1	0.1	Triacetin	102-76-1					6.3E+06	2.6E+07		5.1E+06

RMLs
TR=1E-04
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)
				3.4E-02	O						1.36E+09		1	0.1	Triadimefon	43121-43-3					2.7E+03	1.1E+04		2.1E+03
7.2E-02	O			2.5E-02	O			V			1.36E+09	3.62E+05	1		Triallate	2303-17-5	9.7E+02			9.7E+02	2.0E+03			2.0E+03
				1.0E-02	I						1.36E+09		1	0.1	Triasulfuron	82097-50-5					7.8E+02	3.3E+03		6.3E+02
				8.0E-03	I						1.36E+09		1	0.1	Tribenuron-methyl	101200-48-0					6.3E+02	2.6E+03		5.1E+02
				5.0E-03	I			V			1.36E+09	4.83E+04	1		Tribromobenzene, 1,2,4-	615-54-3					3.9E+02			3.9E+02
				9.0E-03	X						1.36E+09		1	0.1	Tribromophenol, 2,4,6-	118-79-6					7.0E+02	3.0E+03		5.7E+02
				1.0E-04	O						1.36E+09		1	0.1	Tribufos	78-48-8					7.8E+00	3.3E+01		6.3E+00
9.0E-03	P			1.0E-02	P						1.36E+09		1	0.1	Tributyl Phosphate	126-73-8	7.7E+03	2.7E+04		6.0E+03	7.8E+02	3.3E+03		6.3E+02
				3.0E-04	P						1.36E+09		1	0.1	Tributyltin Compounds	E1790678					2.3E+01	9.9E+01		1.9E+01
				3.0E-04	I						1.36E+09		1	0.1	Tributyltin Oxide	56-35-9					2.3E+01	9.9E+01		1.9E+01
											1.36E+09				Trichloramine	10025-85-1								
				3.0E+01	I	5.0E+00	P	V		9.10E+02	1.36E+09	1.29E+03	1		Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1					2.3E+06		6.7E+03	6.7E+03
7.0E-02	I			2.0E-02	I						1.36E+09		1	0.1	Trichloroacetic Acid	76-03-9	9.9E+02	3.5E+03		7.8E+02	1.6E+03	6.6E+03		1.3E+03
2.9E-02	H										1.36E+09		1	0.1	Trichloroaniline HCl, 2,4,6-	33663-50-2	2.4E+03	8.5E+03		1.9E+03				
7.0E-03	X			3.0E-05	X						1.36E+09		1	0.1	Trichloroaniline, 2,4,6-	634-93-5	9.9E+03	3.5E+04		7.8E+03	2.3E+00	9.9E+00		1.9E+00
				8.0E-04	X			V			1.36E+09	3.22E+04	1		Trichlorobenzene, 1,2,3-	87-61-6					6.3E+01			6.3E+01
2.9E-02	P			1.0E-02	I	2.0E-03	P	V		4.04E+02	1.36E+09	2.99E+04	1		Trichlorobenzene, 1,2,4-	120-82-1	2.4E+03			2.4E+03	7.8E+02		6.2E+01	5.8E+01
				2.0E+00	I	5.0E+00	I	V		6.40E+02	1.36E+09	1.65E+03	1		Trichloroethane, 1,1,1-	71-55-6					1.6E+05		8.6E+03	8.1E+03
5.7E-02	I	1.6E-05	I	4.0E-03	I	2.0E-04	X	V		2.16E+03	1.36E+09	7.22E+03	1		Trichloroethane, 1,1,2-	79-00-5	1.2E+03		1.3E+02	1.1E+02	3.1E+02		1.5E+00	1.5E+00
4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I	V	M	6.92E+02	1.36E+09	2.21E+03	1		Trichloroethylene	79-01-6	8.8E+02		1.1E+02	9.4E+01	3.9E+01		4.6E+00	4.1E+00
				3.0E-01	I			V		1.23E+03	1.36E+09	1.04E+03	1		Trichlorofluoromethane	75-69-4					2.3E+04			2.3E+04
				1.0E-01	I						1.36E+09		1	0.1	Trichlorophenol, 2,4,5-	95-95-4					7.8E+03	3.3E+04		6.3E+03
1.1E-02	I	3.1E-06	I	1.0E-03	P						1.36E+09		1	0.1	Trichlorophenol, 2,4,6-	88-06-2	6.3E+03	2.2E+04	1.2E+08	4.9E+03	7.8E+01	3.3E+02		6.3E+01
				1.0E-02	I						1.36E+09		1	0.1	Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5					7.8E+02	3.3E+03		6.3E+02
				8.0E-03	I						1.36E+09		1	0.1	Trichlorophenoxypropionic acid, -2,4,5	93-72-1					6.3E+02	2.6E+03		5.1E+02
				5.0E-03	I			V		1.28E+03	1.36E+09	1.50E+04	1		Trichloropropane, 1,1,2-	598-77-6					3.9E+02			3.9E+02
3.0E+01	I			4.0E-03	I	3.0E-04	I	V	M	1.40E+03	1.36E+09	1.57E+04	1		Trichloropropane, 1,2,3-	96-18-4	5.1E-01			5.1E-01	3.1E+02		4.9E+00	4.8E+00
				3.0E-03	X	3.0E-04	P	V		3.11E+02	1.36E+09	2.34E+03	1		Trichloropropene, 1,2,3-	96-19-5					2.3E+02		7.3E-01	7.3E-01
				2.0E-02	A						1.36E+09		1	0.1	Tricresyl Phosphate (TCP)	1330-78-5					1.6E+03	6.6E+03		1.3E+03
				3.0E-03	I						1.36E+09		1	0.1	Tridiphane	58138-08-2					2.3E+02	9.9E+02		1.9E+02
						7.0E-03	I	V		2.79E+04	1.36E+09	1.58E+04	1		Triethylamine	121-44-8							1.2E+02	1.2E+02
				2.0E+00	P						1.36E+09		1	0.1	Triethylene Glycol	112-27-6					1.6E+05	6.6E+05		1.3E+05
						2.0E+01	P	V		4.81E+03	1.36E+09	7.12E+02	1		Trifluoroethane, 1,1,1-	420-46-2							1.5E+04	1.5E+04
7.7E-03	I			7.5E-03	I			V			1.36E+09	5.13E+05	1		Trifluralin	1582-09-8	9.0E+03			9.0E+03	5.9E+02			5.9E+02
2.0E-02	P			1.0E-02	P						1.36E+09		1	0.1	Trimethyl Phosphate	512-56-1	3.5E+03	1.2E+04		2.7E+03	7.8E+02	3.3E+03		6.3E+02
				1.0E-02	I	6.0E-02	I	V		2.93E+02	1.36E+09	9.44E+03	1		Trimethylbenzene, 1,2,3-	526-73-8					7.8E+02		5.9E+02	3.4E+02
				1.0E-02	I	6.0E-02	I	V		2.19E+02	1.36E+09	7.91E+03	1		Trimethylbenzene, 1,2,4-	95-63-6					7.8E+02		5.0E+02	3.0E+02
				1.0E-02	I	6.0E-02	I	V		1.82E+02	1.36E+09	6.61E+03	1		Trimethylbenzene, 1,3,5-	108-67-8					7.8E+02		4.1E+02	2.7E+02
				1.0E-02	X			V		2.96E+01	1.36E+09	1.00E+03	1		Trimethylpentene, 2,4,4-	25167-70-8					7.8E+02			7.8E+02
				3.0E-02	I						1.36E+09		1	0.019	Trinitrobenzene, 1,3,5-	99-35-4					2.3E+03	5.2E+04		2.2E+03
3.0E-02	I			5.0E-04	I						1.36E+09		1	0.032	Trinitrotoluene, 2,4,6-	118-96-7	2.3E+03	2.6E+04		2.1E+03	3.9E+01	5.2E+02		3.6E+01
				2.0E-02	P						1.36E+09		1	0.1	Triphenylphosphine Oxide	791-28-6					1.6E+03	6.6E+03		1.3E+03
				2.0E-02	A						1.36E+09		1	0.1	Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8					1.6E+03	6.6E+03		1.3E+03
				1.0E-02	X						1.36E+09		1	0.1	Tris(1-chloro-2-propyl)phosphate	13674-84-5					7.8E+02	3.3E+03		6.3E+02
2.3E+00	C	6.6E-04	C					V		4.67E+02	1.36E+09	9.03E+05	1		Tris(2,3-dibromopropyl)phosphate	126-72-7	3.0E+01		3.8E+02	2.8E+01				
2.0E-02	P			7.0E-03	P						1.36E+09		1	0.1	Tris(2-chloroethyl)phosphate	115-96-8	3.5E+03	1.2E+04		2.7E+03	5.5E+02	2.3E+03		4.4E+02
3.2E-03	P			1.0E-01	P						1.36E+09		1	0.1	Tris(2-ethylhexyl)phosphate	78-42-2	2.2E+04	7.7E+04		1.7E+04	7.8E+03	3.3E+04		6.3E+03
				8.0E-04	P						1.36E+09		1		Tungsten	7440-33-7					6.3E+01			6.3E+01
				2.0E-04	A	4.0E-05	A				1.36E+09		1		Uranium	7440-61-1					1.6E+01		5.7E+04	1.6E+01
1.0E+00	C	2.9E-04	C						M		1.36E+09		1	0.1	Urethane	51-79-6	1.5E+01	6.0E+01	4.8E+05	1.2E+01				
		8.3E-03	P	9.0E-03	I	7.0E-06	P				1.36E+09		0.026		Vanadium Pentoxide	1314-62-1			4.6E+04	4.6E+04	7.0E+02		9.9E+03	6.6E+02
				5.0E-03	G	1.0E-04	A				1.36E+09		0.026		Vanadium and Compounds	7440-62-2					3.9E+02		1.4E+05	3.9E+02
				1.0E-03	I			V			1.36E+09	1.23E+05	1		Vernolate	1929-77-7					7.8E+01			7.8E+01
				1.2E-03	O						1.36E+09		1	0.1	Vinclozolin	50471-44-8					9.4E+01	4.0E+02		7.6E+01
				1.0E+00	H	2.0E-01	I	V		2.75E+03	1.36E+09	4.40E+03	1		Vinyl Acetate	108-05-4					7.8E+04		9.2E+02	9.1E+02
		1.5E-05	P			3.0E-03	I	V		2.47E+03	1.36E+09	1.37E+03	1		Vinyl Bromide	593-60-2			2.6E+01	2.6E+01			4.3E+00	4.3E+00
7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	M	3.92E+03	1.36E+09	9.56E+02	1		Vinyl Chloride	75-01-4	9.4E+00		1.6E+01	5.9E+00	2.3E+02		1.0E+02	7.0E+01
				3.0E-04	I						1.36E+09		1	0.1	Warfarin	81-81-2					2.3E+01	9.9E+01		1.9E+01
				2.0E-01	G	1.0E-01	G	V		3.88E+02	1.36E+09	5.47E+03	1		Xylene, m-	108-38-3					1.6E+04		5.7E+02	5.5E+02
				2.0E-01	G	1.0E-01	G	V		4.34E+02	1.36E+09	6.46E+03	1		Xylene, o-	95-47-6					1.6E+04		6.7E+02	6.5E+02
				2.0E-01	G	1.0E-01	G	V		3.90E+02	1.36E+09	5.58E+03	1		Xylene, p-	106-42-3					1.6E+04		5.8E+02	5.6E+02
				2.0E-01	I	1.0E-01	I	V		2.60E+02	1.36E+09	5.74E+03	1		Xylenes	1330-20-7					1.6E+04		6.0E+02	5.8E+02
				3.0E-04	I						1.36E+09		1		Zinc Phosphide	1314-84-7					2.3E+01			2.3E+01
				3.0E-01	I						1.36E+09		1		Zinc and Compounds	7440-66-6					2.3E+04			2.3E+04
				5.0E-02	I						1.36E+09		1	0.1	Zineb	12122-67-7					3.9E+03	1.6E+04		3.2E+03
				8.0E-05	X						1.36E+09		1		Zirconium	7440-67-7					6.3E+00			6.3E+00

RMLs
TR=1E-04
HQ=1.0
RMLs
TR=1E-04

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-04				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	GIABS	ABS_d	Analyte	CAS No.	Ingestion SL TR=1E-04 (mg/kg)	Dermal SL TR=1E-04 (mg/kg)	Inhalation SL TR=1E-04 (mg/kg)	Carcinogenic SL TR=1E-04 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)

THQ=1.0

ATTACHMENT D

Laboratory Method Detection Limits

CHEMTECH 284 Sheffield Street, Mountainside, New Jersey 07092 Phone : 908 789 8900 Fax : 908 789 8922

method	Status	parameter	CAS#	mdl soil (mg/kg)	lod soil (mg/kg)	loq soil (mg/kg)
7471B	Certified	Mercury	7439-97-6	0.00172	0.0035	0.014
6010D-3050B	Certified	Aluminum	7429-90-5	1.55	3.75	5
6010D-3050B	Certified	Antimony	7440-36-0	0.36	0.625	2.5
6010D-3050B	Certified	Arsenic	7440-38-2	0.19	0.75	1
6010D-3050B	Certified	Barium	7440-39-3	0.93	1.25	5
6010D-3050B	Certified	Beryllium	7440-41-7	0.053	0.075	0.3
6010D-3050B	Certified	Cadmium	7440-43-9	0.054	0.075	0.3
6010D-3050B	Certified	Calcium	7440-70-2	17.87	25	100
6010D-3050B	Certified	Chromium	7440-47-3	0.08	0.375	0.5
6010D-3050B	Certified	Cobalt	7440-48-4	0.23	0.375	1.5
6010D-3050B	Certified	Copper	7440-50-8	0.09	0.25	1
6010D-3050B	Certified	Iron	7439-89-6	0.97	3.75	5
6010D-3050B	Certified	Lead	7439-92-1	0.19	0.25	0.6
6010D-3050B	Certified	Magnesium	7439-95-4	16.6	25	100
6010D-3050B	Certified	Manganese	7439-96-5	0.12	0.25	1
6010D-3050B	Certified	Nickel	7440-02-0	0.21	0.5	2
6010D-3050B	Certified	Potassium	7440-09-7	21.6	75	100
6010D-3050B	Certified	Selenium	7782-49-2	0.38	0.75	1
6010D-3050B	Certified	Silver	7440-22-4	0.11	0.125	0.5
6010D-3050B	Certified	Sodium	7440-23-5	17.21	25	100
6010D-3050B	Certified	Thallium	7440-28-0	0.44	0.5	2
6010D-3050B	Certified	Vanadium	7440-62-2	0.37	0.5	2
6010D-3050B	Certified	Zinc	7440-66-6	0.22	1.5	2

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method	Status	parameter	CAS#	MDL Soil (ug/kg)	LOD Soil (ug/kg)	LOQ Soil (ug/kg)
EPA SW-846 8082A	Certified	Aroclor-1016	12674-11-2	3.52	13	17
EPA SW-846 8082A	Certified	Aroclor-1260	11096-82-5	3.03	8.3	17
EPA SW-846 8082A	Certified	Aroclor-1221	11104-28-2	5.69	13	17
EPA SW-846 8082A	Certified	Aroclor-1232	11141-16-5	4.65	13	17
EPA SW-846 8082A	Certified	Aroclor-1242	53469-21-9	3.91	13	17
EPA SW-846 8082A	Certified	Aroclor-1248	12672-29-6	4.33	13	17
EPA SW-846 8082A	Certified	Aroclor-1254	11097-69-1	4.84	13	17
EPA SW-846 8082A	Certified	Aroclor-1262	37324-23-5	3.38	13	17
EPA SW-846 8082A	Certified	Aroclor-1268	11100-14-4	5.71	13	17

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method	Status	parameter	CAS#	MDL Soil (ug/kg)	LOD Soil (ug/kg)	LOQ Soil (ug/kg)
ESW-846 8081B	Certified	4,4-DDD	72-54-8	0.172	0.83	1.7
ESW-846 8081B	Certified	4,4-DDE	72-55-9	0.106	0.33	1.7
ESW-846 8081B	Certified	4,4-DDT	50-29-3	0.186	0.83	1.7
ESW-846 8081B	Certified	Aldrin	309-00-2	0.128	0.33	1.7
ESW-846 8081B	Certified	alpha-BHC	319-84-6	0.199	0.83	1.7
ESW-846 8081B	Certified	alpha-Chlordane	5103-71-9	0.104	0.33	1.7
ESW-846 8081B	Certified	beta-BHC	319-85-7	0.329	0.83	1.7
ESW-846 8081B	Certified	Chlordane	57-74-9	2.391	8.3	17
ESW-846 8081B	Certified	delta-BHC	319-86-8	0.232	0.83	1.7
ESW-846 8081B	Certified	Dieldrin	60-57-1	0.107	0.33	1.7
ESW-846 8081B	Certified	Endosulfan I	959-98-8	0.122	0.33	1.7
ESW-846 8081B	Certified	Endosulfan II	33213-65-9	0.279	0.83	1.7
ESW-846 8081B	Certified	Endosulfan Sulfate	1031-07-8	0.144	0.33	1.7
ESW-846 8081B	Certified	Endrin	72-20-8	0.159	0.33	1.7
ESW-846 8081B	Certified	Endrin aldehyde	7421-93-4	0.366	0.83	1.7
ESW-846 8081B	Certified	Endrin ketone	53494-70-5	0.169	0.83	1.7
ESW-846 8081B	Certified	gamma-BHC (Lindane)	58-89-9	0.213	0.83	1.7
ESW-846 8081B	Certified	gamma-Chlordane	5103-74-2	0.194	0.83	1.7
ESW-846 8081B	Certified	Heptachlor	76-44-8	0.124	0.33	1.7
ESW-846 8081B	Certified	Heptachlor epoxide	1024-57-3	0.233	0.83	1.7
ESW-846 8081B	Certified	Methoxychlor	72-43-5	0.198	0.83	1.7
ESW-846 8081B	Certified	Mirex	2385-85-5	0.319	0.83	1.7
ESW-846 8081B	Certified	Toxaphene	8001-35-2	4.125	17	33

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method	parameter	Status	CAS #	MDL Soil (ug/kg)	LOQ Soil (ug/kg)	LOQ Soil (ug/kg)
SW-846 8270E	1,1-Biphenyl	Certified	92-52-4	70.4	130	170
SW-846 8270E	1,2,4,5-Tetrachlorobenzene	Certified	95-94-3	75.8	130	170
SW-846 8270E	1,2,4-Trichlorobenzene	Certified	120-82-1	64.7	130	170
SW-846 8270E	1,2-Dichlorobenzene	Certified	95-50-1	48.6	130	170
SW-846 8270E	1,3-Dichlorobenzene	Certified	541-73-1	46.0	130	170
SW-846 8270E	1,4-Dichlorobenzene	Certified	106-46-7	46.6	130	170
SW-846 8270E	1,4-Dioxane	Certified	123-91-1	50.6	130	170
SW-846 8270E	2,2-oxybis(1-Chloropropane) {Bis(2-chloroisopropyl) Ether}	Certified	108-60-1	51.7	130	170
SW-846 8270E	2,3,4,6-Tetrachlorophenol	Certified	58-90-2	75.6	130	170
SW-846 8270E	2,4,5-Trichlorophenol	Certified	95-95-4	72.8	130	170
SW-846 8270E	2,4,6-Trichlorophenol	Certified	88-06-2	75.0	130	170
SW-846 8270E	2,4-Dichlorophenol	Certified	120-83-2	66.1	130	170
SW-846 8270E	2,4-Dimethylphenol	Certified	105-67-9	78.6	130	170
SW-846 8270E	2,4-Dinitrophenol	Certified	51-28-5	194.5	270	330
SW-846 8270E	2,4-Dinitrotoluene	Certified	121-14-2	88.0	130	170
SW-846 8270E	2,6-Dinitrotoluene	Certified	606-20-2	68.7	130	170
SW-846 8270E	2-Chloronaphthalene	Certified	91-58-7	67.0	130	170
SW-846 8270E	2-Chlorophenol	Certified	95-57-8	42.0	130	170
SW-846 8270E	2-Methylnaphthalene	Certified	91-57-6	74.4	130	170
SW-846 8270E	2-Methylphenol	Certified	95-48-7	49.7	130	170
SW-846 8270E	2-Nitroaniline	Certified	88-74-4	101.1	130	170
SW-846 8270E	2-Nitrophenol	Certified	88-75-5	80.8	130	170
SW-846 8270E	3,3-Dichlorobenzidine	Certified	91-94-1	90.5	130	170
SW-846 8270E	3+4-Methylphenols (3-Methylphenol and 4-Methyl phenol)	Certified	65794-96-9	61.2	130	330
SW-846 8270E	3-Nitroaniline	Certified	99-09-2	80.7	130	170
SW-846 8270E	4,6-Dinitro-2-methylphenol	Certified	534-52-1	96.8	270	330
SW-846 8270E	4-Bromophenyl-phenylether	Certified	101-55-3	73.5	130	170
SW-846 8270E	4-Chloro-3-methylphenol	Certified	59-50-7	69.5	130	170
SW-846 8270E	4-Chloroaniline	Certified	106-47-8	67.9	130	170
SW-846 8270E	4-Chlorophenyl-phenylether	Certified	7005-72-3	83.6	130	170
SW-846 8270E	4-Nitroaniline	Certified	100-01-6	86.4	130	170
SW-846 8270E	4-Nitrophenol	Certified	100-02-7	137.4	270	330
SW-846 8270E	Acenaphthene	Certified	83-32-9	67.4	130	170
SW-846 8270E	Acenaphthylene	Certified	208-96-8	60.7	130	170
SW-846 8270E	Acetophenone	Certified	98-86-2	58.8	130	170
SW-846 8270E	Aniline	Certified	62-53-3	48.1	130	170
SW-846 8270E	Anthracene	Certified	120-12-7	74.6	130	170
SW-846 8270E	Atrazine	Certified	1912-24-9	106	130	170

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method	parameter	Status	CAS #	MDL Soil (ug/kg)	LOQ Soil (ug/kg)	LOQ Soil (ug/kg)
SW-846 8270E	Azobenzene	Certified	103-33-3	55.2	130	170
SW-846 8270E	Benzaldehyde	Certified	100-52-7	125.2	270	330
SW-846 8270E	Benzidine	Certified	92-87-5	137.2	270	330
SW-846 8270E	Benzo(a)anthracene	Certified	56-55-3	68.6	130	170
SW-846 8270E	Benzo(a)pyrene	Certified	50-32-8	58.2	130	170
SW-846 8270E	Benzo(b)fluoranthene	Certified	205-99-2	52.6	130	170
SW-846 8270E	Benzo(g,h,I)perylene	Certified	191-24-2	76.6	130	170
SW-846 8270E	Benzo(k)fluoranthene	Certified	207-08-9	57.5	130	170
SW-846 8270E	Benzoic acid	Certified	65-85-0	190.2	270	330
SW-846 8270E	Benzyl Alcohol	Certified	100-51-6	121.4	270	330
SW-846 8270E	bis(2-Chloroethoxy)methane	Certified	111-91-1	58.4	130	170
SW-846 8270E	bis(2-Chloroethyl)ether	Certified	111-44-4	38.7	130	170
SW-846 8270E	bis(2-Ethylhexyl)phthalate	Certified	117-81-7	85.6	130	170
SW-846 8270E	Butylbenzylphthalate	Certified	85-68-7	69.9	130	170
SW-846 8270E	Caprolactam	Certified	105-60-2	119.9	270	330
SW-846 8270E	Carbazole	Certified	86-74-8	77.2	130	170
SW-846 8270E	Chrysene {Benzo(a)Phenanthrene}	Certified	218-01-9	64.3	130	170
SW-846 8270E	Dibenzo(a,h)anthracene	Certified	53-70-3	81.2	130	170
SW-846 8270E	Dibenzofuran	Certified	132-64-9	66.0	130	170
SW-846 8270E	Diethylphthalate	Certified	84-66-2	62.3	130	170
SW-846 8270E	Dimethylphthalate	Certified	131-11-3	59.9	130	170
SW-846 8270E	Di-n-butylphthalate	Certified	84-74-2	89.5	130	170
SW-846 8270E	Di-n-octyl phthalate	Certified	117-84-0	86.8	270	330
SW-846 8270E	Fluoranthene	Certified	206-44-0	78.3	130	170
SW-846 8270E	Fluorene	Certified	86-73-7	72.4	130	170
SW-846 8270E	Hexachlorobenzene	Certified	118-74-1	78.9	130	170
SW-846 8270E	Hexachlorobutadiene	Certified	87-68-3	80.7	130	170
SW-846 8270E	Hexachlorocyclopentadiene	Certified	77-47-4	156.3	270	330
SW-846 8270E	Hexachloroethane	Certified	67-72-1	50.7	130	170
SW-846 8270E	Indeno(1,2,3-cd)pyrene	Certified	193-39-5	101.9	130	170
SW-846 8270E	Isophorone	Certified	78-59-1	58.6	130	170
SW-846 8270E	Naphthalene	Certified	91-20-3	60.2	130	170
SW-846 8270E	Nitrobenzene	Certified	98-95-3	57.3	130	170
SW-846 8270E	n-Nitrosodimethylamine	Certified	62-75-9	101.2	270	330
SW-846 8270E	N-Nitroso-di-n-propylamine	Certified	621-64-7	52.5	130	170
SW-846 8270E	n-Nitrosodiphenylamine	Certified	86-30-6	57.3	130	170
SW-846 8270E	Pentachlorophenol	Certified	87-86-5	126.9	270	330
SW-846 8270E	Phenanthrene	Certified	85-01-8	67.5	130	170
SW-846 8270E	Phenol	Certified	108-95-2	48.9	130	170
SW-846 8270E	Pyrene	Certified	129-00-0	55.4	130	170
SW-846 8270E	Pyridine	Certified	110-86-1	84.6	130	170

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method	Status	parameter	CAS#	mdl soil (ug/kg)	lod soil (ug/kg)	loq soil (ug/kg)
SW-846 8260D	Certified	1,1,1,2-Tetrachloroethane	630-20-6	0.60	2.5	5
SW-846 8260D	Certified	1,1,1-Trichloroethane	71-55-6	0.64	2.5	5
SW-846 8260D	Certified	1,1,2,2-Tetrachloroethane	79-34-5	1.10	2.5	5
SW-846 8260D	Certified	1,1,2-Trichloroethane	79-00-5	0.78	2.5	5
SW-846 8260D	Certified	1,1,2-Trichlorotrifluoroethane	76-13-1	1.02	4	5
SW-846 8260D	Certified	1,1-Dichloroethane	75-34-3	0.66	2.5	5
SW-846 8260D	Certified	1,1-Dichloroethene	75-35-4	0.91	4	5
SW-846 8260D	Certified	1,1-Dichloropropene	563-58-6	0.70	2.5	5
SW-846 8260D	Certified	1,2,3-Trichlorobenzene	87-61-6	1.12	4	5
SW-846 8260D	Certified	1,2,3-Trichloropropane	96-18-4	1.42	4	5
SW-846 8260D	Certified	1,2,4-Trichlorobenzene	120-82-1	1.01	2.5	5
SW-846 8260D	Certified	1,2,4-Trimethylbenzene	95-63-6	0.83	4	5
SW-846 8260D	Certified	1,2-Dibromo-3-chloropropane	96-12-8	2.45	4	5
SW-846 8260D	Certified	1,2-Dibromoethane	106-93-4	0.75	2.5	5
SW-846 8260D	Certified	1,2-Dichlorobenzene	95-50-1	0.66	4	5
SW-846 8260D	Certified	1,2-Dichloroethane	107-06-2	0.80	2.5	5
SW-846 8260D	Certified	1,2-Dichloropropane	78-87-5	0.64	2.5	5
SW-846 8260D	Certified	1,3,5-Trimethylbenzene	108-67-8	0.70	2.5	5
SW-846 8260D	Certified	1,3-Dichlorobenzene	541-73-1	0.79	4	5
SW-846 8260D	Certified	1,3-Dichloropropane	142-28-9	0.76	2.5	5
SW-846 8260D	Certified	1,4-Dichlorobenzene	106-46-7	0.60	2.5	5
SW-846 8260D	Certified	1,4-Dioxane	123-91-1	27.44	50	100
SW-846 8260D	Certified	2,2-Dichloropropane	594-20-7	1.27	4	5
SW-846 8260D	Certified	2-Butanone	78-93-3	7.79	20	25
SW-846 8260D	Certified	2-Chloroethyl vinyl ether	110-75-8	5.66	20	25
SW-846 8260D	Certified	2-Chlorotoluene	95-49-8	0.67	2.5	5
SW-846 8260D	Certified	2-Hexanone	591-78-6	5.80	20	25
SW-846 8260D	Certified	4-Chlorotoluene	106-43-4	0.61	2.5	5
SW-846 8260D	Certified	4-Methyl-2-pentanone	108-10-1	5.05	20	25
SW-846 8260D	Certified	Acetone	67-64-1	9.69	20	25
SW-846 8260D	Certified	Acrolein	107-02-8	6.72	25	25
SW-846 8260D	Certified	Acrylonitrile	107-13-1	7.17	20	25
SW-846 8260D	Certified	Benzene	71-43-2	0.64	2.5	5
SW-846 8260D	Certified	Bromobenzene	108-86-1	0.66	2.5	5
SW-846 8260D	Certified	Bromochloromethane	74-97-5	0.92	2.5	5
SW-846 8260D	Certified	Bromodichloromethane	75-27-4	0.66	2.5	5
SW-846 8260D	Certified	Bromoform	75-25-2	0.83	4	5
SW-846 8260D	Certified	Bromomethane	74-83-9	0.95	4	5
SW-846 8260D	Certified	Carbon disulfide	75-15-0	0.70	2.5	5
SW-846 8260D	Certified	Carbon tetrachloride	56-23-5	0.63	2.5	5
SW-846 8260D	Certified	Chlorobenzene	108-90-7	0.61	2.5	5

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method	Status	parameter	CAS#	mdl soil (ug/kg)	lod soil (ug/kg)	loq soil (ug/kg)
SW-846 8260D	Certified	Chlorodibromomethane	124-48-1	0.77	2.5	5
SW-846 8260D	Certified	Chloroethane	75-00-3	1.03	4	5
SW-846 8260D	Certified	Chloroform	67-66-3	0.82	4	5
SW-846 8260D	Certified	Chloromethane	74-87-3	1.54	4	5
SW-846 8260D	Certified	cis-1,2-Dichloroethene	156-59-2	0.89	4	5
SW-846 8260D	Certified	cis-1,3-Dichloropropene	10061-01-5	0.65	2.5	5
SW-846 8260D	Certified	Cyclohexane	110-82-7	1.27	4	5
SW-846 8260D	Certified	Dibromomethane	74-95-3	0.77	2.5	5
SW-846 8260D	Certified	Dichlorodifluoromethane	75-71-8	0.98	4	5
SW-846 8260D	Certified	Ethyl Acetate	141-78-6	1.55	4	5
SW-846 8260D	Certified	Ethyl Benzene	100-41-4	0.67	2.5	5
SW-846 8260D	Certified	Hexachlorobutadiene	87-68-3	0.64	2.5	5
SW-846 8260D	Certified	Hexachloroethane	67-72-1	0.62	2.5	5
SW-846 8260D	Certified	Isopropylbenzene	98-82-8	0.78	2.5	5
SW-846 8260D	Certified	m/p-Xylenes	179601-23-1	1.50	5	10
SW-846 8260D	Certified	Methyl Acetate	79-20-9	1.43	4	5
SW-846 8260D	Certified	Methyl Cyclohexane	108-87-2	0.45	2.5	5
SW-846 8260D	Certified	Methyl Iodide	74-88-4	1.75	4	5
SW-846 8260D	Certified	Methyl tert-butyl Ether	1634-04-4	1.03	4	5
SW-846 8260D	Certified	Methylene chloride	75-09-2	5.96	8	10
SW-846 8260D	Certified	Naphthalene	91-20-3	1.81	4	5
SW-846 8260D	Certified	n-Butylbenzene	104-51-8	0.69	4	5
SW-846 8260D	Certified	N-propylbenzene	103-65-1	0.70	2.5	5
SW-846 8260D	Certified	o-xylene	95-47-6	0.70	2.5	5
SW-846 8260D	Certified	p-Isopropyltoluene	99-87-6	0.86	4	5
SW-846 8260D	Certified	Sec-butylbenzene	135-98-8	0.81	2.5	5
SW-846 8260D	Certified	Styrene	100-42-5	0.92	4	5
SW-846 8260D	Certified	t-1,3-Dichloropropene	10061-02-6	0.73	2.5	5
SW-846 8260D	Certified	Tert butyl alcohol	75-65-0	9.00	20	25
SW-846 8260D	Certified	tert-Butylbenzene	98-06-6	0.81	2.5	5
SW-846 8260D	Certified	Tetrachloroethene	127-18-4	0.64	2.5	5
SW-846 8260D	Certified	Toluene	108-88-3	0.60	2.5	5
SW-846 8260D	Certified	Total Xylenes	1330-20-7	2.20	7.5	15
SW-846 8260D	Certified	Trans-1,2-dichloroethene	156-60-5	0.98	4	5
SW-846 8260D	Certified	Trichloroethene	79-01-6	0.68	2.5	5
SW-846 8260D	Certified	Trichlorofluoromethane	75-69-4	0.97	4	5
SW-846 8260D	Certified	Vinyl Acetate	108-05-4	4.70	20	25
SW-846 8260D	Certified	Vinyl chloride	75-01-4	1.01	4	5

Limits for EPA RST2 - RFP No. 651

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	Units
Gamma Spec	GA-01-R	Actinium 228	14331-83-0	1.00		pCi/g
		Bismuth-212	14913-49-6	3.00		pCi/g
		Bismuth-214	14733-03-0	1.00		pCi/g
		Cesium-137	10045-97-3	0.200		pCi/g
		Lead-212	15092-94-1	0.300		pCi/g
		Lead-214	15067-28-4	1.00		pCi/g
		Potassium-40	13966-00-2	1.50		pCi/g
		Protactinium-234	378783-76-7	1.50		pCi/g
		Radium-224	13233-32-4	5.00		pCi/g
		Radium-226	13982-63-3	1.00		pCi/g
		Radium-228	15262-20-1	1.00		pCi/g
		Thallium-208	14913-50-9	0.200		pCi/g
		Thorium-234	15065-10-8	4.00		pCi/g
Isotopic Uranium (Alpha Spec)	A-01-R	Uranium-233/234	13966-29-5	1.00		pCi/g
		Uranium-235/236	15117-96-1	1.00		pCi/g
		Uranium-238	7440-61-1	1.00		pCi/g
Isotopic Thorium (Alpha Spec)	A-01-R	Thorium-228	14274-82-9	1.00		pCi/g
		Thorium-230	14269-63-7	1.00		pCi/g
		Thorium-232	7440-29-1	1.00		pCi/g
Isotopic Uranium (ICPMS)	6020A	U-233	13968-55-3	0.00600	0.00300	mg/Kg
		U-234	13966-29-5	0.00600	0.00300	mg/Kg
		U-235	15117-96-1	0.00600	0.00300	mg/Kg
		U-236	13982-70-2	0.00600	0.00300	mg/Kg
		U-238	7440-61-1	0.00600	0.00300	mg/Kg
Thorium (ICP/MS)	6020A	Thorium	7440-29-1	0.200	0.135	mg/Kg

Limits for EPA RST2 - RFP No. 651

Analysis Group	Method Description	Analyte Description	CAS Number	RL	MDL	Units
Soil Samples	Fluorinated Alkyl Substances	Perfluorobutanoic acid (PFBA)	375-22-4	0.200	0.0280	ug/Kg
		Perfluoropentanoic acid (PFPeA)	2706-90-3	0.200	0.0770	ug/Kg
		Perfluorohexanoic acid (PFHxA)	307-24-4	0.200	0.0420	ug/Kg
		Perfluoroheptanoic acid (PFHpA)	375-85-9	0.200	0.0290	ug/Kg
		Perfluorooctanoic acid (PFOA)	335-67-1	0.200	0.0860	ug/Kg
		Perfluorononanoic acid (PFNA)	375-95-1	0.200	0.0360	ug/Kg
		Perfluorodecanoic acid (PFDA)	335-76-2	0.200	0.0220	ug/Kg
		Perfluoroundecanoic acid (PFUnA)	2058-94-8	0.200	0.0360	ug/Kg
		Perfluorododecanoic acid (PFDoA)	307-55-1	0.200	0.0670	ug/Kg
		Perfluorotridecanoic acid (PFTriA)	72629-94-8	0.200	0.0510	ug/Kg
		Perfluorotetradecanoic acid (PFTeA)	376-06-7	0.200	0.0540	ug/Kg
		Perfluorobutanesulfonic acid (PFBS)	375-73-5	0.200	0.0250	ug/Kg
		Perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.200	0.0310	ug/Kg
		Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	0.200	0.0350	ug/Kg
		Perfluorooctanesulfonic acid (PFOS)	1763-23-1	0.500	0.200	ug/Kg
		Perfluorodecanesulfonic acid (PFDS)	335-77-3	0.200	0.0390	ug/Kg
		Perfluorooctanesulfonamide (FOSA)	754-91-6	0.200	0.0820	ug/Kg
		N-methylperfluorooctanesulfonamidoacetic acid (I	2355-31-9	2.00	0.390	ug/Kg
		N-ethylperfluorooctanesulfonamidoacetic acid (NE	2991-50-6	2.00	0.370	ug/Kg
		6:2 FTS	27619-97-2	2.00	0.150	ug/Kg
		8:2 FTS	39108-34-4	2.00	0.250	ug/Kg

Field/Equipment Blar	Fluorinated Alkyl Substances	Perfluorobutanoic acid (PFBA)	375-22-4	0.00500	0.00240	ug/L
		Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00200	0.000490	ug/L
		Perfluorohexanoic acid (PFHxA)	307-24-4	0.00200	0.000580	ug/L
		Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00200	0.000250	ug/L
		Perfluorooctanoic acid (PFOA)	335-67-1	0.00200	0.000850	ug/L
		Perfluorononanoic acid (PFNA)	375-95-1	0.00200	0.000270	ug/L
		Perfluorodecanoic acid (PFDA)	335-76-2	0.00200	0.000310	ug/L
		Perfluoroundecanoic acid (PFUnA)	2058-94-8	0.00200	0.00110	ug/L
		Perfluorododecanoic acid (PFDoA)	307-55-1	0.00200	0.000550	ug/L
		Perfluorotridecanoic acid (PFTriA)	72629-94-8	0.00200	0.00130	ug/L
		Perfluorotetradecanoic acid (PFTeA)	376-06-7	0.00200	0.000730	ug/L
		Perfluorobutanesulfonic acid (PFBS)	375-73-5	0.00200	0.000200	ug/L
		Perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.00200	0.000570	ug/L
		Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	0.00200	0.000190	ug/L
		Perfluorooctanesulfonic acid (PFOS)	1763-23-1	0.00200	0.000540	ug/L
		Perfluorodecanesulfonic acid (PFDS)	335-77-3	0.00200	0.000320	ug/L
		Perfluorooctanesulfonamide (FOSA)	754-91-6	0.00200	0.000980	ug/L
		N-methylperfluorooctanesulfonamidoacetic acid (I	2355-31-9	0.00500	0.00120	ug/L
		N-ethylperfluorooctanesulfonamidoacetic acid (NE	2991-50-6	0.00500	0.00130	ug/L
		6:2 FTS	27619-97-2	0.00500	0.00250	ug/L
		8:2 FTS	39108-34-4	0.00200	0.000460	ug/L