INVENTUM ENGINEERING, PC

Pre-Design Investigation Work Plan

Development of Soil Cleanup Objective for Ammonia

Riverview Innovation & Technology Campus

Brownfield Cleanup Program Site No. C915353

3875 River Road

Tonawanda, New York 14150

September 10, 2024

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List of Acronyms and Abbreviations

AA	Alternatives Analysis
AAR	Alternatives Analysis Report
ACM	Asbestos Containing Material
AMSL	Above Mean Sea Level
AOI	Area of Investigation
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAMP	Community Air Monitoring Plan
CSM	Conceptual Site Model
DUSR	Data Usability Summary Report
EDD	Electronic Data Deliverable
ft bgs	Feet below ground surface
ft-amsl	Feet above mean sea level
HASP	Health and Safety Plan
HDPE	High-density polyethylene
HSA	Hollow-Stem Auger
IDW	Investigation Derived Waste
Koc	Organic carbon partition coefficient
Kow	Log octanol-water partition coefficient
MCC	Maximum Concentration of Contaminates
LEAF	Leaching Environmental Assessment Framework
LSP	Liquid-solid partitioning of inorganic and non-volatile organic constituents
L/S	Liquid-to-solid ratio under percolation conditions.
mg/kg	Milligrams per kilogram
mL/min	Milliliters per minute
MW	Monitoring Well
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OSC	Ontario Specialty Contracting
PAH	Polycyclic aromatic hydrocarbon
PID	Photoionization detector
POTW	Publicly Owned Treatment Works
PPE	Personal Protective Equipment
PRAP	Proposed Remedial Action Plan
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Remedial Action
RAO	Remedial Action Objectives
RD	Remedial Design
RDWP	Remedial Design Work Plan

RI	Remedial Investigation
RITC	Riverview Innovation & Technology Campus, Inc.
RIWP	Remedial Investigation Work Plan
SB	Soil Boring
SCG	Standards, Criteria, and Guidance
SCO	Soil Cleanup Objective
SGV	Standards and Guidance Values
SVOC	Semi-volatile organic compound
SWPPP	Stormwater Pollution Prevention Plan
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TCWG	Tonawanda Community Working Group
TOGS	Technical and Operational Guidance Series
TP	Test Pit
TOC	Total Organic Carbon
ug/Kg	Micrograms per kilogram
ug/L	Micrograms per liter
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

Executive Summary

On behalf of Riverview Innovation & Technology Campus, Inc (RITC), Inventum Engineering, P.C. (Inventum) has prepared this Pre-Design Investigation Work Plan (PDIWP) to develop a site-specific Ammonia Soil Cleanup Objective (SCO) for fill materials on the RITC Brownfield Cleanup Program Site (BCP Site #C915353). The Work Plan has been prepared to provide the protocol to be followed for the development of a SCO to be used in the remedial design of the remedy selected and approved by the New York State Department of Environmental Conservation (NYSDEC). The scope includes activities that are appropriate for the development of the Ammonia SCO as defined in Chapter 7 of the New York State Brownfield Cleanup Program, Development of Soil Cleanup Objectives, Technical Support Document (NYSDEC 2006).

Data Gaps

The RI coupled with the ongoing IRMs provide a comprehensive understanding of the nature and extent of overall impacts on the BCP Site. The specific source(s) of the Ammonia impacts, however, have not been quantified. While there is a Class GA Groundwater Standard, neither the NYSDEC nor the US Environmental Protection Agency (USEPA) have a SCO for Ammonia. The data proposed for collection herein are related to the details of the remedial design. Based on the results of the analysis and determination of an Ammonia SCO, the data will be incorporated into the RAWP for management of any remaining potential Ammonia source or impact.

Pre-design Investigation Work Plan

The Work Plan has been developed to provide the sequence of activities to be completed to collect pre-design data and define remedial design criteria for Ammonia in soil.

Engineering Certification

I, John P. Black certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Pre-design Investigation Work Plan Development of Soil Cleanup Objective for Ammonia was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the NYSDEC Technical Guidance for Site Investigation and Remediation (DER-10) and Green Remediation (DER-31), and that all activities producing the data shall be performed in full accordance with NYSDEC-approved work plans and any NYSDEC-approved modifications.

Respectfully Submitted,

Inventum Engineering, P.C.

Date: Sept. 10, 2024

John P. Black, P.E.

License No: 062818-1

Seal:

STATE OF NEW YORK
JOHN P. BLACK
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LICENSED PROFESSIONAL ENGINEER

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1 Introduction

On behalf of Riverview Innovation & Technology Campus, Inc (RITC), Inventum Engineering, P.C. (Inventum) has prepared this Pre-design Investigation Work Plan (Work Plan) for the RITC Brownfield Cleanup Program Site (BCP Site #C915353) located at 3875 River Road in Tonawanda, Erie County, New York.

This Work Plan has been prepared to define the protocols to be followed to develop a site-specific Ammonia Soil Cleanup Objective (SCO) for the fill with Ammonia on the RITC BCP Site. The Work Plan has been prepared to provide the protocol and steps required to be followed for the development of a SCO to be used in the remedial design of the remedy selected and approved by the New York State Department of Environmental Conservation (NYSDEC). The scope includes activities that are appropriate for the development of the Ammonia SCO as defined in Chapter 7 of the New York State Brownfield Cleanup Program, Development of Soil Cleanup Objectives, Technical Support Document (NYSDEC 2006).

1.1 PDIWP Organization

This PDIWP has been organized into the following sections:

Section 1 - Introduction
Section 2 - Sampling and Analysis
Section 3 - Reporting
Section 4 - Schedule
Section 5 - Bibliography

2 Sampling and Analysis

The sampling and analysis activities are proposed to collect data for the remedial designs. Ammonia appears in groundwater samples collected across the site[1] (Figure 2-3) although significant concentrations are primarily in the former production area (AOI 2) sources of the ammonia may have been (1) leaks from pipes, tanks and process equipment and (2) TCC placement of impacted fill on various locations on the property. As the process equipment and piping was removed, the ammonia concentration in the stormwater outfall has dropped, see Figure 2-1.

A similar trend was observed in the influent to the groundwater treatment system, suggesting the IRMs and equipment removals had an influence on the shallow groundwater quality, see Figure 2-2.

While the process equipment and piping has been removed, the concentration of ammonia in fill and soil that may continue to act as a source must be determined.

The purpose of this sampling and analysis is to:

- Collect data for the determination of a site-specific Ammonia SCO(s) using data from the site fill.
- Collect groundwater samples in the vicinity of the soil samples collected for the analysis of the samples to calculate a SCO and back calculate a soil-water distribution coefficient (Kd).
- Produce data to refine the understanding of the distribution of ammonia in groundwater.
- Produce data to understand the effect of solidification on the leachability of ammonia from source materials in the production area.

The ongoing and proposed IRMs in the Production Area are collecting and treating shallow groundwater and solidifying the known potential source areas. The last round of shallow groundwater samples that included ammonia were collected in May 2023 (Figure 2-3), after one year of groundwater collection and treatment but before the solidification of the fill in the target sections of the production area.

The scope of work includes the collection of samples for testing to identify a SCO and estimate the soil-water distribution coefficient (Kd), quantification of the concentration of ammonia in fill samples, and quantification of the concentration of ammonia in groundwater and fill samples (Table 2-1).

Representative fill samples (Table 2-2) will be tested to determine the concentrations in fill that result in groundwater concentrations exceeding the Class GA standards and to calculate the soil water distribution coefficient. Direct testing for the Kd in accordance with ASTM D4646-16 "Standard Test Method for 24hr Batch-type Measurement of Contaminant Sorption by Soils and Sediment" is not possible as the test requires a sample that is free of ammonia. To date, no fill sample analysis for ammonia has been non-detect. Verification samples of solidified material have been tested for ammonia (*Solidification IRM* [Inventum, October 2023]) and results may be referenced in tables 2-3 through 2-10. A sample of solidified fill from the MW-BCP-05 area will be collected as an indicator of the effect of solidification on ammonia dissociation in the fill in that area.

[1] The concentration contours on Figure 2-3 may over predict the distribution of ammonia due to the absence of data in portions of AOI 1, AOI 3, AOI 4, AOI 5, and AOI 6. The data proposed to be collected in this work plan will help refine the mapping to more accurately show the distribution of ammonia on the BCP Site.

Inventum consulted with two laboratories, EurofinsTestAmerica and Prima Environmental in California, and both laboratories recommended using US Environmental Protection Agency, 2017, SW-846 Test Method 1314: "Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio for Constituents in Solid Materials Using An Up-Flow Percolation Column Procedure" to determine the appropriate SCO and allow calculation of the Kd. The approach will include:

1. Collection of groundwater and discrete fill samples at the nineteen locations and one sump sample from Battery No. 2 shown on Figure 2-2;
   a. 36 total groundwater samples (36 Ammonia, 15 VOCs, 20 SVOCs, and 20 Cyanide)
   b. 22 total soil samples (22 Cyanide, 22 Mercury, 22 Ammonia, 22 pH)
2. The fill and groundwater samples will be analyzed in accordance with Table 2-1;
3. The ammonia data from the 22 fill samples will be analyzed and the Maximum, Minimum, Mean, Median, and standard deviation will be calculated;
4. Based on the statistical analyses, six bulk composite samples will be collected: the Minimum, Maximum, and the samples closest to; the Mean, the Mean minus one standard deviation, the Mean plus one standard deviation, and the Mean plus two standard deviations;
5. The six samples will be analyzed in accordance with SW SW-846 Test Method 1314: Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio for Constituents in Solid Materials Using An Up-Flow Percolation Column Procedure (Appendix A) Option A (Complete Characterization). Option A was selected to provide the most robust characterization of ammonia leaching potential.
6. Analysis of a sample from the MW-BCP-05 solidified materials will be analyzed in accordance with SW SW-846 Test Method 1314: Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio for Constituents in Solid Materials Using An Up-Flow Percolation Column Procedure (Appendix A) Option A (Complete Characterization).

The samples will be analyzed in accordance with Table 2-2. Each sample will contain at least 1,210 grams of material for analysis of ammonia (5 grams), pH (5 grams), and to conduct the Leaching Environmental Assessment Framework (LEAF) analyses (1,200 grams). Each test will yield 9 ammonia leachate concentration results based on analysis of leachate collected over the duration of the test. The mean and standard deviation of each set of leachate tests will be calculated. The mean plus one standard deviation will be plotted against the initial ammonia concentration of the six unsolidified fill samples. The estimated fill concentration at the leachate concentration of the Class GA Standard of 2,000 ug/L will be designated as the site-specific SCO. The results of the solidified sample testing will be plotted on the graph but will not be included in the calculation of the proposed SCO.

In accordance with the Technical Support Document, "Using a water quality value which may not be exceeded in leachate and the partition coefficient method, the equilibrium concentration (Cs) will be expressed in the same units as the water standards. The following expression is used:

Allowable Soil Concentration Cs = Kd x Cw

Where:

Kd = soil water distribution coefficient

Cw = groundwater / drinking water standard = 2,000 ug/L for Ammonia

To represent the overall properties at the BCP Site, the proposed SCO determined above will be used to back calculate the Kd using the equation Kd = Cs/Cw.

All sampling and analysis shall be completed in accordance with the Health and Safety Plan (HASP, Appendix B), Quality Assurance Project Plan (QAPP Appendix C), and Community Air Monitoring Plan (CAMP, Appendix D).

2.1 Groundwater Sampling

Groundwater sampling is proposed to refine the identification of the locations affecting surface water quality, primarily ammonia in this work plan, and to determine if there have been any short-term effects of the IRMs. While the presence and distribution of ammonia is the primary target of the pre-design sampling, additional parameters will be collected from selected monitoring wells (Table 2-1) to confirm the current understanding of the potential mechanisms related to sorption in the BCP Site groundwater regime.

Liquid level measurements[2] will be collected from all the monitoring wells and staff gauges. The depth to groundwater will be measured in all monitoring wells, piezometers, and collection system sumps. Water elevations will be recorded at all BCP Site staff gage locations. Depth and elevation measurements will be collected prior to the collection of any analytical samples. The depth to water and overall total depth of the well will be collected using an oil/water interface probe and recorded in a field notebook. The presence of any non-aqueous phase liquid (NAPL) will also be recorded. The total depth of the well will be verified to determine if any significant sediment accumulation has occurred. Redevelopment may be required prior to sampling if sediment has accumulated above the bottom of the screened interval.

Monitoring wells to be sampled (Table 2-1, Figure 2-4) will be purged a minimum of three well volumes or until dry. The monitoring wells will be purged using a bailer or peristaltic pump prior to collecting groundwater samples. Field measurements of pH, temperature, conductivity, turbidity, dissolved oxygen, and oxygen reduction potential (ORP) will be recorded over at least three intervals during the purging process.

Groundwater samples will be collected with a bailer or with dedicated polyethylene tubing and a peristaltic pump. Groundwater samples for analysis will be packed in coolers with ice and delivered by courier to the New York State Certified Laboratory. Groundwater samples for use in the sorption analysis shall be packed in coolers with ice and delivered by courier to the laboratory capable of conducting the column testing. If available, and for consistency, EurofinsTestAmerica of Pittsburgh will be used for all analyses.

2.2 Soil Sample Collection

Initial characterization soil samples will be collected using hydraulic excavators 5 feet from the monitoring wells included in the groundwater sampling program and at the three supplemental soil sample locations (Figure 2-4). Soil samples will be collected from pits advanced using traditional excavation equipment. During sampling the excavations will extend to delineate the extent of the target material including to the underlying clay. A minimum of one fill sample will be collected from each test pit. If field observations warrant additional sample collection, a discrete sample of each zone of apparent ammonia impact in the fill from the ground surface to the top of clay will be collected. Observation of excavated soils/fill and field screening with a PID (10.6eV lamp) will be made directly from each exposed interval. Samples will be collected with a clean stainless-steel spoon. The elevation of the ground surface, sample depth(s), and top of clay will be recorded in the field logs for each test pit.

[2] For purposes of developing an indication of groundwater surface(s), if possible, water level measurements will be coordinated and measured across the BCP Site, Site 110 and Site 109 in a single day.

After the initial characterization sampling results are received and analyzed, the six LEAF sampling locations will be selected. The LEAF sampling locations will be located with on-site GPS equipment using the survey data recorded during the characterization sampling and collected from the same depth in the zone of impact.

Photographs of each test pit will be taken. Photographs of any significant features exposed by the test pit (ex. buried debris, viscous tar seeps, etc.) will be collected after the final depth is reached. All pertinent information will be recorded in the field notebook or on test pit logs.

2.3 Survey

Sample locations and test pits will be surveyed with onsite GPS equipment from a datum established by a surveyor licensed in the state of New York consistent with standard technical practices. Horizontal locations will reference the North American Datum of 1983 and the New York State Plane system (west zone) and be accurate to within ±0.1 foot. Vertical elevations from the ground surface and top of casing (TOC) will be referenced to the North American Vertical Datum of 1988 and reported in feet above mean sea level. Vertical measurements will be accurate to within ±0.01 foot.

2.4 Community Air Monitoring

The air monitoring program during the Pre-deign Investigation will be conducted in accordance with the Community Air Monitoring Plan (CAMP) provided in Appendix D. Three (3) perimeter air monitoring units (1 Upwind and 2 Downwind) were installed on the BCP Site on April 29, 2020 (Appendix D). These units are fixed to monitor perimeter air quality and their location will not be adjusted as work area(s) shift over the course of the design investigations except when the work would undermine the units.

Additional air monitors (PID and particulate meters) will be utilized to monitor downwind air quality more locally to the Test Pit and areal delineation work area(s) during active work shifts. The location of these work area specific perimeter air monitors will be adjusted as necessary as the work area shifts and/or with noticeably sustained shifts in prevalent wind directions. A weather station has been installed at the upwind monitoring station and will be a guide to determine prevalent wind direction. The prevalent wind direction and the location of the air monitors will be documented daily.

2.5 Field Modification Notifications

The NYSDEC BCP PM, or their designated representative, will be notified via electronic mail and telephone if the following conditions occur:

- NYSDEC and NYSDOH will be notified no less than 7 days before any sampling activities.
- Field activities are delayed and/or rescheduled due to unsafe or unsuitable weather conditions and/or equipment malfunctions.
- Proposed test pit locations must be relocated more than 25-feet from the location shown in Figure 2-4 due to surface or subsurface conditions preventing completion of the test pit to the desired depth or unforeseen hazardous overhead conditions.
- A previously unknown underground tank or process piping is encountered.

3 Reporting

The pre-design investigation tasks will be incorporated into the remedial design after a remedial alternative is selected. To provide an ongoing transfer of information, the following reporting is proposed:

1. Sample summary – the initial soil sample analyses, groundwater sample logs, and data will be provided.
2. Groundwater Data – Table 2D of the 2024 data summary will be updated with the 2024 results.
3. The locations of the six LEAF samples will be proposed in a preliminary memorandum.
4. Proposed SCO(s) – The results of the LEAF analysis and the resulting SCO will be provided in a summary memorandum.
5. Solidified Sample Data – The results of the LEAF analysis of the solidified sample from MW-BCP-05 will be presented and the potential for solidified materials to act as a source of groundwater ammonia concentrations will be explained.

4 Schedule

The proposed schedule for the pre-design investigations is expected to take 3 to 4 months overall. Within that overall timeframe:

- Coordination with the laboratories for the sample delivery.
- Groundwater sampling – 1 week (prior to test pit excavation).
- Test pit excavation and sampling – 1 week
- Laboratory testing – 6 weeks (Some may require additional trials)

5 Bibliography

The bibliography provides a list of documents used to develop this pre-design investigation work plan.

1. ASTM International, 2016, Standard test Method for 24-h Batch Type Measurement of Contaminant Sorption by Soils and Sediments”

2. Center for Environmental a & Human Toxicology, University of Florida, 2005, “Technical Report: Development of Cleanup Target Levels (TCLs) For Chapter 62-777, F.A.C.”, February.

3. Inventum Engineering, 2020a, Citizen Participation Plan, Riverview Innovation & Technology Campus, BCP Site No. C915353, March.

4. Inventum Engineering, 2020b, Storm Water Pollution Prevention Plan, Riverview Innovation & Technology Campus, BCP Site No. C915353, June.

5. Inventum Engineering, 2021m, Groundwater IRM Work Plan, West Production Area, December.

6. Inventum Engineering, 2022a, Groundwater IRM Work Plan – Addendum, West Production Area, March.

7. New York State Department of Environmental Conservation, 2010, DER-10: Technical Guidance for Site Investigation and Remediation, June.

8. New York State Department of Environmental Conservation, 2010, DER-31 Green Remediation, September.

9. New York State Department of Environmental Conservation, 2010, CP-51: Soil Cleanup Guidance Policy, October.

10. New York State Department of Environmental Conservation, 2006, “New York State Brownfield Cleanup Program, Development of Soil Cleanup Objectives, Technical Support Document, Prepared By: New York State Department of Environmental Conservation and New York State Department of Health, September.

11. US Environmental Protection Agency, 2017, SW-846 Test Method 1314: Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio for Constituents in Solid Materials Using An Up-Flow Percolation Column Procedure

Tables

Table - 2-1
Initial Sample Location Summary
Ammonia SCO Work Plan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

Plant Subsection	Plant Subsection AOI	Cell Location	Target Location	Monitoring Well Designation	Type	Rationale	Groundwater Sample Analysis				Soil Sample Depth	Fill/Soil Sample Analysis			
							VOCs (8260C)	Mercury (7470)	Cyanide (9012)	Ammonia (E350.1)		Cyanide	Mercury	Ammonia	pH
North-western Perimeter	AOI 3 - Parking Lot	B-15	Downgradient Parking Lot	MW-BCP-01A	Shallow Monitoring Well	Downgradient of former rail yard facilities. No ammonia data.	1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-01B	Medium Depth Monitoring Well					1					
Light Oil Area	AOI 2 - Production Area	F-11	Downgradient Weak Ammonia and Phenol Tanks	MW-BCP-04A	Shallow Monitoring Well	Downgradient Well, downgradient of Light Oil and Weak Ammonia Tanks. Area of potential impact by weak ammonia and light oil.	1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-04B	Medium Depth Monitoring Well					1					
		F-9		N.A.	Soil Sample, Shallow Test Pit	Limit of former Secondary Containment						1	1	1	1
		G-8		N.A.	Soil Sample, Shallow Test Pit	Limit of former Secondary Containment						1	1	1	1
Tar Processing Area	AOI 2 - Production Area	N-6	Tar Processing	MW-BCP-05A	Shallow Monitoring Well	Significant source to groundwater IRM. Highest ammonia concentration in groundwater.	1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-05C	Medium Deep Depth Monitoring Well	Confirm there is no Vertical Migration				1					
		V-6		N.A.	Soil Sample, Shallow Test Pit	Limit of former Secondary Containment						1	1	1	1
North Perimeter Well	AOI 1 - North Rail Corridor	U-1	North Perimeter	MW-BCP-06A	Shallow Monitoring Well	North Perimeter well.	1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-06C	Medium Deep Depth Monitoring Well					1					

Table - 2-1
Initial Sample Location Summary
Ammonia SCO Work Plan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

Plant Subsection	Plant Subsection AOI	Cell Location	Target Location	Monitoring Well Designation	Type	Rationale	Groundwater Sample Analysis				Soil Sample Depth	Fill/Soil Sample Analysis			
							VOCs (8260C)	Mercury (7470)	Cyanide (9012)	Ammonia (E350.1)		Cyanide	Mercury	Ammonia	pH
Coke Management Area	AOI 4 - Coke Yard	O-13	Coke Yard	MW-BCP-08A	Shallow Monitoring Well	No ammonia groundwater data.				1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-08B	Medium Deep Depth Monitoring Well					1					
Process Area	AOI 2 - Production Area	Q-9	South Process Area	MW-BCP-09A	Shallow Monitoring Well	Low concentration adjacent to Battery No. 1	1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-09B	Medium Depth Monitoring Well					1					
Tar Processing Area	AOI 2 - Production Area	R-6	Tar Processing	MW-BCP-10A	Shallow Monitoring Well	Significant source to groundwater IRM.	1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-10C	Medium Deep Depth Monitoring Well	Confirm no vertical migration				1					
Processing Area	AOI 4 - Coke Yard		South of former Battery	MW-BCP-11A	Shallow Monitoring Well	Potential source area, south of Battery No. 2.	1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-11B	Medium Depth Monitoring Well					1					

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Initial Sample Location Summary
Ammonia SCO Work Plan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

Plant Subsection	Plant Subsection AOI	Cell Location	Target Location	Monitoring Well Designation	Type	Rationale	Groundwater Sample Analysis				Soil Sample Depth	Fill/Soil Sample Analysis			
							VOCs (8260C)	Mercury (7470)	Cyanide (9012)	Ammonia (E350.1)		Cyanide	Mercury	Ammonia	pH
Processing Area	AOI 2 - Production Area	AE-8	Boiler House Purifier Box Area	MW-BCP-12A	Shallow Monitoring Well	Potential source area, north of Battery No. 1.	1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-12B	Medium Depth Monitoring Well					1					
Battery No. 2	AOI 2 - Production Area		Battery Sump	N.A.		Battery Sump Data				1					
Coke Yard	AOI 4 - Coke Yard	AQ-16	East Coke Yard, West of Tar Seep No. 1 (On Site 110)	MW-BCP-13A	Shallow Monitoring Well	Area of groundwater impact from Tar Seep No. 1	1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-13B	Medium Depth Monitoring Well		1	1	1	1					
Coal Yard	AOI 7 -	AN-21	South Drainage	MW-BCP-17A	Shallow Monitoring Well	No ammonia data			1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-17B	Medium Depth Monitoring Well				1	1					
Coal Yard	AOI 5 - Coal Yard	AN-21	South Coal Yard, West of Tar Seep No. 2	MW-BCP-19A	Shallow Monitoring Well	Area of groundwater impact from Tar Seep No. 2	1	1		1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-19B	Medium Depth Monitoring Well		1	1		1					

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Initial Sample Location Summary
Ammonia SCO Work Plan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

Plant Subsection	Plant Subsection AOI	Cell Location	Target Location	Monitoring Well Designation	Type	Rationale	Groundwater Sample Analysis				Soil Sample Depth	Fill/Soil Sample Analysis			
							VOCs (8260C)	Mercury (7470)	Cyanide (9012)	Ammonia (E350.1)		Cyanide	Mercury	Ammonia	pH
Mixing Pad	AOI 5 - Coal Yard	AB-24	Downgradient of Mixing Pad	MW-BCP-20A	Shallow Monitoring Well	No ammonia data				1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-20B	Medium Depth Monitoring Well					1					
North Property Boundary	AOI1 - North Rail Corridor		Boundary Wells	MW-BCP-21A	Supplemental Shallow Monitoring Well	Northern Limit	1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-21C	Supplemental Medium Deep Monitoring Well					1					
North Property Boundary	AOI1 - North Rail Corridor		Boundary Well	MW-BCP-22A	Supplemental Shallow Monitoring Well	Northern Limit		1	1	1	Depth TBD based on field observations.	1	1	1	1
Northeast Corner	AOI1 - North Rail Corridor		Boundary Well	MW-BCP-23A	Supplemental Shallow Monitoring Well	Confirm Shallow Water Quality at Northeast Boundary		1	1	1	Depth TBD based on field observations.	1	1	1	1
Coke Yard	AOI4 - Coke yard		Downgradient of MW-BCP-13	MW-BCP-24A			1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-24B				1	1	1					

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Initial Sample Location Summary
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Plant Subsection	Plant Subsection AOI	Cell Location	Target Location	Monitoring Well Designation	Type	Rationale	Groundwater Sample Analysis				Soil Sample Depth	Fill/Soil Sample Analysis			
							VOCs (8260C)	Mercury (7470)	Cyanide (9012)	Ammonia (E350.1)		Cyanide	Mercury	Ammonia	pH
Coal Yard	AOI5 - Coal Yard		Downgradient of MW-BCP-19	MW-BCP-25A			1	1	1	1	Depth TBD based on field observations.	1	1	1	1
				MW-BCP-25B				1	1	1					
Southeast Corner	AOI7 - South Drainage		Boundary Well	MW-BCP-27A	Supplemental Shallow Monitoring Well	Water Quality at Southeast Boundary		1	1	1	Depth TBD based on field observations.	1	1	1	1
						Total Analyses:	**15**	**20**	**20**	**36**		**22**	**22**	**22**	**22**

Note: A minimum of one soil sample will be collected from each test pit. If multiple zones of impacts are observed in the field, additional discrete samples from each zone may be collected.

Table - 2-2
Column Test Sample Location Summary
Ammonia SCO Work Plan
Riverview Innovation Technology Campus
Town of Tonawanda, New York

Plant Subsection AOI	Sample ID	Rationale/Specific Requirements	Test Pit Depth (Feet)	Soil Samples Formation	Sample Depth	pH	Ammonia (350.1)	SW 846 - 1314 (Bulk Sample for LEAF testing)	Ammonia Eluate (350.1)
TBD	CT-BCP-100	Minimum Concentration from Initial Samples	TBD	Shallow fill	Surface to TBD	1	1	1	9
TBD	CT-BCP-101	Maximum Concentration from Initial Samples	TBD	Shallow fill	Surface to TBD	1	1	1	9
TBD	CT-BCP-102	Closest to mean	TBD	Shallow fill	Surface to TBD	1	1	1	9
TBD	CT-BCP-103	Closest to mean less one standard deviation	TBD	Shallow fill	Surface to TBD	1	1	1	9
TBD	CT-BCP-104	Closest to mean plus one standard deviation	TBD	Shallow fill	Surface to TBD	1	1	1	9
TBD	CT-BCP-105	Closest to mean plus two standard deviations	TBD	Shallow fill	Surface to TBD	1	1	1	9
AOI 2	CT-BCP-106	Solidified material from MW-BCP-05 Area	TBD	Solidified Material	Surface to TBD	1	1	1	9
					Total Analyses:	7	7	7	63

Notes:
(1) The TBDs in Plant Subsection AOIs and associated test pitting and sample depths will be selected and recorded after performing the statistical analyses of the initial sampling.
(2) The seven soil samples for Ammonia and pH will be collected to confirm the concentration is similar to the initial sampling concentration.
(3) Nine liquid eluate samples will be produced from each bulk LEAF soil sample and analyzed for Ammonia.

Table 2-3
Pump House Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	H43-V1-10312023	H44-V2-10312023	E48-V5-11302023	D47-V6-12072023	C47-V7-12112023
	LAB ID:	L2364459-01	L2364459-02	L2370531-01	L2372250-01	L2372961-01
	COLLECTION DATE:	10/31/2023	10/31/2023	11/30/2023	12/7/2023	12/11/2023
	SAMPLE DEPTH:	2' - 3' BGS	3' - 4' BGS	2.5' - 3.5' BGS	3' - 4' BGS	4' - 5' BGS
	SAMPLE MATRIX:	SOIL	SOIL	SOLID	SOLID	SOIL
	UNITS	Pump House, Cell H43, 10% Breeze, 6% LKD	Pump House, Cell H44, 10% Breeze, 15% LKD	Pump House, Cell E48, 10% Breeze, 15% LKD	Pump House, Cell D47, 10% Breeze, 15% LKD	Pump House, Cell C46, 10% Breeze, 15% LKD
GENERAL CHEMISTRY						
Nitrogen, Ammonia	mg/kg	**140**	**300**	**27**	**38**	**25**
Solids, Total	%	**84.3**	**80.8**	**78.9**	**80.2**	**80.7**

Qualifiers:
U - Not detected at the reported detection limit for the sample.
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-3
Pump House Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	F45-V8-12142023	D45-V9-12202023	G44-V10-12202023	E43-V11-12222023
	LAB ID:	L2374090-01	L2375164-01	L2375164-02	L2375952-01
	COLLECTION DATE:	12/14/2023	12/20/2023	12/20/2023	12/22/2023
	SAMPLE DEPTH:	5' - 6' BGS	4.5' - 5.5' BGS	5' - 6' BGS	48" BGS
	SAMPLE MATRIX:	SOIL	SOIL	SOIL	SOIL
	UNITS	Pump House, Cell F48, 10% Breeze, 15% LKD	Pump House, Cell D45, 10% Breeze, 15% LKD	Pump House, Cell G44, 10% Breeze, 15% LKD	Pump House, Cell E43, 10% Breeze, 15% LKD
GENERAL CHEMISTRY					
Nitrogen, Ammonia	mg/kg	**230**	**70**	**140**	**140**
Solids, Total	%	**75.3**	**80.8**	**79**	**78.5**

Qualifiers:
U - Not detected at the reported detection lim
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-4
Weak Ammonia Liquor Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	L7-V28-01292024	M6-V31-01292024	M9-V32-01292024	L11-V39-02052024	N10-V38-02052024	N5-V37-02052024	O8-V43-02092024
	LAB ID:	L2404917-01	L2404917-02	L2404917-03	L2406252-03	L2406252-02	L2406252-01	L2407437-02
	COLLECTION DATE:	1/29/2024	1/29/2024	1/29/2024	2/5/2024	2/5/2024	2/5/2024	2/9/2024
	SAMPLE DEPTH:	4' - 5' BGS	4' - 5' BGS	4.5' - 5.5' BGS	4.5' - 5.5' BGS	5' - 6' BGS	5' - 6' BGS	5' - 6' BGS
	SAMPLE MATRIX:	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
	UNITS	WAL Area, Cell L7 5% Breeze, 5% LKD	WAL Area, Cell M6 5% Breeze, 5% LKD	WAL Area, Cell M9 5% Breeze, 5% LKD	WAL Area, Cell L11 5% Breeze, 5% LKD	WAL Area, Cell N10 5% Breeze, 5% LKD	WAL Area, Cell N5 5% Breeze, 5% LKD	WAL Area, Cell O8 5% Breeze, 5% LKD
GENERAL CHEMISTRY								
Nitrogen, Ammonia	mg/kg	**190**	**120**	**99**	**59**	**62**	**62**	**41**
Solids, Total	%	**77.9**	**79.9**	**77.3**	**81.7**	**77.9**	**83.2**	**79.9**

Qualifiers:
U - Not detected at the reported detection limit for the sample.
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-4
Weak Ammonia Liquor Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	N7-V42-02092024	K12-V46-02152024	L13-V45-02152024	L7-V60-03152024	N10-V61-03152024	N11-V62-03152024	M9-V65-03192024	L11-V67-03262024	L7-V72-04182024
	LAB ID:	L2407437-01	L2408354-02	L2408354-01	L2414278-01	L2414278-02	L2414278-03	L2414943-01	L2416469-01	L2421439-01
	COLLECTION DATE:	2/9/2024	2/15/2024	2/15/2024	3/15/2024	3/15/2024	3/15/2024	3/19/2024	3/26/2024	4/18/2024
	SAMPLE DEPTH:	4' - 5' BGS	4.5' - 5.5' BGS	6' - 7' BGS	5' BGS	5.5' BGS	4.5' BGS	4.5' BGS	5.5' BGS	4.5' BGS
	SAMPLE MATRIX:	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
	UNITS	WAL Area, Cell N7 5% Breeze, 5% LKD	WAL Area, Cell K12 5% Breeze, 5% LKD	WAL Area, Cell I13 5% Breeze, 5% LKD	WAL Area, Cell L7 10% Breeze, 15% LKD	WAL Area, Cell N10 10% Breeze,15% LKD	WAL Area, Cell N11 10% Breeze,15% LKD	WAL Area, Cell M9 10% Breeze,15% LKD	WAL Area, Cell L11 10% Breeze,15% LKD	WAL Area, Cell L7 15% Breeze, 22% LKD
GENERAL CHEMISTRY										
Nitrogen, Ammonia	mg/kg	**49**	**27**	**5.4** J	**110**	**54**	**78**	**62**	**37**	**56**
Solids, Total	%	**77.6**	**71.5**	**83.6**	**79.6**	**72.5**	**64.4**	**79.7**	**81.9**	**76**

Qualifiers:
U - Not detected at the reported detection lir
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-5
Exhauster Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	D35-V12-01042024	C33-V14-01092024	F35-V13-01092024	F33-V17-01112024
	LAB ID:	L2400628-01	L2401408-02	L2401408-01	L2401966-01
	COLLECTION DATE:	1/4/2024	1/9/2024	1/9/2024	1/11/2024
	SAMPLE DEPTH:	6.5' - 7' BGS	2' - 3' BGS	5' - 6' BGS	5' - 6' BGS
	SAMPLE MATRIX:	SOIL	SOIL	SOIL	SOIL
	UNITS	Exhauster Area, Cell D35, 5% Breeze, 5% LKD	Exhauster Area, Cell C33 5% Breeze, 5% LKD	Exhauster Area, Cell F35 5% Breeze, 5% LKD	Exhauster Area, Cell F33 5% Breeze, 5% LKD
GENERAL CHEMISTRY					
Nitrogen, Ammonia	mg/kg	**220**	**300**	**72**	**170**
Solids, Total	%	**77.4**	**84**	**78.1**	**81.5**

Qualifiers:
U - Not detected at the reported detection limit for the sample.
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-5
Exhauster Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	G34-V18-01112024	E32-V19-01162024	F31-V21-01162024	G32-V20-01162024
	LAB ID:	L2401966-02	L2402644-01	L2402644-03	L2402644-02
	COLLECTION DATE:	1/11/2024	1/16/2024	1/16/2024	1/16/2024
	SAMPLE DEPTH:	5.5' - 6.5' BGS	8' - 9' BGS	5' - 6' BGS	7' - 8' BGS
	SAMPLE MATRIX:	SOIL	SOIL	SOIL	SOIL
	UNITS	Exhauster Area, Cell G34 5% Breeze, 5% LKD	Exhauster Area, Cell E32 5% Breeze, 5% LKD	Exhauster Area, Cell F31 5% Breeze, 5% LKD	Exhauster Area, Cell G32 5% Breeze, 5% LKD
GENERAL CHEMISTRY					
Nitrogen, Ammonia	mg/kg	**130**	**210**	**160**	**170**
Solids, Total	%	**81.5**	**79.1**	**79.6**	**79.3**

Qualifiers:
U - Not detected at the reported detection limit for the samp
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-6
MW-BCP-05 Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	C30-V15-01092024	D27-V16-01112024	E28-V23-01162024	E30-V22-01162024	E25-V24-01192024	D24-V26-01222024	E23-V27-01222024
	LAB ID:	L2401406-01	L2401960-01	L2402646-02	L2402646-01	L2403586-01	L2403586-03	L2403586-04
	COLLECTION DATE:	1/9/2024	1/11/2024	1/16/2024	1/16/2024	1/19/2024	1/22/2024	1/22/2024
	SAMPLE DEPTH:	4' - 5' BGS	4' - 5' BGS	4.5' - 5' BGS	4.5' - 5.5' BGS	7' - 8' BGS	6' - 7' BGS	5' - 6' BGS
	SAMPLE MATRIX:	SOIL	SOIL	SOIL	SOIL	SOLID	SOLID	SOLID
	UNITS	MW-BCP-05, Cell C30 5% Breeze, 5% LKD	MW-BCP-05, Cell D27 5% Breeze, 5% LKD	MW-BCP-05, Cell E28 5% Breeze, 5% LKD	MW-BCP-05, Cell E30 5% Breeze, 5% LKD	MW-BCP-05, Cell E25 5% Breeze, 5% LKD	MW-BCP-05, Cell D24 5% Breeze, 5% LKD	MW-BCP-05, Cell E23 5% Breeze, 5% LKD
GENERAL CHEMISTRY								
Nitrogen, Ammonia	mg/kg	**260**	**300**	**210**	**170**	**280**	**260**	**330**
Solids, Total	%	**82.8**	**80.6**	**76.8**	**81.4**	**78.6**	**72.7**	**79.3**

Qualifiers:
U - Not detected at the reported detection limit for the sample.
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-6
MW-BCP-05 Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	F27-V25-01222024	F29-V29-01252024	G29-V30-01252024	G26-V33-01292024	F24-V34-01302024	G26-V70-03292024	G29-V69-03292024
	LAB ID:	L2403586-02	L2404351-01	L2404351-02	L2404919-01	L2405118-02	L2417251-02	L2417251-01
	COLLECTION DATE:	1/22/2024	1/25/2024	1/25/2024	1/29/2024	1/30/2024	3/29/2024	3/29/2024
	SAMPLE DEPTH:	5' - 6' BGS	4' - 5' BGS	3' - 4' BGS	5.5' - 6' BGS	3' - 4' BGS	6' BGS	4.5' BGS
	SAMPLE MATRIX:	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
	UNITS	MW-BCP-05, Cell F27 5% Breeze, 5% LKD	MW-BCP-05, Cell F29 5% Breeze, 5% LKD	MW-BCP-05, Cell G29 5% Breeze, 5% LKD, SAND	MW-BCP-05, Cell G26 5% Breeze, 5% LKD	MW-BCP-05, Cell F24 5% Breeze, 5% LKD	MW-BCP-05, Cell G26 10% Breeze, 15% LKD	MW-BCP-05, Cell G29 10% Breeze, 15% LKD
GENERAL CHEMISTRY								
Nitrogen, Ammonia	mg/kg	**240**	**120**	**140**	**260**	**310**	**140**	**87**
Solids, Total	%	**76.9**	**79.1**	**76.8**	**71.5**	**77.5**	**77.2**	**81.5**

Qualifiers:
U - Not detected at the reported detection lin
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-7
Tar Management Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	H42-V4102082024	F41-V47-02152024	D40-V48-02222024	E41-V49-02222024	F39-V53-02282024	C42-V54-03042024	G38-V55-03042024
	LAB ID:	L2407192-01	L2408356-01	L2409722-01	L2409722-02	L2410797-01	L2411555-01	L2411555-02
	COLLECTION DATE:	2/8/2024	2/15/2024	2/22/2024	2/22/2024	2/28/2024	3/4/2024	3/4/2024
	SAMPLE DEPTH:	7' - 8' BGS	7' - 8' BGS	5' - 5.5' BGS	4' - 5' BGS	5' - 6' BGS	5' BGS	5' BGS
	SAMPLE MATRIX:	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
	UNITS	Tar Management, Cell H42 15% Breeze, 20% LKD	Tar Management, Cell F41 15% Breeze, 20% LKD	Tar Management, Cell D40 15% Breeze, 20% LKD	Tar Management, Cell E41 15% Breeze, 20% LKD	Tar Management, Cell F39 15% Breeze, 20% LKD	Tar Management, Cell C42 15% Breeze, 20% LKD	Tar Management, Cell G38 15% Breeze, 20% LKD
GENERAL CHEMISTRY								
Nitrogen, Ammonia	mg/kg	**190**	**210**	**170**	**240**	**160**	**82**	**110**
Solids, Total	%	**80.5**	**83.6**	**81.1**	**80**	**79**	**77.1**	**79.2**

Qualifiers:
U - Not detected at the reported detection limit for the sample.
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-7
Tar Management Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	C38-V56-03082024	B40-V57-03132024	B38-V64-03192024	E37-V63-03192024	C42-V68-03292024
	LAB ID:	L2412741-01	L2413556-01	L2414944-02	L2414944-01	L2417252-01
	COLLECTION DATE:	3/8/2024	3/13/2024	3/19/2024	3/19/2024	3/29/2024
	SAMPLE DEPTH:	4' - 5' BGS	4' BGS	5' BGS	5' BGS	4' BGS
	SAMPLE MATRIX:	SOLID	SOLID	SOLID	SOLID	SOLID
	UNITS	Tar Management, Cell C38 15% Breeze, 20% LKD	Tar Management, Cell B40 15% Breeze, 20% LKD	Tar Management, Cell B38 15% Breeze, 20% LKD	Tar Management, Cell E37 15% Breeze, 20% LKD	Tar Management, Cell C42 22% Breeze, 30% LKD
GENERAL CHEMISTRY						
Nitrogen, Ammonia	mg/kg	**12**	**68**	**100**	**120**	**84**
Solids, Total	%	**83.4**	**77.5**	**66.6**	**82.1**	**64.9**

Qualifiers:
U - Not detected at the reported detection limi
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-8
Phenol Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	J5-V36-02052024		K8-V40-02052024		J9-V44-02092024		J9-V58-03132024		K8-V59-03132024		K8-V71-04182024	
	LAB ID:	L2406250-02		L2406250-03		L2407436-01		L2413557-01		L2413557-02		L2421442-01	
	COLLECTION DATE:	2/5/2024		2/5/2024		2/9/2024		3/13/2024		3/13/2024		4/18/2024	
	SAMPLE DEPTH:	4.5' - 5.5' BGS		4.5' - 5.5' BGS		5' - 6' BGS		4' BGS		5' BGS		5' BGS	
	SAMPLE MATRIX:	SOLID		SOLID		SOLID		SOLID		SOLID		SOLID	
	UNITS	Phenol Area, Cell J5 5% Breeze, 5% LKD		Phenol Area, Cell K8 5% Breeze, 5% LKD		Phenol Area, Cell J9 5% Breeze, 5% LKD		Phenol Area, Cell J9 10% Breeze, 15% LKD		Phenol Area, Cell K8 10% Breeze, 15% LKD		Phenol Area, Cell K8 15% Breeze, 22% LKD	
GENERAL CHEMISTRY													
Nitrogen, Ammonia	mg/kg	**290**		**94**		**56**		**33**		**66**		**6.7**	J
Solids, Total	%	**81.5**		**84.4**		**78**		**82.4**		**77.4**		**78.7**	

Qualifiers:
U - Not detected at the reported detection limit for the sample.
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-9
Light Oil Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	I5-V35-02052024	H9-V51-02282024	I11-V52-02282024	I7-V50-02282024	H12-V66-03262024
	LAB ID:	L2406250-01	L2410796-02	L2410796-03	L2410796-01	L2416468-01
	COLLECTION DATE:	2/5/2024	2/28/2024	2/28/2024	2/28/2024	3/26/2024
	SAMPLE DEPTH:	4' - 5.5' BGS	7' - 8' BGS	5.5' - 6.5' BGS	3' - 4' BGS	6' BGS
	SAMPLE MATRIX:	SOLID	SOIL	SOIL	SOIL	SOLID
	UNITS	Light Oil Area, Cell I5 5% Breeze, 5% LKD	Light Oil Area, Cell H9 10% Breeze, 15% LKD	Light Oil Area, Cell I11 10% Breeze, 15% LKD	Light Oil Area, Cell I7 10% Breeze, 15% LKD	Vitrified Clay Sump 10% Breeze, 15% LKD
GENERAL CHEMISTRY						
Nitrogen, Ammonia	mg/kg	**220**	**72**	**48**	**71**	**51**
Solids, Total	%	**82.6**	**83.3**	**86.8**	**81.7**	**81.7**

Qualifiers:
U - Not detected at the reported detection limit for the sample.
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-10
Tar Seep No. 2 Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	AN87-V73-05012024	AN88-V74-05012024	AO89-V75-05142024	AP87-V76-05142024	AN91-V77-05222024	V78-AQ88-05312024	V79-AL91-05312024
	LAB ID:	L2424061-01	L2424061-02	L2426623-01	L2426623-02	L2428548-01	L2430357-01	L2430357-02
	COLLECTION DATE:	5/1/2024	5/1/2024	5/14/2024	5/14/2024	5/22/2024	5/31/2024	5/31/2024
	SAMPLE DEPTH:	5.5' BGS	6.5' BGS	5.0' BGS	5.0' BGS	6.0' BGS	6.5' BGS	4' BGS
	SAMPLE MATRIX:	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
	UNITS	Tar Seep No. 2, Cell AN87	Tar Seep No. 2, Cell AN88	Tar Seep No. 2, Cell AO89	Tar Seep No. 2, Cell AP87	Tar Seep No. 2, Cell AN91	Tar Seep No. 2, Cell AQ88	Tar Seep No. 2, Cell AL91
GENERAL CHEMISTRY								
Nitrogen, Ammonia	mg/kg	**140**	**150**	**150**	**92**	**240**	**130**	**130**
Solids, Total	%	**72.6**	**71.6**	**76.6**	**77.8**	**74.7**	**69.1**	**75.8**

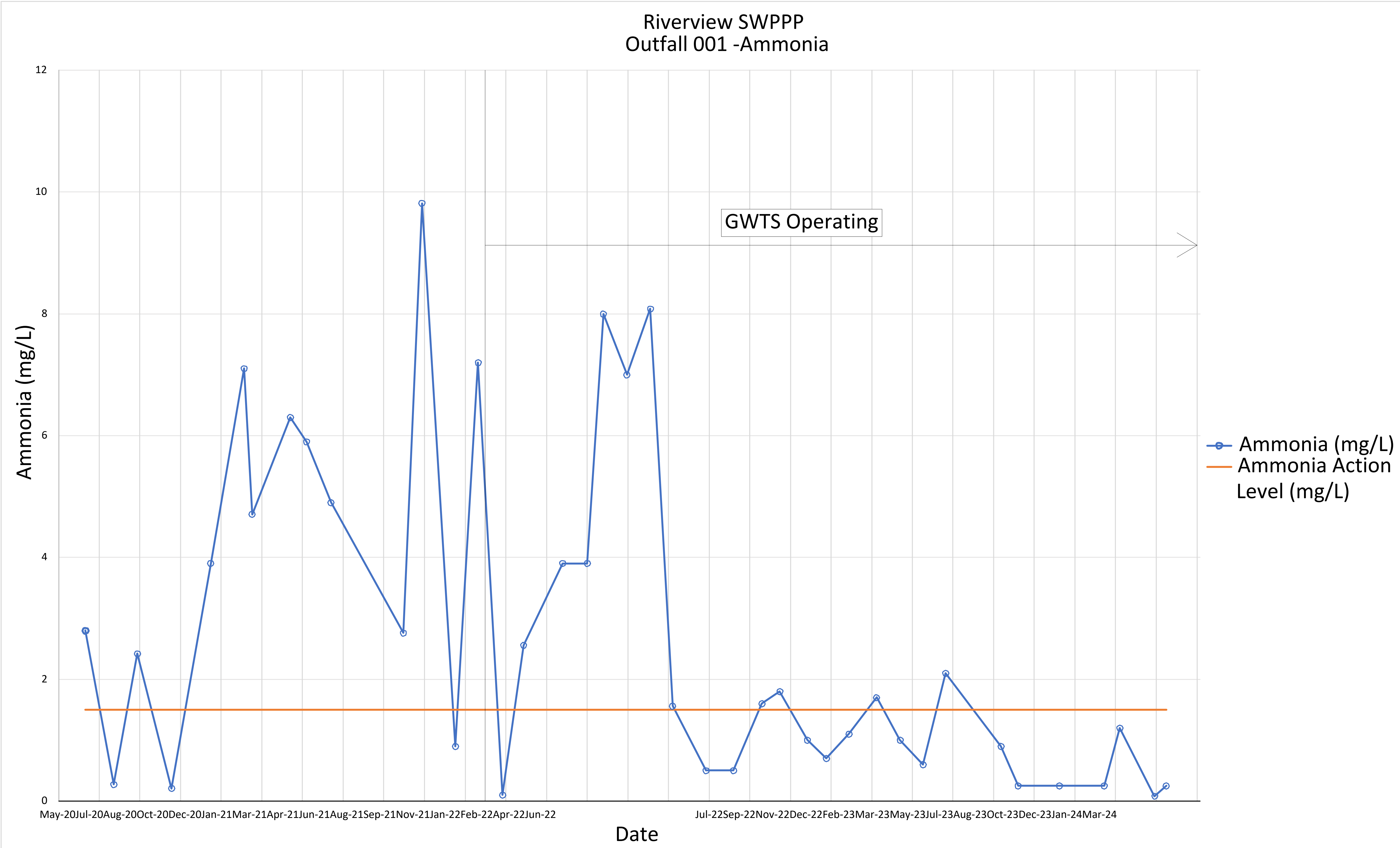
Qualifiers:
U - Not detected at the reported detection limit for the sample.
J - Presumptive evidence of compound.
Bold - Compound is detected

Table 2-10
Tar Seep No. 2 Area Solidification - Ammonia Concentrations
Ammonia SCO Workplan
Riverview Innovation & Technology Campus
Town of Tonawanda, New York

ANALYTE	SAMPLE ID:	V80-AM90-06102024	V81-AQ90-06242024	V82-AP91-06242024
	LAB ID:	L2432391, L2435632	L2435635-01	L2435637-01
	COLLECTION DATE:	6/10/2024	6/24/2024	6/24/2024
	SAMPLE DEPTH:	4.5' BGS	5.0' BGS	4.0' BGS
	SAMPLE MATRIX:	SOLID	SOLID	SOLID
	UNITS	Tar Seep No. 2, Cell AM90	Tar Seep No. 2, Cell AQ90	Tar Seep No. 2, Cell AP91
GENERAL CHEMISTRY				
Nitrogen, Ammonia	mg/kg	**140**	**160**	**97**
Solids, Total	%	**72.1**	**76.2**	**79.8**

Qualifiers:
U - Not detected at the reported detection limit
J - Presumptive evidence of compound.
Bold - Compound is detected

Figures



Inventum Engineering, P.C.

B

DRAWING BY
CHECKED
APPROVED

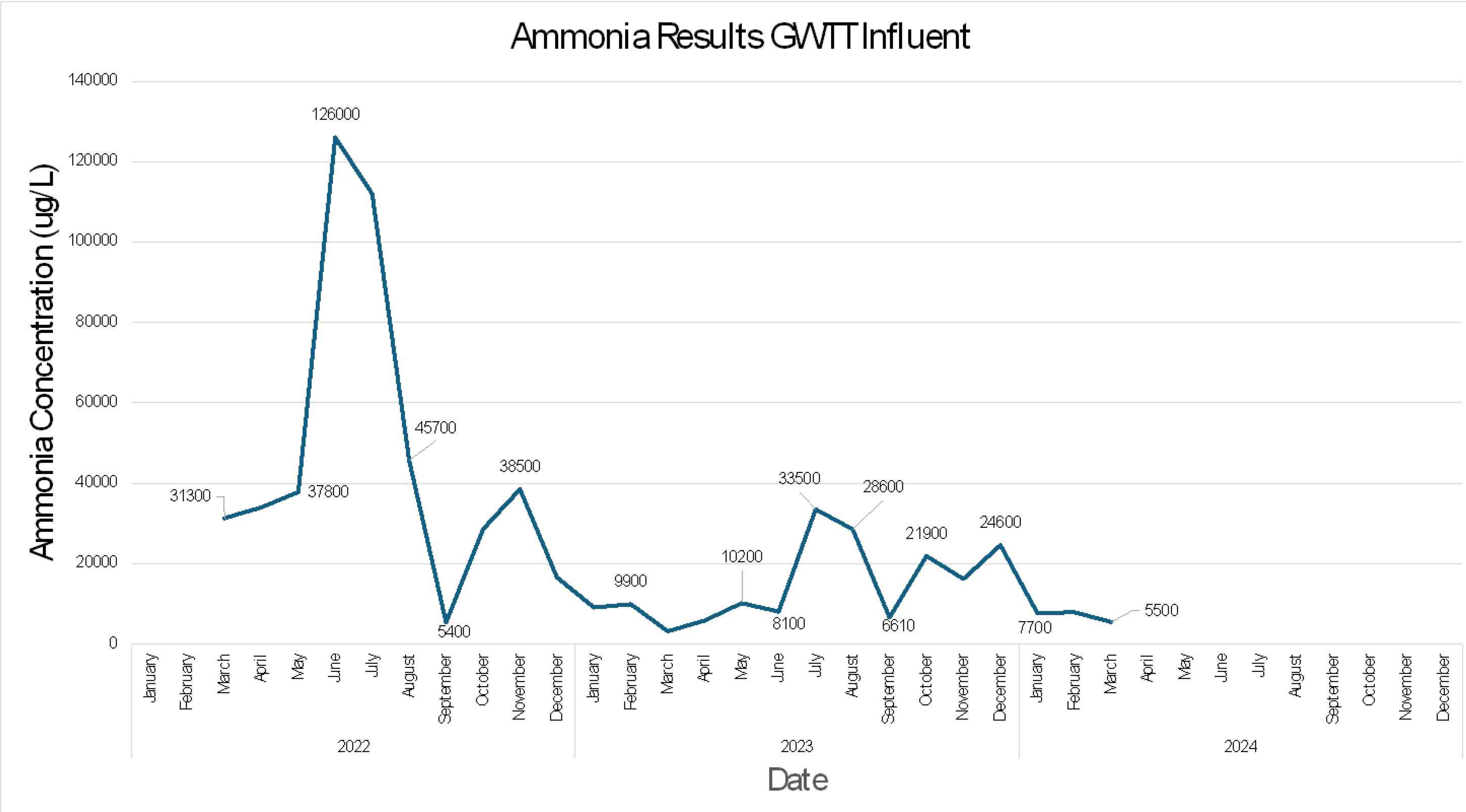
STORMWATER POLLUTION PREVENTION PLAN DATA - OUTFALL #001 JUNE 2020 TO DATE

RIVERVIEW INNOVATION & TECHNOLOGY CAMPUS, INC. TONAWANDA, NEW YORK

INVENTUM ENGINEERING
441 CARLISLE DRIVE
SUITE C
HERNDON, VIRGINIA 20170

FIGURE 2-1

DRAWING NUMBER
AMMONIA SCO WP



Inventum Engineering, P.C.

B

DRAWING BY

CHECKED

APPROVED

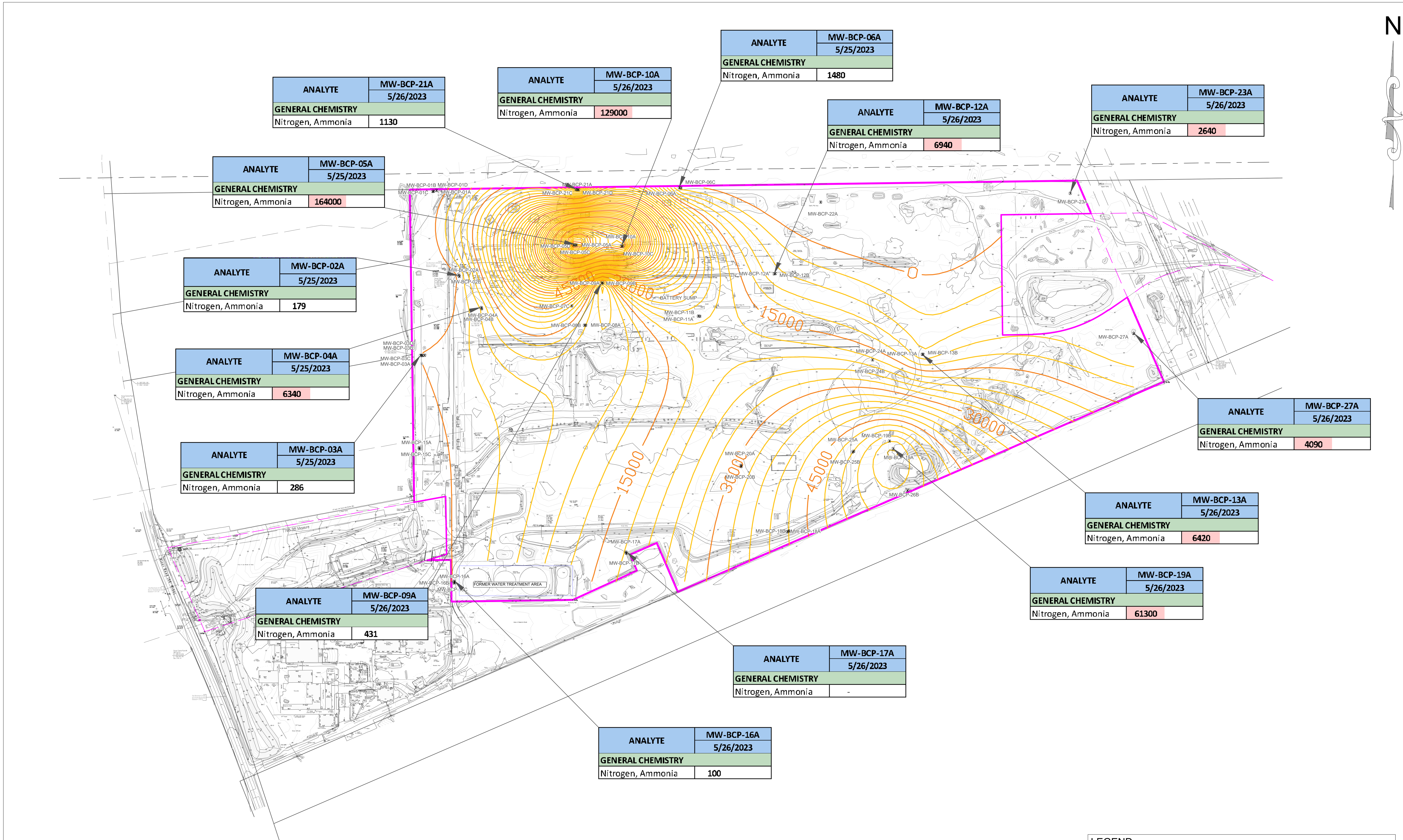
AMMONIA CONCENTRATION - GROUNDWATER TREATMENT PLANT INFLUENT JUNE 2020 TO DATE

RIVERVIEW INNOVATION & TECHNOLOGY CAMPUS, INC.
TONAWANDA, NEW YORK

INVENTUM ENGINEERING
441 CARLISLE DRIVE
SUITE C
HERNDON, VIRGINIA 20170

FIGURE 2-2

DRAWING NUMBER
AMMONIA SCO WP



Notes:

1. Contour interval equals 3,000 µg/L.
2. Former Water Treatment Area has been excavated to native clay.
3. All data compared to the NYS Class GA Ambient Water Quality Standard for Ammonia of 2,000 µg/L. An ammonia concentration exceeding the standard is highlighted in red.
4. Groundwater monitoring wells screened interval are A-Zone, Fill.

LEGEND:

- BCP SITE BOUNDARY
- SSF SITE BOUNDARY
- PRIMARY AMMONIA CONCENTRATION CONTOURS
- SECONDARY AMMONIA CONCENTRATION CONTOURS
- MONITORING WELL LOCATION

D

1" = 200'

Reference: Niagara Boundary, Map Showing Topographic Survey of Property Owned by Riverview Innovation & Technology Campus Inc., April 2022

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AMMONIA CONCENTRATIONS IN SHALLOW GROUNDWATER

RIVERVIEW INNOVATION & TECHNOLOGY CAMPUS, INC.
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TONAWANDA, NY 14150

INVENTUM ENGINEERING
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FIGURE 2-3

AMMONIA SCO WP

Notes:

1. Contours are in 3,000 µg/L intervals.
2. Sampling at selected well clusters will occur at the "A" and "B" wells. If there is no "B" well installed, sampling will occur at the "A" and "C" wells.
3. Former Water Treatment Area has been excavated to native clay.
4. Soil samples will be collected from test pits advanced within 5-feet of the associated monitory wells.

LEGEND:

- BCP SITE BOUNDARY
- SSF SITE BOUNDARY
- MONITORING WELL LOCATION
- MONITORING WELLS TO BE SAMPLED
- SUPPLEMENTAL SOIL SAMPLE

D

1" = 200'

200' 100' 0' 200'

Reference: Niagara Boundary, Map Showing Topographic Survey of Property Owned by Riverview Innovation & Technology Campus Inc., April 2022

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PROPERTY OF INVENTUM ENGINEERING

SOIL & GROUNDWATER SAMPLING LOCATIONS

RIVERVIEW INNOVATION & TECHNOLOGY CAMPUS, INC.
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FIGURE 2-4

AMMONIA SCO WP

Appendices

Appendix A - Laboratory Method

METHOD 1314[1]

LIQUID-SOLID PARTITIONING AS A FUNCTION OF LIQUID-SOLID RATIO FOR CONSTITUENTS IN SOLID MATERIALS USING AN UP-FLOW PERCOLATION COLUMN PROCEDURE

SW-846 is not intended to be an analytical training manual. Therefore, method procedures are written based on the assumption that they will be performed by analysts who are formally trained in at least the basic principles of chemical analysis and in the use of the subject technology.

In addition, SW-846 methods, with the exception of required methods used for the analysis of method-defined parameters, are intended to be guidance methods that contain general information on how to perform an analytical procedure or technique, which a laboratory can use as a basic starting point for generating its own detailed standard operating procedure (SOP), either for its own general use or for a specific project application. Performance data included in this method are for guidance purposes only and must not be used as absolute quality control (QC) acceptance criteria for purposes of laboratory QC or accreditation.

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[1] This method has been derived from the CT001 procedure (Ref. 4) and is analogous to column percolation method CEN/TS 14405 (Ref. 5) developed for the Comité Européen de Normalisation (CEN).

1.0 SCOPE AND APPLICATION

1.1 This method is designed to provide the liquid-solid partitioning (LSP) of inorganic constituents (e.g., metals, radionuclides) and non-volatile organic constituents (e.g., polycyclic aromatic hydrocarbons (PAHs), dissolved organic carbon, etc.) in a granular solid material as a function of liquid-to-solid ratio (L/S) under percolation conditions. The first eluates of the column test may provide insight into the composition of pore solution either in a granular bed (e.g., soil column) or in the pore space of low-permeability material (e.g., solidified monolithic or compacted granular fill). Analyses of eluates for dissolved organic carbon and of the solid phase for total organic carbon afford evaluation of the impact of organic carbon release and the influence of dissolved organic carbon on the LSP of inorganic constituents.

1.2 This method is intended to be used as part of an environmental leaching assessment for the evaluation of disposal, beneficial use, treatment effectiveness, and site remediation. The method is not required by federal regulations to determine whether waste passes or fails the toxicity characteristic as defined at 40 CFR 261.24.

1.3 This method is suitable to a wide range of granular solid materials. Example materials include industrial wastes, soils, sludges, combustion residues, sediments, construction materials, and mining wastes. This method is not suitable to monolithic materials (e.g., cement-based and stabilized materials) without particle size reduction prior to testing.

1.4 This test method is intended as a means for obtaining a series of extracts (i.e., the eluates) of a granular solid material that may be used to show eluate concentrations and/or cumulative release as a function of L/S, which can be related to a time scale when data on mean infiltration rate, density and height of application are available.

1.5 This method provides options for the preparation of analytical samples that provide flexibility based on the level of detail required. For example, when the purpose of characterization is for comparison to previous testing, compositing of eluates may be possible to create a reduced set of analytical samples. Table 1 outlines the eluate fractions and collection options, based on whether concentration or cumulative release is to be reported. The collection schemes are described below.

1.5.1 Complete characterization

For complete characterization of eluate concentration and cumulative release as a function of L/S, nine discrete eluate collections and analyses are required (see Table 1, Option A). No compositing of eluate fractions is performed for complete characterization, and all eluate fractions are analyzed.

Eluate concentrations from complete characterization may be used in conjunction with information regarding environmental management scenarios to estimate anticipated leaching concentrations, release rates, and extents of release for individual material constituents in the management scenarios evaluated. Eluate concentrations may also be used along with geochemical speciation modeling to infer the mineral phases that control the LSP in the pore structure of the solid material.

1.5.2 Limited analysis

Under a limited analysis approach, nine eluate collections and analysis of six analytical samples are required. If evaluation is based on eluate concentrations, six discrete eluate fractions are chemically analyzed (see Table 1, Option B). If evaluation is based on cumulative release, some eluate fractions are composited by volume-weighted averaging to create a set of six analytical samples (see Table 1, Option C). The concentrations of composite analytical samples cannot be interpreted along with eluate fractions on the basis of concentration.

1.5.3 Index testing

For the determination of consistency between the subject material and previously characterized materials, nine eluate collections and analysis of three analytical samples are required. If consistency is to be determined by eluate concentrations, three discrete eluate fractions are chemically analyzed (see Table 1, Option D). If consistency is to be determined by cumulative release, some eluate fractions are composited by volume-weighted averaging to create a set of three analytical samples (see Table 1, Option E). The concentrations of composited analytical samples cannot be interpreted along with eluate fractions on the basis of concentration.

1.6 This method is not applicable to characterize the release of volatile organic analytes.

1.7 This method provides eluate solutions considered indicative of leachate under field conditions only where the field leaching pH is controlled by the alkalinity or acidity of the solid material and the field leachate is not subject to dilution or other attenuation mechanisms. The cumulative mass of constituent released over a L/S range may be considered an estimate of the maximum mass of that constituent to be leached under field leaching over intermediate timeframes (e.g., up to 100 years) and the domain of laboratory test pH.

1.8 Prior to employing this method, analysts are advised to take reasonable measures to ensure that the granular sample is homogenized to the most practical extent. Particle size reduction may provide additional assurance of sample homogenization.

1.9 In preparation of solid materials for use in this method, particle size reduction or exclusion of samples with large grain size is used to enhance the approach towards liquid-solid equilibrium over the residence time of eluent in the column.

1.10 The structure and use of this method is similar to that of NEN 7343 (see Ref. 3) and CEN/TS 14405 (see Ref. 5).

1.11 Prior to employing this method, analysts are advised to consult the base method for each type of procedure that may be employed in the overall analysis (e.g., Methods 9040, 9045 and 9050, and the determinative methods for the target analytes) for additional information on QC procedures, development of QC acceptance criteria, calculations, and general guidance. Analysts also should consult the disclaimer statement at the front of the manual and the information in Chapter Two for: 1) guidance on the intended flexibility in the choice of methods, apparatus, materials, reagents, and supplies, and 2) the responsibilities of the analyst for demonstrating that the techniques employed are appropriate for the analytes of interest, in the matrix of interest, and at the levels of concern.

In addition, analysts and data users are advised that, except where explicitly specified in a regulation, the use of SW-846 methods is *not* mandatory in response to federal testing requirements. The information contained in this method is provided by the Environmental Protection Agency (EPA or the Agency) as guidance to be used by the analyst and the regulated community in making judgments necessary to generate results that meet the data quality objectives (DQOs) for the intended application. Guidance on defining DQOs can be obtained at http://www.epa.gov/QUALITY/qs-docs/g4-final.pdf.

1.12 This method is restricted to use by, or under supervision of, properly experienced and trained personnel. Each analyst must demonstrate the ability to generate acceptable results with this method.

2.0 SUMMARY OF METHOD

Eluent is introduced into a column of moderately packed granular material in an up-flow pumping mode, with eluate collection performed as a function of the cumulative L/S. Up-flow pumping is used to minimize air entrainment and flow channeling. The default eluent for most materials is reagent water. However, a solution of 1.0 mM calcium chloride in reagent water is used when testing materials with either a high clay content (i.e., to prevent deflocculation of clay layers) or high organic matter (i.e., to moderate mobilization of dissolved organic carbon). The flow rate is maintained between 0.5-1.0 L/S per day to increase the likelihood of local equilibrium between the solid and liquid phases, due to residence times longer than one day. Eluate volumes are chemically analyzed for a combination of inorganic and non-volatile organic analytes depending on the constituents of potential concern (COPC). For the purposes of chemical speciation modeling, the entire eluent volume up to 10 mL/g dry sample (g-dry) is collected in nine specific aliquots of varying volume. A limited subset of eluent volumes within the same L/S range may be collected and analyzed for regulatory and compliance purposes. A flowchart for performing this method is shown in Figure 1.

3.0 DEFINITIONS

3.1 Constituent of potential concern (COPC) – A chemical species of interest, which may or may not be regulated, but may be characteristic of release-controlling properties of the sample geochemistry.

3.2 Release – The dissolution or partitioning of a COPC from the solid phase to the aqueous phase during laboratory testing (or under field conditions). In this method, mass release is expressed in units of mg COPC/kg dry solid material.

3.3 Liquid-solid partitioning (LSP) – The distribution of COPCs between the solid and liquid phases at the conclusion of the extraction.

3.4 Liquid-to-solid ratio (L/S) – The fraction of the total liquid volume (including the moisture contained in the "as-used" solid sample) to the dry mass equivalent of the solid material. L/S is typically expressed in volume units of liquid per dry mass of solid material (mL/g-dry).

3.5 "As-tested" sample – The solid sample at the conditions (e.g., moisture content and particle size distribution) present at the time of the start of the test procedure. The "as-tested" conditions will differ from the "as-received" sample conditions if particle size reduction and drying were performed.

3.6 Dry-mass equivalent – The mass of an "as-tested" (i.e., "wet") sample that equates to the mass of dry solids plus associated moisture, based on the moisture content of the "as-tested" material. The dry-mass equivalent is typically expressed in mass units of the "as-tested" sample (g).

3.7 Eluent – The solution used to contact the solid material in a leaching test. The eluent is usually free of COPCs but may contain other species used to control the test conditions of the extraction.

3.8 Eluate – The solution collected as an extract from a leaching test that contains the eluent plus constituents leached from the solid phase.

3.9 Refer to Chapter One, Chapter Three, and the manufacturer's instructions for definitions that may be relevant to this procedure.

4.0 INTERFERENCES

4.1 Solvents, reagents, glassware, and other sample processing hardware may yield artifacts and/or interferences during sample analysis. All of these materials must be demonstrated to be free from interferences under the conditions of the analysis by analyzing method blanks. Specific selection of reagents and purification of solvents by distillation in all-glass systems may be necessary. Refer to each method to be used for specific guidance on QC procedures and to Chapters Three and Four for general guidance on glassware cleaning. Also refer to Methods 9040, 9045 and 9050 and the determinative methods to be used for information regarding potential interferences.

4.2 When the test method is applied to solid materials with a clay content greater than 10% or an organic matter content greater than 1%, a solution of 1.0 mM calcium chloride in reagent water is recommended to minimize deflocculation of clay minerals. However, the use of calcium chloride solution will interfere with the determination of actual calcium and chloride release.

4.3 When this method is applied to fine-grained granular materials, tamping during column preparation may result in flow problems due to a low-permeability sample bed. This problem can be resolved by incorporating 20 - 50% inert material (e.g., 20-30-mesh normal sand or 2-mm borosilicate glass beads) into the solid sample. Alternatively, mass release from low-permeability materials may be measured using Method 1315.

5.0 SAFETY

5.1 This method does not address all safety issues associated with its use. The laboratory is responsible for maintaining a safe work environment and a current awareness file of Occupational Safety and Health Administration (OSHA) regulations regarding the safe handling of the chemicals specified in this method. A reference file of safety data sheets (SDSs) should be available to all personnel involved in these analyses.

5.2 During preparation and processing of extracts and/or eluents/eluates, some waste materials may generate heat or evolve potentially harmful gases when contacted with acids and bases. Adequate prior knowledge of the material being tested should be used to establish appropriate personal protection and workspace ventilation.

6.0 EQUIPMENT AND SUPPLIES

The mention of trade names or commercial products in this manual is for illustrative purposes only, and does not constitute an EPA endorsement or exclusive recommendation for use. The products and instrument settings cited in SW-846 methods represent those products and settings used during the method development or subsequently evaluated by the Agency. Glassware, reagents, supplies, equipment, and settings other than those listed in this manual may be employed provided that method performance appropriate for the intended application has been demonstrated and documented.

This section does not list common laboratory glassware (e.g., beakers and flasks) that might be used.

6.1 Column apparatus

This method recommends the use of a specific column apparatus (see Figure 2). Equipment with equivalent specifications may be substituted. The apparatus should have valves and quick connectors (e.g., Luer lock fittings) such that the column with end caps can be removed for packing with test material and mass measurements.

6.1.1 A 30-cm, straight cylindrical column with an inner diameter (ID) of 5 cm and constructed of inert material, resistant to high and low pH conditions and interaction with constituents of interest.

6.1.1.1 For the evaluation of inorganic COPC mobility, equipment composed of borosilicate glass (e.g., Kimble-Kontes CHROMAFLEX #420830-3020 or equivalent), polytetra-fluoroethylene (PTFE), high density polyethylene (HDPE), polypropylene (PP), or polyvinyl chloride (PVC) is recommended.

6.1.1.2 For the evaluation of non-volatile organic and mixed organic/inorganic COPCs, equipment composed of glass or Type 316 stainless steel is recommended. PTFE is not recommended for non-volatile organics, due to sorption of species with high hydrophobicity (e.g., PAHs). Borosilicate glass is recommended over other types of glass, especially when inorganic analytes are of concern.

6.1.2 The column must be of sufficient volume to accommodate a minimum of 300 g dry material plus a 1-cm layer of silica sand (20-30 mesh) used at the bottom of the column to distribute eluent flow and at the top of the column to form a coarse filter for eluate particulates.

6.1.3 The column must have end cap materials that form a leak-proof seal and that can withstand pressures, such as encountered when pumping eluent through the column.

6.2 Eluent feed stock container – Resealable bottle or other container, constructed of inert material, capable of withstanding extreme pH conditions and interaction with any constituents of interest (see guidance in Sec. 6.1.2)

6.3 Eluent feed tubing – 2-mm or similarly small ID tubing composed of chemically inert material such as PVC or equivalent

NOTE: Larger ID tubing may be required as a feed to the pump and manifold if a single eluent stock container is used to feed multiple column set-ups.

6.4 Eluate collection bottles – Capable of assembly with column apparatus using simple water locks in order to prevent the intrusion of air (see Figure 2)

6.5 20-30 mesh normal washed quartz sand

6.6 Balance – Capable of 0.01 g resolution for masses less than 500 g

6.7 Filtration apparatus – Pressure or vacuum filtration apparatus composed of appropriate materials so as to maximize the collection of extracts and minimize loss of the COPCs (e.g., Nalgene #300-4000 or equivalent) (see Sec. 6.1)

6.8 Filtration membranes – Composed of hydrophilic polypropylene or equivalent material with an effective pore size of 0.45 µm (e.g., Gelman Sciences GH Polypro #66548 from Fisher Scientific or equivalent)

6.9 pH meter – Laboratory model with the capability for temperature compensation (e.g., Accumet 20, Fisher Scientific or equivalent) and a minimum resolution of 0.1 pH units

6.10 pH combination electrode – Composed of chemically resistant materials

6.11 Conductivity meter – Laboratory model (e.g., Accumet 20, Fisher Scientific or equivalent), with a minimum resolution of 5% of the measured value

6.12 Conductivity electrodes – Composed of chemically resistant materials

7.0 REAGENTS AND STANDARDS

7.1 Reagent-grade chemicals, at a minimum, should be used in all tests. Unless otherwise indicated, all reagents should conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society (ACS), where such specifications are available. Other grades may be used, provided the reagent is of sufficiently high purity to permit use without lessening the accuracy of the determination. Inorganic reagents and extracts should be stored in plastic to prevent interaction of constituents from glass containers.

7.2 Reagent water – Reagent water must be interference free. All references to water in this method refer to reagent water unless otherwise specified.

7.3 Calcium chloride (1.0 mM), $CaCl_2$ – Prepared by dissolving 0.11 g of ACS grade (or better) solid calcium chloride in 1 L of reagent water

8.0 SAMPLE COLLECTION, PRESERVATION, AND STORAGE

8.1 See Chapter Three, "Inorganic Analytes," and Chapter Four, "Organic Analytes," for sample collection and preservation instructions.

8.2 All samples should be collected using an appropriate sampling plan.

8.3 All containers should be composed of materials that minimize interaction with solution COPCs. For further information, see Chapters Three and Four.

8.4 Preservatives should not be added to samples before extraction.

8.5 Samples can be refrigerated, unless refrigeration results in an irreversible physical change to the sample.

8.6 Analytical extracts should be preserved according to the guidance given in the individual determinative methods for the COPCs.

8.7 Extract holding times should be consistent with the aqueous sample holding times specified in the determinative methods for the COPCs.

9.0 QUALITY CONTROL

9.1 Refer to Chapter One for guidance on quality assurance (QA) and quality control (QC) protocols. When inconsistencies exist between QC guidelines, method-specific QC criteria take precedence over both technique-specific criteria and Chapter One criteria, and technique-specific QC criteria take precedence over Chapter One criteria. Any effort involving the collection of analytical data should include development of a structured and systematic planning document, such as a quality assurance project plan (QAPP) or a sampling and analysis plan (SAP), which translates project objectives and specifications into directions for those who will implement the project and assess the results.

Each laboratory should maintain a formal QA program. The laboratory should also maintain records to document the quality of the data generated. Development of in-house QC limits for each method is encouraged. Use of instrument-specific QC limits is encouraged, provided such limits will generate data appropriate for use in the intended application. All data sheets and QC data should be maintained for reference or inspection.

9.2 In order to demonstrate the purity of reagents, at least one eluent blank should be tested. If multiple batches of eluent are employed, one eluent blank from each batch should be analyzed.

9.3 The analysis of extracts should follow appropriate QC procedures, as specified in the determinative methods for the COPCs. Refer to Chapter One for specific QC procedures.

9.4 Unless the "as-received" samples are part of a time-dependent (e.g., aging) study, solid materials should be processed and tested within one month of their receipt.

9.5 Initial demonstration of proficiency (IDP)

Leachate methods are not amenable to typical IDPs when reference materials with known values are not available. However, prior to using this method an analyst should have documented proficiency in the skills required for successful implementation of the method. For example, skill should be demonstrated in the use of an analytical balance, the determination of pH using Methods 9040 and 9045, and the determination of conductance using Method 9050.

10.0 CALIBRATION AND STANDARDIZATION

10.1 The balance should be calibrated and certified, at a minimum, annually or in accordance with laboratory policy.

10.2 Prior to measurement of eluate pH, the pH meter should be calibrated using a minimum of two standards that bracket the range of pH measurements. Refer to Methods 9040 and 9045 for additional guidance.

10.3 Prior to measurement of eluate conductivity, the meter should be calibrated using at least one standard at a value greater than the range of conductivity measurements. Refer to Method 9050 for additional guidance.

11.0 PROCEDURE

A flowchart for the method procedure is presented in Figure 1. Microsoft Excel® data templates are available to aid in collecting and archiving of laboratory and analytical data.[2]

11.1 Preparatory procedures – Particle size reduction (if required)

11.1.1 In this method, particle size reduction is used to prepare large-grained samples for the column test so that the approach toward liquid-solid equilibrium is enhanced and fluid channeling along column walls is minimized. The maximum particle size of the solid should ≤ 1/20 of the column diameter. For the column recommended in this method, a maximum particle size of 2.5 mm is acceptable. Therefore, 85% of the test material should pass through a 2.38-mm (U.S. No. 8) sieve. If less than 15% of the solid material is larger than the maximum acceptable particle size, this fraction of the solid may be excluded from the material tested, rather than particle size-reduced. The mass and nature of the discarded fraction should be documented.

11.1.2 Particle size reduction of an "as received" sample may be achieved through crushing, milling, or grinding with equipment made from chemically inert materials. During the reduction process, care should be taken to minimize the loss of sample and potentially volatile constituents in the sample.

11.1.3 If the moisture content of the "as received" material is greater than 15% (wet basis), air drying or desiccation may be necessary. Oven drying is not recommended for the

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[2] These Excel® templates form the basis for uploading method data into the data management program, LeachXS Lite™. Both the data templates and LeachXS Lite™ are available at http://vanderbilt.edu/leaching.

preparation of test samples due to the potential for mineral alteration and volatility loss. In all cases, the moisture content of the "as received" material should be recorded.

NOTE: If the solid material is susceptible to interaction with the atmosphere (e.g., carbonation, oxidation), drying should be conducted in an inert environment.

11.1.4 When the material seems to be of a relatively uniform particle size, calculate the percentage less than the sieve size as follows:

$$\% \text{ Passing} = \frac{M_{sieved}}{M_{total}} \times 100\%$$

Where: M_{sieved} = mass of sample passing the sieve (g)
M_{total} = mass of total sample (g) (e.g., M_{sieved} + mass not passing sieve)

11.1.5 The fraction retained by the sieve should be recycled for further particle size reduction until at least 85% of the initial mass has been reduced below the designated maximum particle size. Calculate and record the final percentage passing the sieve and the designated maximum particle size. For the uncrushable fraction of the "as-received" material, record the fraction mass and nature (e.g., rock, metal or glass shards, etc).

11.1.6 Store the size-reduced material in an airtight container in order to prevent contamination via gas exchange with the atmosphere. Store the container in a cool, dark, and dry place prior to use.

11.2 Determination of solids and moisture content

11.2.1 In order to provide the dry mass equivalent of the "as-tested" material, the solids content of the subject material should be determined. Often, the moisture content of the solid sample is recorded. In this method, the moisture content is determined and recorded on the basis of the "wet" or "as-tested" sample.

WARNING: The drying oven should be contained in a hood or otherwise properly ventilated. Significant laboratory contamination or inhalation hazards may result when drying heavily contaminated samples. Consult the laboratory safety officer for proper handling procedures prior to drying samples that may contain volatile, hazardous, flammable, or explosive materials.

11.2.2 Place a 5 to10-g sample of solid material into a tared dish or crucible. Dry the sample to a constant mass at 105 ± 2 °C. Check for constant mass by returning the dish to the drying oven for 24 hours, cooling to room temperature in a desiccator and re-weighing. The two mass readings should agree within the larger of 0.2% or 0.02 gram.

NOTE: The oven-dried sample is not used for the extraction and should be properly disposed once the dry mass is determined.

11.2.3 Calculate and report the solids content as follows:

$$SC = \frac{M_{dry}}{M_{test}}$$

Where: SC = solids content of "as-tested" material (g-dry/g)
M_{dry} = mass of dry material specified in the method (g-dry)
M_{test} = mass of "as-tested" solid equivalent to the dry-material mass (g)

11.2.4 Calculate and report the moisture content (wet basis) as follows:

$$MC_{wet} = \frac{M_{test} - M_{dry}}{M_{test}}$$

Where: MC_{wet} = moisture content on a wet basis (g_{H_2O}/g)
M_{dry} = mass of dry material specified in the method (g-dry)
M_{test} = mass of "as-tested" solid equivalent to the dry-material mass (g)

11.3 Apparatus preparation

11.3.1 Prepare the column test apparatus as depicted in Figure 2. Eluent feed should be directed through the lower end cap and upwards into the column to minimize air retention in the packed bed and fluid channeling along the column walls.

NOTE: When solid samples may be affected by dissolved oxygen in the feed stock, an inert gas (e.g., nitrogen or argon) may be bubbled through the feed solution to displace oxygen or used to purge the headspace above the feed solution.

NOTE: When alkaline or other air-sensitive eluates are expected, the vapor space of empty collection bottles may be purged with an inert gas (e.g., nitrogen or argon) prior to eluate collection.

11.4 Column packing

11.4.1 The column is packed with test material surrounded by layers of quartz sand at the top and bottom of the column to provide flow pattern regulation and coarse filtration.

NOTE: The following procedure describes the packing of the column from starting at the outflow (top) of the column and ending with the inflow (bottom) of the column. This is done to allow for a wider layer of quartz sand on the inflow side in cases where less than a full column of test material is available. The column is inverted prior to assembly into the leaching apparatus and initial wetting.

11.4.2 Record the mass of the empty column with end caps and any tubing leads or valves that would be needed to completely separate the column, which may include both solid material and water, from the entire apparatus.

11.4.3 Secure one end cap to the outflow side of the column and invert the column and end cap so that the outflow side of the column is facing downward.

11.4.4 Place an approximately 1-cm thick layer of quartz sand (Sec. 6.5) on the outflow side of the column using a small scoop or spoon. Record the mass of the column and sand layer. Level the sand layer by tapping the sides of the column.

11.4.5 Pack the main body of the column with a minimum 300-g dry-mass equivalent of "as-tested" sample in approximately five layers with light tamping with a glass or plastic rod to level the material between layers. When enough test material is available to produce a full column, the top of the packed sample should be approximately 1 cm from the level of the column interface with the inflow end cap (the end facing upwards). Record the mass of the column, lower sand layer, and "as-tested" sample.

11.4.6 Place a layer of sand to fill the remaining gap between the sample packing and the interface between the column and inflow end cap. When enough test material is available to pack a full column, the sand layer at the inflow end of the column should be approximately 1 cm. This gap may be larger if less test material is used. Record the total mass of the completely packed column.

11.4.7 Secure the inflow end cap. Invert the column so that the inflow end of the column is downward prior to inserting the column into the leaching apparatus.

11.4.8 Calculate the "as-tested" mass of the sample packing by subtracting the mass of the column and lower sand layer (Sec. 11.4.4) from the mass of the column, sand layer and packing (Sec. 11.4.5).

11.4.9 Calculate the dry mass equivalent packed of "as-tested" sample into the column using the solids content as follows:

$$M_{dry} = SC \cdot M_{test}$$

Where: M_{dry} = dry-mass equivalent of sample in column (g-dry)
SC = solids content (g-dry/g)
M_{test} = mass of "as-tested" solid equivalent to the dry-material mass (g)

11.5 Pump setup

11.5.1 Prior to the start of the test, set the flow rate of the pump to a value that will provide an eluate production rate of 0.75 ± 0.25 L/S per day. For example, given a dry-mass equivalent of 300 g-dry, an L/S of 0.75 mL/g-dry would translate to a volume of 225 mL/g-dry, in which case the pump should be set to a flow rate of 225 mL (0.75 L/S) per day.

11.5.2 Prime the tubing with eluent

11.5.2.1 Detach the inlet tubing from the bottom of the column and place the open end into a waste container.

11.5.2.2 Turn on the pump and allow the inlet tubing to fill with eluent. Remove any air bubbles trapped in the inlet tubing.

11.5.2.3 When the inlet tubing is full with eluent, stop the pump and reconnect the tubing to the bottom of the column.

11.6 Eluent collection schedule

11.6.1 Table 2 provides a schedule of fraction end-point L/S, interval L/S, and eluate fraction volumes for collection, assuming a dry-mass equivalent of 300 g-dry. The minimum volume of each collection bottle should be scaled so as to capture the entire eluate fraction.

11.6.2 Using the assumed pump rate and the dry mass equivalent of the sample, estimate the durations of column testing required to reach the target eluate collection L/S shown in Table 2 as follows:

$$T_i = \frac{M_{dry} - \sum L/S_i}{R_i}$$

Where: T_i = target time from start for collection of eluent fraction, i (day)
M_{dry} = dry-mass equivalent of sample in column (g-dry)
$\sum L/S$ = target cumulative L/S for interval i from Table 1 (mL/g-dry)
R_i = pump rate assumed for interval, i (mL/day)

Alternatively, use the Microsoft Excel® spreadsheet template available at http://www.vanderbilt.edu/leaching/downloads/test-methods/ to develop the schedule of target collection times.

NOTE: The schedule of predicted collection times is for reference purposes only. Typically, the eluate collection rate is slower that predicted initially, due in part to pump inefficiency, back pressure, and dead-volume lag times. The decision to switch collection bottles should be made based on the volume of eluate collected with time. The schedule may be revised with each eluate fraction collected, so that the prediction of future collections may be more accurate. Pump flow rate adjustment may be necessary.

11.6.3 After each eluate collection, calculate the time required to reach the next collection time using the equation in 11.6.2 and the pump rate calculated from the previous collection interval.

NOTE: If eluate volumes other than those calculated for the fraction volume (i.e., T01, T02, etc.) are collected (e.g., manual collection will have inherent errors in the collection volumes), the cumulative L/S may quickly become out of alignment with the tolerances shown in Table 2. If this happens or appears to be likely, adjustments to the collection volumes for the two large collection fractions (i.e., T06 and T08) can be made in order to bring the cumulative L/S for subsequent collection intervals back in line with tolerances. The objective is to maintain the cumulative L/S target values for fractions T07 and T09. The Excel® data template available with LeachXS Lite™ can be helpful in maintaining target L/S ratios if updated after each collection interval. However, throughout the test, the user should ensure that the minimum eluate volume required for the chosen chemical analyses is collected.

11.7 Column test procedure – Column/eluent equilibration

11.7.1 Turn on the pump and allow the column to fill with eluent, thus wetting the column packing.

11.7.2 When the column packing is completely wetted and the eluent level is even with the top of the column (or just beginning to be seen through the effluent tubing at the top of the column apparatus), stop the pump and allow the column to equilibrate for 21 ± 3 hours.

11.8 Column test

11.8.1 Following equilibration, begin the column test by starting the pump and recording the date and time.

NOTE: The eluate production rate should be monitored frequently during the column test and the pump rate adjusted, such that the eluate production rate is maintained at approximately 0.75 ± 0.25 L/S per day.

11.8.2 When the eluate fraction has reached the target volume according to the predicted collection schedule, release the Luer lock connecting the active collection bottle and attach the eluent tubing to a new collection bottle.

NOTE: Alkaline eluate solutions may be susceptible to neutralization due to carbon dioxide uptake. When materials with alkaline pH are tested, precautions (e.g., purging collection bottles with inert gas) should be taken to prevent contact of the eluate with air.

11.9 Eluate processing

11.9.1 Decant a minimum volume (approximately 5 mL) of the eluate fraction from the collection vessel in order to measure the solution characteristics.

11.9.2 Measure and record the pH, specific conductivity, and oxidation-reduction potential (ORP) of the eluate (see Methods 9040, 9045 and 9050).

NOTE: Measurement of pH, conductivity, and ORP should be taken within 15 minutes of eluate processing (Sec. 11.9.1) to avoid neutralization of the solution due to exposure to carbon dioxide, especially when alkaline materials are tested.

NOTE: The measurement of ORP is optional, but strongly recommended, especially when testing materials where oxidation is likely to change the LSP of COPCs.

11.9.3 Separate any suspended particulates from the remaining liquid in the collection bottle by pressure or vacuum filtration through a 0.45-µm filtration membrane (Sec. 6.8).

NOTE: If either low volatility organic species or mercury is a COPC, pressure filtration is recommended over vacuum filtration in order to minimize volatility losses.

11.9.4 Immediately preserve and store the volume(s) of eluate required for chemical analysis. Preserve all analytical samples in a manner that is consistent with the determinative chemical analyses to be performed.

11.10 Reiterate Secs. 11.8.2 - 11.9.4 until nine eluate fractions are collected up to an L/S of 10 ± 0.2 mL/g-dry.

NOTE: The complete method requires that all nine eluate fractions be collected from the column. However, for purposes of limiting chemical analysis or index testing where interpretation may be based on cumulative release from the column, eluate fractions may be composited by volume-weighted averaging to create a single analytical sample from multiple eluate fractions (see Sec 11.11).

11.11 Analytical sample preparation options

This method allows for options in the preparation of analytical samples based on the detail of characterization required (e.g., complete, limited or index) and the basis for data reporting (e.g., concentration or cumulative release). However, the complete set of nine eluate fractions must be collected in all cases.

11.11.1 Table 1 shows the analytical preparation scheme for Options A-E described in the following sections. Each composite sample may be created either by combining the total eluate volumes and preserving the total sample for analysis; or combining aliquots of two eluate fractions using volume-weighted averages. However, it is recommended that composite analytical samples be prepared using aliquots of eluate fractions whenever possible, rather than whole eluate fractions. This approach allows for potential analysis of discrete eluate fractions, if desired, at a later date.

11.11.1.1 Option A – This sample preparation option is used for complete characterization and includes analysis of all eluate fractions. Since the entire cumulative release curve is captured in nine discrete fractions, reported data may be based on either eluate concentrations or cumulative release.

11.11.1.2 Option B – This sample preparation option is used only for limited analyses based on eluate concentration. Six discrete eluate fractions are analyzed. Data obtained using this option cannot be used for cumulative release since there are sections of the cumulative release curve not analyzed.

11.11.1.3 Option C – This sample preparation option is used only for limited analysis based on cumulative release. Six analytical samples are created from three discrete eluate fractions and three composite samples. In the scheme shown in Table 1, the following fractions are composited:

- T04 and T05
- T06 and T07
- T08 and T09

11.11.1.4 Option D – This sample preparation option is used only for index testing based on eluate concentration. Three discrete eluate fractions are analyzed. Data obtained using this option cannot be used for cumulative release since there are sections of the cumulative release curve not analyzed.

11.11.1.5 Option E – This sample preparation option is used only for index testing based on cumulative release. Three analytical samples are created from one discrete eluate fraction and two composite samples. In the scheme shown in Table 1, the following fractions are composited:

- T02, T03, T04, and T05
- T06, T07, T08, and T09

11.11.2 Volume-weighted composites

11.11.2.1 The volume of aliquots of eluate fractions for composite analytical samples may be calculated using the Excel template provided or the following formula:

$$V_i = \frac{F_i}{\sum_i^n F_i} \times V_{sample}$$

Where: V_i = the volume of an aliquot from eluate fraction, i (mL)
F_i = the collected volume of eluate fraction, i (mL)
V_{sample} = the total volume of the analytical sample (mL)
n = total number of eluate fractions to be composited

As an illustration of volume-weighted averaging, eluate fraction aliquots are calculated as required to create an analytical sample by compositing eluate fractions T06 through T09 for index testing based on cumulative release. The calculation follows the example volumes shown in Table 2 and assumes that an analytical sample volume of 100 mL is required.

$$\sum_i^n F_i = F_{T06} + F_{T07} + F_{T08} + F_{T09} = 450\text{ mL} + 150\text{ mL} + 1350\text{ mL} + 150\text{ mL} = 2100\text{ mL}$$

$$V_{T06} = \frac{F_{T06}}{\sum_i^n F_i} \times V_{sample} = \frac{450\text{ mL}}{2100\text{ mL}} \times 100\text{ mL} = 21.5\text{ mL}$$

$$V_{T07} = \frac{F_{T07}}{\sum_i^n F_i} \times V_{sample} = \frac{150\text{ mL}}{2100\text{ mL}} \times 100\text{ mL} = 7.1\text{ mL}$$

$$V_{T08} = \frac{F_{T08}}{\sum_i^n F_i} \times V_{sample} = \frac{1350\text{ mL}}{2100\text{ mL}} \times 100\text{ mL} = 64.3\text{ mL}$$

$$V_{T09} = \frac{F_{T09}}{\sum_i^n F_i} \times V_{sample} = \frac{150\text{ mL}}{2100\text{ mL}} \times 100\text{ mL} = 7.1\text{ mL}$$

$$V_{sample} = V_{T06} + V_{T07} + V_{T08} + V_{T09} = 21.5\text{ mL} + 7.1\text{ mL} + 64.3\text{ mL} + 7.1\text{ mL} = 100.0\text{ mL}$$

NOTE: The above illustration uses example eluate fraction volumes based on interval L/S ratios and an assumed test material mass. When calculating the aliquots of collected eluate fractions for composite samples, the actual collected fraction volumes should be used.

12.0 DATA ANALYSIS AND CALCULATIONS (Excel® template[3])

12.1 Data reporting

12.1.1 Figure 3 shows an example of a data sheet that may be used to report the concentration results of this method. At a minimum, the basic test report should include the following:

a) Name of the laboratory
b) Laboratory technical contact information
c) Date and time at the start of the test
d) Name or code of the solid material
e) Particle size (85 wt% less than designated particle size)
f) Packed bed dimensions (column ID and bed depth (cm))
g) Mass of solid material in column packing
h) Moisture content of solid material packed in column (g_{H_2O}/g)
i) Eluate specific information (see Sec. 12.1.2 below)

12.1.2 The minimum set of data that should be reported for each eluate includes:

a) Eluate sample ID
b) Eluate collection date and time
c) Amount of eluate collected (mass or volume)
d) Measured eluate pH
e) Measured eluate conductivity (mS/cm)
f) Measured ORP (mV) (optional)
g) Concentration of all COPCs
h) Analytical QC qualifiers as appropriate

12.2 Data Interpretation (optional)

12.2.1 Concentration as a function of L/S

[3] Excel® data templates are provided to aid in collection and archiving of laboratory and analytical data. These templates form the basis for uploading method data into the data management program, LeachXS Lite™. Both the data templates and LeachXS Lite™ are available at http://vanderbilt.edu/leaching.

12.2.1.1 A curve of the eluate concentration as a function of L/S can be generated for each COPC after chemical analysis of all extracts by plotting the constituent concentration in the liquid phase as a function of the cumulative collected L/S ratio. The curve indicates the nominal equilibrium concentration of the constituent of interest as a function of L/S from 0 to 10 mL/g-dry at natural pH. An example curve is provided in Figure 4.

12.2.1.2 The lower limit of quantitation (LLOQ) of the determinative method for each COPC may be shown as a horizontal line. COPC concentrations below this line indicate negligible or non-quantitative concentrations.

NOTE: The LLOQ is highly matrix dependent and should be determined as part of a QA/QC plan.

12.3 Cumulative release as a function of L/S

12.3.1 The cumulative mass release of a COPC per unit solid material may be calculated as follows:

$$\Sigma M_i = \sum_{i=1}^{9} \left[C_i \times \left(\Sigma L/S_i - \Sigma L/S_{i-1} \right) \right]$$

Where: ΣM_i = the cumulative mass release through interval i (mg/kg-dry)

C_i = the concentration of the COPC in the eluent collected during interval i (mg/L)

$\Sigma L/S_i$ = the cumulative L/S of eluate collected through interval i (L/kg-dry)

$\Sigma L/S_{i-1}$ = the cumulative L/S of eluate collected through interval i-1 (L/kg-dry)

12.3.2 Prepare a curve of the cumulative mass release generated for each COPC by plotting the cumulative mass release calculated in Sec. 12.3.1 as a function of the cumulative collected L/S. This curve provides an interpretation of the cumulative mass expected to be leached from a column of material as a function of L/S percolating through the column.

12.3.3 A comparison of the slope of the mass release curve to a unity slope, which is indicative of solubility-controlled release, may be made by plotting the cumulative mass release calculated in Sec. 12.3.1 versus the logarithm of the cumulative collected L/S. An example is provided in Figure 5.

12.4 Interpolation/extrapolation to target L/S values

The collected L/S dependence data may be interpolated or extrapolated to the nearest target L/S value for purposes of comparing different data sets (e.g., test replicates of the same or different materials). The most transparent and straightforward method is linear interpolation/extrapolation of data after $\log_{10}$ transformation.

12.4.1 Log_{10} transformation

Collected concentration values are transformed by taking the $\log_{10}$ of the measured concentration at each test position, i:

$$C_i = \log_{10}(c_i)$$

Where: C_i = $\log_{10}$-transformed concentration at test position i ($\log_{10}$[mL/g-dry])
c_i = the concentration measured at test position i (mg/L)

12.4.2 Linear interpolation/extrapolation

Given a set of coordinate data { ($\Sigma L/S_i$,C_i) : i = 1,...n } sorted by increasing order according to ΣL/S value (e.g., $\Sigma L/S_1 < \Sigma L/S_2 < \cdots < \Sigma L/S_n$), an interpolated/extrapolated $\log_{10}$-transformed concentration at a known L/S target is calculated as:

$$C_T = a_T + b_T \cdot \sum L/S_T$$

Where: C_T = the concentration at target ΣL/S value, $\Sigma L/S_T$ ($\log_{10}$[mg/L])
a_T and b_T are coefficients of the linear interpolation/extrapolation equation
$\Sigma L/S_T$ = a target pH value

Depending on the values of observed L/S values relative to target L/S values, the calculations of the coefficients a_T and b_T in the equation may differ according to the following algorithm:

If $\Sigma L/S_T < \Sigma L/S_1$, then $b_T = (C_2 - C_1) / (\Sigma L/S_2 - \Sigma L/S_1)$ and $a_T = C_2 - b_T \cdot \Sigma L/S_2$ (extrapolation from the two points with closest L/S values);

If $\Sigma L/S_T \geq \Sigma L/S_n$, then $b_T = (C_n - C_{n-1}) / (\Sigma L/S_n - \Sigma L/S_{n-1})$ and $a_T = C_n - b_T \cdot \Sigma L/S_n$ (extrapolation from the two points with closest L/S values);

If $\Sigma L/S_{j-1} \leq \Sigma L/S_T < \Sigma L/S_j$, then $b_T = (C_j - C_{j-1}) / (\Sigma L/S_j - \Sigma L/S_{j-1})$and $a_T = y_j - b_T \cdot \Sigma L/S_j$ (interpolation from the two closest points surrounding $\Sigma L/S_T$).

NOTE: Interpolation or extrapolation of data should only be conducted within a distance of ±20% of the target L/S value. Since the allowable L/S tolerance about a target L/S value is variable (see Table 2), interpolation/extrapolation should not create data at a target L/S value where collected data is missing.

13.0 METHOD PERFORMANCE

13.1 Performance data and related information are provided in SW-846 methods only as examples and guidance. The data do not represent required performance criteria for users of the methods. Instead, performance criteria should be developed on a project-specific basis, and the laboratory should establish in-house QC performance criteria for the application of this method. Performance data must not be used as absolute QC acceptance criteria for purposes of laboratory QC or accreditation.

13.2 Interlaboratory validation of this method was conducted using a contaminated smelter site soil (material code CFS) and a brass foundry sand (material code JaFS). Repeatability and reproducibility were determined at an L/S of 10 mL/g-dry for eluate concentration (see Table 3) and for cumulative mass released (see Table 4). More details on the interlaboratory validation may be found in Ref. 1.

13.3 Ref. 2 and Ref. 4 may provide additional guidance and insight on the use, performance, and application of this method.

14.0 POLLUTION PREVENTION

14.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity and/or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operations. The EPA has established a preferred hierarchy of environmental management techniques that places pollution prevention as the management option of first choice. Whenever feasible, laboratory personnel should use pollution prevention techniques to address their waste generation. When wastes cannot be feasibly reduced at the source, the Agency recommends recycling as the next best option.

14.2 For information about pollution prevention that may be applicable to laboratories and research institutions consult *Less is Better: Laboratory Chemical Management for Waste Reduction*, a free publication available from the ACS, Committee on Chemical Safety, https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/publications/less-is-better.pdf.

15.0 WASTE MANAGEMENT

The EPA requires that laboratory waste management practices be conducted consistent with all applicable rules and regulations. Laboratories are urged to protect air, water, and land by minimizing and controlling all releases from hoods and bench operations, complying with the letter and spirit of any sewer discharge permits and regulations, and by complying with all solid and hazardous waste regulations, particularly the hazardous waste identification rules and land disposal restrictions. For further information on waste management, consult *The Waste Management Manual for Laboratory Personnel* available at: http://www.labsafetyinstitute.org/FreeDocs/WasteMgmt.pdf.

16.0 REFERENCES

1. A.C. Garrabrants, D.S. Kosson, R. DeLapp, P. Kariher, P.F.A.B. Seignette, H.A. van der Sloot, L. Stefanski, and M. Baldwin, "Interlaboratory Validation of the Leaching Environmental Assessment (LEAF) Method 1314 and Method 1315," EPA 600/R-12/624, *U.S. Environmental Protection Agency*, Washington, DC, 2012.

2. A.C. Garrabrants, D.S. Kosson, H.A. van der Sloot, F. Sanchez, and O. Hjelmar, "Background Information for the Leaching Environmental Assessment Framework (LEAF) Test Methods," EPA/600/R-10-170, *U.S. Environmental Protection Agency*, Washington, DC, 2010.

3. NEN 7343, "Leaching Characteristics of Solid Earth and Stony Materials - Leaching Tests - Determination of the leaching of Inorganic Constituents from Powdery and Granular Materials with the Percolation Test," *Dutch Standardization Institute*, Delft, The Netherlands, 1995.

4. D.S. Kosson, H.A. van der Sloot, F. Sanchez, and A.C. Garrabrants, "An Integrated Framework for Evaluating Leaching in Waste Management and Utilization of Secondary Materials," *Environmental Engineering Science,*, 19(3) 159-204, 2002.

5. CEN/TS 14405, "Characterization of Waste - Leaching Behaviour Tests - Up-flow Percolation Test (Under Specified Conditions)," *Comité Européen de Normalisation*, Brussels, Belgium, 2004, 2004.

17.0 TABLES, DIAGRAMS, FLOWCHARTS, AND VALIDATION DATA

The following pages contain the tables and figures referenced by this method.

TABLE 1

SCHEDULE OF FRACTION COLLECTIONS AND ANALYTICAL SAMPLES

Fraction Label	ΣLS (mL/g-dry)	Option A: Characterization – Conc.	Option A: Characterization – ΣRel	Option B: Limited Analysis – Conc.	Option C: Limited Analysis – ΣRel	Option D: Index Testing – Conc.	Option E: Index Testing – ΣRel
T01	0.2 ± 0.1	✓	✓	✓	✓	✓	✓
T02	0.5 ± 0.1	✓	✓	✓	✓	X	↓
T03	1.0 ± 0.1	✓	✓	✓	✓	X	↓
T04	1.5 ± 0.2	✓	✓	X	↓	X	↓
T05	2.0 ± 0.2	✓	✓	✓	T05c	✓	✓T05c
T06	4.5 ± 0.2	✓	✓	X	↓	X	↓
T07	5.0 ± 0.2	✓	✓	✓	✓T07c	X	↓
T08	9.5 ± 0.2	✓	✓	X	↓	X	↓
T09	10.0 ± 0.2	✓	✓	✓	✓T09c	✓	✓T09c

NOTE: ΣRel = Cumulative release

✓ = Collect eluate fraction (or pool of fractions) as analytical sample

↓ = Composite eluate fraction with next fraction to create analytical sample

X = No fraction to collect

TABLE 2

SCHEDULE OF ELUATE FRACTIONS FOR COLLECTION WITH EXAMPLE VOLUMES

Interval Label	End Point ΣL/S (mL/g-dry)	Fraction L/S (mL/g-dry)	Example Fraction Volume (mL)
T01	0.2 ± 0.1	0.2	60
T02	0.5 ± 0.1	0.3	90
T03	1.0 ± 0.1	0.5	150
T04	1.5 ± 0.2	0.5	150
T05	2.0 ± 0.2	0.5	150
T06	4.5 ± 0.3	2.5	750
T07	5.0 ± 0.2	0.5	150
T08	9.5 ± 0.3	4.5	1350
T09	10.0 ± 0.2	0.5	150
B01	Eluent	N/A	100

NOTE: Example fraction volumes based on assumed packing mass of 300 g-dry

TABLE 3

METHOD PRECISION FOR ELUATE CONCENTRATION AT L/S=10 mL/g-dry

Analyte	Symbol	Repeatability – CFS $\%RSD_r$	Repeatability – JaFS $\%RSD_r$	Reproducibility – CFS $\%RSD_R$	Reproducibility – JaFS $\%RSD_R$
Aluminum	Al	8.6	12.7	16.6	28.2
Barium	Ba	6.9	13.9	23.0	24.2
Boron	B	11.9	14.4	14.3	23.9
Cadmium	Cd	9.2	-	14.6	-
Calcium	Ca	6.9	5.6	12.7	52.5
Copper	Cu	8.1	13.3	15.2	31.8
Magnesium	Mg	-	7.7	-	53.3
Manganese	Mn	-	22.0	-	26.6
Molybdenum	Mo	25.2	27.5	28.4	54.4
Lead	Pb	7.3	12.4	14.8	23.5
Thallium	Tl	9.6	-	19.2	-
Zinc	Zn	8.6	23.0	16.0	58.5

Material	Repeatability – CFS $\%RSD_r$	Repeatability – JaFS $\%RSD_r$	Repeatability – Overall	Reproducibility – CFS $\%RSD_R$	Reproducibility – JaFS $\%RSD_R$	Reproducibility – Overall
Mean	10%	15%	13%	18%	38%	28%

Data taken from Ref. 1.

TABLE 4

METHOD PRECISION FOR CUMULATIVE RELEASE AT L/S=10 mL/g-dry

Analyte	Symbol	Repeatability – CFS $\%RSD_r$	Repeatability – JaFS $\%RSD_r$	Reproducibility – CFS $\%RSD_R$	Reproducibility – JaFS $\%RSD_R$
Aluminum	Al	4.6	7.2	14.3	13.1
Barium	Ba	3.4	6.2	23.0	10.9
Boron	B	2.9	4.4	11.1	6.3
Cadmium	Cd	2.2	-	8.5	-
Calcium	Ca	2.1	3.6	8.2	19.9
Copper	Cu	3.9	4.6	15.3	21.4
Magnesium	Mg	-	4.2	-	17.2
Manganese	Mn	-	7.0	-	14.9
Molybdenum	Mo	4.4	4.5	12.3	11.1
Lead	Pb	1.8	9.5	10.8	15.1
Thallium	Tl	2.9	-	10.2	-
Zinc	Zn	4.0	7.3	11.3	18.6

Material	Repeatability – CFS $\%RSD_r$	Repeatability – JaFS $\%RSD_r$	Repeatability – Overall	Reproducibility – CFS $\%RSD_R$	Reproducibility – JaFS $\%RSD_R$	Reproducibility – Overall
Mean	3%	6%	5%	13%	15%	14%

Data taken from Ref. 1.

FIGURE 1

METHOD FLOWCHART

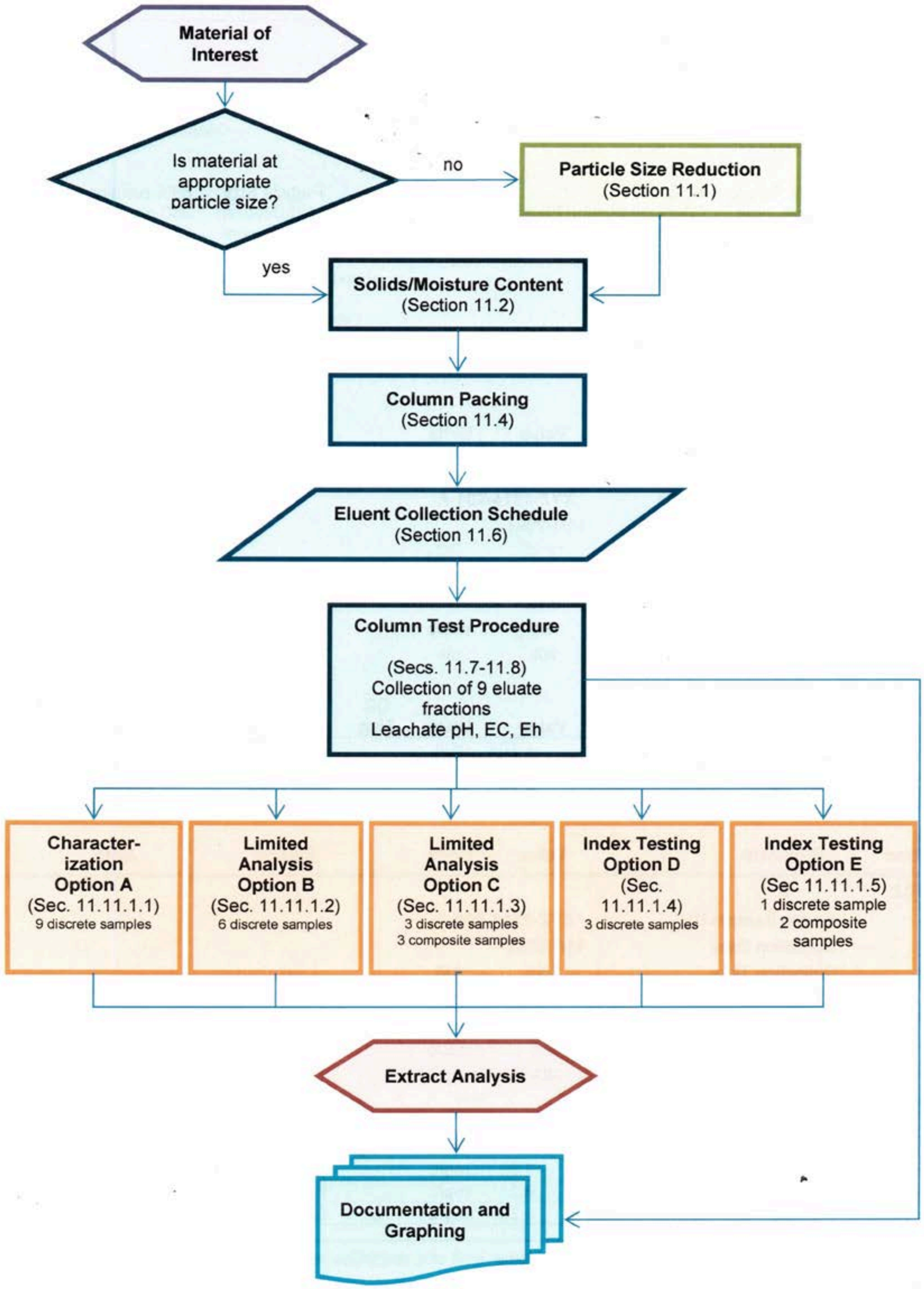
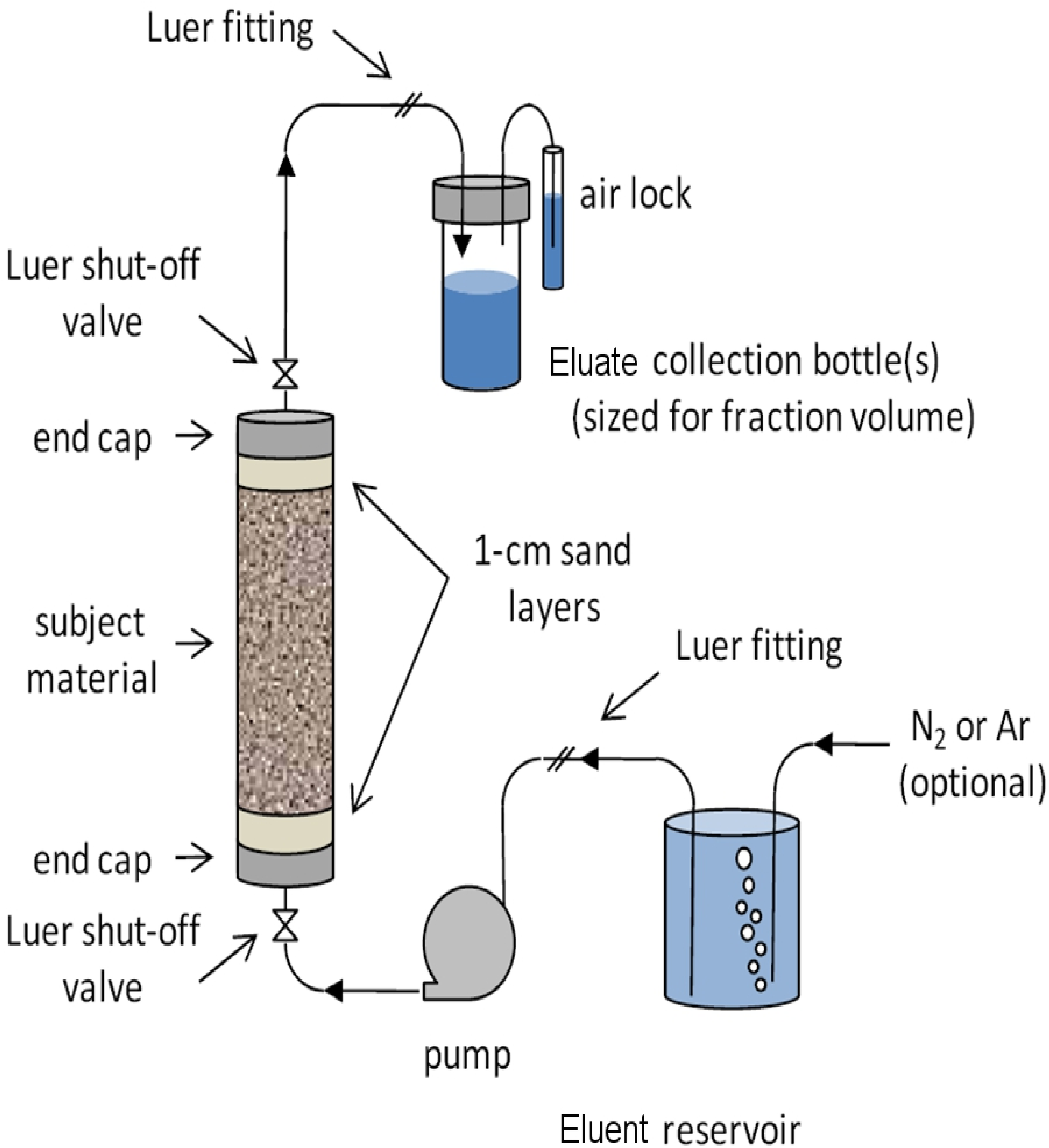


FIGURE 2

SCHEMATIC OF COLUMN TEST APPARATUS



NOTE: Figure not drawn to scale

FIGURE 3

EXAMPLE DATA REPORT FORMAT

EPA METHOD 1314
Report of Analysis

ABC Laboratories
123 Main Street
Anytown, USA
Contact: John Smith
(555) 111-1111

Client Contact: Susan Jones
(555) 222-2222

Material Code:	**XYZ**	Particle Size:	88% passing 2-mm sieve
Material Type:	Coal Combustion Fly Ash	Mass used in Column:	360 g
Date Received:	10/1/20xx	Moisture Content:	0.002 g_{H_2O}/g
Test Date:	11/1/20xx	Column ID:	4.8 cm
Report Date:	12/1/20xx	Packing Bed Depth:	28 cm
		Eluent:	ASTM Type II Water
		Lab Temperature:	21 ± 2 °C

Test Position	Replicate	Value	Units	Method	Note
T01	**A**				
	Eluate Sample ID	**XYZ-1314-T01-A**			
	Collection Date	11/1/20xx			
	Collection Time	12:35	PM		
	Eluate Mass	70.4	g		
	Eluate pH	8.82	-	EPA 9040	
	Eluate Conductivity	5.4	mS/c	EPA 9050	
	Eluate ORP	NA	mv		

Chemical Analysis	Value	Units	QC Flag	Method	Date	Dilution Factor
Al	4.72	mg/L		EPA 6020	11/7/20xx	1000
As	0.12	mg/L		EPA 6020	11/7/20xx	10
Cl	5.42	mg/L		EPA 9056	11/9/20xx	1

Test Position	Replicate	Value	Units	Method	Note
T02	**A**				
	Eluate Sample ID	**XYZ-1314-T02-A**			
	Collection Date	11/1/20xx			
	Collection Time	9:15	AM		
	Eluate Mass	105.1	g		
	Eluate pH	9.15	-		
	Eluate Conductivity	2.3	mS/c		
	Eluate ORP	NA	mv		

Chemical Analysis	Value	Units	QC Flag	Method	Date	Dilution Factor
Al	2.99	mg/L		EPA 6020	11/7/20xx	1000
As	0.21	mg/L		EPA 6020	11/7/20xx	10
Cl	4.20	mg/L	U	EPA 9056	11/7/20xx	1

QC Flag Key: U Value below lower limit of quantitation as reported (< "LLOQ")

FIGURE 4

EXAMPLE ELUATE CONCENTRATION CURVES FOR COMPLETE CHARACTERIZATION OF A COAL COMBUSTION FLY ASH

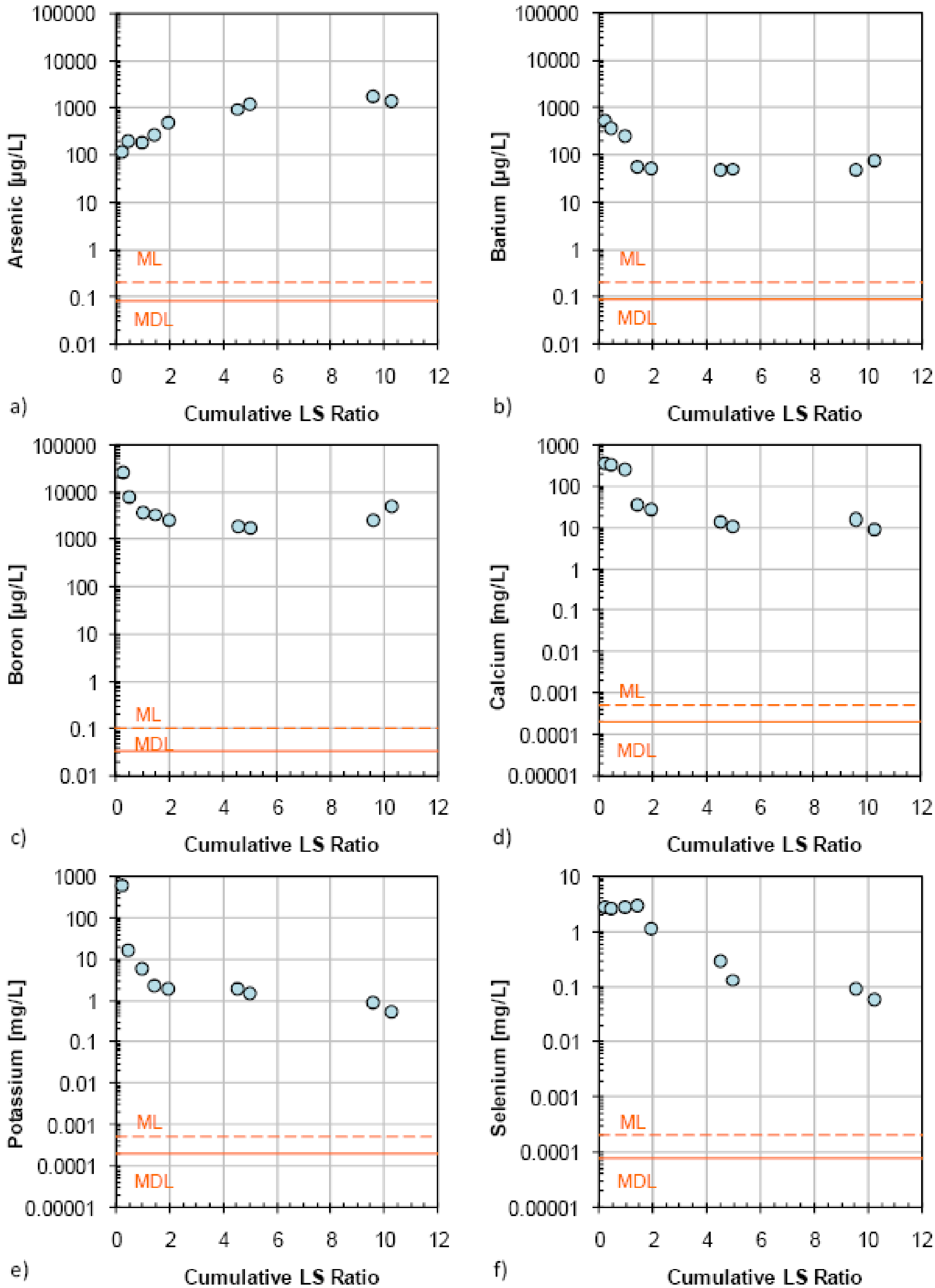
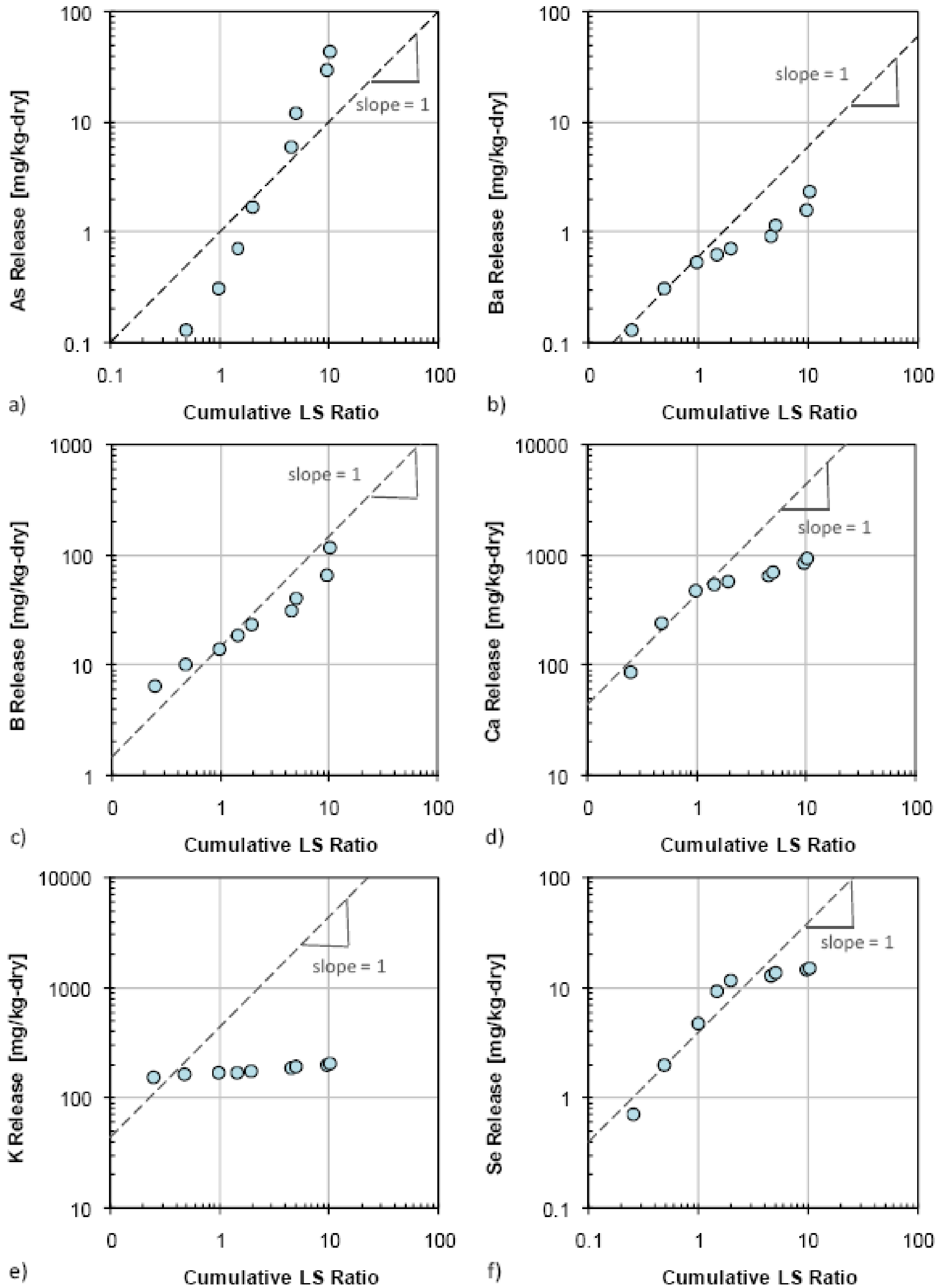


FIGURE 5

EXAMPLE CUMULATIVE RELEASE CURVES FOR COMPLETE CHARACTERIZATION OF A COAL COMBUSTION FLY ASH



NOTE: Dashed line represents solubility control (slope = 1).

Appendix B – Health and Safety Plan

Inventum Engineering
Site-Specific Health and Safety Plan (HASP)

(Required for all Type 2 and 3 projects.)

1. General Information

Client Name: Riverview Innovation and Technology Campus, Inc.	Project #:
Project Name: Brownfield Cleanup Program Remedial Investigation	Project Manager: John Black, PE

Street Address:

3875 River Road

Tonawanda, New York 14150

Prepared By: Todd Waldrop **Date: March 7, 2020**

Approved By: John Black, P.E. **Date: March 10, 2020**

Proposed Date(s) of Work: Q3/Q4 2020

Proposed Scope of Work:

Inventum Engineering, P.C. (Inventum) will be the owner's representative, investigation team and engineer supporting the site management, site investigation(s), and remedial investigation(s) through the New York State Brownfield Cleanup Program (BCP) for the Riverview Innovation and Technology Campus located on the former Tonawanda Coke Corporation Facility (BCP Site). The general scope of work is provided below, and tasks will be updated with additional details/specifications as the project progresses through the BCP.

Task 1 - Site Management and Oversight

Inventum will conduct site visits and provide full-time site management support, general management support, and general contractor and subcontractor oversight related to the remedial investigation of the BCP Site. This task includes site visits related to oversight of the RI, but specifically excludes Inventum personnel directly performing any intrusive site work or oversight of contractors/subcontractors performing intrusive site work. Direct intrusive site work and/or intrusive site work oversight is covered under Tasks 2 through 7 below.

Task 2 – Surficial Soil Sampling

Surficial (approximately 0 to 1 foot below ground surface [bgs]) soil samples will be collected from various locations of the BCP Site to establish current conditions. Shallow samples will be collected using a hand-auger, shovel, or trowel and the material will be recovered for lithological characterization and field screening with a PID equipped with a 10.6 eV lamp. All observations and measurements will be logged in the field notebook. Samples may be collected for various constituents including Metals, Semi-Volatile Organic Compounds (SVOCs), Volatile Organic Compounds (VOCs), Polychlorinated Biphenyls (PCBs), cyanide, mercury, 1,4-Dioxane, and Per- and Polyfluoroalkyl Substances (PFAS).

Task 3 – Subsurface Soil Sampling

Subsurface (> 1 feet bgs) soils samples will be collected from various locations of the BCP Site to establish current conditions. Depending on the depth of sample, subsurface samples may be collected using a hand-auger, shovel, trowel, light or heavy excavating equipment, direct-push equipment, or rotary drilling equipment. Material will be recovered for lithological characterization and field screening with a PID equipped with a 10.6 eV lamp. All observations and measurements will be logged in the field notebook. . Samples may be collected for various constituents including Metals, SVOCs, VOCs, PCBs, cyanide, mercury 1,4-Dioxane, and PFAS.

Task 4 – Permit Compliance Water and Wastewater Sampling

Water samples will be collected periodically in accordance with a Town of Tonawanda Industrial Use Permit (IUP) and a New York State Department of Environmental Conservation (NYSDEC) approved Stormwater Pollution Prevention Plan (SWPPP). Additional water samples may be collected at the site to characterize accumulated liquids in various sumps, pits, tunnels and depressions.

Compliance samples in accordance with requirements of the IUP will be collected on BCP Site from the compliance monitoring point located west of the guard shack and adjacent to the truck scale. locations:

- A 24-hour composite sample and grab samples will be collected using a portable ISCO sampler on a monthly basis from a manhole near the guard gate on the west side of the Site (Attachment A). Monthly samples will be collected for analysis of pH, Oil and Grease, Nonpolar (SGT-HEM), Cyanide, Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Total Phosphorus, Chemical Oxygen Demand (COD), and Total Mercury. On a bi-annual basis (every six months) the samples will also be collected to include analysis for Total Arsenic, Total Selenium, and Priority Pollutant SVOCs.

Compliance samples in accordance with requirements of the approved SWPPP Site from three permitted outfall locations (Outfall Nos 1, 2, and 4; Attachment A):

- Outfall No. 1 is the discharge from the concrete lined settling ponds and will contain stormwater runoff from the former production areas of the Site (RI Area of Investigation [AOI] 2)Grab and 24-hour composite samples will be collected at the frequency established in the SWPPP A. Sample parameters may include pH, TSS, Oil & Grease, Settleable Solids, Temperature, Ammonia, Cyanide, Phenols, Benzene, Benzo(a)pyrene, Naphthalene, Toluene, Fluoride, and Surfactants.
- Outfall No. 2 is the discharge from the stormwater detention basin(s) that capture stormwater runoff from the coke and coal yards (RI AOIs 4 and 5). Grab samples will be collected at the frequency established in the SWPPP. Sample parameters may include pH, TSS, Oil & Grease, Iron, Cyanide, Copper, Nickel, Zinc, Surfactant, Aluminum, and Manganese.
- Outfall No. 4 is the combined flow from Outfalls No. 1 and 2. Outfall No. 4 is located just east of River Road and south of the entrance to the Site off River Road. Grab samples will be collected at the frequency established in the SWPPP.

Additional samples shall be collected as needed to characterize liquids accumulating in sumps, pits, tunnels and depressions at the site. These samples shall be collected in accordance with approved work plans.

Task 5 – Test Pit Excavations

Test pits will be conducted at thirty-one (31) locations as part of the RI. Test pits will be excavated using an excavator to a maximum depth of 10-feet below ground surface (bgs). Excavated soils will be temporarily stockpiled a minimum of 2-feet away from the edge of the pit. Excavated soils will be recovered and presented to Inventum for lithological characterization and field screening with a PID equipped with a 10.6 eV lamp. All observations and measurements will be logged in the field notebook. Samples may be collected for various constituents including Metals, SVOCs, VOCs, PCBs, cyanide, mercury 1,4-Dioxane, and PFAS.

Task 6 – Monitoring Well Installation

Nineteen (19) monitoring well clusters consisting of two (2) to three (3) monitoring wells at each cluster will be installed as part of the RI. The borings for the wells will be advanced to depth using hollow-stem augers and include the collection of soil samples for lithological characterization and for samples for analytical testing. Unconsolidated material samples will be collected for observation and screening with a photo-ionization detector (PID) equipped with a 10.6 eV lamp in a continuous interval over the total depth of the boring with a split barrel sampler driven through the augers. All lithological observations, field measurements, and well construction details will be logged in the field notebook. Surface and subsurface soil samples may be collected in accordance with Tasks 2 and 3.

The new wells will be completed with a 2-inch diameter Schedule 40 polyvinyl chloride (PVC) well casing and 5 to 15-feet of 0.010-inch slotted screen depending on the depth interval monitored. A sand filter pack will be placed from the bottom of the screened interval to a minimum of 1 foot above the top of the screen. A 2-foot bentonite seal will be placed on top the filter pack and the remaining annular space will be completed with a cement grout (Portland Type I cement with 3 – 5% bentonite). The wells may either be completed flush-to-grade within a traffic rated box or within a steel bollard enclosure that protrudes a minimum of 2-feet above ground surface.

All newly installed wells will be developed prior to sampling and any existing monitoring wells may be redeveloped prior to sampling. The water levels in the monitoring wells will be manually measured using an oil/water interface probe prior to redevelopment and the depth to water, depth and thickness of any Light Non-Aqueous Phase Liquid (LNAPL), and the total depth of the well will be measured and logged in the field notebook. The wells will be redeveloped by removing three well volumes, purging the wells until dry, or purging and surging the wells using a submersible pump.

Field parameters (temperature, pH, conductivity, ORP, turbidity) will be measured and logged in the field notebook at least three (3) times during the development process (beginning, middle, and end) using a hand-held water quality monitor. All development water will be containerized and stored in appropriately labeled drums or totes and disposed offsite in accordance with applicable local, state, and federal regulations.

Task 7 – Groundwater Monitoring and Sampling

Inspections will be conducted prior to sampling and will include visual observations of the well head, seal, and cover. Measurements of the depth to liquid (if LNAPL is present), depth to water, and the overall total depth of the well will be collected using an oil/water interface probe and recorded in the field notebook for comparison to construction dimensions and previous records.

Monitoring wells will be sampled using a bailer or peristaltic pump. Field parameters (temperature, pH, conductivity, ORP, turbidity) will be measured and logged in the field notebook at periodic intervals using a hand-held water quality monitor. All purge water will be containerized and stored in appropriately labeled drums or totes and either disposed of in accordance with applicable local, state, and federal regulations.

Samples may be collected for various constituents including Metals, SVOCs, VOCs, PCBs, 1,4-Dioxane, and PFAS.

Task 8 – Sampling of Residuals

Samples will be collected from various sumps, pits, tanks and containers at the BCP Site to characterize contents as part of the RI. To the extent practicable, all samples will be collected from the surface or from equipment outside the accumulation point to avoid the need for confined space entry. Samples may be collected installed using a bailer, hand-auger, shovel, trowel, sludge sampler or other long reach equipment. Material will be recovered, and field screened with a PID equipped with a 10.6 eV lamp. All observations and measurements will be logged in the field notebook. Samples may be collected for various constituents including Metals, SVOCs, VOCs, PCBs, cyanide, mercury, hazardous characteristics, pH and water content.

Inventum Role(s) On Site:

☐ Inventum Staff Will Not Be On Site (HASP and Risk Analysis is for subcontractor information only)

☒ Resident Project Representative (*e.g.*, "Observe and Document")

☐ Construction Manager (*e.g.*, CM, Managing/General Contractor)

☒ Representative for Client (*e.g.*, "Agent for Owner")

☒ General On-site Consulting/Engineering Services

☒ Other

☒ Soil Sampling	☒ Solid Waste Sampling	☒ Liquid Waste Sampling
☒ Groundwater Sampling	☒ Surface Water Sampling	☒ Wastewater Sampling
☒ Sediment Sampling	☐ Surveying	☐ Confined Space Entry

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Major Project Tasks	Inventum Task	Subcontractor Task	Minimum PPE Level Required see HASP for details (suggested levels for Subcontractor work)
1. Site Management and Oversight	☒	☐	☐ N/A ☒ D ☐ C ☐ B ☐ A
2. Surficial Soil Sampling	☒	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
3. Subsurface Soil Sampling	☒	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
4. Permit Compliance Water and Wastewater Sampling	☒	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
5. Test Pit Excavation	☐	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
6. Monitoring Well Installation			
7. Groundwater monitoring and Sampling			
8.			

2. Contingency Planning

LOCAL EMERGENCY RESOURCES:	
Ambulance: 911	Emergency Room: 716.447.6100
Police: 911	Fire Department: 911
NYSDEC Contact: Ben McPherson, Project Manager, 716.851.7220	Poison Control Center: 1-800-222-1222 ☐ Specify:
Other (client services offered, etc.):	

SITE RESOURCES:			
Drinking Water Supply	☐ Inventum	☐ Subcontractor	☒ Client
Wash Water Supply	☐ Inventum	☐ Subcontractor	☒ Client
Telephone – Land Line		☐ Subcontractor	☒ Client
Telephone - Cellular	☒ Inventum	☒ Subcontractor	
First Aid Kit	☒ Inventum	☒ Subcontractor	
Fire Extinguisher	☐ Inventum	☒ Subcontractor	☒ Client
Emergency Shower **N/A**	☐ Inventum	☐ Subcontractor	☐ Client
Eye Wash **N/A**	☐ Inventum	☐ Subcontractor	☐ Client
Other: Confined space retrieval device **N/A**	☐ Inventum	☐ Subcontractor	☐ Client

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

EMERGENCY/SAFETY CONTACTS:	
Inventum Technical Contacts	John Black (571.217.6761); Todd Waldrop (571.217.3627); James Edwards (571.232.5048)
Inventum Project Manager (PM): John Black	571.217.6761
Inventum Office Safety Coordinator (OSC)	John Black (571.217.6761); Todd Waldrop (571.217.3627); James Edwards (571.232.5048)
Inventum Field Contact:	John Black (571.217.6761); Todd Waldrop (571.217.3627); James Edwards (571.232.5048); Keith Adderley (716.335.2045)
Contractor Contact (To Vary – Main Remedial Contractor provided):	Ontario Specialty Contracting; 716.856.3333
Client Contact:	Jon Williams: 716.856.3333; John Yensan (716.856.3333)
Front Gate Guard Shack	716.783.5744

Emergency Route:

Hospitals or clinics identified for emergency medical care should be contacted, to verify that emergency care is provided at that location. Verify the exact location of the medical facility during this call. See directions and map of route to Kenmore Mercy Hospital on the following page:

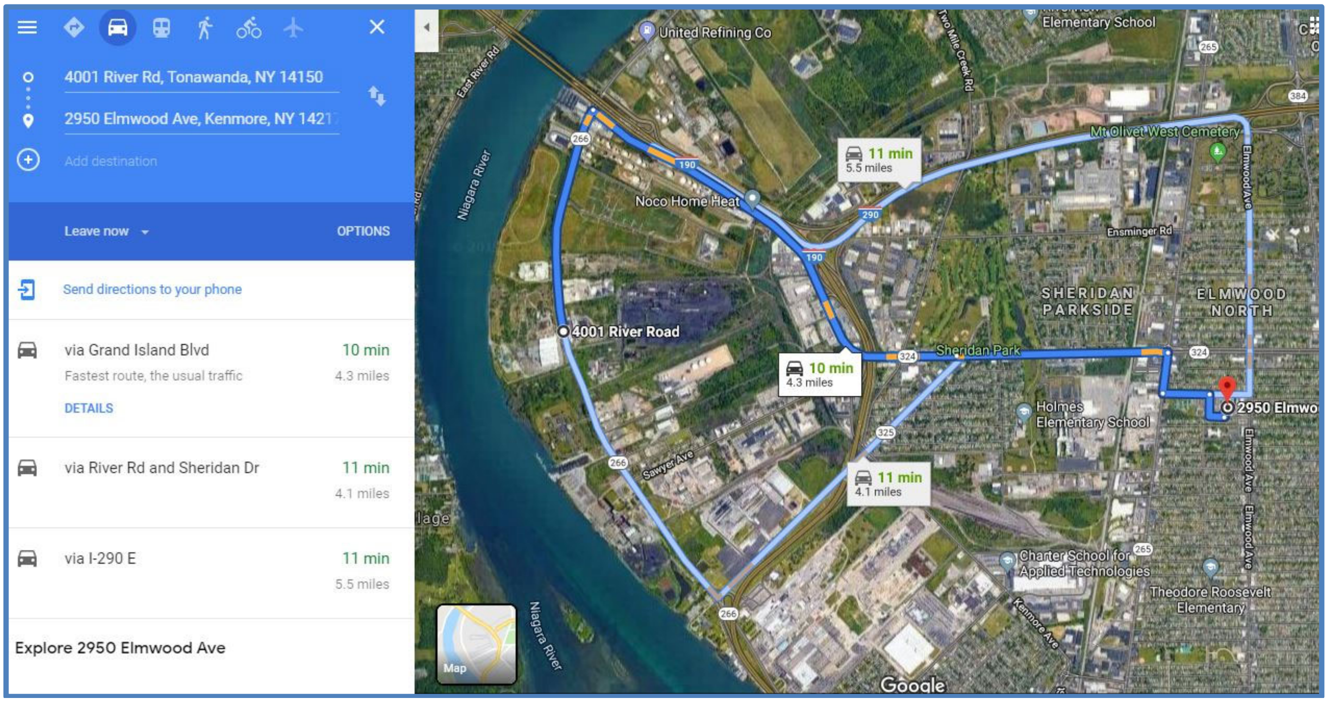
Hospital: **Kenmore Mercy Hospital**
2950 Elmwood Ave
Buffalo, NY 14127
716.447.6100

Other: NA

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Map to Hospital



Directions to Hospital:

- **Turn right onto River Road**
- **Turn right onto Grand Island Blvd (about 2 miles)**
- **Merge onto Sheridan Dr.**
- **Go about 1.5 miles and turn right onto Elmwood Avenue**
- **Make a sharp right and hospital is on left**

Emergency Procedures:

If an emergency develops at the site, the first responder should take the following course of action:

- Notify the proper emergency services for assistance.
- Notify other personnel at the site.
- As soon as possible, contact the Inventum Project Manager to inform them of the incident.
- Complete the Inventum Incident Report Form (see Appendices) within 24 hours of the incident and client notifications, as required.

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Investigation of Near Miss Incident and Initial Report of Incident/Exposure:

Inventum employees are required to report any incident, near miss, or injury, as soon as possible, by contacting the following:

☒ Inventum Managing Partner ☒ Notify supervisor ☒ Notify project manager

☐ Notify Site Manager () ☐ Complete client report: as required

(name):
(phone number):

Emergency Equipment Required On Site:

☒ First Aid Kit

☐ Emergency Eye Wash

☐ Emergency Shower

☐ Fire Extinguisher

☐ Spill Control Media

☐ Tripod/Hoist/Harness for non-entry confined space rescue

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

3. Site Classification

	Identification of Potential Hazards	YES	NO	SITE TYPE[1]
1.	Is the work a Phase I ESA (i.e., supervised plant walk-through, etc.)?	☐	☒	1
2.	Is the work being performed solely by a subcontractor (i.e., INVENTUM not on site)?	☐	☒	1
3.	Is the work just a supervised inspection for process evaluation, other inspections, meetings, records review, or a tour?	☐	☒	1
4.[1]	Is the work completely absent any chemical, physical, biological, or radiological hazards which would require a site-specific health and safety plan?	☐	☒	1
5.	Does the work include any mandatory client H&S requirements?	☒	☐	1, 2, or 3
6.	Does the project include on-site work other than office type areas?	☒	☐	2 or 3
7.	Does the proposed work scope involve any of the following:			
	Known and controlled chemical or biological hazards	☒	☐	2
	Unprotected work at elevation (fall protection required)	☐	☒	2
	Invasive activities (*i.e.*, Phase II ESA, UST Removal, sampling, etc.)	☒	☐	2 or 3
	Exposure to ionizing radiation (i.e., using nuclear gauges, etc.)	☐	☒	2 or 3
	Open excavations/trenches (Competent Person may be required on site)	☒	☐	2 or 3
	Confined space entry (permit may be required)	☐	☒	2 or 3
	The use of scaffolding (qualified inspections are required)	☐	☒	2 or 3
	Heavy equipment	☒	☐	2 or 3
	Facility maintenance (O&M, piping, electrical, lockout/tagout, etc.)	☐	☒	2 or 3
	Underground utilities may be encountered	☒	☐	2 or 3
	Overhead utilities may be encountered	☒	☐	2 or 3
	Stack testing	☐	☒	2 or 3
	Geotechnical drilling	☒	☐	2 or 3
	Demolition Activities with known or suspected contamination	☒	☐	2 or 3
	Unknown or uncontrolled chemical or biological hazards	☐	☒	3
	Known and uncontrolled chemical or biological hazards	☒	☐	3
	Waste sampling	☒	☐	3
	Construction activities with known or suspected contamination	☒	☐	3
	Remedial activities (RCRA, CERCLA, EnviroBlend®, Oxigent, etc.)	☒	☐	3
8.	Is the work regulated by 29 CFR 1910.120 (OSHA) or 30 CFR (MSHA)?	☒	☐	3
9.	Is the work regulated by NPL, CERCLA, RCRA, TSD, or SARA?	☒	☐	3

[1] Denotes typical site level (based on activities).

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Site Type Designation:

☐ **Type 1** Known and controlled hazards associated with consulting/engineering services.

☐ **Type 2** Known and controlled hazards, but with invasive, hazardous activities and/or civil/mechanical construction related services, or sampling.

☒ **Type 3** Unknown and/or uncontrolled hazards associated with corrective action clean-up, and/or remediation of hazardous substances.

4. Site Characterization

Client Requirement(s)[1]:	☒ None	☐ Site Orientation	☐ H&S Orientation
	☐ Permits or Other Requirements (specify and attach, if available):		
Site Information:	☒ Map/Diagram (attach)	☐ Map/Diagram Unavailable	
	☐ Inactive Site	☒ Active Site (specify below)	
General Environmental Concerns:	☒ Contaminated Water	☒ Wastewater	☒ Dust
	☒ Contaminated Soil	☒ Solid Waste	☒ Noise
	☒ Contaminated Air	☒ Waterways	☒ Asbestos
Site Security/Access Control:	☐ None	☒ On Site	
	☐ Other (explain):		
Amenities Available for Work:	☐ None	☒ Waste Storage	☒ Restrooms
	☒ Tools/Equipment Storage	☒ Office/Trailer Space	☒ Supplies Storage
Utilities Available For Work:	☐ None	☒ As Listed: Water, electric	
Medical Services Available:	☐ None On Site	☒ As Listed: First aid	
Facility Alarms/Signals:	☒ None	☐ As Listed:	
Traffic/Parking/Railway Issues:	☐ None	☒ As Listed (On-Site/Off-Site): On-site parking	
☒ Permits Required (specify)[2]:	☐ Confined Space Entry	☒ Local: POTW	☐ State:
	☐ Federal:	☐ Other:	☒ N/A
☒ Utility Locate Service(s):	☒ On Site	☐ Client	☒ Other: Former Site employees contracted to client for daily site management
	☐ Off Site	☐	☒ One Call
		☐	☐ N/A

[1] If relying on the client for any specific hazard identification and control, implemented control and effectiveness should be documented prior to beginning any work activities. This is recommended for all field projects.

[2] Permit examples: Utilities (electrical, water, gas, etc.); Excavations; Explosives; Cranes; Burning; Fuel storage; Traffic control; Hoists; Cutting; Welding; Demolition; Confined space; Restricted access areas; etc.

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

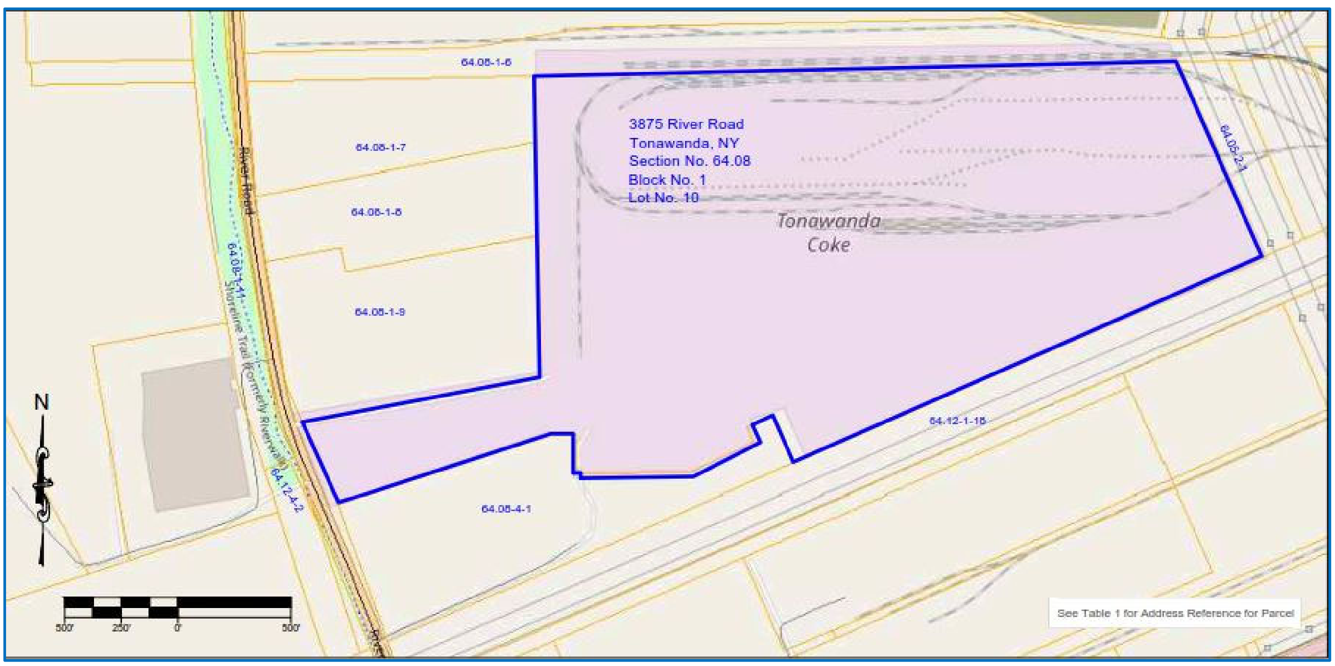
Detailed Physical Description of Site/Facility: ☒ **Map/Diagram Attached**

The Site is located at 3875 River Road, Town of Tonawanda, Erie County, New York. The BCP Site encompasses approximately 86.5 acres of land although Riverview Innovation Technology Campus, Inc (client) will control additional acreage outside the BCP program within the federal/state superfund programs. The Site is located approximately 0.25 miles west of I-90 on the east side of River Road. The surrounding properties are primarily industrial or vacant.

The former coke production facility is located in the northern center portion of the property which includes coke ovens, coke by-product plant, storage tanks, and railway line spurs. The southern portion of the property is mainly open with multiple former raw material coal and coke piles located throughout the area. The facility is no longer in operation; however, activities on site include surficial mining of remaining coal/coke storage areas and water management from secondary containment areas.

Historically, manufacturing processes used at the plant have included: by products coking, light oil distillation, ammonia recovery, and ethene, toluene, and xylene extraction. Historical investigations that were performed at the site have identified some conditions that previously required remediation.

Figure 1; Site Location



Site Activities/Current Operations: ☐ None ☒ As Specified

Other Concurrent Site Activities, Work, and/or Other Adjacent Hazards or Concerns:

☐ None

As Specified:

☐ Schools ☐ Daycare ☐ Hospital ☐ Airport

☐ Residential ☒ Offices ☐ Shopping ☒ Active parking lot in work space

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

5. Hazard Evaluation

Complete [(1)] Substance Name (be specific)	Specific Applicable OSHA Standard (if any)	Physical State [(2)] (S, L, G, Aq, Vap, F, P)	Max. [(3)] Conc. Level Per Physical State	General [(4)] Control Measures (Eng., Admin., PPE)
Coal Tar	0.2 mg/m3	S	Coal Tar Product	Eng., PPE
Benzo(a)pyrene	0.2 mg/m3	S	4,100 ug/kg	Eng., PPE
Benzo(b)fluoranthene	N/A	S	4,600 ug/kg	Eng., PPE
Benzo(a)anthracene	N/A	S	20,000 ug/kg	Eng., PPE
Chrysene	0.2 mg/m3	S	21,000 ug/kg	Eng., PPE
Dibenz(a,h)anthracene	N/A	S	1,700 ug/kg	Eng., PPE
Indeno(1,2,3-cd)pyrene	N/A	S	15,000 ug/kg	Eng., PPE
Cyanide	N/A	L	2.75 mg/L	Eng., PPE
1,4-Dichlorobenzene	75 ppm	L	29 ug/L	Eng., PPE
Benzene	1 ppm	L	85 ug/L	Eng., PPE
Chlorobenzene	75 ppm	L	22 ug/L	Eng., PPE
Xylenes	100 ppm	L	36 ug/L	Eng., PPE
Toluene	200 ppm	L	59 ug/L	Eng., PPE
Iron	N/A	L	160 mg/L	Eng., PPE
Manganese	N/A	L	11.2 mg/L	Eng., PPE
Phenolics	5 ppm	L	0.61 mg/L	Eng., PPE
1,1,1-Trichloroethane	350 ppm	L	12.2 ug/L	Eng., PPE
Methylene chloride	25 ppm	L	52 ug/L	Eng., PPE
Selenium	0.2 mg/m3	L	0.0116 mg/L	Eng., PPE
Nickel	N/A	L	0.153 mg/L	Eng., PPE
Cadmium	0.005 mg/m3	L	0.19 mg/L	Eng., PPE
Chromium Total	1 mg/m3	L	0.086 mg/L	Eng., PPE
Lead	0.050 mg/m3	L	0.025 mg/L	Eng., PPE

(1) Use OSHA regulated name, not elemental forms. If available, attach SDS. Identify any sample preservative or O&M chemicals or subcontractor chemicals in this table also.

(2) S = Solids, L = Liquid, G = Gas, Aq = Aqueous, Vap = Vapor, F = Fume, P = Airborne Particulate.

(3) If available, attach laboratory results or summary tables.

(4) See the following sections for detailed control measures: personal protection equipment (PPE), Air Monitoring (Admin), or Site Control (Admin and Eng.).

(6) IP = Ionization Potential, VP = Vapor Pressure, LEL = Lower Explosive Limit, UEL = Upper Explosive Limit, N/A = Not Applicable, N.D. = Not Determined

(7) IDLH = Immediately Dangerous to Life and Health. NEVER enter IDLH conditions on site without proper respiratory protection.

(8) C = Ceiling Value, ST = Short-Term Exposure Limit, TWA = Time-Weighted Average, None Est. = None Established

(9) R = Respirable Limit, T = Total Limit

(10) Warning Properties: Good (G), Poor (P), None (N)

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

5. Hazard Evaluation (continued)

Site-Specific Physical Hazards

HAZARD	SPECIFIC CONTROL MEASURE
Slip/Trip/Fall Injury	– Use roads or trails whenever possible. – Occasionally reassess route to avoid dangerous terrain. – Maintain good housekeeping and keep work area clear of loose materials and equipment. – Use portable steps to mount and dismount sampling vehicle.
Ingestion of or contact with impacted soil	– Wear safety glasses. – Wear nitrile and appropriate cut-/puncture-resistant gloves (see Glove Selection Guideline) when performing tasks. – Wash hands and arms thoroughly when daily work is completed. – No eating, drinking, or smoking while conducting monitoring or sampling activities.
Pinched fingers or toes	– Where appropriate cut-/puncture-resistant gloves (see Glove Selection Guideline) when the potential for hand injury exists. – Where steel-toed safety shoes with steel shanks while on site.
Strained muscles	– Use proper lifting posture, techniques, and equipment when handling heavy objects. – Use two people for loads >40 lbs. or awkward items. – Take rests as needed during and between carries.
Cutting activities	
Flying debris/eye injuries	– Wear ANSI-approved safety glasses when the potential for flying debris and eye injuries exists.

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Aboveground Storage Tanks (AST)	Be aware of any aboveground storage tanks and the type of material being stored in them. Be aware of the potential of spills, fires, explosions, etc., while working near the tanks. Stay clear of tanks whenever possible, and be aware of any equipment operators near the tank(s).
☒	Animals (dogs, etc.)	Be aware of any animals on site or adjacent to the site. Appropriate care should be taken if any feral (wild) animals are encountered.
☐	Blasting/Explosives	INVENTUM personnel shall not handle any explosive devices or materials. INVENTUM personnel should understand the blasting procedures being used by the subcontractor, and all of the associated health & safety precautions. The subcontractor shall handle, store, and use the explosives in accordance with 29 CFR 1926.900, Subpart H and U.
☐	Boat or Barge	A boat or barge should be used that is adequately stable for the type of activity conducted. The boat or barge should have all of the appropriate and current licensing and registrations required by the applicable regulatory agencies. All applicable laws and regulations will be followed when launching the boat or barge, and when navigating to and from the work site. Personal floatation devices should always be worn while navigating the boat or barge. The boat must be equipped with the following approved United States Coast Guard (USCG) safety equipment: – A Type 1, 2, or 3 personal flotation device (PFD) for every person aboard (should be worn while navigating) The following equipment is recommended: – A Type 4 throwable PFD – Audible distress signal device (air horn, whistle) – Fire extinguisher (if engine-propelled) – Auxiliary propulsion (spare paddles, trolling motor) – Bow and stern lines – Anchor and anchor line – First aid kit – Visual distress signal device(s) (flares, dyes) – Additional PFDs Be familiar with local weather and tidal characteristics. Do not conduct sampling from a boat/barge when threatening weather is imminent, or poor visibility exists. Sampling from a boat is prohibited in water containing substances likely to cause injury upon short-term or prolonged contact. Sampling from a boat is prohibited when the temperature of the water is high or low enough to cause injury upon short-term or prolonged exposure. Avoid sampling from a boat when unsafe water turbulence (waves) exists. Avoid standing in a boat. Always use the buddy system when sampling from a boat or barge; one person should be on shore with visual contact of the barge and should be able to summon emergency assistance if needed. Be familiar with local weather and tidal characteristics. Work on a boat or barge will not be performed when threatening or severe weather is impending or present.

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Briars or Thistles	Be aware of any briars or thistles on site. Wear appropriate clothing and gloves. Avoid contact with briars or thistles whenever possible.
☒	Business Traffic	Be aware of traffic patterns associated with local businesses near the work site. Allow traffic to enter and exit the businesses in such a manner to avoid creating traffic hazards, back-ups, delays, or potential accident situations.
☐	Cement Dust	Stay clear of mixing operations and avoid contact with or breathing of the dust.
☐	Chain Saws	Stay clear of any chain saw operations. Subcontractor is responsible for the safe use of chain saws on site.
☒	Cleaning Agents	Use caution when applying cleaning agent to equipment. Use gloves, safety glasses, splash shields, and protective clothing as needed.
☒	Client Activities	Be aware of client activities at or adjacent to the site. Work activities should be coordinated with other site activities to avoid conflicts. Contact EDP offices prior to starting work.
☒	Cold Stress	Work schedules may be modified when temperatures are below 20° F as measured by the wind chill factor. Take frequent breaks to warm up. Drink plenty of fluids. Wear appropriate clothing, and monitor for cold stress symptoms (frostbite, hypothermia, etc.).
☒	Compressed Air or Gas Cylinders	Compressed air or gas cylinders should be clearly marked, and they should be stored, transported, and secured in an approved manner.
☒	Compressed Air/Gas or Pressurized Liquids Hoses, Lines & Fittings	Compressed air or gas, or pressurized liquid lines or hoses should be inspected at least daily, or in the event a leak develops, or if a line or hose is run over or crimped.
☐	Concrete/Masonry/ Foundations	No construction loads shall be placed on a concrete structure or portion of a concrete structure unless a person who is qualified in structural design has determined that the structure or portion of the structure is capable of supporting the loads. All protruding reinforcing steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of impalement. No employee shall be permitted to work under concrete buckets while buckets are being elevated or lowered into position. To the extent practical, elevated concrete buckets shall be routed so that no employee, or the fewest number of employees, are exposed to the hazards associated with falling concrete buckets. A limited access zone shall be established whenever a masonry wall is being constructed. All masonry walls over eight feet in height shall be adequately braced to prevent overturning and to prevent collapse unless the wall is adequately supported so that it will not overturn or collapse. The bracing shall remain in place until permanent supporting elements of the structure are in place.
☐	Confined Spaces (tanks, vaults, vessels, trenches, manholes, some excavations, etc.)	The scope of this project does entail entry into confined spaces. Confined spaces will not be entered unless a confined space entry permit has been completed, signed, and approved, and all participating personnel are trained in confined space entry procedures, including safety, and rescue procedures. All potential hazards of confined space may not be addressed by this hazard assessment, and health and safety plan.
☒	Cutting Tools	Stay clear of contractors' cutting tools, especially saws and torches. Be aware that cutting operations could create other hazards, such as falling objects, or shifting materials, etc. Safety glasses should be worn while using cutting tools. Spark-proof tools should be used when working in areas of potential explosive or flammable conditions. Fixed-open blade knives are prohibited.

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Demolition Activities	Stay clear of walls, ceilings, roofs, etc., as they are being demolished.
☒	Demolition Debris	Demolition material should only be handled by appropriate equipment because of sharp points, edges, etc. Demolition material may also pose a trip hazard, fall, or puncture hazard, so avoid walking or climbing on debris piles, etc.
☒	Drums	If drums are used on-site, they should be clearly labeled with the name of the contents and the appropriate label. Drums should only be handled with the appropriate equipment. Drums discovered during excavations, etc., shall not be opened or moved until appropriate identification can be performed. At a minimum, Level B protection is required for sampling any unlabeled drums discovered during remediation procedures.
☒	Dust/Particulates (Particulates Not Otherwise Regulated) (PNOR) (OSHA PEL = 15 mg./m^3, total) (OSHA PEL = 5 mg./m^3, respirable)	For general dust, work should be performed up-wind if possible. <u>If conditions warrant it</u>, monitoring should be done with a PM-10. Monitoring should occur at least 3 times per day, and every time re-entering the site. Readings should be taken downwind from the work area or inside the equipment as indicated by the conditions on site. If the OSHA PEL is exceeded, or is likely to be exceeded, engineering or administrative controls should be used, or a dust respirator must be worn. For hazardous dusts, a detailed air monitoring plan and a respiratory protection plan should be developed for the site activities.
☐	Elevated Work	For any construction work activities elevated 6 feet or more, or other non-construction activities elevated 4 feet or more, fall protection must be provided. Caution should be taken on catwalks and ladders because of potential slippery conditions, or the potential for footwear to catch on the surfaces.
☒	Energized Sources (electrical equipment or hookups, lines, etc.,) (Lockout/Tagout)	Contractors for all electrical activities, and any facility equipment with moving parts should follow proper lock-out/tag-out procedures, and only properly trained employees will perform the work. Employees will not perform any lock-out/tag-out activities unless personnel are properly trained in lockout/tagout procedures. Heed any caution signs or labels.
☒	Equipment Exhaust	Equipment exhaust should be ventilated away from the work area while drilling inside structures. Industrial fans can be used to move exhaust out of the area.
☒	Ergonomic Issues (job hazard analysis)	Ergonomic hazards will be addressed on a site-specific basis once mobilization to the field has occurred. Workstations will be evaluated on an individual basis.
☒	Evening Work	If work is performed during the evening hours, work shall be limited by the availability and the quality of artificial lighting. Care should also be taken to avoid slip, trip, and fall hazards that are not as easy to identify during low light conditions.
☒	Excavations	Stay clear of excavation walls. INVENTUM personnel will not enter an excavation, in accordance with 1926 Sub Part P. Subcontractor must provide a Competent Person on site, if one is required by the planned activities. Side cuts should conform to 1926 Subpart P requirements, or shoring should be used. All open excavations should be secured using traffic cones, barrier tape, or barricade signs stating "Do Not Enter Excavations", especially if left open overnight.
☐	Explosives	Be aware of potential explosive materials and how to identify them. No smoking is allowed on-site or near where potential explosive materials may be present.
☒	Facility Conveyors (product or waste lines)	Stay clear of facility conveyors, product process lines, and waste disposal lines. Be aware of any client-specific health and safety requirements to work in these areas.

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Facility Equipment/Machinery	Be aware of active and moving client equipment on site.
☒	Facility Piping - aboveground	Stay clear of aboveground pipes. Client is responsible to identify all applicable aboveground facility pipes prior to any work activities in the area. Pipes can be overhead hazards, or trip hazards. Pipes can be hazardous because of the material flowing through them, such as steam, natural gas, toxic chemicals, etc. Some pipes are also coated with hazardous material such as asbestos.
☒	Facility Piping - belowground	Client is responsible to identify all applicable underground facility pipe locations prior to any subsurface activities.
☒	Fall Hazard	Proper tie-off, harnesses, railings, etc. should be used when performing work on ladders, scaffolding, man-lifts, or on the roof of buildings, etc. Stay clear of the edges of pits, trenches, quarries, etc.
☒	Falling Objects	Be aware of any potential falling objects or materials on site. Stay clear of any areas identified as potential falling object areas.
☒	Fences	Be aware of fences in disrepair that may be trip hazards or may have materials that could cause punctures or cuts. Use caution when crossing over or under fences.
☒	Field Equipment	If field equipment is heavy or awkward to carry, get assistance or use carts to help move around the site.
☒	Field Vehicle	Inventum personnel shall follow all applicable state and federal traffic laws while traveling to and from the site, and while working on the site. In particular, the following laws should be followed: speed limits, parking restrictions, use of wipers and lights during precipitation events, limiting cell phone use, etc. It is the responsibility of the driver to verify that all safety equipment on the vehicle is working properly before driving the vehicle. In particular, the following items should be checked: tire pressure, tire tread, windshield wipers, windshield washer, headlights, tail lights, brake lights, spare tire, fire extinguisher, first aid kit, etc.
☒	Fire Hazards	Eliminate sources of ignition in work areas that have ignitable materials. Provide an ABC fire extinguisher in close proximity to the support zone.
☒	Flooded Areas	Do not drive through flooded areas or standing water. Do not wade into moving water, or water deeper than 2 feet without adequate assistance.
☒	Flying Debris/ Eye Injuries	Be aware of any flying debris on site and wear protective eyewear when necessary.
☒	Fork Lifts	Be aware of forklift patterns and stay clear of those routes.
☒	Hand Tools	Use only the appropriate tool for the task at hand. Use the tool(s) as designed, described, and intended by the manufacturer.
☒	Heat Stress	The work schedule may be modified if the ambient temperature is more than 80° F. Take breaks as necessary, and drink plenty of fluids. If necessary, wear sunscreen and sunglasses on bright days. Monitor site personnel for signs of heat stress symptoms (heat rash, heat cramps, heat exhaustion, or heat stroke).

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Heavy Equipment	Contractor is responsible for safe operation of equipment. All mobile heavy equipment must have a functioning backup alarm, and operators must comply with equipment manufacturer's instructions. Maintain proper distance and remain in line of sight of operator and out of reach of equipment. Isolate equipment swings, if possible. Make eye contact with the equipment operator before approaching the equipment. Understand and review hand signals, and wear orange safety vest, if necessary.
☒	Heavy Lifting	Use proper lifting procedures and equipment when handling heavy objects such as drums, manhole covers, tank covers, etc.
☒	High Pressure Gas Lines, etc.	Be aware of high-pressure gas lines and follow approved safety precautions when working with or around the lines.
☐	Highway Traffic	Traffic control within the right-of-way will be in accordance with the WDOT "Work Zone Safety – Guidelines for Construction, Maintenance, and Utility Operations" procedures. Work may be restricted within specific lanes during peak traffic times. Verify peak traffic times, and review planned activities with the WDOT, so that appropriate lane closures can be coordinated.
☒	Housekeeping	All field vehicles, job trailers, and field offices will be properly cleaned and organized to prevent cluttered work and storage areas.
☐	Hunters/Firing Range, etc.	Be aware of surrounding activities that may involve hunting, firearms, etc. that may not be in your immediate area, but could create an unsafe work environment.
☒	Ice (thin)	When project activities include either crossing ice or working directly on the ice, a detailed plan should be developed that will be used to continually evaluate the ice conditions, and to determine when work should be terminated due to unsafe conditions. All staff working on the ice will wear an appropriate and approved personal floatation device. Other emergency equipment such as ropes, a throwable floatation device, a means to warm a wet and cold worker, etc. must be available. A buddy system should also be used for this type of work, such that one person is always on shore or at least on previously determined safe ice.
☒	Insects (ticks, bees, spiders, etc.)	Site workers with known allergies to insect bites should carry their own medication. In case of emergencies, inform fellow workers of any severe allergies. Use insect repellant as necessary, and as specifically allowed on site. If possible, wear long-sleeved shirts and pants. If appropriate, check for ticks at the end of each day. Have other appropriate first aid supplies handy for bites.
☒	Stakeholders	Be aware of the potential for irate neighbors or outsiders that may interfere with work activities, or that may potentially damage equipment or on-site materials, etc.
☐	Ladders	Ladders should only be used if they are in good condition, conform to OSHA requirements, and if they will be used in an appropriate manner. Be especially cautious of slipping on ladders when the ladder or footwear is wet or dirty.
☐	Landfill Gas (Methane, CO_2, Hydrogen Sulfide)	Avoid breathing gas, especially in low oxygen areas (simple asphyxiant). Potentially flammable and explosive, so keep ignition sources away from gas. Explosive conditions of LEL >5% in a work area should be ventilated as soon as possible, or the area should be evacuated.

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☐	Leachate (Municipal Solid Waste (MSW))	MSW leachate may contain hazardous biological substances, so avoid physical contact with leachate and, if possible, stay up-wind. If contact is made with leachate, wash affected areas thoroughly with soap and water. If boots contact leachate, they should be thoroughly washed with soap and water also.
☒	Lead	Wear gloves when in contact with lead contaminated soil, etc. Thoroughly wash hands and arms when daily work is completed.
☒	Long Hours/Fatigue	Long work hours can lead to fatigue, and fatigue can lead to the physical inability to perform the work in a safe manner, or travel to or from, a work site in a safe manner. If long work hours are scheduled, or if the scheduled work takes longer than planned, field staff should determine if fatigue is, or will be, an issue. Field staff should evaluate whether they are able to complete the work in a safe manner, or whether they are able to travel in a safe manner. If fatigue is an issue, appropriate breaks should be planned or taken, including overnight stays when necessary.
☒	Material Handling	Move containers and heavy material only with the proper equipment, and secure them to prevent dropping, falling, or loss of control during transport. Stay clear of material handling operations, especially near slopes. Do not stand down the slope from equipment, supplies or materials being moved above on the slope, or being deployed onto the slope.
☒	Material Storage	Stored material may be a falling hazard, or a crush hazard. Do not stand adjacent to materials stacked up, such as pipes, geosynthetic rolls, etc., or in the area of deployment.
☐	Methane Gas (Landfill Gas)	Explosive conditions (5% LEL) will be ventilated, if encountered, prior to working in an area. Methane is a simple asphyxiant.
☐	Mine or Quarry	No work shall be performed within 15 feet (or other designated client setback, whichever is greatest) of the mine or quarry walls. Be aware of the potential for falling rocks or slope failures.
☒	Municipal Solid Waste (MSW)	MSW may contain hazardous biological substances, so avoid physical contact, and if possible, stay up-wind. Wear appropriate PPE, such as gloves, safety shoes, and safety glasses. Wash hands, arms, and face after working near MSW. Reusable PPE and equipment should be thoroughly decontaminated after exposure to MSW. MSW may also contain sharp objects with the potential to puncture PPE.
☒	Natural Gas	Natural gas is flammable and explosive. Keep ignition sources away from gas sources. Use spark-proof tools when working with gas lines, etc.
☒	Noise	Hearing protection must be worn when noise levels exceed 85 dBA in the work area. If you need to raise your voice to be heard at the work site, then hearing protection should be worn. Hearing protection will be worn near drill rigs.
☒	Overhead Hazards	Pay attention to overhead equipment, piping, and structures. A hard hat must be worn at all times when overhead hazards are present on site including the operation of a drill rig.
☒	Pedestrian Traffic (public, client, workers)	Be aware of pedestrian traffic patterns and, route traffic around the exclusion zone(s), as necessary, to avoid distractions and the potential for exposures or accidents. Use appropriate barricades and caution tape to mark work areas.
☒	Poisonous Plants	Be able to identify any local poisonous plants and avoid them if possible or wear protective clothing as necessary. When removing potentially exposed clothing or PPE, the clothing or PPE should be carefully and thoroughly washed or decontaminated.
☒	Portable Heaters	Be aware of portable heater locations and stay a safe distance from them.

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Power Washing Equipment	Stay clear of the power washing nozzles and equipment.
☒	Propane Tanks	Be aware of propane tank locations, and any gas lines leading to or from the tanks.
☐	Radiation (ionizing)	Exposure to ionizing radiation can be controlled by one of three methods: time, distance, or shielding. Limit your time near the radioactive source. Keep your distance from the radioactive source. Shield yourself from the radioactive source with appropriate shielding material. If the radioactive source(s) are from INVENTUM equipment, the INVENTUM employee using the equipment needs required training to use the equipment and must be monitored using a dosimeter badge.
☐	Rock Blasting	Contractor is responsible for following safe blasting protocol. Heed all contractor warnings at time of blasting and stay well clear until safe to return to area, as indicated by the contractor.
☒	Sample Preservative Chemicals:	Wear safety glasses and nitrile gloves when adding preservative chemicals to sample bottles or vials. Have clean wash water nearby.
☐	Scaffolding	Stay clear of scaffolding. Be aware of the OSHA safety requirements for using constructing and scaffolding.
☒	Severe Weather	Work may be suspended if dangerous weather conditions (lightning, tornadoes, high winds, heavy rain, freezing rain, etc.) occur. Be aware of changing weather conditions and be prepared to take shelter as necessary. Potential shelters should be identified prior to beginning work.
☒	Sharp Objects	Wear appropriate gloves when handling sharp objects or use appropriate equipment to move objects.
☒	Slippery Ground/Surfaces	Exercise caution, especially on slopes, field trailer floors and stairs, after a precipitation event. Use slip resistant boots or implement surface preparations to eliminate the slippery nature of the surface prior to accessing the area. Spill control measures and general housekeeping should be utilized to help prevent slipping on wet floors, wet pavement, and general work areas.
☒	Slips, Trips, and Falls:	Maintain clear walkways for work areas.
☒	Snakes	Be aware of the potential for snakes in the area and wear snake boots, snake chaps, gaiters, or leggings as needed.
☒	Steam Cleaning Equipment	Stay clear of the steam cleaning nozzles and equipment.
☐	Steel Erection	All materials, equipment, and tools, which are not in use while aloft, shall be secured against accidental displacement. The controlling contractor shall bar other construction processes below steel erection unless overhead protection for the employees below is provided. Employees engaged in steel erection activities on a walking/working surface with an unprotected side or edge more than 15 feet above a lower level shall be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems.
☐	Steep Slopes or Banks	Pay attention to footing and walking. Stay a safe distance from unstable or extremely steep slopes. Wear appropriate footwear. Be aware of potential slope or bank failures. Heavy equipment should not be operated on or near unstable slopes or banks.
☒	Strong Nuisance Odors	Strong odors should be ventilated before entering a work area, or a respirator shall be worn as needed.

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Sunburn	For extended periods of time outdoors on sunny days, sunglasses, long-sleeved shirts and long pants should be worn to help prevent sunburn and eye problems. Wear sunscreen as appropriate for the project.
☒	Surface Water	Working next to or on, bodies of water shall be done using the buddy system. Staff shall wear USCG-approved personal floatation devices when on or adjacent to bodies of water.
☒	Terrain	Uneven or steep terrain can cause hazardous conditions for walking and transporting equipment around the site. Site personnel should use caution when working on uneven surfaces, and they should avoid working down-slope from heavy equipment, or materials being moved or stored.
☒	Traffic (client, contractors, public, semi-trucks, forklifts, etc.)	Obey all posted speed limits. Park in designated areas only. Be aware of traffic patterns on site, and during access to the site. Use orange traffic cones and barrier warning tape, as needed, or if within 25 feet of the right-of-way. INVENTUM personnel must wear orange safety vests when working in or near traffic areas. Class 2 traffic vests are required with traffic speeds 25 mph or higher. Class 3 traffic vests are required with traffic speeds 50 mph or higher.
☐	Trains/Railroad Tracks	Be aware of any train activities on the site, entering or leaving the site, or immediately adjacent to the site. Do not walk between the rails or on the railroad ties. When driving, stop at all railroad crossings, even if they are unmarked, and look in both directions before proceeding across the tracks.
☒	Transporting Hazardous Materials	INVENTUM personnel who transport hazardous materials shall have the required DOT training prior to transporting materials, and will comply with all applicable DOT regulations and requirements for labeling, packaging, etc.
☐	Tree Cutting	Stay clear of tree cutting activities.
☒	Trenching	INVENTUM personnel will enter trenches in accordance with 1926 Sub Part P. Be aware that some trenching conditions may result in a confined space condition.
☒	Trip Hazards (wires, cords, hoses, debris, corn stubble, uneven surfaces, etc.)	Temporary wires, cords, hoses, etc., should be properly located, marked, and protected to help prevent tripping and disruption to work activities. Trip hazards are particularly a problem early in the morning, late in the day, or under other poor lighting conditions.
☒	Underground Storage Tanks (USTs) (Septic Tanks)	If any unknown USTs are encountered, drilling or excavations will be terminated in that location until a new scope of work, Risk Assessment and Health & Safety Plan can be developed.
☒	Uneven Surfaces	Be aware of uneven walking or driving surfaces and exercise caution when moving around the site.
☒	Utilities – Overhead (electrical, telephone, cable TV, etc.)	A subcontractor, the client, or INVENTUM will locate and identify all overhead utilities. The owner or client will be responsible for identifying all applicable overhead utilities, product lines, pipes, and aboveground tanks. A minimum clearance of 20 feet must be maintained between equipment and overhead utility lines.
☒	Utilities – Underground (electric, gas, telephone, water, storm sewer, sanitary sewer, cable TV, etc.)	A subcontractor, the client, or INVENTUM will call Digger's Hotline to locate all underground utilities. The owner or client will be responsible for marking all applicable on-site underground utilities, product lines, pipes, and tanks.

Risk Analysis (RA)

(Required for all Inventum Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Waterways	Exercise caution near, around, or in waterways. Harnesses should be worn when working in, or within 4 feet of, the waterway, especially when attempting to sample from shore or a boat or barge. All applicable laws and regulations will be followed when navigating a boat or barge to and from a work site.
☒	Welding Tools	Stay clear of welding operations, and do not look directly at the welding process without appropriate eyewear and shield.
☐	Traffic Control	**Traffic Control**: Traffic control within the right-of-way will be in accordance with the local Public Right-of-Way Agency. Work may be restricted within specific lanes during peak traffic times. Verify peak traffic times and review planned activities with the local Public Right-of-Way Agency, so that appropriate lane closures can be coordinated.

Proposed Date(s) of Inventum Work: June 2020 through October 202

ON-SITE PROJECT TEAM MEMBER	ON-SITE PROJECT RESPONSIBILITIES
John Black	Inventum Site Health and Safety Representative (Supervisor); Remedial Contractor Oversight
Todd Waldrop	Inventum Site Health and Safety Representative (Supervisor); Remedial Contractor Oversight
James Edwards	Inventum Site Health and Safety Representative (Supervisor); Remedial Contractor Oversight

Any required construction/demolition activities: ☒ No ☐ Yes If Yes, complete Section 1

Site-Specific Health and Safety Plan

(Required for all Inventum Type 2 or Type 3 field projects.)

1. Construction Tasks: work tasks to be performed by Inventum staff or Inventum subcontractors

Civil

- ☐ Sewer (utility)
- ☐ Water (utility)
- ☐ Electric (utility)
- ☐ Communications (utility)
- ☐ Siding
- ☐ Roofing
- ☐ Drywall
- ☐ Flooring
- ☐ Ceilings
- ☐ Casework
- ☐ Masonry
- ☐ Escalator
- ☐ Steel (erection)
- ☐ Pre-cast (erection)
- ☐ Concrete (erection)
- ☐ Re-bar
- ☐ Elevator
- ☐ Fireproofing
- ☐ Windows
- ☐ Landscaping
- ☐ Painting
- ☐ Insulation
- ☐ Doors
- ☐ Finish Concrete

Mechanical

- ☐ Insulation
- ☐ Millwright
- ☐ Fire Protection
- ☐ Boiler
- ☐ Industrial Ventilation
- ☐ Steel Fabrication/Erection

Other

- ☐ Electrical
- ☐ Demolition (attach a detailed "**Demolition Plan**")

- ☐ Others
- ☐ Others
- ☐ Others

Estimated Direct-Hire Inventum Employees:

Home Office: ☐ Not Applicable ☐ Specify:

Craft Labor: ☐ Not Applicable ☐ Specify:

Craft Quantity

Craft Quantity

Site-Specific Health and Safety Plan

(Required for all Inventum Type 2 or Type 3 field projects.)

2. Applicable Safety Standards or Regulations:

☒ Federal OSHA ☐ State OSHA ☐ Owner/Client

Specific Standards:	29 CFR 1910 (OSHA)	29 CFR 1926 (Other Regulations)
☒ Medical Services and First Aid	1910.151	1926.50
☒ Hazard Communication (HAZCOM)	1910.1200	1926.59
☐ Lead Exposure	1910.1025	1926.62
☒ HAZWOPER	1910.120	1926.65
☒ Personal Protective Equipment (PPE)	1910.132-138	1926.95-107
☒ Respiratory Protection	1910.134	1926.103
☒ Ventilation	1910.94	1926.57
☒ Noise Exposure	1910.95	1926.52
☐ Illumination	N/A	1926.56
☐ Fire Protection	1910.157	1926.24 and 150-155
☐ Sanitation	1910.141	1926.51
☐ Materials Handling (rigging, etc.)	1910.176	1926.250-251
☐ Welding/Cutting	1910.251-255	1926.350-354
☐ Lockout/Tagout	1910.147	1926.417
☐ Electrical (flexible cords, etc.)	1910.305	1926.400-449
☐ Scaffolding	1910.28-29	1926.450-454
☐ Fall Protection (elevated work)	1910.23-29, 1910.66-68	1926.104-107; 500-503
☐ Ladders/Stairways	1910.25-27	1926.1050 and 1060
☐ Cranes, Derricks, Hoists, Elevators, etc.	1910.179-181	1926.550-555
☐ Aerial Lifts	1910.66-68	1926.556
☒ Earthmoving Equipment	N/A	1926.602
☐ Powered Industrial Trucks (forklifts)	1910.178	1926.602
☒ Excavations and Trenching	N/A	1926.650-652
☐ Concrete and Masonry	N/A	1926.700-706
☐ Steel Erection	N/A	1926.750-761
☐ Demolition	N/A	1926.850-860
☒ Asbestos	1910.1001	1926.1101
☐ Confined Space Entry	1910.146	1926.21

Site-Specific Health and Safety Plan

(Required for all Inventum Type 2 or Type 3 field projects.)

☐	Commercial Diving	1910.401-441	1926.1071-1092
☒	Compressed Gases	1910.101-105	N/A
☐	Ionizing Radiation	1910.1096	1926.53
☒	Benzene	1910.1028	1926.1128
☒	Cadmium	1910.1027	1926.1127
☒	Tools - Hand and Power	N/A	1926.300-307
☐	Blasting and Using Explosives	N/A	1926.900-914

Site-Specific Health and Safety Plan

(Required for all Inventum Type 2 or Type 3 field projects.)

3. Training Required

(* required for all "Type 3" sites; but minimum recommended)

Check "A" if training required for everyone, and check "T" if training required for specific task.

A	T	SUBJECT	REFERENCE 29 CFR 1910	29 CFR 1926 or Other
☒	☐	HAZWOPER 40 hour*	1910.120	1926.65
☐	☐	3-Day HAZWOPER Supervised On-Site*	1910.120	1926.65
☒	☐	8-Hour HAZWOPER Refresher*	1910.120	1926.65
☐	☐	8-Hour Supervisor HAZWOPER*	1910.120	1926.65
☐	☒	First Aid, CPR*	1910.151	1926.23,.50
☐	☒	Respiratory Protection	1910.134	1926.103
☐	☐	Confined Space ☐ Permit attached	1910.146	1926.21
☐	☐	Mine Safety (MSHA)	N/A	30 CFR 48.8
☐	☐	Lockout/Tagout ☐ Permit attached	1910.147	1926.417
☒	☐	Bloodborne Pathogens	1910.1030	N/A
☒	☐	Noise Exposure	1910.95	1926.52
☐	☒	Competent Person	N/A	1926.32,.450,.650
☐	☐	Construction Health and Safety OSHA 10-Hour	N/A	1926.21
☐	☐	Demolition	N/A	1926.850
☐	☐	Excavations ☐ Permit attached	N/A	1926.650-652
☐	☐	Electrical Work	1910.332	1926.400-.449
☐	☐	Ladders/Stairways	N/A	1926.1050-1060
☐	☐	Scaffolding	1910.28	1926.450-454
☐	☐	Fall Protection	1910.23-29; 1910.66-68	1926.104,.501
☐	☐	Commercial Diving	1910.410	1926.1071-1092
☐	☐	Hot Work ☐ Permit attached	1910.251-255	1926.350
☐	☐	Lead Awareness	1910.1025	1926.62
☐	☐	Asbestos Awareness	1910.1001	1926.1101
☐	☐	Cadmium	1910.1027	1926.1127
☐	☐	Benzene	1910.1028	1926.1128
☐	☐	Ionizing Radiation	1910.1096	1926.53; 10 CFR 19.12
☐	☐	Troxler or NITON Gauge User	1910.1096	10 CFR 19.12
☐	☐	Radiation Safety Program	1910.1096	10 CFR 20.1101
☒	☐	Hazard Communication (HAZCOM)	1910.1200	1926.59
☐	☒	DOT Hazardous Materials Shipping	1910.1201	49 CFR 172.704

Client-specific training: ☒ Not Applicable ☐ Specify

Site-specific orientation: ☒ Not Applicable ☐ Specify

Competent person: ☒ Not Applicable ☐ Specify

Direct-hire employee training/certification: ☒ Not Applicable ☐ Specify

4. Medical Surveillance

Surveillance Required: * required for all "Type 3" sites; baseline is minimum recommended
** Specify frequency below

	29 CFR 1910	29 CFR 1926 or Other
☒ HAZWOPER Physical - Baseline*	1910.120	1926.65
☒ HAZWOPER Physical – Annual	1910.120	1926.65
☐ HAZWOPER Physical - Biennial*	1910.120	1926.65
☒ OSHA Respiratory Protection Questionnaire	1910.134	1926.103
☐ Respiratory Certification Exam	1910.134	1926.103
☒ Arsenic (urine) ** **Annual**	1910.1018	N/A
☐ Asbestos **	1910.1001	1926.1101
☒ Cadmium (blood) ****Annual**	1910.1027	1926.1127
☒ Lead/ZPP (blood) ****Annual**	1910.1025	1926.62
☒ Mercury (blood) ****Annual**	N/A	N/A
☒ PCB ****Annual**	N/A	N/A
☐ Vinyl Chloride **	1910.1017	1926.117
☐ Hepatitis B Vaccine (series) **	1910.1030	N/A
☐ Tetanus/Diphtheria	N/A	Stay Current
☐ Stress Test	N/A	Only as requested
☒ Visual Acuity Test	N/A	Only as requested
☒ Hearing Test (Audiometry)	N/A	Only as requested
☒ Pulmonary Function	N/A	Only as requested

Client-specific drug testing:	☒ Not Applicable	☐ Specify
Client-specific medical monitoring[1]:	☒ Not Applicable	☐ Specify
Site-specific medical monitoring:	☒ Not Applicable	☐ Specify
**Frequency of medical monitoring:	☒ Not Applicable	☐ Specify

Site-Specific Health and Safety Plan

(Required for all Inventum Type 2 or Type 3 field projects.)

5. Personal Protective Equipment (PPE)

Based on evaluation of potential hazards, the following levels of personal protection have been designated for the applicable work tasks:

Specific Inventum Job Task or Function	Minimum Level of Protection
Task 1 – Site management and Oversight	☒ D
Level D: safety glasses (ANSI), safety shoes (ANSI),; safety vest (ANSI)	
Task 2 – Surficial Soil Sampling	☒ D ☐ C ☐ B ☐ A
Level D: safety glasses (ANSI), safety shoes (ANSI), ear plugs (ANSI); safety vest (ANSI), nitrile gloves,	
Task 3 – Subsurface Soil Sampling	☒ D ☐ C ☐ B ☐ A
Level D: Hard hat, safety glasses (ANSI), safety shoes (ANSI), nitrile gloves	
Task 4 – Permit Compliance Water and Wastewater Sampling	
Level D: safety glasses (ANSI), safety shoes (ANSI), ear plugs (ANSI); safety vest (ANSI), nitrile gloves,	
Level D: safety glasses (ANSI), safety shoes (ANSI), ear plugs (ANSI); safety vest (ANSI), nitrile gloves,	
Level D: safety glasses (ANSI), safety shoes (ANSI), ear plugs (ANSI); safety vest (ANSI), nitrile gloves,	
Level D: safety glasses (ANSI), safety shoes (ANSI), safety vest (ANSI), nitrile gloves,	
Level D: safety glasses (ANSI), safety shoes (ANSI), safety vest (ANSI), nitrile gloves,	
	☒ D ☐ C ☐ B ☐ A
	☒ D ☐

Site-Specific Health and Safety Plan

(Required for all Inventum Type 2 or Type 3 field projects.)

Criteria for changing protection levels are as follows:

EVACUATION[2] or PROTECTION LEVEL CHANGE[3] CRITERIA	APPROVALS REQUIRED [1] OSC
Site Evacuation Plan: ☒ Not Applicable ☐ Specify or Attach Plan:	
Change to Level D when: ☐ Not Applicable ☒	☒N/A All site work in Level D
Change to Level C when: ☒ Not Applicable ☐ dust levels exceed 2.5 mg/m^3 in the breathing zone continuously for 5 minutes.	☒ No work will be conducted in Level C. Site work will stop, controls reevaluated, and HASP updated as necessary
Change to Level B when: ☒ Not Applicable ☐ Specify	☒ Inventum will not conduct any work in Level B.
Change to Level A when: ☒ Not Applicable ☐ Specify	☒ Inventum will not conduct any work in Level A. ☒

(1) OSC: Office Safety Coordinator

(2) General Recommendations: Evacuate the area when LEL readings are >10% LEL in the atmosphere, or when PID readings are greater than the PEL in the breathing zone.

(3) General Recommendation: To Level C when PID readings are greater than the PEL in the breathing zone. To Level B or A only after detailed evaluation and planning.

Note: Changes to the level of protection shall be made only after the required approvals are obtained. All changes shall be recorded in the field log and reported to the Project Manager as soon as possible. Inventum's goal is to avoid using respiratory protection unless it is absolutely necessary or required. Administrative controls or engineering controls should always be considered as a means to reduce potential exposures, before PPE is required or considered.

Site-Specific Health and Safety Plan

(Required for all Inventum Type 2 or Type 3 field projects.)

6. Air Monitoring (1)

The following monitoring instruments shall be used on site to measure airborne contaminant concentrations in either the breathing zone, or as part of the overall site **Air Monitoring Plan** (attach detailed plan):

MONITORING EQUIPMENT	LOCATION OF MONITORING	FREQUENCY OF MONITORING	ACTION LEVELS
☐ Combustible Gas Indicator	☐ N/A ☐ Monitoring Plan Attached ☐ Confined Space ☐ Manhole	☐ Continuously when potential combustible gases or lack of oxygen are suspected. ☐ Specify	5-10% LEL: continue with caution > 10 % LEL: evacuate the area ☐ Specify
☐ O2 Monitor ☐ CO Monitor ☐ H_2S Monitor	☐ N/A ☐ Confined Space ☐ Manhole – monitor oxygen, carbon monoxide, hydrogen sulfide , and lower explosive limit	☐ Continuously when excess oxygen (>22.5%) or lack of oxygen (<19.5%) are suspected. ☐ Test atmosphere prior to entry and continuous during confined space entry.	< 19.5% Oxygen: evacuate the area; supplied air may be needed. > 22.5% Oxygen: evacuate the area; potential fire hazard. ☐ Specify
☐ Colorimetric Tubes Type: Type: Type:	☐ N/A ☐ Specify ☐ Sample Container ☐ Confined Space ☐ Specify	☐ Periodically during sampling for analytical purposes only. ☐ Whenever noticeable odor is present. ☐ Specify	☐ Specify
☒ PID Lamp Needed: ☐ 9.8 eV ☒ 10.6 eV ☐ 11.7 eV Calibration Gas: Isobutylene Correction Factor:	☒ Personal Monitoring ☒ Sample Container ☐ Confined Space ☐ Specify	☒ Periodically during sampling for analytical purposes only. ☒ Continuously within the employee breathing zone. ☐ Specify ☐ Specify	☒ None. ☒ >5 ppm above background in breathing zone for 5+ min. Stop work and reevaluate potential sources and controls.
☐ FID	☐ N/A ☐ Specify	☐ Specify	☐ Specify
☒ Personal Dust Monitor	☐ N/A ☒ Personal Monitoring in Breathing Zone (Task 2 - 6 only)	☒ Continuously within the employee breathing zone	☒ >2.5 mg/m3 at work perimeter for 15 min sustained. Stop work and apply dust controls

Site-Specific Health and Safety Plan

(Required for all Inventum Type 2 or Type 3 field projects.)

☒Other: Perimeter Monitoring	☒ Perimeter Air Monitoring in accordance with the CAMP	☐ Specify	☐ Specify
☐Laboratory Supported ☐Personal ☐Area ☒Perimeter	☐ N/A ☐ Specify Employee breathing zone	☐ Specify continuous	☒ When visible dust is present apply dust control measures (water spray) until abated.

(1) Whenever air monitoring is required to be performed, a detailed **Air-Monitoring Plan** should be developed and attached to the HASP. The plan should include **Monitoring Locations, Frequency of Readings**, and any **Action Levels** being used to control the work site**.**

Air Monitoring Plan

Field monitoring of dust production is anticipated only during subsurface soil sampling (Task 2), test pit excavations (Task 5), and installation of monitoring wells (Task 7). A visual assessment of dust levels will be used continuously during the work along with personal employee monitoring and perimeter air monitoring in accordance with an approved CAMP.

Dust production during monitoring well abandoned, monitoring well installation, and surficial soil sampling is not anticipated due to the typical moisture content of the soil.

This level of nuisance dust is visually observable. If dust is observable continuously in the breathing zone for 5 minutes, dust control methods will be used (*e.g.*, water spray will be applied) until dust is abated. Work will be temporarily discontinued until dust is reduced to acceptable levels within the breathing zone. Should particulate levels above the action level be a continual problem, relevant field personnel will reassess the situation with the project manager.

Site-Specific Health and Safety Plan

(Required for all Inventum Type 2 or Type 3 field projects.)

7. Site Controls and Work Zones (describe in detail)

Facility Alarms or Signals: ☒ Not Applicable ☐ Specify

Work Permits Required: ☒ Not Applicable ☐ Specify

Work Traffic Issues: ☒ Not Applicable ☐ Specify

Parking Issues: ☒ Not Applicable ☐ Specify

Railway Traffic Issues: ☒ Not Applicable ☐

Support Zone(s):

☒ Field vehicle ☒ Job Trailer On Site ☐ Other:

Contamination Reduction Zone(s):

☒ Field vehicle ☐ Facility restroom/utility room ☐ Other:

Exclusion Zone(s):

☒ Area immediately surrounding work area ☐ Other:

Site Entry Procedures:

☒ **Notify Site Safety Contact Representative.**

☒ **Read HASP Plan and sign Acknowledgment Statement.**

☒ **Check in with the facility contact person.** ☒ **Check in with owners full time site representatives.**

☒ **Check in with facility security guard.** ☒ **All visitors must check in and sign visitor logbook in guard house.**

☒ **Wear proper personal protective equipment.**

☐ Attend facility orientation. ☐

☒ **Conduct daily safety meeting (document).**

☐ Other: Confined space – do not enter the confined space if LEL >10%, oxygen <21% or >23.5%, carbon monoxide >35 ppm, or hydrogen sulfide >7 ppm. Exit the confined space if the atmospheric conditions become hazards as noted.

Decontamination Procedures:

Personnel: (specify)

Work will be performed in Level D or Modified Level D, and minimal contamination is expected. Follow standard decontamination procedures, and good personal hygiene. Disposable PPE should be removed, contained, and disposed in an appropriate manner. Prior arrangements should be made if disposal is planned for at the project site.

Site workers should plan and stage for wash water and soap at the site, prior to beginning the work. Site workers should wash hands and any exposed skin extremely well with soap and water, prior to leaving the contamination reduction zone, eating, drinking, driving, or leaving the site. Any soiled or contaminated clothing should be removed and handled appropriately, by either washing as soon as possible, or if necessary, disposing. Soiled or contaminated clothing should be carefully bagged prior to disposal or washing, to reduce potential exposure.

Equipment: (specify)

Site workers should plan and stage for the appropriate decontamination method at the site prior to beginning the work. Any contaminated single-use disposable equipment or PPE should be appropriately containerized and disposed as soon as possible in an appropriate manner. Prior arrangements should be made if disposal is planned for at the project site. Contaminated equipment or PPE that will be re-used should be handled and cleaned while wearing the appropriate PPE. Typically, equipment is decontaminated using Alconox soap and deionized water.

Disposal of Investigation-derived Material:

☒ Leave on site for disposal. Location TBD ☐ Other:

Work Limitations (time of day, buddy system, etc.):

☒ Buddy system required for some tasks.

☒ Work will be performed during daylight hours only.

☐ Work will be performed using artificial light.

Describe or attach a lighting plan: A lighting plan is attached.

☒ No eating, drinking, or smoking in contamination reduction zone(s) or exclusion zone(s).

☒ When temperatures are either above 80°F or below 20°F, work schedules may be modified.

☒ Other site-specific limitations: Do not enter battery building. Do not enter any former process buildings unaccompanied.

Site-Specific Health and Safety Plan

(Required for all Inventum Type 2 or Type 3 field projects.)

Radiation Safety:

- ☒ Radiation information is not applicable to this project.
- ☐ Notify RSO.
- ☐ Wear dosimeter badge when handling gauge.
- ☐ Post applicable radiation signs and documents.
- ☐ Post emergency numbers.
- ☐ Provide at least two lock systems for overnight storage.
- ☐ Maintain storage at least 15 feet from full-time workstations.
- ☐ Block, brace, and securely lock the gauge during "all" transportation.
- ☐ Limit "public" exposure to gauge while in use.
- ☐ Provide sketch of gauge storage to RSO.

Site-Specific Health and Safety Plan

(Required for all Inventum Type 2 or Type 3 field projects.)

Acknowledgment Statement:

As an employee of Inventum, I have reviewed the Hazard Assessment (HA)/Health & Safety Plan (HASP). I hereby acknowledge that I have received the **required level of training and medical surveillance as necessary**, that I am knowledgeable about the contents of this site-specific RA/HSP, and that I will use personal protective equipment (PPE) and follow procedures specified in the HASP.

Signatures of Inventum Site Personnel:

	Date:	
	Date:	
	Date:	
	Date:	
	Date:	
	Date:	
	Date:	
	Date:	
	Date:	
	Date:	
	Date:	
	Date:	

INVENTUM SAFETY OBSERVATION FORM

Revised March 2019

Location/Project Name: ______________________	**Date:** __________
Observer Name: ______________________	
Observee Name: ______________________	**Time:** __________
Task Observed	
Description of Task Observed and Background Information	
Positive Comments	

INVENTUM SAFETY OBSERVATION FORM

Revised March 2019

Conclusions / Why the Questionable Items Occurred?

Feedback Session Conducted By: ______________________ **Date:** ____________

Name of Observee's Supervisor: ______________________ **Time:** ____________

At-Risk Observations/Root Cause Analysis

Personal Factor:
(1) Lack of skill or knowledge
(2) Correct way takes more time/requires more effort
(3) Shortcutting standard procedures is rewarded or appreciated
(4) In past, did not follow procedures or acceptable practices and no incident occurred

Job Factor:
(5) Lack of or inadequate operational procedures or work standards
(6) Inadequate communication of expectations or work standards
(7) Inadequate tools or equipment

At-Risk Observation #	Root Cause Analysis #	Solution(s) To Prevent Potential Incident from Occurring	Person Responsible	Agreed Due Date	Date Completed

Results of Verification (were solutions done?) and Validation (were solutions effective?)

Reviewed by (PM/Supervisor): ______________________ **Date:** ____________

Approved by (Practice Safety Leader): ______________________ **Date:** ____________

INVENTUM SAFETY OBSERVATION FORM

Revised March 2019

PERSONAL PROTECTIVE EQUIPMENT	Safe	At-Risk	Comments
1. Hearing Protection (e.g., Ear Plugs)			
2. Head Protection (e.g., Hard Hat)			
3. ANSI Rated Eye Protection (e.g., Safety Glasses)			
4. Hand Protection (e.g., Kevlar Gloves)			
5. Foot Protection (e.g., Safety Shoes)			
6. Respiratory Protection			
7. Fall Protection Inspected (e.g., Harness)			
8. ANSI Rated Reflective Vest/High Visibility Clothing			
9. Other (Specify)			
BODY USE AND POSITIONING	**Safe**	**At-Risk**	**Comments**
10. Correct Body Use and Positioning When Lifting/Pushing/Pulling			
11. Pinch Points/Moving Equipment - Hands/Body Clear			
12. Mounts/Dismounts Using 3-Points of Contact			
13. Other (Specify)			

INVENTUM SAFETY OBSERVATION FORM

Revised March 2019

WORK ENVIRONMENT	Safe	At-Risk	Comments
14. Work/Walk Surface Free of Obstructions (e.g., Tripping Hazards)			
15. Housekeeping/Storage			
16. Defined and Secured (e.g., warning devices, barricades, cones, flags)			
17. Suspended Load, Swing Radius & Lift Area is Barricaded			
18. Safety Shutdown Devices			
19. Proper Storage & Labeling /Disposal of Sample & Waste Materials			
20. Cylinders Stored Upright, Secured, & Caps in Place			
21. Manhole/vault Inspected for Hazards			
22. Other (Specify)			

INVENTUM SAFETY OBSERVATION FORM

Revised March 2019

OPERATING PROCEDURES	Safe	At-Risk	Comments
23. Job Planning (HASP reviewed, JSAs, etc.)			
24. Fire Extinguishers Accessible and Inspections Current			
25. Work Permit/Authorization to Work (Hot, Cold, LOTO, Confined Space)			
26. JSA Reviewed & Followed			
27. Hazard Assessment - Hazard Hunt			
28. Interfaces with Other Functions (awareness with other personnel on site)			
29. Operators Looking Behind Prior to Backing Up			
30. Operators Wearing Seat Belts While Operating Equipment			
31. Subsurface Structures Identified			
32. Proper Trench Protective Equipment in Place			
33. Adequate Egress Is Available for Excavation & Trench (within 25 ft. if depth is <4 ft.)			
34. All Materials Set Back at Least 2 Feet From Edge of Trench/Excavation			
35. Other (Specify)			

INVENTUM SAFETY OBSERVATION FORM

Revised March 2019

TOOLS/EQUIPMENT	Safe	At-Risk	Comments
36. Hand Tools (Proper Equipment Selection, Condition, and Use)			
37. Power Tools (Proper Equipment Selection, Condition, and Use)			
38. Equipment, Including Heavy (Proper Equipment Selection, Condition, and Use)			
39. Hoses Inspected			
40. Required Monitoring Equipment Calibrated & Used			
41. Ladders Set up Correctly & Inspected			
42. Right Tools for the Job are Available and in Good Condition - No Fixed Open Blade Knives (FOBKs)			
43. Other (Specify)			
Total #	0	0	

Daily Hazard Review Topic and Sign-In:

Daily Review Topic	Date

Acknowledgment Statement:

As an affected employee of Inventum Engineering, I hereby acknowledge that I have reviewed the contents of this site-specific HSP and the **daily safety meeting topic**, and that I will use the applicable personal protective equipment (PPE) and follow the procedures specified in the HASP.

Signatures of all onsite Inventum Personnel, including Direct-Hires (Required):

______________________________ Date: ______________

______________________________ Date: ______________

______________________________ Date: ______________

______________________________ Date: ______________

______________________________ Date: ______________

______________________________ Date: ______________

______________________________ Date: ______________

______________________________ Date: ______________

______________________________ Date: ______________

______________________________ Date: ______________

______________________________ Date: ______________

Attachment A – Permit Compliance Water and Wastewater Sampling (Task 4) Locations

INDUSTRIAL USE PERMIT REQUIREMENTS

WASTEWATER STREAMS AUTHORIZED FOR DISCHARGE

WASTEWATER STREAM	APPROXIMATE FLOW(GPD)	YES	NO
A. Sanitary	17,000	x	
B. Boiler Blowdown			
C. Treated Process Wastewater	72,000	x	

MONITORING LOCATION: Sampling Manhole near Guard Gate
SAMPLE TYPE: 24 Composite for all parameters except pH and SGT-HEM which will be grabs

PARAMETERS	SAMPLE FREQUENCY	LIMIT	PURPOSE
pH	Monthly	5.0-9.5 SU	Compliance
SGT-HEM	"	100 ppm	"
Cyanide	"	1.1 mg/l	"
Biochemical Oxygen Demand	"	250 mg/l	Surcharge
Total Suspended Solids	"	"	"
Total Phosphorus	"	6.0 mg/l	"
Chemical Oxygen Demand	"	----------	Monitor Only
Total Mercury	"	0.001 mg/l	"
Total Arsenic	Every Six Months	0.5 mg/l	Compliance[1]
Total Selinium	" " "	----------	"
Priority Pollutant Semivolatiles	" " "	----------	"

SPDES PERMIT REQUIREMENTS

FINAL PERMIT LIMITS, LEVELS AND MONITORING

OUTFALL No.	WASTEWATER TYPE	RECEIVING WATER	EFFECTIVE	EXPIRING
001	Non-contact cooling, boiler blowdown and stormwater runoff	Niagara River (A-Special)	EDM	ExDP

PARAMETER	MINIMUM	MAXIMUM	UNITS	SAMPLE FREQUENCY	SAMPLE TYPE	FOOTNOTES (FN)
pH	6.0	9.0	SU	2 / month	Grab	

PARAMETER	COMPLIANCE LIMIT		MONITORING ACTION LEVEL		UNITS	SAMPLE FREQUENCY	SAMPLE TYPE	FN
	Daily Avg.	Daily Max.	TYPE I	TYPE II				
Flow	Monitor	Monitor			GPD	Continuous	Recorder	
Solids, Total Suspended, (Net)	Monitor	50			mg/l	Monthly	24-hr. Comp.	1, 2
Oil & Grease, (Net)	Monitor	15.0			mg/l	Monthly	Grab	1,2
Settleable Solids	Monitor	0.1			ml/l	Monthly	Grab	2
Temperature	Monitor	102			° F	Monthly	Grab	2
Ammonia (as N)			1.5		mg/l	Semi-annual	24-hr Comp.	
Ammonia (as N)			monitor		lb/day	Semi-annual	Calculated	
Cyanide. Total			0.03		mg/l	Semi-annual	24-hr Comp.	
Cyanide, Total			monitor		lb/day	Semi-annual	Calculated	
Phenols (4AAP), (Net)			0.08		mg/l	Semi-annual	24-hr Comp.	1
Phenols (4AAP), (Net)			monitor		lb/day	Semi-annual	Calculated	1
Benzene			0.0015		mg/l	Semi-annual	Grab	
Benzene			monitor		lb/day	Semi-annual	Calculated	
Benzo(a)pyrene			0.002		mg/l	Semi-annual	24-hr Comp	
Benzo(a)pyrene			monitor		lb/day	Semi-annual	Calculated	
Naphthalene			0.003		mg/l	Semi-annual	24-hr Comp.	
Naphthalene			monitor		lb/day	Semi-annual	Calculated	
Toluene			0.003		mg/l	Semi-annual	Grab	
Toluene			monitor		lb/day	Semi-annual	Calculated	
Fluoride			1.5		mg/l	Semi-annual	24-hr Comp.	
Surfactant			0.5		mg/l	Semi-annual	24-hr Comp.	

Footnotes:
1. The permittee shall collect intake sample whenever all Outfall 001 sample is taken and analyze the concentrations for those parameters qualifying for "Net."
2. Report average value if more than one sample analysis is performed during the month.

SPDES PERMIT REQUIREMENTS

FINAL PERMIT LIMITS, LEVELS AND MONITORING

OUTFALL No.	WASTEWATER TYPE	RECEIVING WATER	EFFECTIVE	EXPIRING
002	Coal Pile Runoff	Niagara River (A-Special)	EDM	ExDP

PARAMETER	MINIMUM	MAXIMUM	UNITS	SAMPLE FREQUENCY	SAMPLE TYPE	FOOTNOTES (FN)
pH	6.0	9.0	SU	Monthly	Grab	

PARAMETER	COMPLIANCE LIMIT		MONITORING ACTION LEVEL		UNITS	SAMPLE FREQUENCY	SAMPLE TYPE	FN
	Daily Avg.	Daily Max.	TYPE I	TYPE II				
Flow		Monitor			GPD	Monthly	Instantaneous	
Solids, Total Suspended		50			mg/l	Monthly	Grab	
Oil & Grease		15			mg/l	Monthly	Grab	
Iron		4.0			mg/l	Monthly	Grab	
Cyanide			0.1		mg/l	Semi-annual	Grab	
Copper			0.2		mg/l	Semi-annual	Grab	
Nickel			0.5		mg/l	Semi-annual	Grab	
Zinc			0.5		mg/l	Semi-annual	Grab	
Surfactant			0.5		mg/l	Semi-annual	Grab	
Aluminum			1.0		mg/l	Semi-annual	Grab	
Manganese			1.0		mg/l	Semi-annual	Grab	

SPDES PERMIT REQUIREMENTS

OUTFALL No.	WASTEWATER TYPE	RECEIVING WATER	EFFECTIVE	EXPIRING
004	Combined flow for Outfalls (001 + 002 + 003)	Niagara River	EDM	EDP + 5 yrs.

PARAMETER	ENFORCEABLE LIMIT		MONITORING ACTION LEVEL		UNITS	SAMPLE FREQUENCY	SAMPLE TYPE	FN
	Monthly Avg.	Daily Max.	TYPE I	TYPE II				
Flow (May 1 to Oct. 31)	Monitor	Monitor			MGD	Monthly	Calculated	
Temperature (May 1 to Oct. 31)	Monitor	Monitor			Degree F	2 / Month	Grab	

INDUSTRIAL USE PERMIT REQUIREMENTS

MONITORING LOCATION: **Post Equalization Tank**

COMBINED WASTESTREAM FORMULA APPLIES AT THIS LOCATION NO

CATEGORICAL PRETREATMENT LIMITS (PSES)

In accordance with the provisions of 40 CFR Paragraph 420.04(b), the permittee chooses to use the daily average production rate (based upon monthly production) for the highest of the previous 5 years. Under this option, the production number used in calculating limits is 462.9 tons/day. Documented monthly production rates for the last 5 years shall be provided to the Town by September 15th of each year and limits shall be adjusted to reflect any major changes in production.

PARAMETER	MONTHLY AVERAGE		DAILY MAXIMUM	
	(# /1000 #)	(lbs/day)	(# /1000 #)	(lbs/day)
Ammonia Nitrogen	.0200	(18.52)	.0333	(30.83)
Cyanide	.00506	(4.67)	00724	(6.70)
Naphthlalene	.0000392	(.036)	.0000472	(.044)

MONITORING AND REPORTING SCHEDULE

PARAMETER	SAMPLE FREQUENCY	SAMPLE TYPE	REPORTING FREQUENCY
Ammonia Nitrogen	Semi-annually	24 Hour Composite	January & July
Cyanide	Semi-annually	24 Hour Composite	January & July
Naphthalene	Semi-annually	24 Hour Composite	January & July

Flow must be reported for the sampling day in order to calculate the pounds per day.

DRAWING BY	J. BLACK II
CHECKED	J. BLACK
APPROVED	XXX

TONAWANDA COKE CORP. CLEAN WATER ACT COMPLIANCE AUDIT
TONAWANDA, NEW YORK

INVENTUM ENGINEERING
481 CARLISLE DRIVE
SUITE 202
HERNDON, VIRGINIA 20170
(703) 722-6049
www.InventumEng.com

FIGURE- 1

DRAWING NUMBER: 01 of 02

D

Appendix C – Quality Assurance Project Plan

INVENTUM ENGINEERING, PC

Quality Assurance Project Plan

Pre-design Investigation Work Plan Development of Soil Cleanup Objective for Ammonia

Riverview Innovation & Technology Campus

Brownfield Cleanup Program Site No. C915353

3875 River Road

Tonawanda, NY 14150

July 30, 2024

441 CARLISLE DRIVE
SUITE C
HERNDON, VA 20170
WWW.INVENTUMENG.COM

Table of Contents

1 Introduction

The purpose of this Quality Assurance Project Plan (QAPP) is to serve as a guidance document during implementation of the Pre-Design Investigation Work Plan (PDIWP) Development of Soil Cleanup Objective (SCO) for Ammonia for the Riverview Innovation and Technology Campus Brownfield Cleanup Program Site (BCP Site) located at 3875 River Road in Tonawanda, Erie County, New York. The PDIWP is being conducted in accordance with the BCP Agreement (Index No. C915353-02-20) between the New York Statement Department of Environmental Conservation (NYSDEC) and Riverview dated February 14, 2020. The BCP Site is listed as Site Number C915353.

This QAPP is designed to provide an overview of Quality Assurance/Quality Control (QA/QC) procedures. Specific methods and QA/QC procedures for chemical testing of environmental samples obtained from the site as part of the PDIWP for development of the SCO for Ammonia are defined.

An Inventum Engineering, P.C. (Inventum) Project Manager will be responsible for verifying that QA procedures are followed during the investigation and analysis. This will provide for the valid collection of representative samples. The Project Manager will be in direct contact with the analytical laboratory to ensure that holding times and other QA/QC requirements are met. The selected laboratory will be responsible for overseeing analytical QA/QC activities.

The estimated number of environmental samples and corresponding analytical parameters/methods are provided in Table 1 below. These sample quantities may vary depending on media availability and routine adjustments made during the field work.

Table 1 – Analytical Parameters and Methods

Parameter	EPA Method Reference	Groundwater	Soil (Fill Material)
Volatile Organic Compounds	8260C	15	
Mercury	7470A	20	22
Cyanide	9012	20	22
Ammonia	E350.1	36	22
pH	9045D		22
Ammonia[1]	SW-846 Method 1314[2]		7

[1] During the column test (SW-846 Method 1314) 9 leachate samples will be produced from each sample sent for analysis. The eluate samples produced from the SW-846 Method 1314 will be analyzed for Ammonia by Method E350.1.

[2] Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio for Constituents in Solid Materials Using an Up-Flow Percolation Column Procedure

pH	9045D		7
Field Duplicates (1)		1 per 20 Samples Collected	1 per 20 Samples Collected
MS/MSD (2)		1 per 20 Samples Collected	1 per 20 Samples Collected
Trip Blanks (3)	8260C	One per Volatile Shipment	N/A

The analytical laboratory utilized will be a certified NYSDOH ELAP laboratory for the appropriate categories. The laboratory QA Manager will be responsible for performing project-specific audits and overseeing the quality control data generated.

2 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of data required to support the investigation of the Site. DQOs focus on the identification of the end use of the data to be collected. The project DQOs will be achieved utilizing the definitive data category, as outlined in Guidance for the Data Quality Objectives Process, EPA QA/G-4 (September 1994). All samples will provide definitive data, which are generated using rigorous analytical methods, such as the reference methods approved by the United States Environmental Protection Agency (USEPA). The purpose of this investigation is to establish a baseline of current conditions in order to aid in the development of an Ammonia SCO for the BCP Site.

Within the context of the purpose stated above, the project DQOs for data collected during the investigation are:

- To assess the current nature and extent of Ammonia in groundwater.
- To assess the current nature and extent of Ammonia in surficial soils.
- To assess the current nature and extent of Ammonia in subsurface soils.

2.1 QA Objectives for Chemical Data Management

Sample analytical methodology for the media sampled and data deliverables will meet the requirements in the most recent NYSDEC Analytical Services Protocol (ASP). Laboratories will be instructed that completed Sample Preparation and Analysis Summary forms are to be submitted with the analytical data packages. The laboratory will also be instructed that matrix interferences must be cleaned up, to the extent practicable. Data Usability Summary Reports (DUSRs) will be generated. In order to achieve the definitive data category described above, the data quality indicators of precision, accuracy, representativeness, comparability, and completeness will be measured during offsite chemical analysis.

2.1.1 Precision

Precision examines the distribution of the reported values about their mean. The distribution of reported values refers to how different the individual reported values are from the average reported value. Precision may be affected by the natural variation of the matrix or contamination within that matrix, as well as by errors made in field and/or laboratory handling procedures. Precision is evaluated using analyses of a laboratory matrix spike/matrix spike duplicate (for organics) and matrix duplicates (for inorganics), which not only exhibit sampling and analytical precision, but indicate analytical precision through the reproducibility of the analytical results. Relative Percent Difference (RPD) is used to evaluate precision. RPD criteria must meet the method requirements identified in QAPP Section 6.1.

2.1.2 Accuracy

Accuracy measures the analytical bias in a measurement system. Sources of error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques. These data help to assess the potential concentration contribution from various outside sources. The laboratory objective for accuracy is to equal or exceed the accuracy demonstrated for the applied analytical methods on samples of the same matrix. The percent recovery criterion is used to estimate accuracy based on recovery in the matrix spike/matrix spike duplicate and matrix spike blank samples. The spike and spike duplicate, which will give an indication of matrix effects that may be affecting target compounds is also a good gauge of method efficiency.

2.1.3 Representativeness

Representativeness expresses the degree to which the sample data accurately and precisely represent the characteristics of a population of samples, parameter variations at a sampling point, or environmental conditions. Representativeness is a qualitative parameter, which is most concerned with the proper design of the sampling program or sub-sampling of a given sample. Objectives for representativeness are defined for sampling and analysis tasks and are a function of the investigative objectives. The sampling procedures have been selected with the goal of obtaining representative samples for the media of concern.

2.1.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. A DQO for this program is to produce data with the greatest practicable degree of comparability. This goal is achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. Complete field documentation will support the assessment of comparability. Comparability is limited by the other parameters (e.g., precision, accuracy, representativeness, completeness), because only when precision and accuracy are known can data sets be compared with confidence. In order for data sets to be comparable, it is imperative that contract-required methods and procedures be explicitly followed.

2.1.5 Completeness

Completeness is defined as a measure of the amount of valid data obtainable from a measurement system compared to the amount that was expected to be obtained under normal conditions. It is important that appropriate QA procedures be maintained to verify that valid data are obtained in order to meet project needs. For the data generated, a goal of 90% is required for completeness (or usability) of the analytical data. If this goal is not met, then NYSDEC, Inventum, and Riverview project personnel will determine whether the deviations might cause the data to be rejected.

3 Sampling Locations, Custody, Holding Times, and Analysis

Sample locations and procedures are discussed in the PDIWP for development of the SCO for Ammonia and the accompanying Tables and Figures. Procedures for chain of custody, holding times and laboratory analyses shall be followed as per SW-846 and as per the laboratory's Quality Assurance Plan. All holding times begin with validated time of sample receipt (VTSR) at the laboratory. The laboratory must meet the method required detection limits which are referenced within the EPA Methods (QAPP Table 1).

4 Calibration Procedures and Frequency

In order to obtain a high level of precision and accuracy during sample processing procedures laboratory instruments must be calibrated properly. Several analytical support areas must be considered so the integrity of standards and reagents is upheld prior to instrument calibration. The following section describes the analytical support areas and laboratory instrument calibration procedures.

4.1 Analytical Support Areas

Prior to generating quality data, several analytical support areas must be considered; these are detailed in the following paragraphs.

- Standard/Reagent Preparation - Primary reference standards and secondary standard solutions shall be obtained from National Institute of Standards and Technology (NIST), or other reliable commercial sources to verify the highest purity possible. The preparation and maintenance of standards and reagents will be accomplished according to the methods referenced. All standards and standard solutions are to be formally documented (i.e., in a logbook) and should identify the supplier, lot number, purity/concentration, receipt/preparation date, preparers name, method of preparation, expiration date, and any other pertinent information. All standard solutions shall be validated prior to use. Care shall be exercised in the proper storage and handling of standard solutions (e.g., separating volatile standards from nonvolatile standards). The laboratory shall continually monitor the quality of the standards and reagents through well documented procedures.

- Balances - The analytical balances shall be calibrated and maintained in accordance with manufacturer specifications. Calibration is conducted with two Class AS" weights that bracket the expected balance use range. The laboratory shall check the accuracy of the balances daily and they must be properly documented in permanently bound logbooks.

- Refrigerators/Freezers - The temperature of the refrigerators and freezers within the laboratory shall be monitored and recorded daily. This will verify that the quality of the standards and reagents is not compromised, and the integrity of the analytical samples is upheld. Appropriate acceptance ranges (2 to 6°C for refrigerators) shall be clearly posted on each unit in service.

- Water Supply System - The laboratory must maintain a sufficient water supply for all project needs. The grade of the water must be of the highest quality (analyte-free) in order to eliminate false positives from the analytical results. Ultraviolet cartridges or carbon absorption treatments are recommended for organic analyses and ion-exchange treatment is recommended for inorganic tests. Appropriate documentation of the quality of the water supply system(s) will be performed on a regular basis.

4.2 Laboratory Instruments

Calibration of instruments is required to verify that the analytical system is operating properly and at the sensitivity necessary to meet established quantitation limits. Each instrument for organic and inorganic analyses shall be calibrated with standards appropriate to the type of instrument and linear range established within the analytical method(s). Calibration of laboratory instruments will be performed according to specified methods.

In addition to the requirements stated within the analytical methods, the contract laboratory will be required to analyze an additional low-level standard at or near the detection limits. In general, standards will be used that bracket the expected concentration of the samples. This will require the use of different concentration levels, which are used to demonstrate the instrument's linear range of calibration.

Calibration of an instrument must be performed prior to the analysis of any samples and then at periodic intervals (continuing calibration) during the sample analysis to verify that the instrument is still calibrated. If the contract laboratory cannot meet the method required calibration requirements, corrective action shall be taken as discussed in QAPP Section 7. All corrective action procedures taken by the contract laboratory are to be documented, summarized within the case narrative, and submitted with the analytical results.

5 Internal Quality Control Checks

Internal QC checks are used to determine if analytical operations at the laboratory are in control, as well as determining the effect sample matrix may have on data being generated. Two types of internal checks are performed and are described as batch QC and matrix-specific QC procedures. The type and frequency of specific QC samples performed by the contract laboratory will be according to the specified analytical method and project specific requirements. Acceptable criteria and/or target ranges for these QC samples are presented within the referenced analytical methods.

QC results which vary from acceptable ranges shall result in the implementation of appropriate corrective measures, potential application of qualifiers, and/or an assessment of the impact these corrective measures have on the established data quality objectives. Quality control samples, including any project-specific QC, that will be analyzed are discussed below.

5.1 Batch QC

Method Blanks - A method blank is defined as laboratory-distilled or deionized water that is carried through the entire analytical procedure. The method blank is used to determine the level of laboratory background contamination. Method blanks are analyzed at a frequency of one per analytical batch.

Matrix Spike Blank Samples - A matrix spike blank (MSB) sample is an aliquot of water spiked (fortified) with all the elements being analyzed for calculation of precision and accuracy to verify that the analysis that is being performed is in control. An MSB will be performed for each matrix and organic parameter only.

5.2 Matrix-Specific QC

Matrix Spike Samples - An aliquot of a matrix is spiked with known concentrations of specific compounds as stipulated by the methodology. The matrix spike (MS) and matrix spike duplicate (MSD) are subjected to the entire analytical procedure in order to assess both accuracy and precision of the method for the matrix by measuring the percent recovery and relative percent difference of the two spiked samples. The samples are used to assess matrix interference effects on the method, as well as to evaluate instrument performance. MS/MSDs are analyzed at a frequency of one each per 20 samples per matrix.

Matrix Duplicates - The matrix duplicate (MD) is two representative aliquots of the same sample which are prepared and analyzed identically. Collection of duplicate samples provides for the evaluation of precision both in the field and at the laboratory by comparing the analytical results of two samples taken from the same location. Obtaining duplicate samples from a soil matrix requires homogenization (except for volatile organic compounds) of the sample aliquot prior to filling sample containers, in order to best achieve representative samples. Every effort will be made to obtain replicate samples; however, due to interferences, lack of homogeneity, and the nature of the soil samples, the analytical results are not always reproducible.

Rinsate (Equipment) Blanks - A rinsate blank is a sample of laboratory demonstrated analyte free water passed through and over the cleaned sampling equipment. A rinsate blank is used to indicate potential contamination from ambient air and from sample instruments used to collect and transfer samples. This water must originate from one common source within the laboratory and must be the same water used by the laboratory performing the analysis. The rinsate blank should be collected, transported, and analyzed in the same manner as the samples acquired that day. Rinsate blanks for nonaqueous matrices should be performed at a rate of 10 percent of the total number of samples collected throughout the sampling event. Rinse blanks will not be performed on samples (i.e., groundwater) where dedicated disposable equipment is used. It is not anticipated that rinsate blanks will be collected as all sample equipment in contact with the soil or groundwater being sample will be disposal during this PDIWP for development of the SCO for Ammonia.

Trip Blanks - Trip blanks are not required for nonaqueous matrices. Trip blanks are required for aqueous sampling events. They consist of a set of sample bottles filled at the laboratory with laboratory demonstrated analyte free water. These samples then accompany the bottles that are prepared at the lab into the field and back to the laboratory, along with the collected samples for analysis. These bottles are never opened in the field. Trip blanks must return to the lab with the same set of bottles they accompanied to the field. Trip blanks will be analyzed for volatile organic parameters. Trip blanks must be included at a rate of one per volatile sample shipment.

6 Calculation of Data Quality Indicators

6.1 Precision

Precision is evaluated using analyses of a field duplicate and/or a laboratory MS/MSD which not only exhibit sampling and analytical precision but indicate analytical precision through the reproducibility of the analytical results. RPD is used to evaluate precision by the following formula:

$$RPD = \frac{(X1 - X2) \times 100\%}{[(X1 + X2)/2]}$$

Where:

X1= Measured value of sample or matrix spike

X2= Measured value of duplicate or matrix spike duplicate

Precision will be determined through the use of MS/MSD (for organics) and matrix duplicates (for inorganics) analyses.

6.2 Accuracy

Accuracy is defined as the degree of difference between the measured or calculated value and the true value. The closer the numerical value of the measurement comes to the true value or actual concentration, the more accurate the measurement is. Analytical accuracy is expressed as the percent recovery of a compound or element that has been added to the environmental sample at known concentrations before analysis. Analytical accuracy may be assessed through the use of known and unknown QC samples and spiked samples. It is presented as percent recovery. Accuracy will be determined from matrix spike, matrix spike duplicate, and matrix spike blank samples, as well as from surrogate compounds added to organic fractions (i.e., volatiles, semi volatiles, PCB), and is calculated as follows:

$$\text{Accuracy (\%R)} = \frac{(X_s - X_u) \times 100\%}{K}$$

Where:

Xs- Measured value of the spike sample
Xu- Measured value of the unspiked sample
K - Known amount of spike in the sample

6.3 Completeness

Completeness is calculated on a per matrix basis for the project and is calculated as follows:

$$\text{Completeness (\%C)} = \frac{(X_v - X_n) \times 100\%}{N}$$

Where:

Xv- Number of valid measurements
Xn- Number of invalid measurements
N - Number of valid measurements expected to be obtained

7 Corrective Actions

Laboratory corrective actions shall be implemented to resolve problems and restore proper functioning to the analytical system when errors, deficiencies, or out-of-control situations exist at the laboratory. Full documentation of the corrective action procedure needed to resolve the problem shall be filed in the project records, and the information summarized in the case narrative. A discussion of the corrective actions to be taken is presented in the following sections.

7.1 Incoming Samples

Problems noted during sample receipt shall be documented by the laboratory. The Inventum Project Manager shall be contacted immediately for problem resolution. All corrective actions shall be documented thoroughly.

7.2 Sample Holding Times

If any sample extraction and/or analyses exceed method holding time requirements, the Inventum Project Manager shall be notified immediately for problem resolution. All corrective actions shall be documented thoroughly.

7.3 Instrument Calibration

Sample analysis shall not be allowed until all initial calibrations meet the appropriate requirements. All laboratory instrumentation must be calibrated in accordance with method requirements. If any initial/continuing calibration standards exceed method QC limits, recalibration must be performed and, if necessary, reanalysis of all samples affected back to the previous acceptable calibration check.

7.4 Reporting Limits

The laboratory must meet the method required detection limits listed in NYSDEC ASP, 10/95 criteria. If difficulties arise in achieving these limits due to a particular sample matrix, the laboratory must notify Inventum personnel for problem resolution. In order to achieve those detection limits, the laboratory must utilize all appropriate cleanup procedures in an attempt to retain the project required detection limits. When any sample requires a secondary dilution due to high levels of target analytes, the laboratory must document all initial analyses and secondary dilution results. Secondary dilution will be permitted only to bring target analytes within the linear range of calibration. If samples are analyzed at a secondary dilution with no target analytes detected, the Project Manager will be immediately notified so that appropriate corrective actions can be initiated.

7.5 Method QC

All QC method-specified QC samples shall meet the method requirements referenced in the analytical methods. Failure of method-required QC will result in the review and possible qualification of all affected data. If the laboratory cannot find any errors, the affected sample(s) shall be reanalyzed and/or re-extracted/redigested, then reanalyzed within method-required holding times to verify the presence or absence of matrix effects. If matrix effect is confirmed, the corresponding data shall be flagged accordingly using the flagging symbols and criteria. If matrix effect is not confirmed, then the entire batch of samples may have to be reanalyzed and/or re-extracted/redigested, then reanalyzed. Inventum shall be notified as soon as possible to discuss possible corrective actions should unusually difficult sample matrices be encountered.

7.6 Calculation Errors

All analytical results must be reviewed systematically for accuracy prior to submittal. If upon data review calculation and/or reporting errors exist, the laboratory will be required to reissue the analytical data report with the corrective actions appropriately documented in the case narrative.

8 Data Reduction, Validation, and usability

8.1 Data Reduction

Laboratory analytical data are first generated in raw form at the instrument. These data may be either in a graphic or printed tabular format. Specific data generation procedures and calculations are found in each of the referenced. Analytical results must be reported consistently. Identification of all analytes must be accomplished with an authentic standard of the analyte traceable to NIST or USEPA sources. Individuals experienced with a methods particular analysis and knowledgeable of requirements will perform data reduction.

8.2 Data Validation

Data validation is a systematic procedure of reviewing a body of data against a set of established criteria to provide a specified level of assurance of validity prior to its intended use. All analytical samples collected will receive a limited data review. The data validation will be limited to a review of holding times, completeness of all required deliverables, review of QC results (surrogates, spikes, duplicates) and a 10% check of all samples analyzed to ensure they were analyzed properly. The methods as well as the general guidelines presented in the following documents will be used during the data review USEPA Contract Laboratory Program (CLP) Organic Data Review, SOP Nos. HW-6, Revision #11 and USEPA Evaluation of Metals Data for the Contract Laboratory Program based on 3/90, SOW, Revision XI. These documents will be used with the following exceptions:

- Technical holding times will be in accordance with NYSDEC ASP, 10/95 edition.
- Organic calibration and QC criteria will be in accordance with NYSDEC ASP, 10/95 edition. Data will be qualified if it does not meet NYSDEC ASP, 10/95 criteria.

Where possible, discrepancies will be resolved by the project manager (i.e., no letters will be written to laboratories). A complete analytical data validation is not anticipated. However, if the initial limited data audit reveals significant deviations and problems with the analytical data, project personnel may recommend a complete variation of the data.

Inventum will submit all analytical data packages for third-party data validation review. A third-party Data Usability Summary Report (DUSR) will be prepared for each laboratory data package.

9 References

- Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Quality Assurance Manual, Final Copy, Revision I, October 1989.
- National Enforcement Investigations Center of USEPA Office of Enforcement. NEIC Policies and Procedures. Washington: USEPA.
- New York State Department of Environmental Conservation (NYSDEC). 1995. Analytical Services Protocol, (ASP) 10/95 Edition. Albany: NYSDEC.

Appendix D – Community Air Monitoring Plan

INVENTUM ENGINEERING PC

Community Air Monitoring Plan

Riverview Innovation & Technology Campus

Brownfield Cleanup Program Site No. C915353

3875 River Road

Tonawanda, NY 14150

March 12, 2020

Rev. 2: January 15, 2021

Rev. 3 January 22, 2021

Rev. 4 November 8, 2021

Rev. 5 December 3, 2021

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1 Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required.

- *The Riverview Site will have a perimeter air monitoring program before and during the RI. If there are detections at the property line, additional monitoring requirements will be considered*[1].
- *Three (3) perimeter air monitoring units (1 Upwind and 2 Downwind) were installed on the BCP Site on April 29, 2020. Monitoring locations are shown on the Figure provided in Appendix D-2.*

Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

- *There are no sensitive receptors on the property. The closest residence is more than 0.25 miles away from the property boundary.*

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

2 Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

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[1] The text in *italic font* are comments inserted by Riverview in addition to the standard CAMP Template.

- *VOC and particulate monitoring will be incorporated into the RI and IRM activities.*

Continuous monitoring will be required for all ground intrusive activities during the demolition of contaminated or potentially contaminated structures, installing groundwater conveyance trenches, operation of a groundwater treatment system when housed indoors, and during the decontamination and deconstruction of Above Ground Storage Tanks (ASTs). Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells. Decontamination and deconstruction of ASTs include, but are not limited to, removal of residual products, decontamination of ASTs and ancillary piping and equipment, and emptying and decontamination of secondary containment structures.

VOC monitoring during operation of the groundwater treatment system when housed indoors will be by completed a photoionization detector or PID. For the groundwater treatment system to be housed the former maintenance building, two PIDs will be positioned inside. One near the largest open top tank which will be the WetSep and the second PID at the bag filter. The PIDs will be set to alarm at 5 parts per million (ppm) for any 15-minute period based on the potential Benzene exposure. Actions described in Section 3 will be implemented if 5ppm for 15 minutes is observed. Downwind monitoring will not occur because the work being monitored is indoors. The PIDs will no longer be used if observed ambient conditions within the 8-weeks of operation show elevated PID reading over 5ppm for a 15-minute period have not been detected.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

- *During sampling periodic monitoring will be implemented with hand-held instruments.*

3 VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

5. The NYSDEC and NYSDOH project managers will be notified there is an exceedance of the VOC action levels.

4 Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

4. The NYSDEC and NYSDOH project managers will be notified where there is an exceedance of the CAMP particulate monitoring action levels.

5 Controlled Demolition with Asbestos

The four controlled demolition buildings have been designated because they were either not safe for entry by the Asbestos Containing Material (ACM) inspection contractor (BCP-14, BCP-66 and BCP-68) or that contain loose asbestos packing that cannot be safely removed (BCP-56). These buildings will be demolished in place and the resulting demolition materials will be inspected and sampled after they are safely on the ground.

The demolition with ACM present will be preformed in accordance with NYS Code, Rules and Regulations Section 56-11.5(a)(b)(c). Required dust control measure of Section 56-11.5 will consist of:

1. Air sampling for asbestos at the upwind and downwind perimeter of the building work area will be conducted daily during activities including demolition, abatement, and cleaning.

2. All debris generated by the demolition shall be considered to be asbestos contaminated waste, except for structural members, steel components and similar non-suspect items which shall be fully decontaminated as per this Part, until sample results are available indicating ACM is not present.

3. The demolition waste shall be wetted on a continuous basis that is prior to, during and subsequent to its actual collection and removal. Fog nozzles or similar type of equipment shall be used to perform the wetting.

4. Wetted piles of waste. Piles of waste not actively being worked on, *i.e.*, piles being added to or portions being removed or piles left over extended periods of time, shall be covered with at least one layer of six mil polyethylene to retain its moisture level and to prevent fiber release.

5. Wetted piles of waste. Piles of waste not actively being worked on, *i.e.*, piles being added to or portions being removed or piles left over extended periods of time, shall be covered with at least one layer of six mil polyethylene to retain its moisture level and to prevent fiber release.

Appendix A-1
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;

(b) Measurement Ranges: 0.001 to 400 mg/m^3 (1 to 400,000 :ug/m^3);

(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m^3 for one second averaging; and +/- 1.5 g/m^3 for sixty second averaging;

(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);

(e) Resolution: 0.1% of reading or 1g/m^3, whichever is larger;

(f) Particle Size Range of Maximum Response: 0.1-10;

(g) Total Number of Data Points in Memory: 10,000;

(h) Logged Data: Each data point with average concentration, time/date and data point number

(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;

(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;

(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;

(l) Operating Temperature: -10 to 50^o C (14 to 122^o F);

(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m^3 (15 minutes average). While conservative, this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m^3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m^3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m^3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential-- such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads and demolitions;

(b) Wetting equipment and excavation faces;

(c) Spraying water on buckets during excavation and dumping;

(d) Hauling materials in properly tarped or watertight containers;

(e) Restricting vehicle speeds to 10 mph;

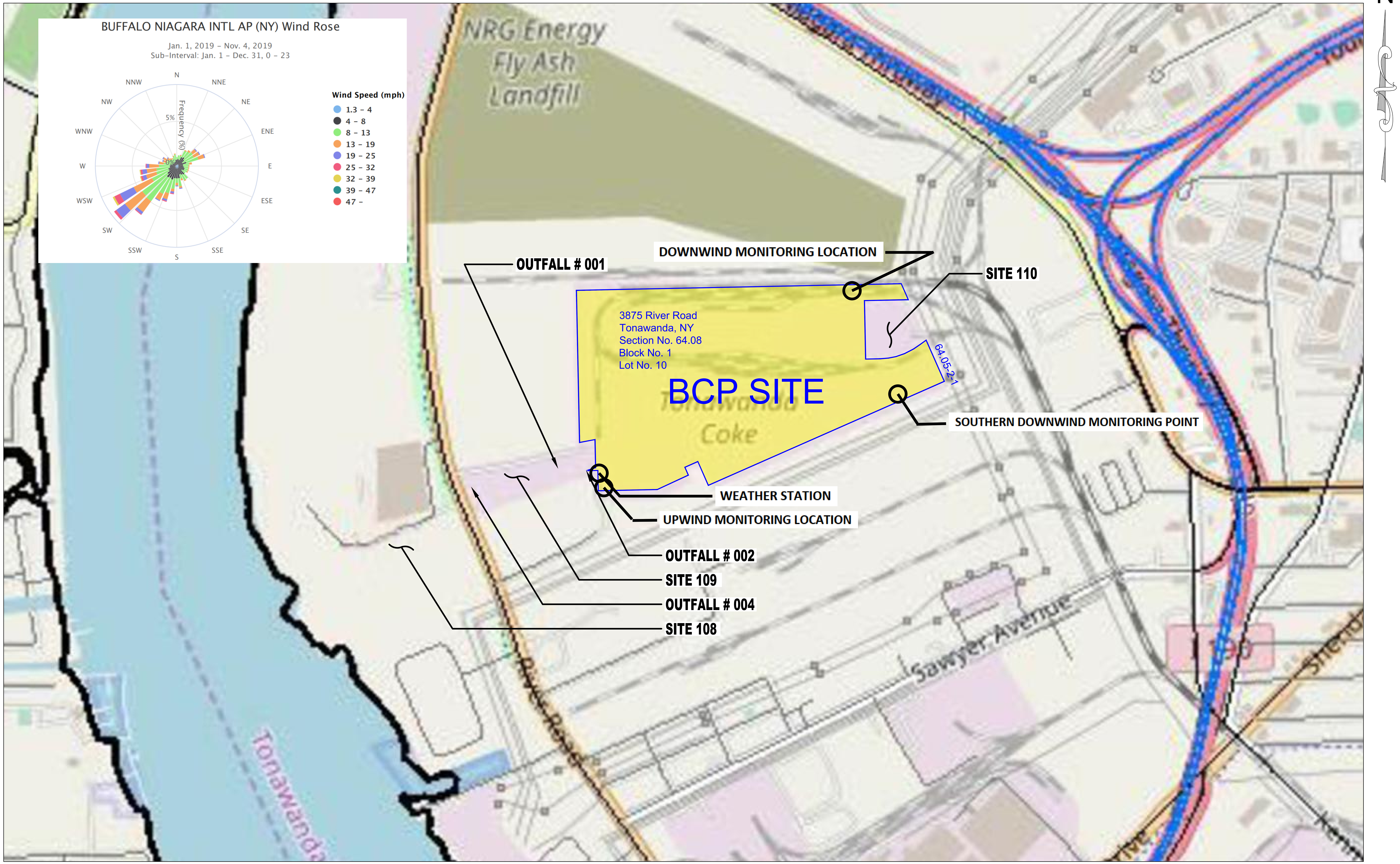
(f) Covering excavated areas and material after excavation activity ceases; and

(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m^3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

Appendix A-2
Perimeter Air Monitoring Locations



Erie County, New York, Interactive Mapping Viewer, www2.erie.gov/gis

64.08-1-10 Section No., Block No., Lot No. (SBL)

Brownfield Area

D

500 0 100 200 600 1000

1 INCH = 350 FEET (22X34)

DRAWING BY
CHECKED
APPROVED

BAESLINE AIR MONITORING STATIONS

SITE LOCATION MAP
RIVERVIEW INNOVATION & TECHNOLOGY CAMPUS, INC.
3875 RIVER ROAD
TONAWANDA, NEW YORK 14150

INVENTUM ENGINEERING
481 CARLISLE DRIVE
SUITE 202
HERNDON, VIRGINIA 20170
(703) 722-6049
www.InventumEng.com

FIGURE 3

DRAWING NUMBER
101

https://inventumengineering.sharepoint.com/Shared Documents/Inventum/Project Files/Tonawanda/Work Plans and Site Management Plans/Ammonia SCO/Ammonia SCO Work Plan.docx