TRIPLE CITIES METAL FINISHING
HILLCREST FACILITY
4 NOWLAN ROAD
BROOME COUNTY
BINGHAMTON, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: 704045

Prepared for:
Binghamton Realty, Inc.
349 Industrial Park Drive, Binghamton, New York 13904
607-722-3431

Prepared by:
GeoLogic NY, Inc.
PO Box 350, Homer, NY 13077
607-749-5000

NOVEMBER 2016

Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

NOVEMBER 2016

CERTIFICATION STATEMENT

I SUSAN M. CUMMINS certify that I am currently a Qualified Environmental Professional as in defined in 6 NYCRR Part 375 and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Susan M. Cummins [QEP]

11/1/2016 DATE

I KENNETH TETER, P. E. ertify that I am currently a NYS registered professional engineer and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with DER Technical Guidance for Site Investigation and Remediation (DER-10).

[NYSPE]

11/1/16 DATE

Triple Cities Metal Finishing Corporation
Hillcrest Facility
4 Nowlan Road
Broome County, Binghamton, New York

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

List of Acronyms

BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CAMP	Community Air Monitoring Plan
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CP	Commissioner Policy
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
HASP	Health and Safety Plan
IC	Institutional Control
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RP	Remedial Party
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SSD	Sub-slab Depressurization
SVM	Soil Vapor Mitigation
TCL	Target Compound List
VOC	Volatile Organic Compound

ES EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance and reporting activities required by this Site Management Plan:

Site Identification:	**BCP Site No. 704045, Triple Cities Metal Finishing Corporation, Hillcrest Facility, 4 Nowlan Road, Broome County, Binghamton, New York**
Institutional Controls:	1. The property may be used for commercial or industrial use;
	2. Institutional Controls defined in the Environmental Easement include: • Compliance with the Environmental Easement and this SMP by the Grantor and the Grantor's successors and assigns; • All Engineering Controls must be operated and maintained as specified in this SMP; • All Engineering Controls on the Controlled Property must be inspected at the frequency and in a manner defined in the SMP: • Groundwater monitoring must be performed as defined in the SMP; • Data and information pertinent to the site management of the Controlled Property must be reported at the frequency and in the manner defined in this SMP;
Engineering Controls:	1. Sub-Slab Depressurization Systems within the Site building 2. Site Cover to included asphalt pavement and Site building.

Inspections:	Frequency
1. SSD Systems	Annually

Site Identification:	BCP Site No. 704045, Triple Cities Metal Finishing Corporation, Hillcrest Facility, 4 Nowlan Road, Broome County, Binghamton, New York
2. Site Cover	Annually
Monitoring:	
1. Groundwater Monitoring Wells MW-3, MW-3HA, MW-4, MW-5R and MW-6, MW-7R, MW-8, and MW-9.	May 2017 November 2017
Maintenance:	
1. SSD Systems	Annually
2. Groundwater Monitoring Wells	Annually
Reporting:	
1. Periodic Review Report	Annually

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.

1.0 INTRODUCTION

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the Triple Cities Metal Finishing Corporation, Hillcrest Facility, located in Binghamton, Broome County, New York (hereinafter referred to as the "Site"). See Figure 1. The Site is currently in the New York State (NYS) Brownfield Cleanup Program (BCP Site No. 704045 and EPA No. NYD002226041) which is administered by New York State Department of Environmental Conservation (NYSDEC).

Binghamton Realty, Inc. entered into a Brownfield Cleanup Agreement (BCA), on June 29, 2004 with the NYSDEC to remediate the Site. A figure showing the site location and boundaries of this Site is provided in Figure 2. The boundaries of the Site are more fully described in the metes and bounds site description that is part of the Environmental Easement provided in Appendix B.

After completion of the remedial work, some contamination was left at this Site, which is hereafter referred to as "remaining contamination". Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC, and recorded with the Broome County Clerk, requires compliance with this SMP and all ECs and ICs placed on the Site.

This SMP was prepared to manage remaining contamination at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the Environmental Easement, which is a ground for revocation of the Certificate of Completion (COC).
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the BCA Site #704045 for the Site, and thereby subject to applicable penalties.

All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the Site is provided in Appendix A of this SMP.

This SMP was prepared by GeoLogic NY, Inc., on behalf of Binghamton Realty, Inc., in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May, 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the Site.

1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut-down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the Site conditions. In accordance with the Environmental Easement for the Site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

Notifications will be submitted by the property owner to the NYSDEC, as needed, in accordance with NYSDEC's DER-10 for the following reasons:

- 60-day advance notice of any proposed changes in Site use that are required under the terms of the BCA, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 7-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.
- Notice within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the Site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the Brownfield Cleanup Agreement (BCA), and all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the Site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1-1 on the following page includes contact information for the above notification. A full listing of site-related contact information is provided in Appendix A. The information on this table will be updated as necessary to provide accurate contact information.

Table 1-1 Notifications*

Name	Contact Information
Mr. Gary Priscott, NYSDEC Project Manager	607.775.2545 gary.priscott@dec.ny.gov
Mr. Harry Warner, NYSDEC Regional HW Engineer	315.426.7400 harry.warner@dec.ny.gov
Kelly Lewandowski, NYSDEC Site Control	518.402.9569 kelly.lewandowski@dec.ny.gov

* Note: Notifications are subject to change and will be updated as necessary

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS & REMEDIAL ACTIONS

2.1 Site Location and Description

The Site is located in Town of Fenton, Binghamton, Broome County, New York and is identified as Section 129.05 Block 4 and Lot 2 and Section 129.05 Block 4 and Lot 5 on the Broome County Tax Map (see Figure 3). The Site, encompassing approximately 0.953-acre area is bounded by Beckwith Avenue to the south, to the east by B. W. Elliot Manufacturing Company, to the north by Nowlan Road, to the west by an auto repair business, a residence and an electrical contractor (see Figure 2-Site Layout Map). The boundaries of the Site are more fully described in Appendix B-Environmental Easement. The owner of the Site parcels at the time of issuance of this SMP is:

Binghamton Realty, Inc.

2.2 Physical Setting

2.2.1 Land Use

An industrial building that connects with a former residential structure and asphalt parking areas cover most of the Site. A small grass covered area is located on the south side of the former residential structure. The 14,544 square foot industrial building consists of a series of interconnected structures constructed between circa-1930 through the 1980s. The industrial building consists of masonry structures with slab-on-grade foundations with the exception of an area in the southwestern section of the building that is approximately 4 feet below grade. The former residential structure is a wood-framed, two-story building with a full basement.

The properties adjoining the Site and in the neighborhood surrounding the Site include residential, commercial and industrial properties. The properties immediately south of the Site include residential properties; the properties immediately north of the Site include a residential property, an access drive to a small commercial plaza and the Xtra Mart Sunoco Gas Station; the property immediately east of the Site is the B. W. Elliot Manufacturing Company parking area; and the properties to the west of the Site include Panko Electric, a residence, and T & C Auto Clinic. B. W. Elliot Manufacturing Company, a manufacturer of power transmission products, occupies at the former CAE Electronic facility, an inactive hazardous waste disposal site (Site No. 704015).

2.2.2 Geology

Triple Cities Metal Finishing (TCMF) is located on a terrace approximately 50 feet above the current Chenango River channel. The topographic features in the vicinity of the Site include a hillside rising over 400 feet approximately 2,000 feet east of the Site; Phelps Creek flowing off the hillside in a southwesterly direction within 1,000 feet southeast of the Site and the Chenango River with its southerly flow located within 2,000 feet west of the Site. TCMF and a large portion of the Hillcrest community are located on the terrace above the river channel and along the east hillside. TCMF overlies the

NYSDEC designated Endicott-Johnson City Area Aquifer.

The geology of the terrace consists of a surficial glacial meltwater (outwash) deposit of sand and gravel with variable silt content that range in thickness from approximately 30 to 55 feet. Lacustrine silt, sand and clay deposits underlie the outwash sand and gravel unit ranging in thickness from 130 to 160 feet. Underlying the lacustrine deposit is a sand and gravel deposit. The Town of Fenton Water Supply Wells are screened in this lower sand and gravel deposit.

2.2.3 Hydrogeology

The general direction of mapped groundwater flow within the aquifer is to the west toward the Chenango River. The local direction of groundwater flow at the Site is to the west, southwest, as determined during recent and previous evaluations at the Site. Groundwater has been encountered between 28 and 30 feet below ground surface at the Site. Fluctuations in groundwater levels observed between 2000 and 2016 have been less than 2 feet. Depth to bedrock at the Site was not determined.

The following two tables summarize the monitoring well construction details and groundwater elevations recorded during remediation activities.

Table 2-1 Groundwater Monitoring Well Installation Details

Well Designation	Reference Elevation	Depth of Well (feet)	Length of Well Screen (feet)	Top of Well Screen Elevation	Bottom of Well Screen Elevation
MW-3	899.30	40	10	869.3	859.3
MW-3HA	901.53	39	Unknown		862.5
MW-4	899.01	38	10	871.0	861.0
MW-5R	898.27	35	10	873.3	863.3
MW-6	897.21	35	10	872.2	862.2
MW-7R	896.40	39	20	877.4	857.4
MW-8	899.47	37	10	872.5	862.5
MW-9	898.64	34	10	874.6	864.6

Note: Reference elevation is the top of the PVC well casing

A groundwater contour map for the April 2016 monitoring event is shown in Figure 4. Site-specific boring and monitoring well logs are provided in Appendix C.

Table 2-2 Groundwater Elevation Data

Date	Groundwater Monitoring Well Location							
	MW-3	MW-3HA	MW-4	MW-5R	MW-6	MW-7R	MW-8	MW-9
Oct-2015	868.55	*	865.79	*	868.63	873.65	*	*
Apr-2016	869.38	869.53	866.13	869.69	869.51	875.03	869.49	869.53

* - Well installed after November 2015

2.3 Remedial Investigation History

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site.

Remedial Investigations have been performed to characterize the nature and extent of contamination at the Site. Vapor mitigation of occupied spaces within the Site industrial building was implemented and Remedial Actions of source areas were completed. The results of the remedial investigation and remedial action are described in detail in the following reports:

- Remedial Investigation Report, Triple Cities Metal Finishing Corporation, 4 Nowlan Road, Hillcrest, NY prepared by GeoLogic NY, Inc. November 2009.
- Annual Interim Maintenance and Monitoring Reports, Triple Cities Metal Finishing Corporation, 4 Nowlan Road, Hillcrest, NY prepared by GeoLogic NY, Inc. 2009 through 2015.
- Alternative Analysis Report, Triple Cities Metal Finishing Corporation, 4 Nowlan Road, Hillcrest, NY prepared by GeoLogic NY, Inc. April 2011.
- Remedial Action Work Plan, Triple Cities Metal Finishing Corporation, 4 Nowlan Road, Binghamton, NY prepared by GeoLogic NY, Inc. July 2015.

- Addendum to the Remedial Action Work Plan, Triple Cities Metal Finishing Corporation, 4 Nowlan Road, Binghamton, NY prepared by GeoLogic NY, Inc. July 2016.

- Final Engineering Report, Triple Cities Metal Finishing Corporation, 4 Nowlan Road, Binghamton, NY by GeoLogic NY, Inc. November 2016

2.3.1 Site-Related Soil/Sediments

Soil samples were collected from depths ranging from ground surface to 44 feet below ground surface (bgs) and analyzed for total metals and volatile organic compounds at locations off-site adjacent to the industrial building, at the monitoring well locations, on-site outside the Site buildings, and from below the industrial building. The NYSDEC Soil Cleanup Objectives (SCOs) for the Protection of Public Health for Commercial Use properties and/or for the Protection of Groundwater were exceeded for cadmium, chromium, copper, nickel and zinc content. Soils exhibiting metal concentration exceeding the SCOs for the protection of public health and groundwater are present under the TCMF industrial building and in the former outfall areas. The following table summarizes metal concentrations in the soils.

Table 2-3 Summary of Metal Concentrations in Soils/Sediments

Analytes	No. of Samples Analyzed	Concentration Range mg/kg	6NYCRR Part 375 SCO* mg/kg	No. of Samples Exceeding Part 375 SCO
Cadmium	61	<0.105 to 761	7.5	31
Chromium	61	7.8 to 18,900	19	39
Hexavalent Chromium	2	<4.78 to 6.39	19	0
Copper	46	13.7 to 3250	270	8
Nickel	46	11 to 1050	130	6
Zinc	50	37.9 to 22,100	2,480	7

The SCO is the lower concentration of the SCO for the Protection of Groundwater and the SCO for the Protection of Public Health for Commercial Use

As noted above, soils with elevated metals outside the industrial building footprint are associated with two former on-site drywell systems, Outfall 002 and Outfall 003. Based on the findings of the Remedial Investigation (RI), historical disposal of waste

materials to these outfalls has resulted in metal contamination of soil. The primary contaminants of concern are cadmium and chromium.

During the remedial investigation, waste sediments were observed at Outfall 002. Waste sediments were not observed at Outfall 003. The concentration of cadmium and chromium within these waste sediments and surrounding soils are above the SCOs for the protection of public health and/or groundwater.

2.3.2 Site-Related Groundwater

Monitoring wells were installed as part of the RCRA and BCP Remedial Investigations. Groundwater samples were analyzed for RCRA metals and volatile organic compounds (VOCs) content during these investigations. The historical data indicated that groundwater quality exceed the SCGs for metals. The VOCs in groundwater, especially trichloroethene (TCE) have also been found in upgradient monitoring wells at similar or greater concentrations, and appear to be associated with prior releases at the adjacent CAE Electronic site (Site No. 704015). Therefore the presence of VOC compounds in groundwater does not necessarily indicated site-related impacts.

Groundwater samples were collected from the existing monitoring wells in October 2015 prior to the implementation of the remedial actions. The excavation of Outfall 002 and 003 was completed in February 2016. Another round of groundwater samples were collected from existing monitoring wells in April 2016. Analysis of groundwater for both sampling events included analysis for metals. The following table summarizes these results.

Table 2-4 Pre and Post-Excavation Groundwater Data Summary

Contaminant	NYSDEC * Water Quality ug/L	Pre-Excavation Concentration Ranges ug/L	Post-Excavation Concentration Ranges ug/L
Cadmium	5	ND to 80	ND to 10.5
Chromium	50	13.6 to 363	ND to 161

* - NYSDEC TOGS 1.1.1 Ambient Water Quality Standards and Guidance Values

2.3.3 Soil Vapor

There is the potential for soil vapor intrusion resulting from the presence of volatile contamination in soil vapor beneath the site buildings; therefore a sub-slab depressurization (SSD) system was installed in the occupied spaces of the industrial building.

As noted in the Statement of Basis, action has been implemented to address off-site soil vapor intrusion concerns associated with contamination from the adjacent CAE Electronic site. These off-site soil vapor intrusion concerns are not the result of contamination from the TCMF facility.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the Statement of Basis dated February 2015 are as follows:

2.4.1 Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Remove the source of ground or surface water contamination.

2.4.2 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

2.4.3 Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a Site.

2.5 Remedial Action Summary

The structures associated with Outfall 002A and 003 were removed to the extent feasible via excavation. Approximately 271 tons of soil and the outfall structures were removed from the Site. Six cubic yards of waste sediments were also removed from Outfall 002A for off-site disposal. In-situ stabilization of chromium and cadmium remaining in the subsurface in the outfall areas was implemented to reduce the overall leachability of metals in soil so that impacted soils could remain in place.

Post-remediation analysis of metals in soil included the analysis for trivalent and hexavalent chromium to better determine whether remaining chromium contamination in soils meet the SCOs for the protection of groundwater. Previous analysis of soils for chromium concentrations represented total concentrations.

The following summary of pre and post-remediation metal concentrations in soils and sediments at Outfall 002 and 003 reflects a decrease of chromium and cadmium in the subsurface attributed to source removal via excavation. Also the majority of chromium in the subsurface is trivalent chromium, and therefore the soils meet the SCO for the protection of groundwater within the former outfall areas with the exception of Outfall 002A.

Table 2-5 Subsurface Soils/Sediments Contaminant Concentration Summary, Outfall 002 and Outfall 003

Contaminants of Concern	Pre-Remediation Historic Concentration Range (mg/kg)[a]	Post-Remediation Concentration Range (mg/kg)	6NYCRR Part 375 SCO Protection of Groundwater (mg/kg)
Outfall 002A			
Cadmium	15-68	16-31.2	7.5
Chromium	910-3,700	294-797	
Trivalent Chromium		294-775	NS
Hexavalent Chromium		ND-22.1	19
Outfall 002B			
Cadmium	340-650	9.5-80.3	7.5
Chromium	180-7100	36.1-49.3	
Trivalent Chromium		34.7-49.3	NS
Hexavalent Chromium		ND-1.4	19
Outfall 003			
Cadmium	8.4-410	2.9-621	7.5
Chromium	16.4-1,310	6.7-58.2	
Trivalent Chromium		6.7-56.2	NS
Hexavalent Chromium		ND-4.0	19

a - milligrams per kilogram, mg/kg, in soil is equivalent to parts per million (ppm)
ND – Not detected above the method detection limits; NS – Not Specified

2.6 Remaining Contamination Summary

Outside the building footprint in the area of the former outfall structures, cadmium and chromium remain in soils that exceed the SCOs for the Protection of Groundwater and/or for the Protection of Public Health for Commercial Use (see Figure 5). Although stabilization does not reduce total concentrations of cadmium and chromium in soils, it does reduce the leachability characteristics of cadmium and chromium in the soils reducing the migration of these metals into groundwater. Since the total concentrations for chromium and cadmium in soils in the areas as well as other areas at the Site exceed SCOs, management of these areas are required for the Protection of Public Health for Commercial Use under the ICs/ECs of this SMP. Asphalt pavement provides a protective cap for these impacted soils. Stabilization has reduces the leachability characteristics of cadmium and chromium in soils.

The industrial building is part of the cover system for impacted soils that remain in the subsurface. Metals in soils under the industrial building are at concentrations that exceed their respective SCOs for the Protection of Groundwater and/or for the Protection of Public Health for Commercial Use.

Due to the presence of remaining contaminants, continuing operation of the SSD system, limited groundwater monitoring and sampling, and the imposition of land use and groundwater use restrictions will be implemented to protect public health and the environment.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

Since remaining contamination exists at the Site, Institutional Controls (ICs) and Engineering Controls (ECs) are required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the Site. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC.

This plan provides:

- A description of all IC/ECs on the Site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix D for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the Site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the Site remedy, as determined by the NYSDEC.

3.2 Institutional Controls

A series of ICs is required by the Statement of Basis to (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and, (3) limit the use and development of the Site to commercial and industrial uses only. Adherence to these ICs on the Site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on Figures 7. These ICs are:

- Compliance with the Environmental Easement and this SMP by the Grantor and the Grantor's successors and assigns;
- All Engineering Controls must be operated and maintained as specified in this SMP;
- All Engineering Controls on the Controlled Property must be inspected at the frequency and in the manner defined in the SMP;

- Groundwater monitoring must be performed as defined in this SMP;
- Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
- Access to the Site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 7, and any potential impacts that are identified must be monitored or mitigated.

Institutional Controls identified in the Environmental Easement may not be discontinued without an amendment to, or extinguishment of the Environmental Easement.

3.3 Engineering Controls

3.3.1 Cover System

Exposure to remaining contamination at the Site is prevented by a cover system placed over the Site. This cover system is comprised of a minimum of 12 inches of clean soil, asphalt pavement, concrete sidewalks, and concrete building slabs. Figure 7 identifies the locations of the asphalt pavement and buildings that comprises the cover system. The Excavation Work Plan (EWP) provided in Appendix D outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, and any underlying remaining contamination is

disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the Site and provided in Appendix F.

3.3.2 Sub-Slab Depressurization Systems

A sub-slab depressurization (SSD) system has been installed within occupied spaces inside the industrial building on the Site. The installed SSD system included sealing areas between occupied spaces and unoccupied spaces through the installation of doors and walls and the installation of suction points beneath the concrete floor slabs. The suction points were constructed by coring 4-inch diameter holes through the concrete floors, removing soils immediately below the concrete slab and seating 4-inch diameter PVC piping into the underlying sub-slab material. PVC piping runs carry the soil vapor from below the concrete floor to effluent lines that were installed and connected to high volume blowers. The piping was installed in a configuration that ensures that any water within the piping drains back toward the extraction points. Seals were placed around extraction point penetrations through the concrete floor and the effluent pipe penetrations through the exterior wall.

The location of the depressurization blowers, associated piping and suction points installed in the industrial building are shown on Figure 6.

Annual System Reports have been submitted to NYSDEC since 2009 summarizing semi-annual monitoring data and visual inspections of the SSD system, and any modifications and expansion that were made to the system. The Annual System Reports will be incorporated into the Periodic Review Report procedures.

Procedures for operating and maintaining the sub-slab depressurization system are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP).

3.3.3 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

3.3.3.1 Cover System

The cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

3.3.3.2 Sub-Slab Depressurization (SSD) System

The active SSD system will not be discontinued unless prior written approval is granted by the NYSDEC and the NYSDOH. In the event that monitoring data indicates that the SSD system may no longer be required, a proposal to discontinue the SSD system will be submitted by the remedial party to the NYSDEC and NYSDOH.

The Site has Institutional Controls in the form of site restrictions. Adherence to these Institutional Controls is required by the Environmental Easement. Site restrictions that apply to the Controlled Property are:

- Requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);
- The Controlled Property may be used for Commercial as described in 6NYCRR Part 375-1.8 (g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv), although land is subject to local zoning laws;
- Restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Department, NYSDOH or County DOH; and

- Requires compliance with the Department approved Site Management Plan.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the Site are included in the Field Sampling & Quality Assurance Project Plan provided in Appendix C.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater, Indoor air, soil vapor, soils;
- Monitoring requirements of the SSD System;
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards and Part 375 SCOs for soil; and
- Evaluating Site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for groundwater monitoring wells and SSD system;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Site-wide Inspection

Site-wide inspections will be performed at a minimum of once per year. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections the following information will be recorded in field books, and copies will be provided to NYSDEC.

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General site conditions at the time of the inspection;
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that site records are up to date.

Inspections of all remedial components or ECs installed at the Site will be conducted. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review report. The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirement of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and
- If site records are complete and up to date.

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the Site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the Site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

4.3 SSD System Monitoring

4.3.1 Annual System Monitoring

The SSD System monitoring will be performed on an annual basis. Modifications to the frequency will require approval from NYSDEC. A visual inspection of the complete system will be conducted during the monitoring event. The following will be conducted during each monitoring event:

- Confirm operation of the vacuum blowers;
- PID readings of the effluent emission;
- Direct airflow within the extraction point PVC piping will be measured with a digital air flow meter recording in feet-per-minute to assure extraction is occurring at each point; and
- A visual inspection of the complete system will be performed by individual(s) experienced in troubleshooting the system components. Components that are damaged or not operating properly will be corrected;
- Inspection of building conditions to assure that changes or renovations have not occurred to impact air exchange between the occupied portion(s) of the building with the remaining unoccupied spaces. Any new air exchange pathways will be sealed; and
- Inspection of new building components, especially HVAC components that could affect the depressurization of the sub-slab will be performed. If

adequate depressurization is not occurring, reasons will be identified and corrected.

4.3.2 SSD System Expansion Requirements

If additional space within the industrial building on the Site becomes occupied, the SSD system will be expanded to influence the additional occupied space. If the attached office building that has a basement (residential structure) becomes occupied, a separate SSD system will be installed.

Before expanding the current SSD system or installing a separate SSD system in the attached building, a pilot study will be performed to determine the extent of potential airflow through the soils underlying the building slab. A pilot hole will be drilled through the concrete floor into the subsurface soils, a vacuum will be pulled through a pilot hole and the pressure will be measured to establish the radius of influence (ROI). Extraction points for a depressurization system will be laid out to effectively influence the entire sub-slab area using the determined ROI. Four-inch diameter holes will be cored into the concrete floor at the determined locations and the soils immediately below the concrete slab will be pulled through the core hole. PVC piping extraction points will be seated into the sub-slab material. PVC piping runs carry the soil vapor from below the concrete floor to effluent lines that will be installed at locations appropriate to existing building conditions. The effluent piping will exit the building and connect to a blower or an in-line fan capable of extracting at the required vacuum. The piping will be installed in a configuration that ensures that any water within the piping drains back toward the extraction points. Seals will be placed around extraction point penetrations through the concrete floor and the effluent pipe penetrations through roof or wall.

Verification of communication for the SSD system will be performed. Pilot holes will be drilled through the concrete floor and pressure measurements using a magnehelic gage with an accuracy of 0.001 inches of water will be recorded at each pilot point. The blower or fan will be turned on and allowed to run for 15 minutes prior to recording

airflow measurements. The NYSDOH minimum recommended pressure difference to assure sufficient vacuum is 0.004 inches of water.

The airflow within each extraction point will be measured with a digital air flow meter recording in feet-per-minute. The flow measurements will be collected between 3 and 5 feet above the floor surface from the vertical pipes connected to the points.

As part of the expansion of the SSD system, the follow building conditions will be revaluated:

- Reduction to air exchange between the occupied space(s) with the remaining unoccupied portions of the building. Reduction of air exchange may include installing seals on the sliding and overhead doors between the occupied and unoccupied space, sealing floor drains with grout/concrete, and sealing spaces where ceiling joints span the common wall between the occupied space and the unoccupied space; and
- The sealing of any cracks/joints in the concrete floor of the occupied space.

4.4 Post-Remediation Media Monitoring and Sampling

In accordance with the Remedial Action Work Plan, groundwater sampling is required semi-annually for one year. The sampling locations, required analytical parameters and schedule are provided in Table 4-1 – Post Remediation Groundwater Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table 4-1 Post Remediation Groundwater Sampling Requirements and Schedule

Sampling Location	Analytical Parameters	Schedule
	Cadmium, Chromium, Hexavalent Chromium and TCL Volatiles	
MW-3, MW-3HA, MW-4, MW-5R, MW-6, MW-7R, MW-8 and MW-9	X	May 2017 November 2017

Detailed sample collection and analytical procedures and protocols are provided in Appendix C – Field Sampling and Quality Assurance Project Plan.

4.4.1 Groundwater Sampling

Groundwater monitoring will be performed at the frequency noted in Table 4-1. Modification to the schedule or sampling requirements will require approval from the NYSDEC.

Monitoring wells have been installed to monitor on-site groundwater conditions at the Site. The monitoring well constructions details are presented on the Monitoring Well Construction Log in Appendix C, and elevation construction data has been summarized on Table 2-1.

If biofouling or silt accumulation occurs in the on-site and off-site monitoring well, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced, if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 7.0 – Reporting Requirements.

4.4.2 Soil Vapor Intrusion Sampling

Soil vapor sampling will not be required to be performed to assess the performance of the SSD system. Performance assessment of the SSD system will be based on blower operation and air flow measurement through the system.

4.4.3 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book. Other observations (e.g., groundwater monitoring well integrity, etc.) will be noted in the field book, and copies of this data will be available to NYSDEC.

5.0 OPERATION AND MAINTENANCE PLAN

5.1 General Operation and Maintenance of Sub-Slab Depressurization System

This Operation and Maintenance Plan provides a description of the measures necessary to operate, monitor and maintain the mechanical components of the remedy selected for the Site. This Operation and Maintenance Plan:

- Includes the procedures necessary to allow individuals unfamiliar with the Site to operate and maintain the SSD systems
- Will be updated periodically to reflect changes in site conditions or the manner in which the SSD system are operated and maintained.

SSD systems have been installed within the current occupied spaces of the Site's industrial building. The O&M associated with the SSD system is as follows.

- Operation: The SSD system is hardwired into the electrical system of the industrial building and designed to operate continuously. If power loss should occur, the SSD system will shut down. Upon power restoration, the system will restart automatically.

- Maintenance: If the SSD system is no longer operating, malfunctioning or there is a loss of vacuum, maintenance of the SSD system will be required. The type of maintenance will vary depending upon the component requiring attention. It will require a visit to the Site by a qualified individual to assess the problem.

- Monitoring: The SSD system will be visually inspected annually. Air flow measurement will be recorded from each extraction point to assure adequate flow.

5.2 SSD System Performance Criteria

Because the SSD system is designed to operate on a continual basis, the performance criteria for the system will be limited to the following items:

- SSD system should always be operational; and

- SSD system piping should remain intact with piping exhaust at the designated exterior locations.

5.3 O&M of SSD System

5.3.1 General SSD System Component Overview

There are seventeen (17) 4-inch diameter PVC pipes that run vertically from the floor slabs up to the ceiling joists that are connected to 4-inch diameter PVC horizontal runs that exit the industrial building through the roof at two locations. There are two roof-mounted high volume blowers (a 405 and a 505 Roton Blower) that operate continuously. Vapor from below the floor slab is pulled up through the vertical and horizontal extraction pipes and vented to the outdoors. The horizontal piping has been

pitched to allow for any moisture collection from within the system to flow back down the vertical piping.

There are holes in the vertical piping approximately 4 feet above floor level that are portals for recording air flow measurements.

The current tenant has been instructed to contact Mr. Joseph Morgan, if the system is not operating, or if the mitigation system becomes damaged (ex. breakage of extraction piping).

5.3.2 Expansion of the SSD System

As noted in Section 4.3.2, if additional space within the industrial building becomes occupied, the SSD system will be expanded to influence the additional occupied space. If the attached office building that has a basement (residential structure) becomes occupied, a separate SSD system will be installed.

5.3.3 Annual Monitoring Requirements

The annual monitoring requirements of the SSD system are as follows:

- Visual inspections of the system components and building will be performed by a qualified professional. Airflow readings using a digital air flow meter recording in feet-per-minute. and PID measurements will be made within each accessible extraction pipe during the inspections;
- Identify any changes to the building or to the HVAC system that would change or impact air exchange pathways; and
- Visually review to ensure all vertical and horizontal piping and associated couplings are in proper working conditions.

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climatic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

A summary of vulnerability assessments will not be conducted for the Site during periodic assessments, beyond those discussed in Section 4.2.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology.

6.3 Remedial System Optimization

A Remedial System Optimization (RSO) study will be conducted any time that the NYSDEC or the remedial party requests in writing that an in-depth evaluation of the remedy is needed. An RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the Decision Document;

- The management and operation of the remedial system is exceeding the estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- Plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;
- There is an anticipated transfer of the site management to another remedial party or agency; and
- A new and applicable remedial technology becomes available.

An RSO will provide a critique of a Site's conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the Site's cleanup goals, gather additional performance or media specific data and information and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy.

The RSO study will focuses on overall site cleanup strategy, process optimization and management with the intent of identifying impediments to cleanup and improvements to Site operations to increase efficiency, cost effectiveness and remedial time frames. Green remediation technology and principals are to be considered when performing the RSO.

7.0 REPORTING REQUIREMENTS

7.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded in field books, and copies provided to NYSDEC.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the Site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of the Periodic Review Report.

Table 9-1 Schedule of Inspection Reports

Task/Report	Reporting Frequency*
Periodic Review Report	Annually, or as otherwise determined by the Department

* The frequency of events will be conducted as specified until otherwise approved by the NYSDEC.

All inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and

- A determination as to whether contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and,
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

7.2 Periodic Review Report

A Periodic Review Report (PRR) will be submitted to the Department beginning sixteen (16) months after the Certificate of Completion is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted annually to the Department or at another frequency as may be required by the Department. In the event that the Site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the Site described in Appendix B -Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ICs required by the remedy for the site.
- Results of the required annual site inspections and severe condition inspections, if applicable.
- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS^{TM} database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.

A site evaluation, which includes the following:

- The compliance of the remedy with the requirements of the site-specific Decision Document;
- The operation and effectiveness of all treatment units; etc., including identification of any needed repairs or modifications;
- Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
- Recommendations regarding any necessary changes to the Monitoring and Sampling Plan;
- Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document; and
- The overall performance and effectiveness of the remedy.

A performance summary for all treatment systems at the site during the calendar year, including information such as:

- The number of days the system operated for the reporting period;
- The average, high, and low flows per day;
- The contaminant mass removed;
- A description of breakdowns and/or repairs along with an explanation for any significant downtime;
- A description of the resolution of performance problems;
- Alarm conditions;
- Trends in equipment failure;
- A summary of the performance, effluent and/or effectiveness monitoring; and
- Comments, conclusions, and recommendations based on data evaluation.

7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a qualified environmental professional or Professional Engineer licensed to practice in New York State will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

"*For each institutional or engineering control identified for the site, I certify that all of the following statements are true:*

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the site is compliant with the environmental easement;*
- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practices; and*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner/Remedial Party or Owner's/Remedial Party's Designated Site Representative]: [I have been authorized and designated by all site owners/remedial parties to sign this certification] for the site."

- *The assumptions made in the qualitative exposure assessment remain valid.*

The signed certification will be included in the Periodic Review Report.

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located and the NYSDOH Bureau of Environmental Exposure Investigation. The Periodic Review Report may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

At the end of each certifying period, as determined by the NYSDEC, the following certification will be provided to the Department:

"For each institutional identified for the site, I certify that all of the following statements are true:

- *The institutional control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*

- *Use of the site is compliant with the environmental easement.*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner or Owner's Designated Site Representative] or [and I have been authorized and designated by all site owners to sign this certification] for the site."

- *No new information has come to my attention, including groundwater monitoring data from wells located at the site boundary, if any, to indicate that the assumptions made in the qualitative exposure assessment of off-site contamination are no longer valid; and*
- *The assumptions made in the qualitative exposure assessment remain valid.*

The signed certification will be included in the Periodic Review Report.

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located and the NYSDOH Bureau of Environmental Exposure Investigation. The Periodic Review Report may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

7.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a Corrective Measures Work Plan will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC.

7.4 Remedial System Optimization Report

In the event that an RSO is to be performed (see Section 6.3, upon completion of an RSO), an RSO report must be submitted to the Department for approval. The RSO report will document the research/ investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, HASPs etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located, Site Control and the NYSDOH Bureau of Environmental Exposure Investigation.

8.0 REFERENCES

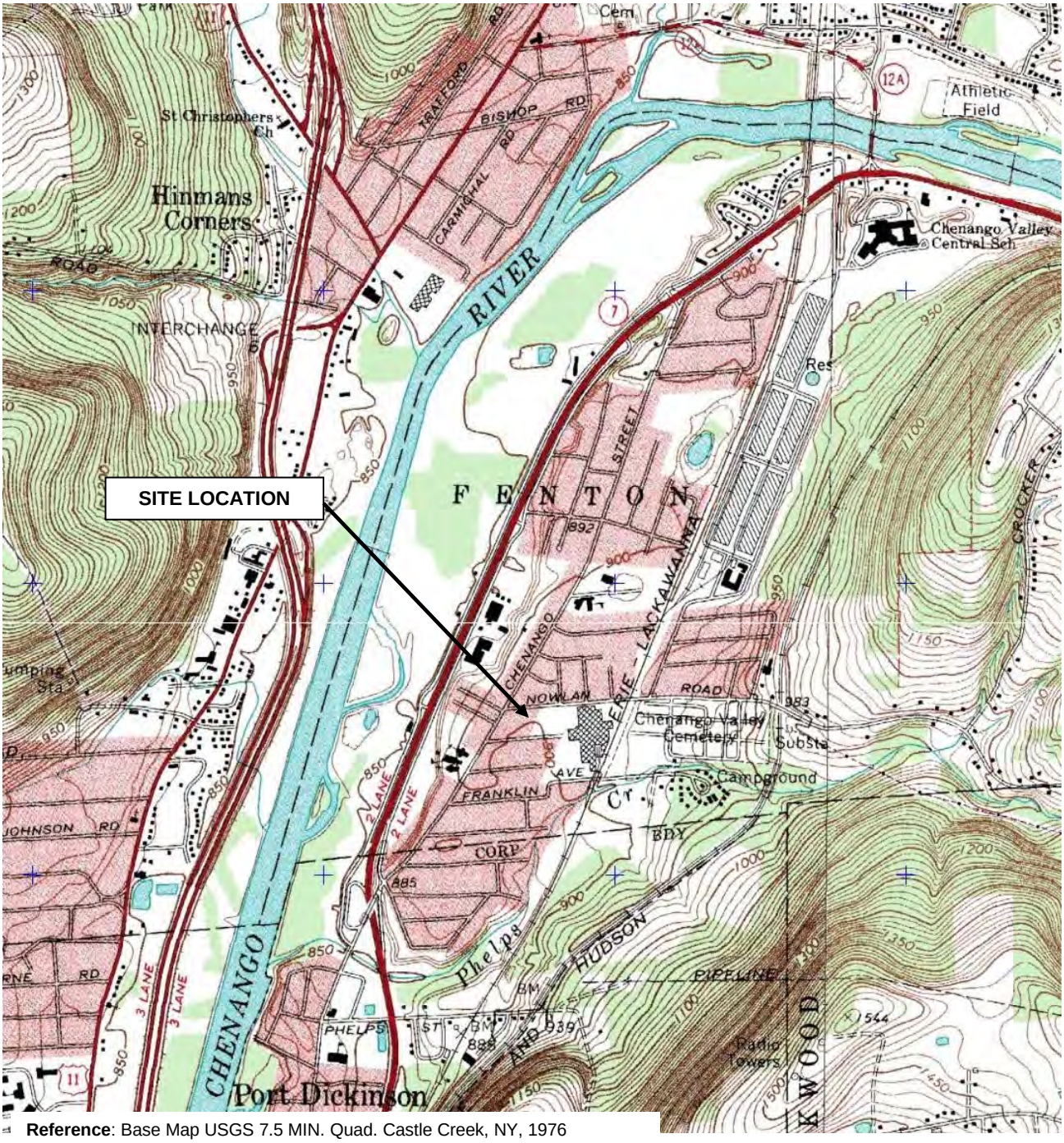
6NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.

DEC Program Policy. NYSDEC DER-10 – Technical Guidance for Site Investigation and Remediation. May 3, 2010.

NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).

NYSDOH. Guidance for Evaluating Soil Vapor Intrusion in the State of New York.

NYSDEC, 2015. Statement of Basis. TCMF Hillcrest Facility, Binghamton, Broome County, Site No. 704045, EPA No. NYD002226041. February 2015.



Reference: Base Map USGS 7.5 MIN. Quad. Castle Creek, NY, 1976
Approximate Scale: 1" = 2000'

N

North

GeoLogic

GeoLogic NY, Inc.

SITE LOCATION MAP
Triple Cities metal Finishing
Binghamton, New York
BCP Site No. 704045

DRAWN BY:	SCALE:	PROJECT NO:
sc	As Noted	99011A
REVIEWED BY:	DATE:	FIGURE NO:
kt	October 2016	1

N

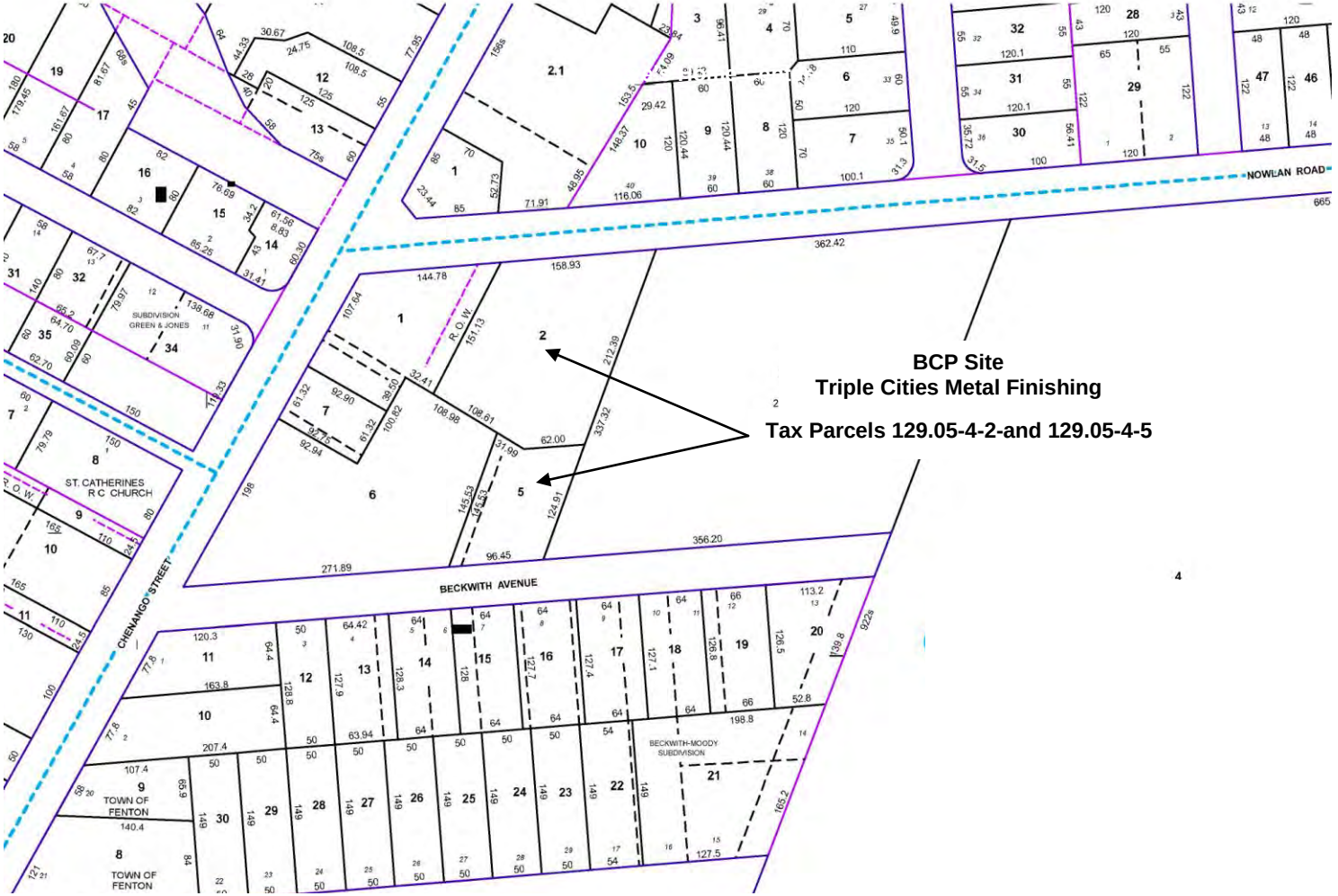
North

GeoLogic

GeoLogic NY, Inc.

SITE LAYOUT MAP
Triple Cities Metal Finishing
Binghamton, New York
BCP Site No. 704045

DRAWN BY:	SCALE:	PROJECT NO:
sc	As Noted	99011A
REVIEWED BY:	DATE:	FIGURE NO:
kt	October 2016	2



N

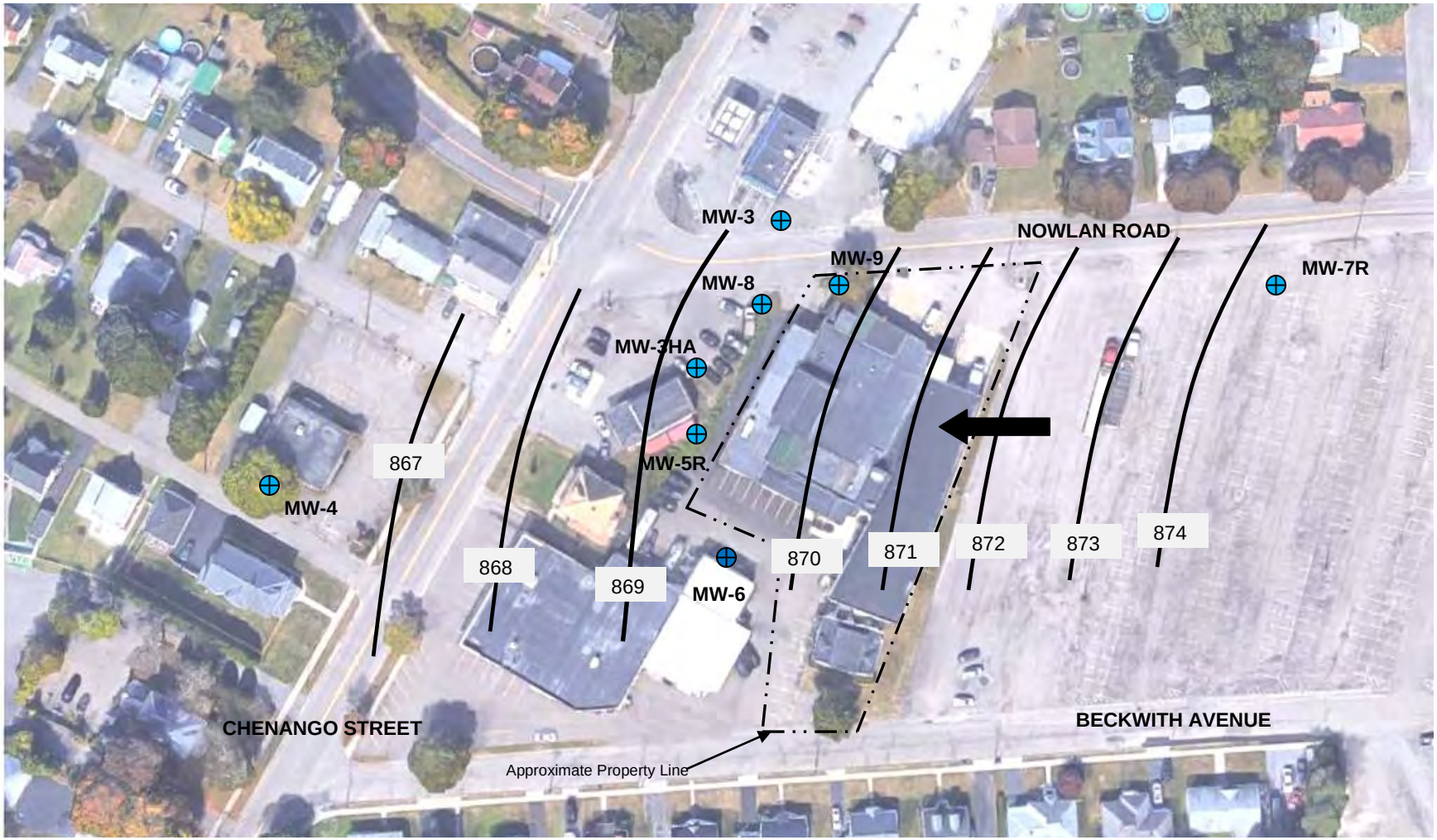
North

GeoLogic

GeoLogic NY, Inc.

TAX MAP
Triple Cities Metal Finishing
Binghamton, New York
BCP Site No. 704045

DRAWN BY:	SCALE:	PROJECT NO:
sc	Not To Scale	99011A
REVIEWED BY:	DATE:	FIGURE NO:
kt	October 2016	3



N

North

Legend:

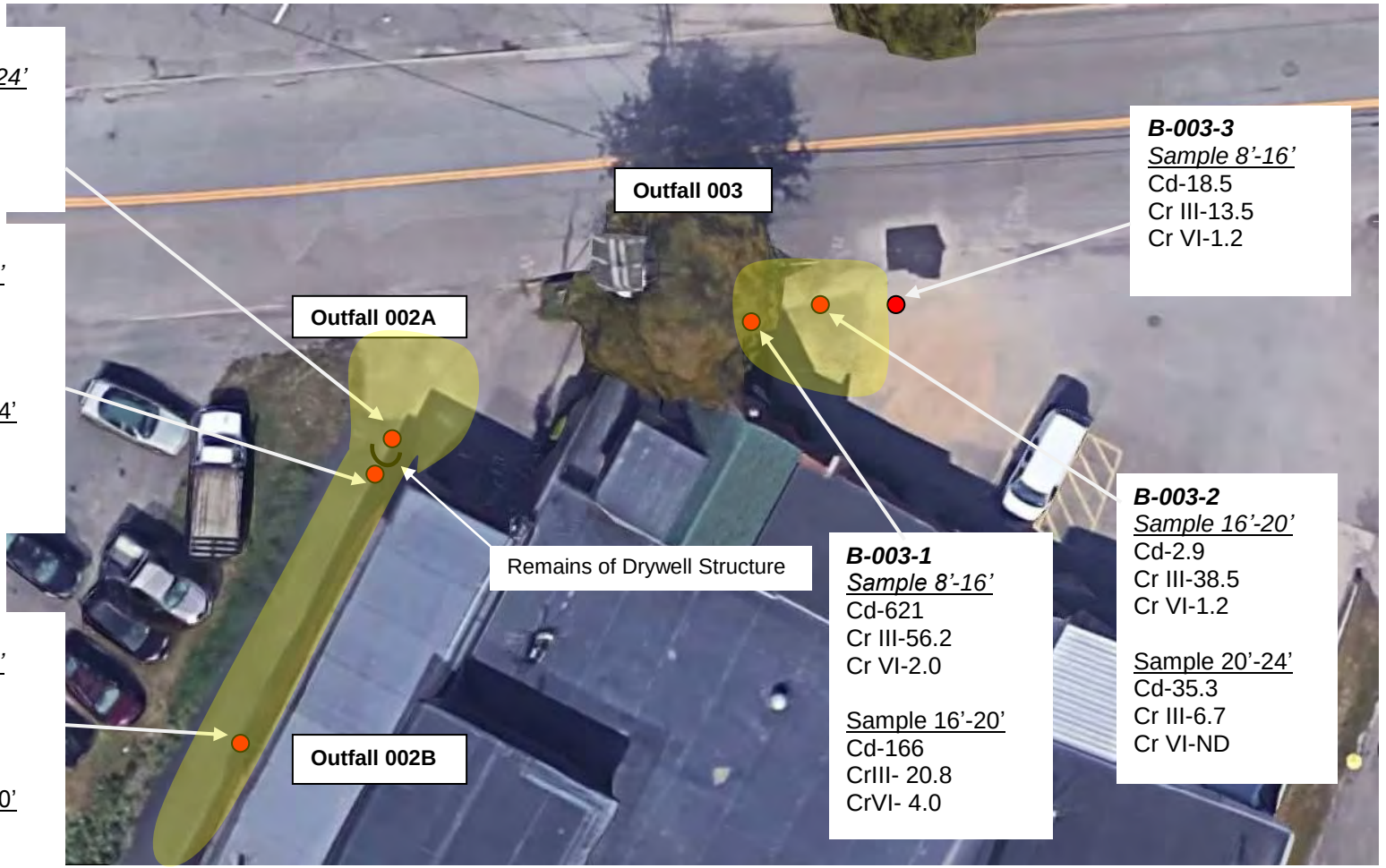
- Boring Location (Approximate)
- Groundwater Contour
- 867 Water Table Elevation, April 2016
- Direction of Groundwater Flow

GeoLogic

GeoLogic NY, Inc.

BORING LOCATION & WATER TABLE MAP
Triple Cities Metal Finishing
Binghamton, New York
BCP Site No. 704045

DRAWN BY:	SCALE:	PROJECT NO:
sc	Not To Scale	99011A
REVIEWED BY:	DATE:	FIGURE NO:
kt	October 2016	4



STABILIZATION AREA

POST-INJECTION SOIL BORING

N

North

Sample ID:	*Sample 8'-16'*
Total Concentration:	mg/kg
ND	Not detected above detection limit
Cd	Cadmium
Cr	Chromium
CR III	Trivalent Chromium
Cr VI	Hexavalent Chromium

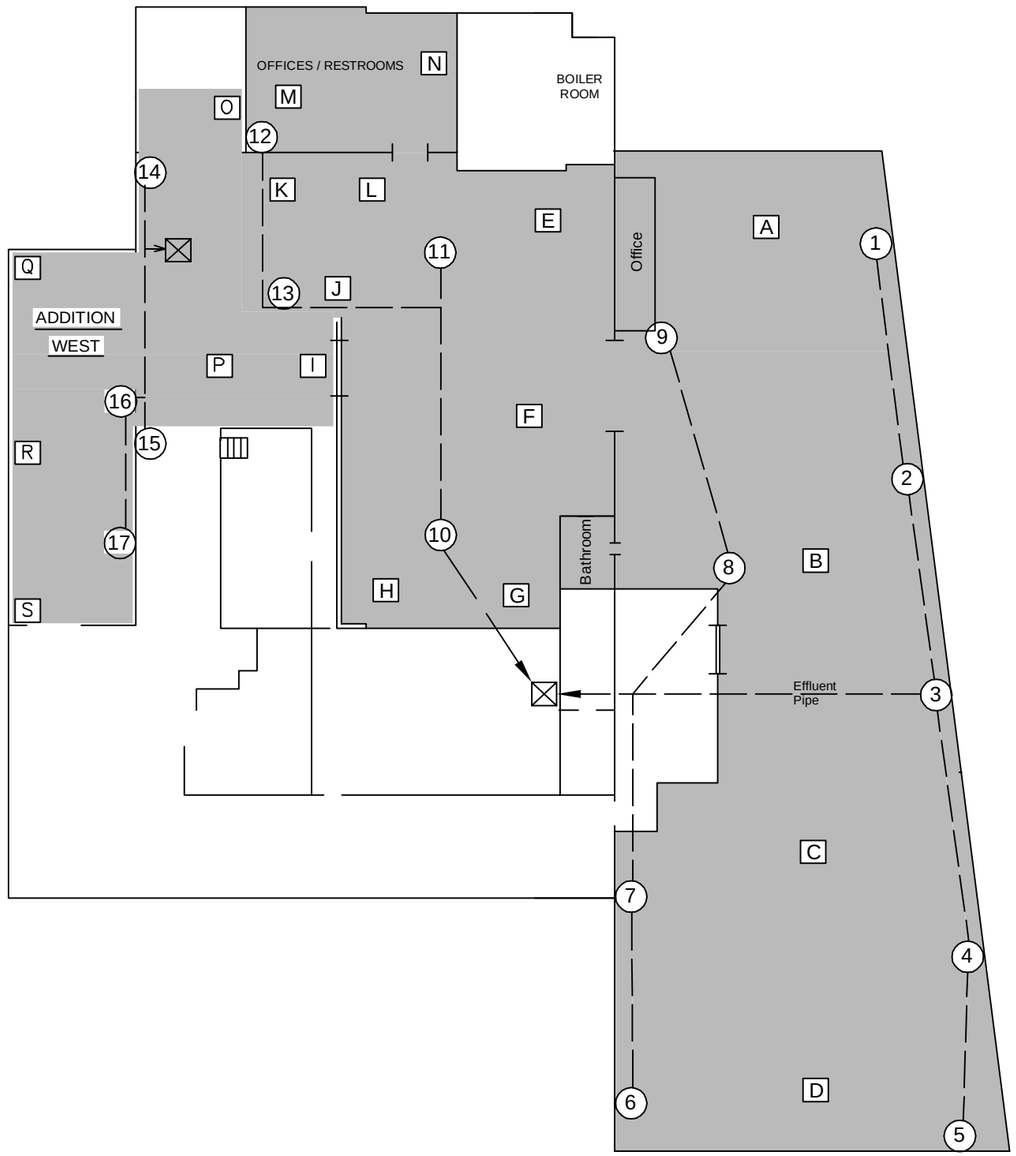
GeoLogic

GeoLogic NY, Inc.

REMAINING SOIL EXCEEDENCES & STABILIZATION AREA
Triple Cities Metal Finishing
Binghamton, New York
BCP Site No. 704045

DRAWN BY:	SCALE:	PROJECT NO:
sc	Not To Scale	99011A
REVIEWED BY:	DATE:	FIGURE NO:
kt	October 2016	5

NOWLAN ROAD



N

LEGEND:

1 EXTRACTION POINT-4" DIAMETER PVC PIPING

A PILOT POINT

ROTRON 404 AND 505 BLOWER

OCCUPIED AREA

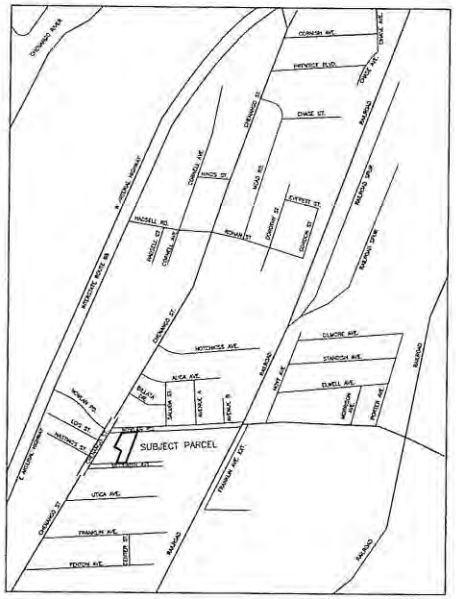
\..\99011A\BCP Files\Drawings\SSD SYSTEM 07-20-16.dwg

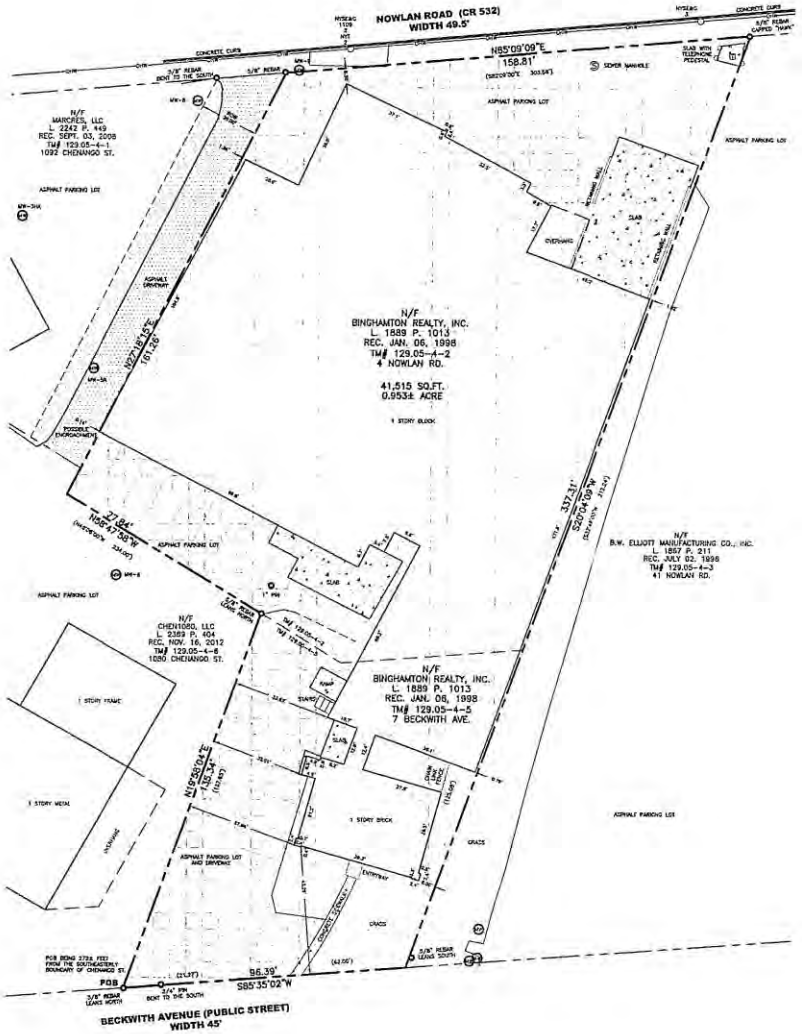
GeoLogic

GeoLogic NY, Inc., Homer, New York

SSD SYSTEM LOCATION MAP
TRIPLE CITIES METAL FINISHING
BINGHAMTON, NEW YORK
BCP Site No. 704045

DRAWN BY:	SCALE:	PROJECT NO.:
SMC/SDW	NTS	99011A
REVIEWED BY:	DATE:	FIGURE NO.:
KT	JULY 2016	6





LEGEND

- ● 5/8" REBAR "KEYSTONE ENG NY"
- ✪ MONUMENT FOUND AND NOTED
- ( ) RECORD DISTANCE
- N/F NOW OR FORMERLY
- TM# TAX MAP NUMBER
- PROPERTY LINE
- TAX MAP LINE
- UTILITY LINE
- OHW OVERHEAD UTILITIES
- BOLLARD
- MONITORING WELL
- ENVIRONMENTAL EASEMENT HATCH

NOTES

1. PREMISES SOURCE OF TITLE BEING L. 1889 P. 1013 RECORDED IN THE BROOME COUNTY CLERK'S OFFICE JANUARY 06, 1998.
2. SUBJECT TO ANY AND ALL EASEMENTS OF RECORD AND/OR AS FOUND IN THE FIELD.
3. THIS SURVEY WAS PREPARED WITHOUT THE BENEFIT OF AN ABSTRACT OF TITLE TO THE PROPERTY OR A TITLE REPORT.
4. BEARING SHIFT IS DIFFERENT FROM DEED. KEYSTONE ASSOCIATES USED A GRID NORTH FROM GPS. REFERENCE BEARINGS SHOWN.
5. COORDINATES ARE NEW YORK STATE PLANE, CENTRAL ZONE, NAD83. VERTICAL DATUM IS BASED ON NAVD 88.

WELL #	NORTHING	EASTING	CENTER CASING ELEV.	PVC TOP ELEV.	LOCATION
MW-3	783403.5122	1005886.2478	899.48	899.20	OFF SITE
MW-3RA	783304.3395	1005812.8401	901.76	901.53	SHOWN
MW-4	783209.7827	1005831.7598	899.66	899.09	OFF SITE
MW-5R	783252.8406	1005857.6358	898.65	898.27	SHOWN
MW-6	783182.3429	1005845.9462	897.46	897.21	SHOWN
MW-7R	783360.8092	1005938.7681	896.99	896.42	OFF SITE
MW-8	783343.6211	1005872.5918	899.68	899.47	SHOWN
MW-9	783354.1739	1005907.1997	899.02	898.64	SHOWN

REFERENCE MAPS

1. MAP ENTITLED "BOUNDARY SURVEY, B.W. ELLIOTT MANUFACTURING CO., INC., 11 BECKWITH AVENUE, TOWN OF FENTON, BROOME COUNTY, NEW YORK STATE" PREPARED BY HAWK ENGINEERING, P.C. AS PROJECT # 552.88.02 ON AUGUST 23, 1988.
2. MAP ENTITLED "BOUNDARY MAP, PARCEL TO BE ACQUIRED BY TRIPLE CITIES METAL FINISHING CORP., BECKWITH AVENUE, TOWN OF FENTON, BROOME COUNTY, NEW YORK STATE" PREPARED BY HAWK ENGINEERING, P.C. AS PROJECT # 493.88.01 ON SEPTEMBER 30, 1988.
3. MAP ENTITLED "BOUNDARY MAP, PARCEL TO BE ACQUIRED BY TRIPLE CITIES METAL FINISHING CORPORATION, 1080 CHENANGO STREET (CR. 129), TOWN OF FENTON, BROOME COUNTY, NEW YORK STATE" PREPARED BY HAWK ENGINEERING, P.C. AS PROJECT # 99493.01 ON MARCH 31, 1997.

SURVEYOR'S DESCRIPTION OF TM# 129.05-4-2 & TM# 129.05-4-5
ALSO BEING THE ENVIRONMENTAL EASEMENT AREA

ALL THOSE TRACTS OR PARCELS OF LAND situate in the Town of Fenton, County of Broome, State of New York, being all of the property now or formerly of Binghamton Realty Inc. as recorded in the Broome County Clerk's Office in L. 1889 P. 1013 on January 06, 1998 (TM# 129.05-4-2 and TM# 129.05-4-5), together hereinafter referred to as Binghamton Realty, Inc., bounded and described as follows:

BEGINNING at a 5/8" rebar on the northerly boundary of Beckwith Avenue at its intersection with the division line between the property now or formerly of Chen1080, LLC per L. 2383 P. 404 (TM# 129.05-4-6) on the north-east and said Binghamton Realty, Inc. on the southeast;

RUNNING THENCE along the division lines between said Chen1080, LLC and said Binghamton Realty, Inc. the following three (3) courses and distances:
1) N19°58'04"E, a distance of 128.34 feet to a 5/8 inch rebar;
2) N56°47'58"W, a distance of 27.84 feet to a point;
3) N27°18'15"E and along the division line between the property now or formerly of Marcres, LLC per L. 2242 P. 449 (TM# 129.05-4-1) on the north-east and said Binghamton Realty, Inc. on the southeast, a distance of 161.26 feet to a 5/8 inch rebar at its intersection with the southerly boundary of Nowlan Road; thence N85°09'09"E along said southerly boundary, a distance of 158.81 feet to a 5/8 inch rebar capped "HAWK" at its intersection with the division line between the property now or formerly of B.W. Elliott Manufacturing Co., Inc. per L. 1857 P. 211 (TM# 129.05-4-3) on the east and said Binghamton Realty, Inc. on the west; thence S20°04'09"W along the last mentioned division line, a distance of 337.31 feet to a point at its intersection with said northerly boundary of Beckwith Avenue; thence S85°35'02"W along said Beckwith Avenue, a distance of 96.39 feet to the POINT OF BEGINNING.

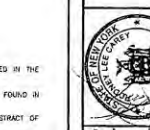
The above described parcel contains 41,515 square feet or 0.953 acre, more or less.

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the New York Environmental Conservation Law. The engineering and institutional controls for this Easement are set forth in more detail in the Site Management Plan (SMP). A copy of the SMP must be obtained by any party with an interest in the property. The SMP can be obtained from NYS Department of Environmental Conservation, Division of Environmental Remediation, Site Control Section, 625 Broadway, Albany, NY 12233 or at www.derweb@dec.ny.gov.

I hereby certify to BINGHAMTON REALTY, INC.; NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, GEOLOGIC NY, INC., and BOND SCHOENECK & KING that this survey was prepared in accordance with the current Code of Practice for Land Surveys adopted by the New York State Association of Professional Land Surveyors, Inc. and with the "Survey Requirements for Environmental Easements". This certification is limited to persons for whom this map is prepared, to the title company and to the lending institution listed. Certifications are not transferable to additional institutions or subsequent owners.

59 Exchange Street
Binghamton, New York 13901
Phone: 607.722.1100
Fax: 607.722.5515
Email: info@keystoneprof.com
www.keystoneprof.com

KEYSTONE ASSOCIATES
ARCHITECTS, ENGINEERS AND SURVEYORS, LLC



MICHAEL L. CAREY, PLS, NY LIC. NO. 049640

REVISIONS AND RESUBMITTALS

DESCRIPTION	DATE

ENVIRONMENTAL EASEMENT DESCRIPTION
FOR
DEPARTMENT SITE NO. C704045
BINGHAMTON REALTY, INC.
4 NOWLAN ROAD & 7 BECKWITH AVENUE
TOWN OF FENTON BROOME COUNTY NEW YORK STATE

SHEET NO.
EED-1

PROJECT NO.
1999.02119

DATE OF FIELD WORK
04/12/16

DATE OF MAP
04/22/16

LAST REVISED
(PROPOSED EASEMENT)

INSTITUTIONAL CONTROL BOUNDARIES
Triple Cities Metal Finishing
Binghamton, New York
BCP SITE No. 704045
Figure No. 7

APPENDIX A – LIST OF SITE CONTACTS

Joseph C. Morgan Sr.; President, Binghamton Realty, Inc.	607.722.3431; jmorgan@tcmfcorp.com
Charles Morgan, President, Triple Cities Metal Finishing Corporation	607.722.3431; cmorgan@tcmfcorp.com
Gary W. Priscott, NYSDEC Project Manager	607.775.2545, gary.priscott@dec.ny.gov
Harry Warner, NYSDEC HW Engineer	315.426.7551, harry.warner@dec.ny.gov
Kelly Lewandowski, NYSDEC Site Control	518.402.9569; kelly.lewandowski@de.ny.gov

APPENDIX B – ENVIRONMENTAL EASEMENT

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 24th day of October, 2016 between Owner(s) Binghamton Realty, Inc., having an office at 349 Industrial Park Drive, Binghamton, New York 13904, County of Broome, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 4 Nowlan Road and 7 Beckwith Avenue in the Town of Fenton, County of Broome and State of New York, known and designated on the tax map of the County Clerk of Broome as tax map parcel numbers: Section 129.05 Block 4 Lots 2 and 5, being the same as that property conveyed to Grantor by deed dated December 12, 1997 and recorded in the Broome County Clerk's Office in Liber and Page 01889/1013. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 0.953 +/- acres, and is hereinafter more fully described in the Land Title Survey dated April 22, 2016 prepared by Rodney Lee Carey, L.L.S. of Keystone Associates, which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is

extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Brownfield Cleanup Agreement Index Number: B7-0675-04-09, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the Controlled Property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Broome County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the Controlled Property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the Controlled Property must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential or Restricted Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i) and (ii), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation

Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the Controlled Property to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to the controlled property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against

the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: C704045
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the

recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Controlled Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

Remainder of Page Intentionally Left Blank

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

Binghamton Realty, Inc.:

By: _____

Print Name: Charles J Morgan

Title: President Date: 10-10-16

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF Broome)

On the 10th day of October, in the year 2016, before me, the undersigned, personally appeared Charles J Morgan, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Penny L Greene
Notary Public - State of New York

PENNY L. GREENE
Notary Public, State of New York
Registration No. 01GR6037425
Qualified in Broome County
Commission Expires 3-22-2018

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting By and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: _____
Robert W. Schick, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 24th day of October, in the year 2016, before me, the undersigned, personally appeared Robert W. Schick, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public / State of New York

David J. Chiusano
Notary Public, State of New York
No. 01CH5032146
Qualified in Schenectady County
Commission Expires August 22, 2018

SCHEDULE "A" PROPERTY DESCRIPTION

ENVIRONMENTAL EASEMENT DESCRIPTION
DEPARTMENT SITE NO. C704045
BINGHAMTON REALTY INC.
4 NOWLAN ROAD
7 BECKWITH AVENUE
TOWN OF FENTON
BROOME COUNTY, NEW YORK STATE

ALL THOSE TRACTS OR PARCELS OF LAND situate in the Town of Fenton, County of Broome, State of New York, being all of the property now or formerly of Binghamton Realty Inc. as recorded in the Broome County Clerk's Office in L. 1889 P. 1013 on January 06, 1998 (TM# 129.05-4-2 and TM# 129.05-4-5), together hereinafter referred to as Binghamton Realty, Inc., bounded and described as follows:

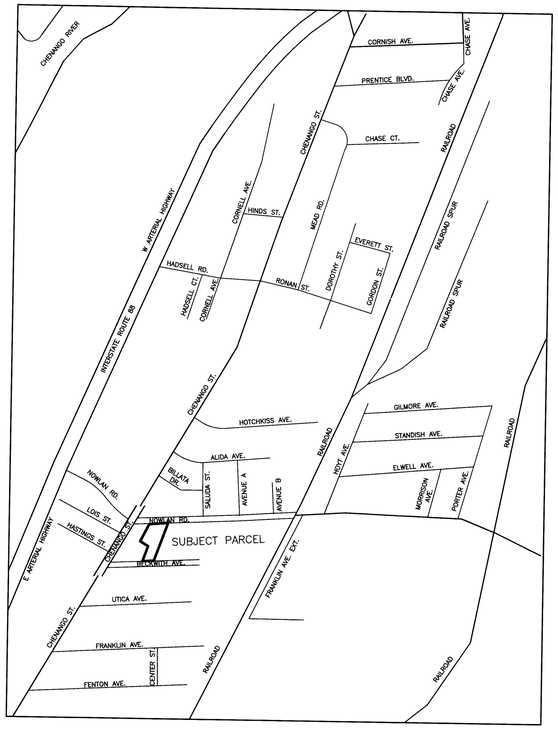
BEGINNING at a 5/8" rebar on the northerly boundary of Beckwith Avenue at its intersection with the division line between the property now or formerly of Chen1080, LLC per L. 2389 P. 404 (TM# 129.05-4-6) on the northwest and said Binghamton Realty, Inc. on the southeast;

RUNNING THENCE along the division lines between said Chen1080, LLC and said Binghamton Realty, Inc. the following three (3) courses and distances:

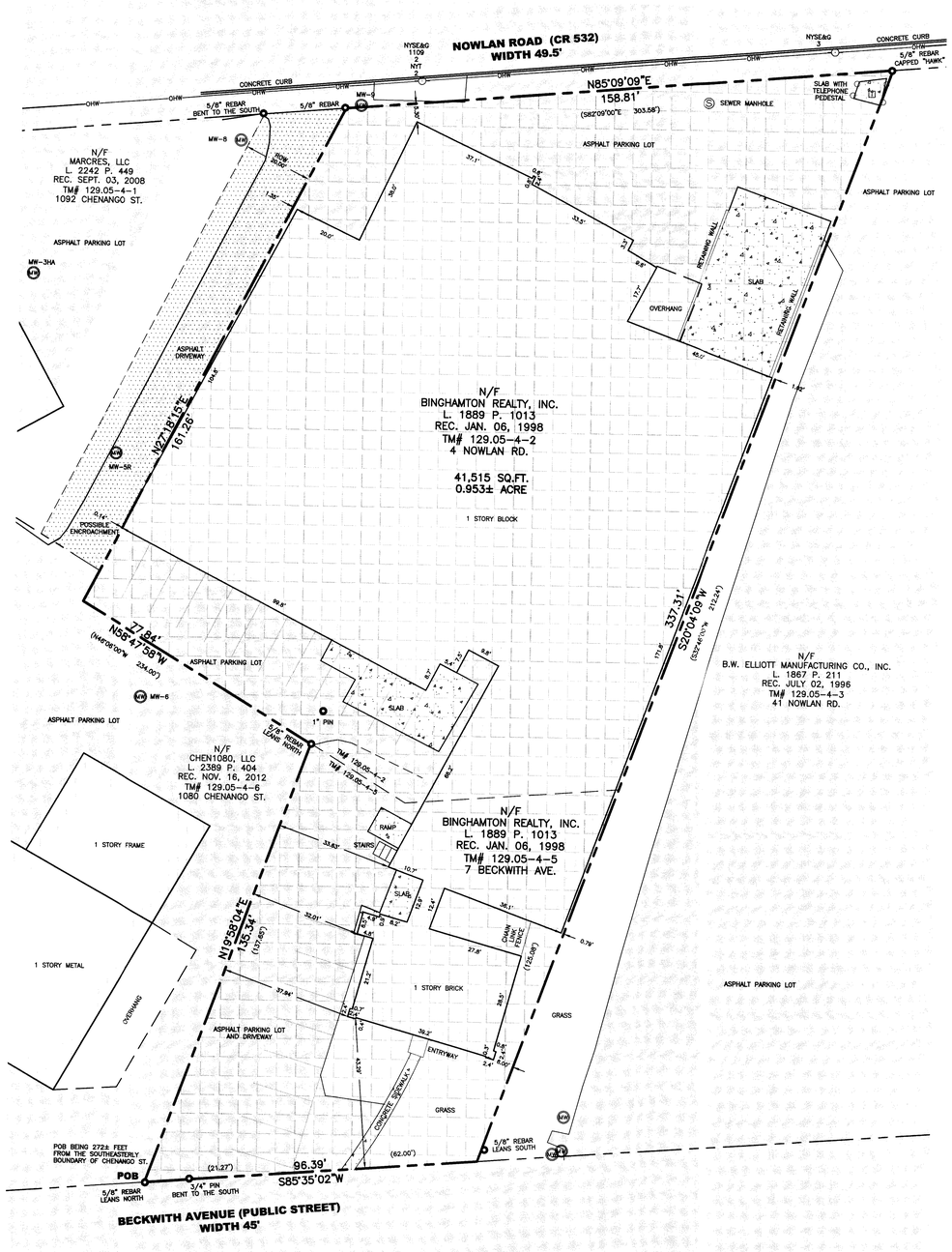
1) N19°58'04"E, a distance of 135.34 feet to a 5/8 inch rebar;
2) N58°47'58"W, a distance of 77.84 feet to a point;
3) N27°18'15"E and along the division line between the property now or formerly of Marcres, LLC per L. 2242 P. 449 (TM# 129.05-4-1) on the northwest and said Binghamton Realty, Inc. on the southeast, a distance of 161.26 feet to a 5/8 inch rebar at its intersection with the southerly boundary of Nowlan Road; thence N85°09'09"E along said southerly boundary, a distance of 158.81 feet to a 5/8 inch rebar capped "HAWK" at its intersection with the division line between the property now or formerly of B.W. Elliott Manufacturing Co., Inc. per L. 1867 P. 211 (TM# 129.05-4-3) on the east and said Binghamton Realty, Inc. on the west; thence S20°04'09"W along the last mentioned division line, a distance of 337.31 feet to a point at its intersection with said northerly boundary of Beckwith Avenue; thence S85°35'02"W along said Beckwith Avenue, a distance of 96.39 feet to the POINT OF BEGINNING.

The above described parcel contains 41,515 square feet or 0.953 acre, more or less.

TRUE NORTH
NYSG MERIDIAN
WEST ZONE/ISLAND



VICINITY MAP
1" = 600'



LEGEND

- ● 5/8" REBAR "KEYSTONE BING NY"
- ○ MONUMENT FOUND AND NOTED
- ( ) RECORD DISTANCE
- N/F NOW OR FORMERLY
- TM# TAX MAP NUMBER
- PROPERTY LINE
- TAX MAP LINE
- UTILITY POLE
- OHW OVERHEAD UTILITIES
- BOLLARD
- MW MONITORING WELL
- ENVIRONMENTAL EASEMENT HATCH

NOTES

1. PREMISES SOURCE OF TITLE BEING L. 1889 P. 1013 RECORDED IN THE BROOME COUNTY CLERK'S OFFICE JANUARY 06, 1998.
2. SUBJECT TO ANY AND ALL EASEMENTS OF RECORD AND/OR AS FOUND IN THE FIELD.
3. THIS SURVEY WAS PREPARED WITHOUT THE BENEFIT OF AN ABSTRACT OF TITLE TO THE PROPERTY OR A TITLE REPORT.
4. BEARING SHIFT IS DIFFERENT FROM DEED. KEYSTONE ASSOCIATES USED A GRID NORTH FROM GPS. REFERENCE BEARINGS SHOWN.
5. COORDINATES ARE NEW YORK STATE PLANE, CENTRAL ZONE, NAD83. VERTICAL DATUM IS BASED ON NAVD 88.

WELL #	NORTHING	EASTING	CENTER CASING ELEV	PVC TOP ELEV	LOCATION
MW-3	783403.1122	1008886.2479	899.48	899.30	OFF SITE
MW-3HA	783304.3395	1008812.9401	901.76	901.53	SHOWN
MW-4	783209.7827	1008531.7598	899.66	899.01	OFF SITE
MW-5R	783252.8408	1008837.6359	898.65	898.27	SHOWN
MW-6	783182.5429	1008845.9412	897.46	897.21	SHOWN
MW-7R	783360.8092	1009238.7661	896.99	896.40	OFF SITE
MW-8	783343.6211	1008872.5918	899.88	899.47	SHOWN
MW-9	783354.1739	1008907.1997	899.02	898.64	SHOWN

SURVEYOR'S DESCRIPTION OF TM# 129.05-4-2 & TM# 129.05-4-5
ALSO BEING THE ENVIRONMENTAL EASEMENT AREA

ALL THOSE TRACTS OR PARCELS OF LAND situate in the Town of Fenton, County of Broome, State of New York, being all of the property now or formerly of Binghamton Realty Inc. as recorded in the Broome County Clerk's Office in L. 1889 P. 1013 on January 06, 1998 (TM# 129.05-4-2 and TM# 129.05-4-5), together hereinafter referred to as Binghamton Realty, Inc., bounded and described as follows:

BEGINNING at a 5/8" rebar on the northerly boundary of Beckwith Avenue at its intersection with the division line between the property now or formerly of Chen1080, LLC per L. 2389 P. 404 (TM# 129.05-4-6) on the northwest and said Binghamton Realty, Inc. on the southeast;

RUNNING THENCE along the division lines between said Chen1080, LLC and said Binghamton Realty, Inc. the following three (3) courses and distances:
1) N19°58'04"E, a distance of 135.34 feet to a 5/8 inch rebar;
2) N58°47'58"W, a distance of 77.84 feet to a point;
3) N27°18'15"E and along the division line between the property now or formerly of Marcres, LLC per L. 2242 P. 449 (TM# 129.05-4-1) on the northwest and said Binghamton Realty, Inc. on the southeast, a distance of 161.26 feet to a 5/8 inch rebar at its intersection with the southerly boundary of Nowlan Road; thence N85°09'09"E along said southerly boundary, a distance of 158.81 feet to a 5/8 inch rebar capped "HAWK" at its intersection with the division line between the property now or formerly of B.W. Elliott Manufacturing Co., Inc. per L. 1867 P. 211 (TM# 129.05-4-3) on the east and said Binghamton Realty, Inc. on the west; thence S20°04'09"W along the last mentioned division line, a distance of 337.31 feet to a point at its intersection with said northerly boundary of Beckwith Avenue; thence S85°35'02"W along said Beckwith Avenue, a distance of 96.39 feet to the POINT OF BEGINNING.

The above described parcel contains 41,515 square feet or 0.953 acre, more or less.

REFERENCE MAPS

1. MAP ENTITLED "BOUNDARY SURVEY, B.W. ELLIOTT MANUFACTURING CO., INC., 11 BECKWITH AVENUE, TOWN OF FENTON, BROOME COUNTY, NEW YORK STATE" PREPARED BY HAWK ENGINEERING, P.C. AS PROJECT # 552.88.02 ON AUGUST 23, 1988.
2. MAP ENTITLED "BOUNDARY MAP, PARCEL TO BE ACQUIRED BY TRIPLE CITIES METAL FINISHING CORP., BECKWITH AVENUE, TOWN OF FENTON, BROOME COUNTY, NEW YORK STATE" PREPARED BY HAWK ENGINEERING, P.C. AS PROJECT # 493.88.01 ON SEPTEMBER 30, 1988.
3. MAP ENTITLED "BOUNDARY MAP, PARCEL TO BE ACQUIRED BY TRIPLE CITIES METAL FINISHING CORPORATION, 1080 CHENANGO STREET (CR. 129), TOWN OF FENTON, BROOME COUNTY, NEW YORK STATE" PREPARED BY HAWK ENGINEERING, P.C. AS PROJECT # 99493.01 ON MARCH 31, 1997.

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the New York Environmental Conservation Law. The engineering and institutional controls for this Easement are set forth in more detail in the Site Management Plan (SMP). A copy of the SMP must be obtained by any party with an interest in the property. The SMP can be obtained from NYS Department of Environmental Conservation, Division of Environmental Remediation, Site Control Section, 625 Broadway, Albany, NY 12233 or at www.derweb@dec.ny.gov.

GRAPHIC SCALE
4.8 2.4 0 2.4 4.8 9.6
(IN METERS)
1 centimeter = 2.4 meters

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

I hereby certify to BINGHAMTON REALTY, INC.; NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION; GEOLOGIC NY, INC.; and BOND SCHOENECK & KING that this survey was prepared in accordance with the current Code of Practice for Land Surveys adopted by the New York State Association of Professional Land Surveyors, Inc. and with the "Survey Requirements for Environmental Easements". This certification is limited to persons for whom this map is prepared, to the title company and to the lending institution listed. Certifications are not transferable to additional institutions or subsequent owners.

58 Exchange Street
Binghamton, New York 13901
Phone: 607.722.1100
Fax: 607.722.2515
Email: info@keystonep.com
www.keystonep.com

KEYSTONE ASSOCIATES
ARCHITECTS, ENGINEERS AND SURVEYORS, LLC

STATE OF NEW YORK
ROBERT LEE CAREY
No 049642
LICENSED LAND SURVEYOR
ROBERT L. CAREY, PLS LIC. NO. 049642

REVISIONS AND DESCRIPTIONS | NO. | DATE:

ENVIRONMENTAL EASEMENT DESCRIPTION
FOR
DEPARTMENT SITE NO. C704045
BINGHAMTON REALTY, INC.
4 NOWLAN ROAD & 7 BECKWITH AVENUE
TOWN OF FENTON BROOME COUNTY NEW YORK STATE

SHEET NO.
EED-1

PROJECT NO.
1899.02116

DATE OF FIELD WORK:
04/12/16

DATE OF MAP:
04/22/16

CAD FILE NO.:
1899021 6EED-1.dwg

APPENDIX C
FIELD SAMPLING AND QUALITY ASSURANCE PROJECT PLAN AND MONITORING WELL CONSTRUCTION LOGS

GeoLogic

TRIPLE CITIES METAL FINISHING
HILLCREST FACILITY
4 NOWLAN ROAD
BINGHAMTON, BROOME COUNTY, NEW YORK

FIELD SAMPLING AND QUALITY ASSURANCE PROJECT PLAN

FOR THE

SITE MANAGEMENT PLAN
NYSDEC Site No. 704045

Prepared By:
GeoLogic NY, Inc.
October 2016

INTRODUCTION

This Field Sampling and Quality Assurance Project Plan is for the Site Management Plan for Triple Cities Metal Finishing, Hillcrest Facility Brownfield Project in Binghamton, Broome County, New York.

QUALITY ASSURANCE PROJECT PLAN (QAPP)

Project Description

This Sampling and Analysis Plan includes identification of sampling locations and media; methods for collection, handling, and preservation; and the protocols to be used for sample analysis. Environmental media to be sampled is groundwater. The data will be utilized to form conclusions as to the presence, transport, and fate of site specific contaminants.

Field Sampling Procedures

All sampling objectives, locations and procedures have been included IN the Field Sampling Plan and described in this Sampling and Analysis Plan. Items include field measurement techniques, general field decontamination procedures, and sample acquisition and management.

Analytical Methodologies

Sampling and analysis will be performed for the Superfund Target Compound List (TCL) parameters for volatile organic compounds by EPA Method 8260, hexavalent chromium by EPA Method 7196, total chromium and cadmium by EPA Method 6010. Analysis of these samples will be consistent with the NYSDEC ASP 2005, Category B requirements. Trip blanks will accompany each shipment of aqueous samples. If several samples are collected for analysis on any one day, all samples will be packed in the same cooler with the trip blank. All trip blanks will be analyzed according to NYSDEC ASP (2005) protocol. All data will be presented in modified Category B reportables/deliverables format.

Additional groundwater analyses will be conducted to evaluate the post injection stabilization as indicated in the Addendum to the Remedial Action Work Plan, dated July 2016. Analysis of these samples will not be consistent with the NYSDEC ASP 2005, Category B requirements

Laboratory Certification and Coordination

All chemical analyses for samples collected will be completed by Pace Analytical, a CLP laboratory capable of performing project-specific analysis indicated in the attached QA/QC requirements. The project manager will be responsible for all project-related laboratory coordination.

Analytical Quality Control

Analytical quality control will be consistent with the methodologies and quality assurance/quality control requirements in the NYSDEC ASP 2005. This analytical data will be subject to data usability reviews in general accordance with NYSDEC ASP Category B reportable and deliverable formats. Data Usability Summary Reports (DUSR) will be prepared in a manner consistent with NYSDEC's Guidance for Data Deliverables and Development of Data Usability Summary Reports, NYSDEC DER-10, May 2010. The main objective of a DUSR is to determine whether the data presented meets the project-specific needs for data quality and data use.

FIELD SAMPLING PLAN

Sampling Objectives

Field sampling at Triple Cities Metal Finishing has been designed to obtain representative samples of environmental media to further assess the impact that the site may have upon human health and the environment, as well as analyzed for parameters that influence the biodegradation of the contaminant. The field sampling plan includes sampling for groundwater.

Groundwater

Monitoring wells MW-3, MW-3HA, MW-4, MW-5R, MW-6, MW-7R, MW-8 and MW-9 are the wells that will be sampled at the frequency indicated in the Remedial Action Work Plan and the Addendum to the Remedial Action Work Plan.

Field Measurement Techniques

Water Level Measurement – Water elevations will be taken on all wells prior to purging and sampling. The procedure for measuring water levels in the monitoring wells is:

- Unlock and remove well cap;
- Measure water level to nearest 0.01 foot with a water level indicator (electronic); and
- Decontaminate water level indicators before moving to next well. The tape and cable are decontaminated by washing in a bucket of potable water-biodegradable phosphate-free detergent solution, followed by a rinse with distilled water.

Field Parameter - Multimeter – The meters will be field calibrated daily and operated in accordance with the manufacturer's instructions.

Photoionization Detector (PID) – The PID will be calibrated daily (and more often as required by the manufacturer's data) prior to use in the field, using calibration test gases.

Sampling Procedures

The following sections provide procedures for collecting soil and groundwater samples.

Preparation for Sampling

The sample collection technique is of prime importance to assure the integrity of the collected sample. The following techniques include provisions so that:

- A representative sample is obtained;
- Contamination of the sample is minimized;
- The sample is properly preserved; and
- An acceptable Chain-of-Custody record is maintained.

The QA/QC Sampling Component of the Plan includes:

- Incorporation of accepted sampling techniques referenced in the sampling plan;
- Procedures for documenting any field actions contrary to the QA/QC Plan;
- Documentation of all preliminary activities such as equipment check-out, calibrations, and container storage and preparation;
- Documentation of field measurement quality control data (quality control procedures for such measurements shall be equivalent to corresponding QC procedures);
- Documentation of field activities;
- Documentation of post-field activities including sample shipment and receipt, field team debriefing, and equipment check-in;
- Generation of quality control samples including duplicate samples and trip blanks; and
- The use of these samples in the context of data evaluation with details of the methods employed (including statistical methods) and of the criteria upon which the information generated will be judged.

The personnel responsible for collection of groundwater samples will be familiar with standard sampling procedures and follow the appropriate protocol. Field records will be maintained in bound notebooks with numbered pages to document daily instrument calibration, locations sampled, field observations, and weather conditions. Each page will be dated and signed by the sampler. Each notebook will be numbered and a log of notebooks will be maintained by the project manager.

Prior to sampling, all equipment must be procured and accommodations for sample container delivery, and sample shipment must be made. The following is a list of general equipment that would be on hand for sampling events. Special equipment for each sampling event is presented in the section describing that specific sampling event.

General Field Sampling Equipment

- Project Data Information/Plans
- Chain-of-Custody forms
- Nitrile/Vinyl gloves
- Photoionization detector (PID)
- Bio-degradable phosphate free detergent

- Coolers (with ice)
- Sample bottles
- Tap water/Distilled water

Groundwater Sample Collection

Groundwater samples will be collected using dedicated, disposable HDPE bailers following evacuation of three borehole volumes or complete purging of the well using low-flow purging techniques. All other related sampling equipment will be properly decontaminated in the field. The following equipment will be available for sampling of monitoring wells in addition to the general sampling equipment list:

- Well Data Information/Plans
- Dedicated disposable bailers/Peristaltic pump with disposable tubing
- Electronic water level indicator
- YSI Multimeter (or comparable)
- Preserved sample containers
- Nitrile/Vinyl gloves

The following steps describe the sample preparation and collection of groundwater:

1. Obtain the sampling parameters for each well to be sampled.

2. Select the appropriate sample containers for the day's sampling.

3. Unlock and remove the well cap.

4. In order to obtain a representative sample of the formation water, the well must be purged of the static water within the well. Prior to purging, the static water level within the well must be measured and the measurement recorded in the field book. To determine the amount of water necessary to purge, find the liquid column height in the well to determine the total volume (three liquid column borehole volumes) of liquid to be purged.

5. Attach the single-use disposable nylon/polypropylene rope to the sample bailer OR single-use disposable tubing to the peristaltic pump.

6. Purge the well; lower bailer slowly into the well until it is below the water surface OR lower the tubing attached to the peristaltic pump and purge. Consistent with NYSDEC Guidance, purge waters will be containerized or passed through a granulated carbon filter prior to discharge to the ground surface.

7. Record the amount of water purged and the field parameter (pH, temperature, specific conductance, ORP, DO) in the field book.

8. If the well goes dry during bailing, allow for recovery and then sample.

9. Fill the appropriate sample bottles according to the sampling schedule for each well. While filling the sample bottles, record the well number, type, volume of container, and the preservatives used.

10. Volatile organic analyses samples must be free of air bubbles. When a bubble-free sample has been obtained, it must be immediately chilled.

11. Collect the duplicates. Take samples according to sampling schedule presented in the Work Plan.

12. Record all pertinent information in the field logbook (include color, odor, sediment content of sample, etc.). Any situations at the site that have the potential to interfere with the analytical results should also be recorded here.

13. Lock well, inspect well site, and note any maintenance required.

14. Dispose of potentially contaminated materials in designated containers for contaminated solids.

Duplicate samples shall be collected at least once with each field batch with a minimum of one for each twenty samples.

General Decontamination

The following procedures will be performed for the decontamination of exploration equipment, sampling equipment, and personnel after each drilling/sampling event:

Injection Equipment – To avoid cross contamination, use of a PID meter and cleaning between each sampling site will be employed on down-hole tools associated with the Geoprobe®.

Reusable Equipment – The following steps will be employed to decontaminate reusable equipment:

- Rinse equipment of soil or foreign material with potable water;
- Immerse and scrub equipment with bio-degradable phosphate-free detergent and potable water;
- Immerse and scrub in a potable water rinse without detergent; and

- The decontamination wash and rinse water will not be considered hazardous unless visual inspection or monitoring by the PID and other equipment indicate that contaminants may be present. The rinse waters can be discharged on-site if they are not contaminated. If contaminants are expected to be present, the rinsate waters will be passed through a granulated carbon filter before discharging to the ground surface.

Sample Containers – Upon filling and capping sample bottles, the outside of the bottle will be wiped off with a clean paper towel. These towels will be disposed of in a dedicated container for contaminated solids.

Personnel Decontamination – The following procedures will be used to decontaminate sampling personnel:

- After each sampling event chemical-resistant gloves will be disposed of in a dedicated container for contaminated solids;
- At the end of each sampling day, Tyvek™ coveralls, if used, will be disposed of in a dedicated container for contaminated solids;
- Boots will be bagged and removed from the site for cleaning; and
- Personnel will be required to follow procedures outlined in the Health and Safety Plan.

Sample Management Plan

The Sample Management Plan provides procedures to document and track samples and results obtained during this work effort. A series of pre-printed forms with the appropriate information serves as a vehicle for documentation and tracking. In order to accomplish this task, the documentation materials will include sample labels, sample characterization and Chain-of-Custody sheets, daily field reports, and a sample log.

Sample Label – A sample label will be completed for each sample obtained and will be affixed to the sample container. The label is configured in a way to address various types of mediums. Information on the label includes, at a minimum, client name, location, sample description, sample number, date, time, grab sample, composite sample, notes, and sampler's name.

Sample Characterization & Chain-of-Custody Sheet – All pertinent field information will be entered into the field book and chain-of-custody (COC) sheets. The COC sheets will include client

name, sample ID, sample description, location of sample, number of containers, container type, analysis required, and preservation. The Chain-of-Custody section of the form will document the sample's pathway of sample shipment, which will include names of persons delivering/receiving, dates, and times. Copies of the completed forms will be retained by the Engineer and the analytical laboratory. Chain-of-Custody sheets will be included in the laboratory data package submittal. Information regarding the well including depth to water, well volume, sample pH, temperature, turbidity, specific conductance, color, etc. will be recorded in the field book.

Sample Designation – Each sample will have a unique sample code that will include, where appropriate, the sample media, and the sample location.

Sample Handling – Each collected sample will be dispensed into the appropriate sample containers for the type of analysis to be performed. Appropriate sample preservatives will be added to the sample containers by the contracted analytical laboratory prior to delivery into the field, except in cases where the sample preservative must be added after sample collection. All samples that require cool storage will be immediately placed in coolers with appropriate packaging materials so as to protect the breakage of sample containers during shipment. The sample coolers will be filled with cubed ice prior to leaving the sample collection location. Careful packaging techniques will be used to prevent sample containers from breakage during shipment. Materials such as cardboard, foam wrap, or Styrofoam may be used as packaging materials. All samples will be either hand-delivered to the contracted analytical laboratory or arrangement for pick-up by the laboratory will be made.

QUALITY ASSURANCE MANUAL

Quality Assurance/Quality Control Policies and Procedures

Pace Analytical Services – Pittsburgh

1638 Roseytown Road, Suites 2, 3 and 4, Greensburg, Pennsylvania 15601
Phone: 724-850-5600

CORPORATE APPROVAL

Steve A. Vanderboom
President/CEO
1800 Elm Street, Suite 200
Minneapolis, MN 55414 (612) 607-6400

02/08/2016
Date

Richard M. Henson
Corporate Director of Quality
1800 Elm Street, Suite 200
Minneapolis, MN 55414 (612) 607-6400

02/08/2016
Date

LOCAL APPROVAL

Laboratory General Manager
724-850-5600

02/08/16
Date

Laboratory Senior Quality Manager
724-850-5630

02/08/16
Date

Effective Date is the date of the last signature.

Valerie Lambert

Administrative Business Manager
(724)-850-5600

02/08/16
Date

Penelope J Westrick

Client Services Manager
(724)-850-5600

02/08/16
Date

Additional Signatures:

Signature — Semivolatile Supervisor (Title) — 02/08/16 (Date)

Signature — Laboratory Service Manager (Title) — 02/08/16 (Date)

Signature — Volatile Supervisor (Title) — 02/08/16 (Date)

Signature — Radiochemistry Operations Manager (Title) — 02/08/16 (Date)

Table of Contents

1.0. INTRODUCTION AND ORGANIZATIONAL STRUCTURE

"Working together to protect our environment and improve our health"
Pace Analytical Services Inc. - Mission Statement

1.1. Introduction to PASI

1.1.1. Pace Analytical Services, Inc. (PASI) is a privately held, full-service analytical testing firm operating a nationwide system of laboratories. PASI offers extensive services beyond standard analytical testing, including: bioassay for aquatic toxicity, air toxics, dioxins and coplanar PCB's by high resolution mass spectroscopy , radiochemical analyses, product testing, pharmaceutical testing, field services and mobile laboratory capabilities. PASI has implemented a consistent Quality System in each of its laboratories and service centers. In addition, the company utilizes an advanced data management system that is highly efficient and allows for flexible data reporting. Together, these systems ensure data reliability and superior on-time performance. This document defines the Quality System and QA/QC protocols.

1.1.2. Our goal is to combine our expertise in laboratory operations with customized solutions to meet the specific needs of our customers.

1.2. Statement of Purpose

1.2.1. To meet the business needs of our customers for high quality, cost-effective analytical measurements and services.

1.3. Quality Policy Statement and Goals of the Quality System

1.3.1. PASI management is committed to maintaining the highest possible standard of service for our customers by following a documented quality system that is fully compliant with the applicable NELAC, TNI, or ISO Standards and is in accordance with the stated methods and customer requirements. The overall objective of this quality system is to provide reliable data of known quality through adherence to rigorous quality assurance policies and quality control procedures as documented in this Quality Assurance Manual.

1.3.2. All personnel within the PASI network are required to be familiar with all facets of the quality system relevant to their position and implement these policies and procedures in their daily work. This daily focus on quality is applied with initial project planning, continued through all field and laboratory activities, and is ultimately included in the final report generation.

1.3.3. PASI management demonstrates its commitment to quality by providing the resources, including facilities, equipment, and personnel to ensure the adherence to these documented policies and procedures and to promote the continuous improvement and effectiveness of the quality system. All PASI personnel must comply with all current applicable state, federal, and industry standards (e.g., 2003 NELAC Standard, 2009 TNI Standards, ISO/IEC 17025 standard, DOD, etc.), and are required to perform all tests in accordance with stated methods and customer requirements. When required, lab shall also comply with the program requirements for NQA-1/10CFR50, Appendix B when performing safety related tests on materials used for nuclear facilities.

1.4. Core Values

1.4.1. Integrity- Pace personnel are required to abide by the PASI Code of Ethics and all Pace employees must go through Data Integrity/Ethics training upon initial orientation and as an annual refresher.

1.4.2. Value Employees- Pace management views employees as our most important asset and communicates to them the relevance and importance of their activities within their job functions and how they contribute to the achievement of the objectives of the quality management system.

1.4.3. Know Our Customers- Pace makes every effort to know our customers and address their sampling and analytical needs. More information on this item can be found in section 2.0.

1.4.4. Honor Commitments- Pace labs focus on making solid commitments with regards to quality, capacity, and agreed upon turnaround time to our customers.

1.4.5. Flexible Response To Demand- Pace labs are equipped with both the material and personnel resources to enable them to be responsive to the demands of customers when situations or projects need change.

1.4.6. Pursue Opportunities- Pace is committed to pursuing opportunities for the growth of the company by constantly exploring markets and areas where we can expand.

1.4.7. Continuously Improve- Pace has committed much time and effort into establishing a continuous improvement program where company personnel meet on a regular basis to share ideas in cost reduction, production improvement and standardization in order to develop best practices. This information, as well as company financial and production metrics, are tracked, evaluated, and shared with each Pace facility.

1.5. Code of Ethics

1.5.1. PASI's fundamental ethical principles are as follows:

1.5.1.1. Each PASI employee is responsible for the propriety and consequences of his or her actions;

1.5.1.2. Each PASI employee must conduct all aspects of Company business in an ethical and strictly legal manner, and must obey the laws of the United States and of all localities, states and nations where PASI does business or seeks to do business;

1.5.1.3. Each PASI employee must reflect the highest standards of honesty, integrity and fairness on behalf of the Company with customers, suppliers, the public, and one another.

1.5.1.4. Each PASI employee must recognize and understand that our daily activities in environmental laboratories affect public health as well as the environment and that environmental laboratory analysts are a critical part of the system society depends upon to improve and guard our natural resources:

1.5.2. Strict adherence by each PASI employee to this Code of Ethics and to the Standards of Conduct is essential to the continued vitality of PASI and to continue the pursuit of our common mission to protect our environment and improve our health.

1.5.3. Failure to comply with the Code of Ethics and Standards of Conduct will result in disciplinary action up to and including termination and referral for civil or criminal prosecution where appropriate. An employee will be notified of an infraction and given an opportunity to explain, as prescribed under current disciplinary procedures.

1.5.4. Any Pace employee can contact corporate management to report an ethical concern by calling the anonymous hotline at 612-607-6431.

1.6. Standards of Conduct

1.6.1. Data Integrity

1.6.1.1. The accuracy and integrity of the analytical results and its supporting documentation produced at PASI are the cornerstones of the company. Lack of data integrity is an assault on our most basic values putting PASI and its employees at grave financial and legal risk and will not be tolerated. Therefore, employees are to accurately prepare and maintain all technical records, scientific notebooks, calculations, and databases. Employees are prohibited from making false entries or misrepresentations of data for any reason.

1.6.1.2. Managerial staff must make every effort to ensure that personnel are free from any undue pressures that may affect the quality or integrity of their work including commercial, financial, over-scheduling, and working condition pressures.

1.6.2. Confidentiality

1.6.2.1. PASI employees must not use or disclose confidential or proprietary information except when in connection with their duties at PASI. This is effective over the course of employment and for an additional period of two years thereafter.

1.6.2.2. Confidential or proprietary information, belonging to either PASI and/or its customers, includes but is not limited to test results, trade secrets, research and development matters, procedures, methods, processes and standards, company-specific techniques and equipment, marketing and customer information, inventions, materials composition, etc.

1.6.3. Conflict of Interest

1.6.3.1. PASI employees must avoid situations that might involve a conflict of interest or could appear questionable to others. The employee must be careful in two general areas:

1.6.3.1.1. Participation in activities that conflict or appear to conflict with the employees' PASI responsibilities.

1.6.3.1.2. Offering or accepting anything that might influence the recipient or cause another person to believe that the recipient may be influenced to behave or in a different manner than he would normally. This includes bribes, gifts, kickbacks, or illegal payments.

1.6.3.2. Employees are not to engage in outside business or economic activity relating to a sale or purchase by the Company. Other problematic activities include service on the Board of Directors of a competing or supplier company, significant ownership in a competing or supplier company, employment for a competing or supplier company, or participation in any outside business during the employee's work hours.

1.6.4. **Compliance**

1.6.4.1. All employees are required to read, understand, and comply with the various components of the standards listed in this document. As confirmation that they understand their responsibility, each employee is required to sign an acknowledgment form annually that then becomes part of the employee's permanent record. Employees will be held accountable for complying with the Quality Systems as summarized in the Quality Assurance Manual.

1.7. **Laboratory Organization**

1.7.1. The PASI Corporate Office centralizes company-wide accounting, business development, financial management, human resources development, information systems, marketing, quality, safety, and training activities. PASI's Director of Quality is responsible for assisting the development, implementation and monitoring of quality programs for the company. See Attachment IIB for the Corporate Organizational structure.

1.7.2. Each laboratory within the system operates with local management, but all labs share common systems and receive support from the Corporate Office.

1.7.3. A Senior General Manager (SGM) oversees all laboratories and service centers in their assigned region. Each laboratory or facility in the company is then directly managed by an SGM, a General Manager (GM), an Assistant General Manager (AGM), or an Operations Manager (OM). Quality Managers (QM) or Senior Quality Managers (SQM) at each laboratory report directly to the highest level of local laboratory management, however named, that routinely makes day-to-day decisions regarding that facility's operations. The QMs and SQMs will also receive guidance and direction from the corporate Director of Quality.

1.7.4. The SGM, GM, AGM or OM, or equivalent functionality in each facility, bears the responsibility for the laboratory operations and serves as the final, local authority in all matters. In the absence of these managers, the SQM/QM serves as the next in command, unless the manager in charge has assigned another designee. He or she assumes the responsibilities of the manager, however named, until the manager is available to resume the duties of their position. In the absence of both the manager and the SQM/QM, management responsibility of the laboratory is passed to the Technical Director, provided such a position is identified, and then to the most senior department manager until the return of the lab manager or SQM/QM. The most senior department manager in charge may include the Client Services Manager or the Administrative Business Manager at the discretion of the SGM/GM/AGM/OM.

1.7.5. A Technical Director who is absent for a period of time exceeding 15 consecutive calendar days shall designate another full-time staff member meeting the qualifications of the technical director to temporarily perform this function. The laboratory SGM/GM/AGM/OM

or SQM/QM has the authority to make this designation in the event the existing Technical Director is unable to do so. If this absence exceeds 35 consecutive calendar days, the primary accrediting authority shall be notified in writing.

1.7.5.1. The laboratory manager or SrQM/QM will assume the responsibilities of the Technical Director if there are no qualified personnel who can fulfill the position requirements.

1.7.6. The SQM/QM has the responsibility and authority to ensure the Quality System is implemented and followed at all times. In circumstances where a laboratory is not meeting the established level of quality or following the policies set forth in this Quality Assurance Manual, the SQM/QM has the authority to halt laboratory operations should he or she deem such an action necessary. The SQM/QM will immediately communicate the halting of operations to the SGM/GM/AGM/OM and keep them posted on the progress of corrective actions. In the event the SGM/GM/AGM/OM and the SQM/QM are not in agreement as to the need for the suspension, the Chief Operating Officer and Director of Quality will be called in to mediate the situation.

1.7.6.1. The lab is required to appoint deputies for key managerial personnel. These deputies must be documented for auditing purposes. For DoD labs, key managerial personnel for the local labs are defined as: Lab Director, Technical Managers (e.g., Technical Directors and Section Supervisors), Senior Quality Managers/Quality Managers, Support Systems and Administrative Managers (e.g., LIMS Manager, Purchasing Manager, Project Managers), and Customer Service Managers. All of these personnel must have documented deputies for DoD labs.

1.7.7. The technical staff of the laboratory is generally organized into the following functional groups:

- Organic Sample Preparation
- Wet Chemistry Analysis
- Metals Analysis
- Volatiles Analysis
- Semi-volatiles Analysis
- Radiochemical Analysis
- Microbiology

1.7.8. Appropriate support groups are present in each laboratory. The actual organizational structure for PASI Pittsburgh is listed in Attachment IIA. In the event of a change in SGM/GM/AGM/OM, SQM/QM, or any Technical Director, the laboratory will notify its accrediting authorities and revise the organizational chart in the Quality Assurance Manual (QAM) within 30 days. For changes in Department Managers or Supervisors or other laboratory personnel, no notifications will be sent to the laboratory's accrediting agencies; changes to the organizational chart will be updated during or prior to the annual review process. Changes or additions in these key personnel will also be noted by additional signatures on the QAM, as applicable. In any case, the QAM will remain in effect until the next scheduled revision.

1.8. Laboratory Job Descriptions

1.8.1. Senior General Manager

- Oversees all functions of all the operations within their designated region;
- Oversees the development of local GMs/AGMs/OMs within their designated region;
- Oversees and authorizes personnel development including staffing, recruiting, training, workload scheduling, employee retention and motivation;
- Oversees the preparation of budgets and staffing plans for all operations within their designated region;
- Ensures compliance with all applicable state, federal and industry standards;
- Works closely with Regional Sales Management.

1.8.2. General Manager

- Oversees all functions of their assigned operations;
- Authorizes personnel development including staffing, recruiting, training, workload scheduling, employee retention and motivation;
- Prepares budgets and staffing plans;
- Monitors the Quality Systems of the laboratory and advises the SQM/QM accordingly;
- Ensures compliance with all applicable state, federal and industry standards.

1.8.3. Senior Quality Manager

- Provides quality oversight for multiple laboratories where there is not a local quality manager or for labs where there are multiple and separately distinct quality systems in the same facility;
- Responsible for implementing, maintaining and improving the quality system while functioning independently from laboratory operations. Reports directly to the highest level of local laboratory facility management, however named, that routinely makes day-to-day decisions regarding laboratory operations, but receives direction and assistance from the Corporate Director of Quality;
- Ensures that communication takes place at all levels within the lab regarding the effectiveness of the quality system and that all personnel understand their contributions to the quality system;
- Monitors Quality Assurance/Quality Control activities to ensure that the laboratory achieves established standards of quality (as set forth by the Corporate Quality office). The Quality Manager is responsible for reporting the lab's level of compliance to these standards to the Corporate Director of Quality on a quarterly basis;
- Maintains records of quality control data and evaluates data quality;
- Conducts periodic internal audits and coordinates external audits performed by regulatory agencies or customer representatives;
- Reviews and maintains records of proficiency testing results;
- Maintains the document control system;
- Assists in development and implementation of appropriate training programs;
- Provides technical support to laboratory operations regarding methodology and project QA/QC requirements;
- Maintains certifications from federal and state programs;
- Ensures compliance with all applicable state, federal and industry standards;
- Maintains the laboratory training records, including those in the Learning Management System (LMS), and evaluates the effectiveness of training;

- Monitors correctives actions;
- Maintains the currency of the Quality Manual.

1.8.4. Quality Manager

- Responsible for implementing, maintaining and improving the quality system while functioning independently from laboratory operations. Reports directly to the highest level of local laboratory facility management, however named, that routinely makes day-to-day decisions regarding laboratory operations, but receives direction and assistance from the Corporate Director of Quality. They may also report to a Senior Quality Manager within the same facility;
- Ensures that communication takes place at all levels within the lab regarding the effectiveness of the quality system and that all personnel understand their contributions to the quality system;
- Monitors Quality Assurance/Quality Control activities to ensure that the laboratory achieves established standards of quality (as set forth by the Corporate Quality office). The Quality Manager is responsible for reporting the lab's level of compliance to these standards to the Corporate Director of Quality on a quarterly basis;
- Maintains records of quality control data and evaluates data quality;
- Conducts periodic internal audits and coordinates external audits performed by regulatory agencies or customer representatives;
- Reviews and maintains records of proficiency testing results;
- Maintains the document control system;
- Assists in development and implementation of appropriate training programs;
- Provides technical support to laboratory operations regarding methodology and project QA/QC requirements;
- Maintains certifications from federal and state programs;
- Ensures compliance with all applicable state, federal and industry standards;
- Maintains the laboratory training records, including those in the Learning Management System (LMS), and evaluates the effectiveness of training;
- Monitors correctives actions;
- Maintains the currency of the Quality Manual.

1.8.5. Quality Assurance Analyst

- Assists the SQM/QM in the performance of quality department responsibilities as delegated by the SQM/QM;
- Assists in monitoring QA/QC data;
- Assists in internal audits;
- Assists in maintaining training records;
- Assists in maintaining the document control system.

1.8.6. Technical Director

- Monitors the standards of performance in quality assurance and quality control data;
- Monitors the validity of analyses performed and data generated;

- Reviews tenders, contracts and QAPPs to ensure the laboratory can meet the data quality objectives for any given project;
- Serves as the manager of the laboratory in the absence of the SGM/GM/AGM/OM and SQM/QM;
- Provides technical guidance in the review, development, and validation of new methodologies.

1.8.7. Administrative Business Manager

- Responsible for financial and administrative management for the entire facility;
- Provides input relative to tactical and strategic planning activities;
- Organizes financial information so that the facility is run as a fiscally responsible business;
- Works with staff to confirm that appropriate processes are put in place to track revenues and expenses;
- Provide ongoing financial information to the SGM/GM/AGM/OM and the management team so they can better manage their business;
- Utilizes historical information and trends to accurately forecast future financial positions;
- Works with management to ensure that key measurements are put in place to be utilized for trend analysis—this will include personnel and supply expenses, and key revenue and expense ratios;
- Works with SGM/GM/AGM/OM to develop accurate budget and track on an ongoing basis;
- Works with entire management team to submit complete and justified capital budget requests and to balance requests across departments;
- Works with project management team and administrative support staff to ensure timely and accurate invoicing.

1.8.8. Client Services Manager

- Oversees all the day to day activities of the Client Services Department which includes Project Management and, possibly, Sample Control;
- Responsible for staffing and all personnel management related issues for Client Services;
- Serves as the primary senior consultant to customers on all project related issues such as set up, initiation, execution and closure;
- Performs or is capable of performing all duties listed for that of Project Manager.

1.8.9. Project Manager

- Coordinates daily activities including taking orders, reporting data and analytical results;
- Serves as the primary technical and administrative liaison between customers and PASI;
- Communicates with operations staff to update and set project priorities;

- Provides results to customers in the requested format (verbal, hardcopy, electronic, etc.);
- Works with customers, laboratory staff, and other appropriate PASI staff to develop project statements of work or resolve problems of data quality;
- Responsible for solicitation of work requests, assisting with proposal preparation and project initiation with customers and maintain customer records;
- Mediation of project schedules and scope of work through communication with internal resources and management;
- Responsible for preparing routine and non-routine quotations, reports and technical papers;
- Interfaces between customers and management personnel to achieve customer satisfaction;
- Manages large-scale complex projects;
- Supervises less experienced project managers and provide guidance on management of complex projects;
- Arranges bottle orders and shipment of sample kits to customers;
- Verifies login information relative to project requirements and field sample Chains-of-Custody.

1.8.10. Project Coordinator

- Responsible for preparation of project specifications and provides technical/project support;
- Coordinates project needs with other department sections and assists with proposal preparation;
- Prepares routine proposals and invoicing;
- Responsible for scanning, copying, assembling and binding final reports;
- Other duties include filing, maintaining forms, process outgoing mail, maintaining training database and data entry.

1.8.11. Department Manager/Supervisor

- Oversees the day-to-day production and quality activities of their assigned department;
- Ensures that quality assurance and quality control criteria of analytical methods and projects are satisfied;
- Assesses data quality and takes corrective action when necessary;
- Approves and releases technical and data management reports;
- Ensures compliance with all applicable state, federal and industry standards.

1.8.12. Group Supervisor/Leader

- Trains analysts in laboratory operations and analytical procedures;
- Organizes and schedules analyses with consideration for sample holding times;
- Implements data verification procedures by assigning data verification duties to appropriate personnel;

- Evaluates instrument performance and supervises instrument calibration and preventive maintenance programs;
- Reports non-compliance situations to laboratory management including the SQM/QM.

1.8.13. Laboratory Analyst

- Performs detailed preparation and analysis of samples according to published methods and laboratory procedures;
- Processes and evaluates raw data obtained from preparation and analysis steps;
- Generates final results from raw data, performing primary review against method criteria;
- Monitors quality control data associated with analysis and preparation. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks;
- Reports data in LIMS, authorizing for release pending secondary approval;
- Conducts routine and non-routine maintenance of equipment as required;
- Performs or is capable of performing all duties associated with that of Laboratory Technician.

1.8.14. Laboratory Technician

- Prepares standards and reagents according to published methods or in house procedures;
- Performs preparation and analytical steps for basic laboratory methods;
- Works under the direction of a Laboratory Analyst on complex methodologies;
- Assists Laboratory Analysts on preparation, analytical or data reduction steps for complex methodologies;
- Monitors quality control data as required or directed. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks.

1.8.15. Field Technician

- Prepares and samples according to published methods, PASI Quality Assurance Manual and/or customer directed sampling objectives;
- Capable of the collection of representative environmental or process related air samples;
- Use computer software to compile, organize, create tables, create graphics and write test reports;
- Reviews project documentation for completeness, method compliance and contract fulfillment;
- Train less experienced environmental technicians and provide guidance on sampling and analysis;
- Responsible for project initiation and contact follow-up;
- Develop sampling plans and prepare test plan documents.

1.8.16. **Field Analyst**

- Analyzes field samples according to published methods, PASI Quality Assurance Manual and/or customer directed sampling objectives,
- Capable of the collection and analysis of representative environmental or process related air samples,
- Proficient in a variety of analytical tests; specifically on-site gas-phase organic and inorganic compounds by extractive fourier transform infrared spectroscopy (FTIR),
- Train less experienced staff and provide guidance on FTIR sampling and analysis,
- Assist in reporting tasks and project management responsibilities, and
- Perform back-up support for manager tasks such as reporting needs and customer concerns.

1.8.17. **Sample Management Personnel**

- Signs for incoming samples and verifies the data entered on the Chain of custody forms;
- Enters the sample information into the Laboratory Information Management System (LIMS) for tracking and reporting;
- Stages samples according to EPA requirements;
- Assists Project Managers and Coordinators in filling bottle orders and sample shipments.

1.8.18. **Systems Administrator or Systems Manager**

- Assists with the creation and maintenance of electronic data deliverables (EDDs);
- Coordinates the installation and use of all hardware, software and operating systems;
- Performs troubleshooting on all aforementioned systems;
- Trains new and existing users on systems and system upgrades;
- Maintains all system security passwords;
- Maintains the electronic backups of all computer systems.

1.8.19. **Radiation Safety/Chemical Hygiene Officer**

- Maintains the laboratory Radiation Safety Manual;
- Maintains the laboratory Chemical Hygiene Plan;
- Plans and implements safety policies and procedures;
- Maintains safety records;
- Organizes and/or performs safety training;
- Performs safety inspections and provides corrective/preventative actions;
- Assists personnel with safety issues.

1.8.20. **Program Director/Hazardous Waste Coordinator (or otherwise named)**

- Evaluates waste streams and helps to select appropriate waste transportation and disposal companies;
- Maintains complete records of waste disposal including waste manifests and state reports;
- Assists in training personnel on waste-related issues such as waste handling and storage, waste container labeling, proper satellite accumulation, secondary containment, etc.;
- Conducts a weekly inspection of the waste storage areas of the laboratory.

1.9. Training and Orientation

1.9.1. Training for Pace employees is managed through a web-based Learning Management System. After a new employee has been instructed in matters of human resources, they are given instructional materials for the LMS and a password for access.

1.9.2. A new hire training checklist is provided to the new employee that lists training items for the employee to work through either independently on LMS or with their supervisor or trainer. The training items that can be completed independently include:

- Reading through applicable Standard Operating Procedures;
- Reviewing the Quality Manual and Chemical Hygiene Plan;
- Core training modules such as quality control indicators, basic laboratory skills, etc.;
- Quality Systems training including traceability of measurements, method calibration, calibration verification, accuracy, precision and uncertainty of measurements, corrective actions, documentation, and root cause analysis;
- Data Integrity/Ethics training.

1.9.3. The new employee's Department Supervisor provides the employee with a basic understanding of the role of the laboratory within the structure of PASI and the basic elements of that individual's position. Supervised training uses the following techniques:

- Hands-on training
- Training checklists/worksheets
- Lectures and training sessions
- Method-specific training
- Conferences and seminars
- Short courses
- Specialized training by instrument manufacturers
- Proficiency testing programs.
- On-line courses

1.9.4. Group Supervisors/Leaders are responsible for providing documentation of training and proficiency for each employee under their supervision. The employee’s training file indicates what procedures an analyst or a technician is capable of performing, either independently or with supervision. The files also include documentation of continuing capability, which are fully detailed in Section 3.4. Training documentation files for each person are maintained by the Quality Office either in hardcopy format or within the LMS.

1.9.5. All procedures and training records are maintained and available for review during laboratory audits. These procedures are reviewed/updated periodically by laboratory management. Additional information can be found in SOP S-ALL-Q-020 **Training and Employee Orientation** or its equivalent revision or replacement.

1.10. Data Integrity System

1.10.1. The data integrity system at PASI provides assurances to management that a highly ethical approach is being applied to all planning, training and implementation of methods. Data integrity is crucial to the success of our company and Pace Analytical is committed to creating and maintaining a culture of quality throughout the organization. To accomplish this goal, PASI has implemented a data integrity system that encompasses the following four requirements:

1.10.1.1. A data integrity training program: standardized training is given to each new employee and a yearly refresher is presented to all employees. Key topics addressed by this training include:

1.10.1.1.1. Need for honesty and transparency in analytical reporting

1.10.1.1.2. Process for reporting data integrity issues

1.10.1.1.3. Specific examples of unethical behavior and improper practices

1.10.1.1.4. Documentation of non-conforming data that is still useful to the data user

1.10.1.1.5. Consequences and punishments for unethical behavior

1.10.1.1.6. Examples of monitoring devices used by management to review data and systems

1.10.1.2. Signed data integrity documentation for all employees: this includes a written quiz following the Ethics training session and written agreement to abide by the Code of Ethics and Standards of Conduct explained in the employee manual.

1.10.1.3. In-depth, periodic monitoring of data integrity including peer data review and validation, internal raw data audits, proficiency testing studies, etc.

1.10.1.4. Documentation of any review or investigation into possible data integrity infractions. This documentation, including any disciplinary actions involved, corrective actions taken, and notifications to customers must be retained for a minimum of five years.

1.10.2. PASI management makes every effort to ensure that personnel are free from any undue pressures that affect the quality of their work including commercial, financial, over scheduling, and working condition pressures.

1.10.3. Corporate management also provides all PASI facilities a mechanism for confidential reporting of data integrity issues that ensures confidentiality and a receptive environment in which all employees are comfortable discussing items of ethical concern. The anonymous message line is monitored by the Corporate Director of Quality who will ensure that all concerns are evaluated and, where necessary, brought to the attention of executive management and investigated. Any Pace employee can contact corporate management to report an ethical concern by calling the anonymous hotline at 612-607-6431.

1.11. Laboratory Safety

1.11.1. It is the policy of PASI to make safety and health an integral part of daily operations and to ensure that all employees are provided with safe working conditions, personal protective equipment, and requisite training to do their work without injury. Each employee is responsible for his/her own safety as well as those working in the immediate area by complying with established company rules and procedures. These rules and procedures as well as a more detailed description of the employees' responsibilities are contained in the corporate Safety Manual and Chemical Hygiene Plan.

1.12. Security and Confidentiality

1.12.1. Security is maintained by controlled access to laboratory buildings. Exterior doors to laboratory buildings remain either locked or continuously monitored by PASI staff. Keyless door lock access cards that are broken are replaced, in instances where access cards are not returned to the laboratory upon termination, the access cards are disabled. Keyless door lock combinations and computer access codes/logins are changed as per G-All-IT-030, System Security and Integrity Guide. Posted signs direct visitors to the reception office and mark all other areas as off limits to unauthorized personnel. All visitors, including PASI staff from other facilities, must sign the Visitor's Logbook maintained by the receptionist. A staff member will accompany them during the duration of their stay on the premises unless the SGM/GM/AGM/OM, SQM/QM, or Technical Director specify otherwise. In this instance, the staff member will escort the visitor back to the reception area at the end of his/her visit where he/she signs out. The last staff member to leave their department for the day must ensure that all outside access points to that area are secure.

1.12.2. Additional security is provided where necessary, (e.g., specific secure areas for sample, data, and customer report storage), as requested by customers, or cases where national security is of concern. These areas are lockable within the facilities, or are securely offsite. Access is limited to specific individuals or their designees. Security of sample storage areas is the responsibility of the Client Services Manager or Sample Management Personnel. Security of samples and data during analysis and data reduction is the responsibility of Group Supervisors. Security of customer report archives is the responsibility of the Client Services Manager. These secure areas are locked whenever these individuals or their designees are not present in the facility.

1.12.3. Access to designated laboratory sample storage locations is limited to authorized personnel only. Provisions for lock and key access are provided. No samples are to be removed without proper authorization. If requested by customer or contract, samples are not to be removed from secure storage areas without filling out an associated internal chain of custody.

1.12.4. Standard business practices of confidentiality are applied to all documents and information regarding customer analyses. Specific protocols for handling confidential documents are described in PASI SOPs. Additional protocols for sample identification by internal laboratory identification numbers only are implemented as required under contract specific Quality Assurance Project Plans (QAPPs).

1.12.5. All information pertaining to a particular customer, including national security concerns will remain confidential. Data will be released to outside agencies only with written authorization from the customer or where federal or state law requires the company to do so.

1.13. Communications

1.13.1. Management within each lab bears the responsibility of ensuring that appropriate communication processes are established and that communication takes place regarding the effectiveness of the management/quality system. These communication processes may include email, regular staff meetings, senior management meetings, etc.

1.13.2. Corporate management bears the responsibility of ensuring that appropriate communication processes are established within the network of facilities and that communication takes place at a company-wide level regarding the effectiveness of the management/quality systems of all Pace facilities. These communication processes may include email, quarterly continuous improvement conference calls for all lab departments, and annual continuous improvement meetings for all department supervisors, quality managers, client services managers, and other support positions.

2.0. SAMPLE CUSTODY

2.1. Sampling Support

2.1.1. Each individual PASI laboratory provides shipping containers, properly preserved sample containers, custody documents, and field quality control samples to support field-sampling events. Guidelines for sample container types, preservatives, and holding times for a variety of methods are listed in Attachment VIII. Note that all analyses listed are not necessarily performed at all PASI laboratories and there may be additional laboratory analyses performed that are not included in these tables. Customers are encouraged to contact their local Pace Project Manager for questions or clarifications regarding sample handling. PASI - Pittsburgh may provide pick-up and delivery services to their customers when needed.

2.2. Field Services

2.2.1. Pace Analytical has a large Field Services Division which is based in their Minneapolis facility as well as limited field service capabilities in some of our other facilities. Field Services provides comprehensive nationwide service offerings including:

- Stack Testing
- Ambient Air
- CEM Certification Testing
- Air Quality Monitoring
- Onsite Analytical Services- FTIR and GC
- Real-time Process Diagnostic/Optimization Testing
- Wastewater, Groundwater and Drinking Water Monitoring
- Storm Water and Surface Water Monitoring
- Soil and Waste Sampling
- Mobile Laboratory Services

2.2.2. Field Services operates under the PASI Corporate Quality System, with applicable and necessary provisions to address the activities, methods, and goals specific to Field Services. All procedures and methods used by Field Services are documented in Standard Operating Procedures and Procedure Manuals.

2.3. Project Initiation

2.3.1. Prior to accepting new work, the laboratory reviews its performance capability. The laboratory confirms that sufficient personnel, equipment capacity, analytical method capability, etc., are available to complete the required work. Customer needs, certification requirements, and data quality objectives are defined and the appropriate sampling and analysis plan is developed to meet the project requirements by project managers or sales representatives. Members of the management staff review current instrument capacity, personnel availability and training, analytical procedures capability, and projected sample load. Management then informs the sales and client services personnel whether or not the laboratory can accept the new project via written correspondence, email, and/or daily operations meetings.

2.3.2. The laboratory maintains records of all such reviews, including discussions with customers. Routine analytical project documentation of quotes, notes, dates, initials, and/or recordings is maintained in a project folder by project management. Conditions for new and more complex contracts are determined by the SGM/GM/AGM/OM and sales representatives. Quality Management is consulted on technical requirements and operations staff provides input on volume capacities. Evidence of these reviews is maintained in the form of awarded Request for Proposals (RFPs), signed quotes or contracts, and a Customer Relationship Management (CRM) database. If a review identifies a potential mismatch between customer requirements and laboratory capabilities and/or capacities, Pace will specify its level of commitment by listing these exceptions to the requirements within the RFP, quote or contract.

2.3.3. Additional information regarding specific procedures for reviewing new work requests can be found in SOP PGH-C-033 **Review of Analytical Requests** or its equivalent revision or replacement.

2.4. Chain of Custody

2.4.1. A chain of custody (COC) provides the legal documentation of samples from time of collection to completion of analysis. PASI has implemented Standard Operating Procedures to ensure that sample custody traceability and responsibility objectives are achieved for every project.

2.4.2. Field personnel or client representatives must complete a chain of custody for all samples that are received by the laboratory. The importance of completeness of COCs is stressed to the samplers and is critical to efficient sample receipt and to insure the requested methods are used to analyze the correct samples.

2.4.3. If sample shipments are not accompanied by the correct documentation, the Sample Receiving department notifies a Project Manager. The Project Manager then obtains the correct documentation/information from the customer in order for analysis of samples to proceed.

2.4.4. The sampler is responsible for providing the following information on the chain of custody form:

- Customer project name
- Project location or number
- Field sample number/identification
- Date and time sampled
- Sample matrix
- Preservative
- Requested analyses
- Sampler signature
- Relinquishing signature
- Date and time relinquished
- Sampler remarks as needed
- Custody Seal Number if present
- Regulatory Program Designation
- The state where the samples were collected to ensure all applicable state requirements are met.
- Turnaround time requested

- Purchase order number

2.4.5. The COC is filled out completely and legibly with indelible ink. Errors are corrected by drawing a single line through the initial entry and initialing and dating the change. All transfers of samples are recorded on the chain of custody in the “relinquished” and “received by” sections. All information except signatures is printed.

2.4.6. Additional information can be found in PGH-C-001 **Sample Management** or its equivalent revision or replacement.

2.5. Sample Acceptance Policy

2.5.1. In accordance with regulatory guidelines, PASI complies with the following sample acceptance policy for all samples received.

2.5.2. If the samples do not meet the sample receipt acceptance criteria outlined below, the laboratory is required to document all non-compliances, contact the customer, and either reject the samples or fully document any decisions to proceed with analyses of samples which do not meet the criteria. Any results reported from samples not meeting these criteria are appropriately qualified on the final report.

2.5.3. All samples must:

- Have unique customer identification that is clearly marked with indelible ink on durable waterproof labels affixed to the sample containers that match the chain of custody.
- Have clear documentation on the chain of custody related to the location of the sampling site with the time and date of sample collection.
- Have the sampler’s name and signature.
- Have all requested analyses clearly designated on the COC.
- Have clear documentation of any special analytical or data reporting requirements.
- Be in appropriate sample containers with clear documentation of the preservatives used.
- Be correctly preserved unless the method allows for laboratory preservation.
- Be received within holding time. Any samples with hold times that are exceeded will not be processed without prior customer approval.
- Have sufficient sample volume to proceed with the analytical testing. If insufficient sample volume is received, analysis will not proceed without customer approval.
- Be received within appropriate temperature ranges - not frozen but ≤6°C (See Note 1), unless program requirements or customer contractual obligations mandate otherwise (see Note 2). The cooler temperature is recorded directly on the COC and the SCUR. Samples that are delivered to the laboratory immediately after collection are considered acceptable if there is evidence that the chilling process has been started. For example, by the arrival of the samples on ice. If samples arrive that are not compliant with these temperature requirements, the customer will be notified. The analysis will NOT proceed unless otherwise directed by the customer. If less than 72 hours remain in the hold time for the analysis, the analysis may be started while the customer is contacted to avoid missing the hold time. Data associated with any deviations from the above sample acceptance policy requirements will be appropriately qualified.

Note 1: Temperature will be read and recorded based on the precision of the measuring device. For example, temperatures obtained from a thermometer graduated to 0.1°C will be read and recorded to ±0.1°C. Measurements obtained from a thermometer graduate to 0.5°C will be read to ±0.5°C. Measurements read at the specified precision are not to be rounded down to meet the ≤6°C limit

Note 2: Some microbiology methods allow sample receipt temperatures of up to 10°C. Consult the specific method for microbiology samples received above 6°C prior to initiating corrective action for out of temperature preservation conditions.

Note 3: Biological Tissue Samples must be received at the following temperature based on program and contract: frozen at $\leq 0^{o}$C; frozen at $\leq$ - 10^{o}C, or cooled $\leq 6^{o}$C. TNI rules also apply if the samples are brought straight from the field; they are acceptable if evidence of cooling is present (i.e., received on ice).

2.5.4. Upon sample receipt, the following items are also checked and recorded:

- Presence of custody seals or tapes on the shipping containers;
- Sample condition: Intact, broken/leaking, bubbles in VOA samples;
- Sample holding time;
- Sample pH and residual chlorine when required;
- Appropriate containers.

2.5.5. Samples for drinking water analysis that are improperly preserved, or are received past holding time, are rejected at the time of receipt, with the exception of VOA samples that are tested for pH at the time of analysis.

2.5.6. Additional information can be found in PGH-C-001 **Sample Management** or its equivalent revision or replacement.

2.6. Sample Log-in

2.6.1. After sample inspection, all sample information on the chain of custody is entered into the Laboratory Information Management System (LIMS). This permanent record documents receipt of all sample containers including:

- Customer name and contact
- Customer number
- Pace Analytical project number
- Pace Analytical Project Manager
- Sample descriptions
- Due dates
- List of analyses requested
- Date and time of laboratory receipt
- Field ID code
- Date and time of collection
- Any comments resulting from inspection for sample rejection

2.6.2. All samples received are logged into the LIMS within one working day of receipt. Sample login may be delayed due to customer clarification of analysis needed, corrective actions for

sample receipt non-conformance, or other unusual circumstances. If the time collected for any sample is unspecified and Pace is unable to obtain this information from the customer, the laboratory will use 12:01am as the time sampled. All hold times will be based on this sampling time and qualified accordingly if exceeded.

2.6.3. For DoD work, if the time of the sample collection is not provided, the laboratory must assume the most conservative time of day. This is defined as 12:01am.

2.6.4. The Laboratory Information Management System automatically generates a unique identification number for each sample created in the system. The LIMS sample number follows the general convention of 30XXXXX-YYY. The first two numbers (30) designates the project as a PASI-Pittsburgh project, the last three digits (YYY) are used to designate the individual sample numbers, and the digits XXXXX (Where the "X's" are sequential numbers generated by the LIMS) identify the project number. This unique identification number is placed on each sample container as a durable label and becomes the link between the laboratory's sample management system and the customer's field identification; and will be a permanent reference number for all future interactions.

2.6.5. Current division codes are noted below. These division codes are used primarily for accounting purposes and LIMS sample identifications. More division codes may be added without updating this document.

00 = Corporate
10 = Minnesota/Montana/Virginia MN
12 = Virginia/Duluth MN
20 = New Orleans/Puerto Rico
30 = Pittsburgh
35 = Florida/South Florida
36 = South Florida (accounting only)
40 = Green Bay
50 = Indianapolis/Columbus
51 = Columbus (accounting only)
55/56 = Pace Energy Services Labs
60 = Kansas
65 = New York (Schenectady)
70 = Long Island
75 = Dallas
92 = Carolinas

2.6.6. Sample labels are printed from the LIMS and affixed to each sample container.

2.6.7. Samples with hold times that are near expiration date/time may be sent directly to the laboratory for analysis at the discretion of the Project Manager and/or SGM/GM/AGM/OM.

2.6.8. Additional information can be found in PGH-C-001 Sample Management or its equivalent revision or replacement.

2.7. Sample Storage

2.7.1. Storage Conditions

2.7.1.1. Samples are stored away from all standards, reagents, or other potential sources of contamination. Samples are stored in a manner that prevents cross contamination. Volatile samples are stored separately from other samples. All sample fractions, extracts, leachates, and other sample preparation products are stored in the same manner as actual samples or as specified by the analytical method.

2.7.1.2. Storage blanks, consisting of two 40mL aliquots of reagent water, are stored with volatile samples and are used to measure cross-contamination acquired during

storage. If applicable, laboratories must have documented procedures and criteria for evaluating storage blanks, appropriate to the types of samples being stored.

2.7.1.3. Additional information can be found in PGH-Q-044 **Monitoring Temperature Controlled Units.**

2.7.2. **Temperature Monitoring**

2.7.2.1. Samples are taken to the appropriate storage location immediately after sample receipt and check-in procedures are completed. All sample storage areas are located in limited access areas and are monitored to ensure sample integrity.

2.7.2.2. The temperature of each refrigerated storage area is maintained at ≤6°C (but above freezing) unless state or program requirements differ. The temperature of each freezer storage area is maintained at <-10°C unless state or program requirements differ. The temperature of each storage area is checked and documented each day of use (each calendar day). If the temperature falls outside the acceptable limits, the following corrective actions are taken and appropriately documented:

- The temperature is rechecked after two hours to verify temperature exceedance. Corrective action is initiated and documented if necessary.
- The SQM/QM and/or laboratory management are notified if the problem persists.
- The samples are relocated to a proper environment if the temperature cannot be maintained after corrective actions are implemented.
- The affected customers are notified.
- Documentation is provided on analytical report.

Additional information can be found in PGH-Q-044 **Monitoring Temperature Controlled Units.**

2.7.3. **Hazardous Materials**

2.7.3.1. Pure product or potentially heavily contaminated samples must be tagged as "hazardous" or "lab pack" and stored separately from other samples.

2.7.3.2. Clients must properly label all samples that contain radioactivity. These samples are screened by the Radiation Safety Officer and if noted to be of concern this information is communicated to the necessary laboratory personnel. Any samples with levels of radiation that are noted to be of concern will be placed into a separate storage area of the laboratory to prevent cross-contamination.

2.7.4. **Foreign/Quarantined Soils**

2.7.4.1. Depending on the soil disposal practices of the laboratory, foreign soils and soils from USDA regulated areas are adequately segregated to enable proper sample disposal. The USDA requires these samples to be incinerated or sterilized by an approved treatment procedure. Additional information regarding USDA regulations and sample handling can be found in applicable local laboratory SOPs.

2.7.4.2. Additional information on sample storage can be found in PGH-C-001 Sample Management or its equivalent revision or replacement and in PGH-C-017 Waste Handling and Management.

2.8. Sample Protection

2.8.1. PASI laboratory facilities are operated under controlled access protocols to ensure sample and data integrity. Visitors must register at the front desk and be properly escorted at all times.

2.8.2. Samples are removed from storage areas by designated personnel and returned to the storage areas, if necessary, immediately after the required sample quantity has been taken.

2.8.3. Upon customer request, additional and more rigorous chain of custody protocols for samples and data can be implemented. For example, some projects may require internal chain-of-custody protocols.

2.8.4. Additional information can be found in PGH-C-001 **Sample Management** or its equivalent revision or replacement.

2.9. Subcontracting Analytical Services

2.9.1. Every effort is made to perform all analyses for PASI customers within the laboratory that receives the samples. When subcontracting to a laboratory other than the receiving laboratory, whether inside or outside the PASI network, becomes necessary, a preliminary verbal communication with that laboratory is undertaken. Customers are notified in writing of the laboratory's intention to subcontract any portion of the testing to another laboratory. Work performed under specific protocols may involve special considerations.

2.9.2. Prior to subcontracting samples to a laboratory outside Pace Analytical, the potential sub-contract laboratory will be pre-qualified by verifying that the subcontractor meets the following criteria:

- All certifications required for the proposed subcontract are in effect,
- Sufficient professional liability and other required insurance coverage is in effect, and
- Is not involved in legal action by any federal, state, or local government agency for data integrity issues and has not been convicted in such investigation at any time during the past 5 years.

2.9.3. The contact and preliminary arrangements are made between the PASI Project Manager and the appropriate subcontract laboratory personnel. The specific terms of the subcontract laboratory agreement include:

- Method of analysis
- Number and type of samples expected
- Project specific QA/QC requirements
- Deliverables required
- Laboratory certification requirement
- Price per analysis
- Turn-around time requirements

2.9.4. Chain-of-custody forms are generated for samples requiring subcontracting to other laboratories. Sample receiving personnel re-package the samples for shipment, create a transfer chain of custody form and record the following information:

- Pace Analytical Laboratory Number
- Matrix
- Requested analysis
- Special instructions regarding turnaround, required detection or reporting limits, or any unusual information known about the samples or analytical procedure.
- Signature in "Relinquished By"

2.9.5. All subcontracted sample data reports are sent to the PASI Project Manager. Pace will provide a copy of the subcontractor's report to the client when requested.

2.9.6. Any Pace Analytical work sent to other labs within the PASI network is handled as subcontracted work and all final reports are labeled clearly with the name of the laboratory performing the work. Any non-TNI work is clearly identified. PASI will not be responsible for analytical data if the subcontract laboratory was designated by the customer.

2.9.7. Additional information can be found in PGH-C-008 Subcontracting Samples or its equivalent revision or replacement. Evaluation and Qualification of Vendors is described in the SOP PGH-Q-041.

2.9.8. Subcontracted labs used for DoD work must be accredited by DoD or its designated representatives. Subcontracted labs must receive project specific approval from the DoD client before any samples are analyzed. These requirements also apply to the use of any laboratory under the same corporate umbrella, but at a different facility or location.

2.10. Sample Retention and Disposal

2.10.1. Samples, extracts, digestates, and leachates must be retained by the laboratory for the period of time necessary to protect the interests of the laboratory and the customer.

2.10.2. Unused portions of samples are retained by each laboratory based on program or customer requirements for sample retention and storage. The minimum sample retention time is 45 days from receipt of the samples. Samples requiring thermal preservation may be stored at ambient temperature when the hold time is expired, the report has been delivered, and/or allowed by the customer, program, or contract. Samples requiring storage beyond the minimum sample retention time due to special requests or contractual obligations may be stored at ambient temperature unless the laboratory has sufficient capacity and their presence does not compromise the integrity of other samples.

2.10.3. After this period expires, non-hazardous samples are properly disposed of as non-hazardous waste. The preferred method for disposition of hazardous samples is to return the excess sample to the customer. If it is not feasible to return samples, or the customer requires PASI to dispose of excess samples, proper arrangements will be made for disposal by an approved contractor.

2.10.4. Additional information can be found in PGH-C-017 Waste Handling and Management and PGH-C-001 Sample Management or their equivalent revisions or replacements.

3.0. ANALYTICAL CAPABILITIES

3.1. Analytical Method Sources

3.1.1. PASI laboratories are capable of analyzing a full range of environmental samples from a variety of matrices, including air, surface water, wastewater, groundwater, soil, sediment, biota, and other waste products. The approved valid editions of methodologies are applied from regulatory and professional sources including EPA, ASTM, USGS, NIOSH, Standard Methods, and State Agencies. Section 11 is a representative listing of general analytical protocol references. PASI discloses in writing to its customers and regulatory agencies any instances in which modified methods are being used in the analysis of samples.

3.1.2. In the event of a customer-specific need, instrumentation constraint or regulatory requirement, PASI laboratories reserve the right to use valid versions of methods that may not be the most recent edition available.

3.2. Analytical Method Documentation

3.2.1. The primary form of PASI laboratory documentation of analytical methods is the Standard Operating Procedure (SOP). SOPs contain pertinent information as to what steps are required by an analyst to successfully perform a procedure. The required contents for the SOPs are specified in the company-wide SOP template for Preparation of SOPs (SOT-ALL-Q-001).

3.2.2. The SOPs may be supplemented by other training materials that further detail how methods are specifically performed. This training material will undergo periodic, documented review along with the other Quality System documentation.

3.3. Analytical Method Validation and Instrument Validation

3.3.1. In some situations, PASI develops and validates methodologies that may be more applicable to a specific problem or objective. When non-standard methods are required for specific projects or analytes of interest, or when the laboratory develops or modifies a method, the laboratory validates the method prior to applying it to customer samples. Method validity is established by meeting criteria for precision and accuracy as established by the data quality objectives specified by the end user of the data. The laboratory records the validation procedure, the results obtained and a statement as to the usability of the method. The minimum requirements for method validation include evaluation of sensitivity, quantitation, precision, bias, and selectivity of each analyte of interest.

3.3.1.1. Exceptionally permitting departures from documented policies and procedures or from standard specifications

3.3.1.1.1. Departures must be evaluated and approved by the Department Supervisor/Manager and/or the Quality Manager prior to implementation. Minor departures (i.e. Surrogate or Spike failures) may be addressed in the specific analytical SOP's.

3.3.1.1.2. The evaluation should include determination of effects of the changes made to the policy, procedure or specification and the need for additional QC to show validation of the changes (i.e. MDL's, DOC's).

3.3.1.1.3. Evaluation should include a review of any agency or client requirements for the prior approval of changes to policies, procedures or specifications and the process for securing these approvals.

3.3.1.1.4. Departures must be fully documented in the laboratory records and in the final reports using case narratives.

3.3.2. When the laboratory implements new methods, develops new methods, or adds a new analyte of interest to a method, at the very minimum the method is validated for sensitivity even in instances where a method detection study may not apply. The laboratory also tries to procure and analyze a performance test (PT) sample however there may be instances where no such sample is obtainable. In these instances the laboratory either consults with other vendors (that may not be actual PT providers) to procure the necessary sample or the laboratory itself may make a blind matrix spike for the laboratory to analyze.

3.3.2.1. At a minimum, the laboratory may conduct a three concentration/three standard approach by spiking at least three samples at three different concentration levels. Those levels must include one sample at 1-3 times the sensitivity level, (or 2-4 times if it's a multi-analyte test), one at ten times the sensitivity level and one at a concentration in-between those two levels.

3.3.2.1.1. The samples should be spiked at these levels and carried through the entire procedure.

3.3.2.1.2. In the case of radiological samples it is not acceptable to spike at one level and then allow for half-lives to pass for the lower concentration levels.

3.3.2.1.3. The demonstration of capability described below may be used for one of the above mentioned levels providing it is within the desired spiking range.

3.3.2.1.4. The sensitivity level must have a positive detection; the other levels may be evaluated by percent recovery.

3.3.2.1.5. The above reference method validation is performed when applicable regardless as to the certification or accreditation status of the method for the laboratory

3.4. Demonstration of Capability (DOC)

3.4.1. Analysts complete an initial demonstration of capability (IDOC) study prior to performing a method or when there is a change in instrument type, personnel, or test method, or at any time that a method has not been performed by the laboratory or analyst in a 12-month period. The mean recovery and standard deviation of each analyte, taken from 4 replicates of a quality control standard is calculated and compared to method criteria (if available) or established laboratory criteria for evaluation of acceptance. Each laboratory maintains copies of all demonstrations of capability, including those that fail acceptance criteria and corresponding raw data for future reference and must document the acceptance criteria prior to the analysis of the DOC. Demonstrations of capability are verified on an annual basis.

3.4.2. For Continuing Demonstrations of Capability, the laboratories may use Performance Testing (PT) samples in lieu of the 4-replicate approach listed above. For methods or procedures that do not lend themselves to the "4-replicate" approach, the demonstration of capability requirements will be specified in the applicable SOP.

3.4.3. Demonstration of Capability studies for radiological drinking water methods must be performed at a concentration that is above the MDC and below the MCL for the target parameter. [Required in the EPA Manual for the Certification of Laboratories for Drinking Waters Chapter VI section 1.5]

3.4.4. Additional information can be found in SOP S-ALL-Q-020 **Training and Employee Orientation** or its equivalent revision or replacement.

3.5. Regulatory and Method Compliance

3.5.1. PASI understands that expectations of our customers commonly include the assumption that laboratory data will satisfy specific regulatory requirements. Therefore PASI attempts to ascertain, prior to beginning a project, what applicable regulatory jurisdiction, agency, or protocols apply to that project. This information is also required on the chain of custody submitted with samples.

3.5.2. PASI makes every effort to detect regulatory or project plan inconsistencies, based upon information from the customer, and communicate them immediately to the customer in order to aid in the decision making process. PASI will not be liable if the customer chooses not to follow PASI recommendations.

3.5.3. It is PASI policy to disclose in a forthright manner any detected noncompliance affecting the usability of data produced by our laboratories. The laboratory will notify customers within 30 days of fully characterizing the nature of the nonconformance, the scope of the nonconformance and the impact it may have on data usability.

3.5.4. When PASI-PGH develops and implements methods or tests that are not certified or accredited, PASI-PGH will document with footnotes or in a written statement within the case narrative of the final report that the tests are for informational purposes only and are not to be used for compliance or regulatory decisions. In instances where the parameter accreditation is not available the need to specify will be determined on a client by client basis.

4.0. QUALITY CONTROL PROCEDURES

Quality control data is analyzed and where they are found to be outside pre-defined criteria, planned action is taken to correct the problem in order to prevent incorrect results from being reported. Quality control samples are to be processed in the same manner as client samples.

4.1. Method Blank

4.1.1. A method blank is used to evaluate contamination in the preparation/analysis system and is processed through all preparation and analytical steps with its associated samples.

4.1.2. A method blank is processed at a minimum frequency of one per preparation batch (see glossary section of this document for further clarification of the definition of batch). In the case of a method that has no separate preparation step, a method blank is processed with no more than 20 samples of a specific matrix performed by the same analyst, using the same method, standards, and reagents.

4.1.3. The method blank consists of a matrix similar to the associated samples that is known to be free of analytes of interest. Method blanks are not applicable for certain analyses, such as pH, conductivity, flash point and temperature

4.1.4. Each method blank is evaluated for contamination. The source of any contamination is investigated and documented corrective action is taken when the concentration of any target analyte is detected above the reporting limit and is greater than 1/10 of the amount of that analyte found in any associated sample. Some labs, due to client requirements, etc., may have to evaluate their method blanks down to ½ the reporting limit or down to the method detection limit as opposed to the reporting limit itself. Corrective actions for blank contamination may include the re-preparation and re-analysis of all samples (where possible) and quality control samples. Data qualifiers must be applied to results that are considered affected by contamination in a method blank.

4.1.5. For DoD samples, the method blank will be considered to be contaminated if: 1) The concentration of any target analyte in the blank exceeds 1/2 the reporting limit and is greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit whichever is greater; 2) The concentration of any common laboratory contaminant in the blank exceeds the reporting limit and is greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit whichever is greater or 3) The blank result otherwise affects the sample results as per the test method requirements or the project-specific objectives. If the method blank is contaminated as described above, then the laboratory shall reprocess affected samples in a subsequent preparation batch, except when sample results are below the LOD. If insufficient sample volume remains for reprocessing, the results shall be reported with appropriate data qualifiers.

4.1.6. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.1.7. Method blanks are only applicable to batches processed to report client data. Batches used for screening purposes may contain more than 20 samples and may not have an associated MB.

4.2. Laboratory Control Sample

4.2.1. The Laboratory Control Sample (LCS) is used to evaluate the performance of the entire analytical system including preparation and analysis.

4.2.2. An LCS is processed at a minimum frequency of one per preparation batch. In the case of a method that has no separate preparation step, an LCS will be processed with no more than 20 samples of a specific matrix performed by the same analyst, using the same method, standards, and reagents.

4.2.3. The LCS consists of a matrix similar to the associated samples that is known to be free of the analytes of interest that is then spiked with known concentrations of target analytes.

4.2.4. The LCS contains all analytes specified by a specific method or by the customer or regulatory agency, which may include full list of target compounds, with certain exceptions. These exceptions may include analyzing only specific Aroclors when PCB analysis is requested or not spiking with all EPA Appendix IX compounds when a full Appendix IX list of compounds is requested. However, the lab must ensure that all target components in its scope of accreditation are included in the spike mixture for the LCS over a two (2) year period. In the absence of specified components, the laboratory will spike the LCS with the following compounds:

- For multi-peak analytes (e.g. PCBs, technical chlordane, toxaphene), a representative standard will be processed.
- For methods with long lists of analytes, a representative number of target analytes may be chosen. The following criteria is used to determine the number of LCS compounds used:
  - For methods with 1-10 target compounds, the laboratory will spike with all compounds
  - For methods with 11-20 target compounds, the laboratory will spike with at least 10 compounds or 80%, whichever is greater
  - For methods with greater than 20 compounds, the laboratory will spike with at least 16 compounds.

4.2.5. The LCS is evaluated against the method default or laboratory-derived acceptance criteria. For those methods that require laboratory-derived limits, method default control limits may be used until the laboratory has a minimum of 20, but preferably greater than 30, data points from which to derive internal acceptance criteria. Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Any associated sample containing an ‘out-of-control’ compound must either be re-analyzed with a successful LCS or reported with the appropriate data qualifier. When the acceptance criteria for the LCS are exceeded high, and there are associated samples that are non-detects, then those non-detects can be reported with data qualifiers, or when the acceptance criteria are exceeded low, those associated sample results may be reported if they exceed the maximum regulatory limit/decision level with data qualifiers.

4.2.6. For LCSs containing a large number of analytes, it is statistically likely that a few recoveries will be outside of control limits. This does not necessarily mean that the system is out of control, and therefore no corrective action would be necessary (except for proper documentation). TNI has allowed for a minimum number of marginal exceedances, defined as recoveries that are beyond the LCS control limits (3X the standard deviation) but less than the marginal exceedance limits (4X the standard deviation). The number of allowable exceedances depends on the number of compounds in the LCS. If more analyte recoveries exceed the LCS control limits than is allowed (see below) or if any one analyte

exceeds the marginal exceedance limits, then the LCS is considered non-compliant and corrective actions are necessary. The number of allowable exceedances is as follows:

- >90 analytes in the LCS- 5 analytes
- 71-90 analytes in the LCS- 4 analytes
- 51-70 analytes in the LCS- 3 analytes
- 31-50 analytes in the LCS- 2 analytes
- 11-30 analytes in the LCS- 1 analyte
- <11 analytes in the LCS- no analytes allowed out)

Refer to laboratory SOPs for details of LCS criteria and marginal exceedance limits.

Note: the use of marginal exceedances is not approved for work from the state of South Carolina.

4.2.7. A matrix spike (MS) can be used in place of a non-compliant LCS in a batch as long as the MS passes the LCS acceptance criteria (this is a TNI allowance). Note: the use of the MS to replace a non-compliant LCS is not approved for work from the state of South Carolina. When this happens, full documentation must be made available to the data user. If this is not allowed by a customer or regulatory body, the associated samples must be rerun with a compliant LCS (if possible) or reported with appropriate data qualifiers.

4.2.8. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.2.9. For Department of Defense projects, the laboratory is not allowed to have any target analytes that exceed DoD LCS control limits. In the case of LCS failures, the laboratory is required to reanalyze the associated samples with an acceptable LCS for all target compounds if there is sufficient sample remaining. The laboratory must make every effort to take the appropriate corrective actions and resolve any anomalies regarding LCSs for Department of Defense projects. All LCS failures must be accounted for in project case narratives. See applicable method SOPs for further corrective action.

4.2.10. Laboratory Control Samples are only applicable to batches processed to report client data. Batches used for screening purposes may contain more than 20 samples and may not have an associated LCS.

4.2.11. Deviations made from this policy must be approved by the SQM prior to release of the data.

4.3. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

4.3.1. A matrix spike (MS) is used to determine the effect of the sample matrix on compound recovery for a particular method. The information from these spikes is sample or matrix specific and is not used to determine the acceptance of an entire batch unless the MS is actually used as the LCS.

4.3.2. A Matrix Spike/Matrix Spike Duplicate (MS/MSD) set is processed at a frequency specified in a particular method or as determined by a specific customer request. This frequency will be specified in the applicable method SOP or customer QAPP. In the absence of such

requirements, an MS/MSD set is routinely analyzed once per every 20 samples per matrix per method.

4.3.3. The MS and MSD consist of the sample matrix that is then spiked with known concentrations of target analytes. Laboratory personnel spike customer samples that are specifically designated as MS/MSD samples or, when no designated samples are present in a batch, randomly select samples to spike that have adequate sample volume or weight. Spiked samples are prepared and analyzed in the same manner as the original samples and are selected from different customers if possible.

4.3.4. The MS and MSD contain all analytes specified by a specific method or by the customer or regulatory agency. In the absence of specified components, the laboratory will spike the MS/MSD with the same number of compounds as previously discussed in the LCS section. However, the lab must ensure that all targeted components in its scope of accreditation are included in the spike mixture for the MS/MSD over a two (2) year period.

4.3.5. The MS and MSD are evaluated against the method or laboratory derived criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. The spike recoveries give the data user a better understanding of the final results based on their site specific information.

4.3.6. A matrix spike and sample duplicate will be performed instead of a matrix spike and matrix spike duplicate when specified by the customer or method.

4.3.7. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.3.8. For DoD work, each non-radiochemistry preparation batch of samples must contain an associated MS and MSD (or sample duplicate) using the same matrix collected for the specific DoD project. For radiochemical analyses, tests that do not incorporate the use of a carrier or tracer for yield assessment must contain an associated MS and MSD (or sample duplicate) using the same matrix collected for the specific DOD project. Gamma spectroscopy analyses are excluded from the MS/MSD requirement as the test does not require chemical processing of samples for analysis. If adequate sample material is not available, then the lack of MS/MSDs shall be noted in the case narrative. Additional MS/MSDs may be required on a project-specific basis. The MS/MSD must be spiked with all target analytes with the exception of PCB analysis, which is spiked per the method. The concentration of the spiked compounds shall be at or below the midpoint of the calibration range or at the appropriate concentration of concern. Multiple spiked samples may need to be prepared to avoid interferences.

4.3.9. For DoD work, the results of all MS/MSD must be evaluated using the same acceptance criteria used for the LCS.

4.3.10. Matrix Spike/Matrix Spike Duplicate samples are only applicable to batches processed to report client data. Batches used for screening purposes may contain more than 20 samples and may not have an associated MS/MSD.

4.3.11. Deviations made from this policy must be approved by the SQM prior to release of the data.

4.4. Sample Duplicate

4.4.1. A sample duplicate is a second portion of sample that is prepared and analyzed in the laboratory along with the first portion. It is used to measure the precision associated with preparation and analysis. A sample duplicate is processed at a frequency specified by the particular method or as determined by a specific customer.

4.4.2. The sample and duplicate are evaluated against the method or laboratory derived criteria for relative percent difference (RPD). Any duplicate that is outside of these limits is considered to be 'out of control' and must be qualified appropriately.

4.4.3. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.4.4. Sample Duplicates are only applicable to batches processed to report client data. Batches used for screening purposes may contain more than 20 samples and may not have an associated sample duplicate.

4.4.5. Deviations made from this policy must be approved by the SQM prior to release of the data.

4.5. Surrogates

4.5.1. Surrogates are compounds that reflect the chemistry of target analytes and are typically added to samples for organic analyses to monitor the effect of the sample matrix on compound recovery.

4.5.2. Surrogates are added to each customer sample (for applicable organics), method blank, LCS, MS, and calibration standard prior to extraction or analysis. The surrogates are evaluated against the method or laboratory derived acceptance criteria or against project-specific acceptance criteria specified by the client, if applicable. Any surrogate compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Samples with surrogate failures are typically re-extracted and/or re-analyzed to confirm that the out-of-control value was caused by the matrix of the sample and not by some other systematic error. An exception to this would be samples that have high surrogate values but no reportable hits for target compounds. These samples would be reported, with a qualifier, because the implied high bias would not affect the final results. For methods with multiple surrogates, documentation regarding acceptance and associated compounds will be found in the individual method SOPs.

4.5.3. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.5.4. Deviations made from this policy must be approved by the SQM prior to release of the data.

4.6. Internal Standards

4.6.1. Internal Standards are method-specific analytes added to every standard, method blank, laboratory control sample, matrix spike, matrix spike duplicate, sample, and calibration standard at a known concentration, prior to analysis for the purpose of adjusting the response factor used in quantifying target analytes. At a minimum, the laboratory will

follow method specific guidelines for the treatment of internal standard recoveries as they are related to the reporting of data.

4.6.2. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.7. Field Blanks

4.7.1. Field blanks are blanks prepared at the sampling site in order to monitor for contamination that may be present in the environment where samples are collected. These field quality control samples are often referenced as field blanks, rinsate blanks, or equipment blanks. The laboratory analyzes these field blanks as normal samples and informs the customer if there are any target compounds detected above the reporting limits.

4.8. Trip Blanks

4.8.1. Trip blanks are blanks that originate from the laboratory as part of the sampling event and are used to monitor for contamination of samples during transport. These blanks accompany the empty sample containers to the field and then accompany the collected samples back to the laboratory. These blanks are routinely analyzed for volatile methods where ambient background contamination is likely to occur.

4.9. Limit of Detection (LOD)

4.9.1. PASI laboratories are required to use a documented procedure to determine a limit of detection for each analyte of concern in each matrix reported. All sample processing steps of the preparation and analytical methods are included in this determination including any clean ups. For any test that does not have a valid LOD, sample results below the limit of quantitation (LOQ) cannot be reported.

4.9.2. The LOD is initially established for the compounds of interest for each method in a clean matrix with no target analytes present and no interferences at a concentration that would impact the results. The LOD is then determined every time there is a change in the test method that affects how the test is performed or when there has been a change in the instrument that affects the sensitivity. If required by customer, method or accreditation body, the LOD will be re-established annually for all applicable methods.

4.9.3. Unless otherwise noted, the method used by PASI laboratories to determine LODs is based on the Method Detection Limit (MDL) procedure outlined in 40 CFR Part 136, Appendix B. Where required by regulatory program or customer, the above referenced procedure will be followed.

4.9.4. Where specifically stated in the published method, LODs or MDLs will be performed at the listed frequency.

4.9.5. The validity of the LOD must be shown by detection (a value above zero) of the analytes in a QC sample in each quality system matrix. The QC sample must contain the analyte at no more than 3X the LOD for a single analyte test and 4X the LOD for multiple analyte tests. This verification must be performed on each instrument used for sample analysis and reporting of data. The validity of the LOD must be verified as part of the LOD

determination process. This verification must be done prior to the use of the LOD for sample analysis.

4.9.6. An LOD study is not required for any analyte for which spiking solutions or quality control samples are not available such as temperature.

4.9.7. The LOD, if required, shall be verified annually for each quality system matrix, technology and analyte. In lieu of performing full LOD (MDL) studies annually, the laboratory can verify the LOD (MDL) on an annual basis, providing this verification is fully documented and does not contradict other customer or program requirements that the laboratory must follow. The requirements of this verification are:

- The spike concentration of the verification must be no more than 3X times the LOD for single analyte tests and 4X the LOD for multiple analyte tests.
- The laboratory must verify the LOD on each instrument used for the reporting of sample data.
- The laboratory must be able to identify all target analytes in the verification standard (distinguishable from noise).
- Radiological tests do not have to perform LOD studies; however drinking water tests should have annual sensitivity tests of DOCs at a concentration between the required detection limit and the MCL.

4.9.8. DoD definition for LOD- The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate is 1%.

4.9.9. For DOD, the LOD is set at the concentration used to verify the MDL. This verification is required on a quarterly basis for all targets and must be at concentration that is between the MDL and reporting limit concentrations.

4.9.10. Additional information can be found in SOP PGH-Q-035 Determination of LOD and LOQ or its equivalent revision or replacement.

4.10. Limit of Quantitation (LOQ)

4.10.1. A limit of quantitation (LOQ) for every analyte of concern must be determined. For PASI laboratories, this LOQ is referred to as the RL, or Reporting Limit. This RL is based on the lowest calibration standard concentration that is used in each initial calibration. Results below this level are not allowed to be reported without qualification since the results would not be substantiated by a calibration standard. For methods with a determined LOD, results can be reported out below the LOQ but above the LOD if they are properly qualified (e.g., J flag).

4.10.2. The LOQ must be higher than the LOD.

4.10.3. To verify the LOQ, the laboratory will prepare a sample in the same matrix used for the LCS. The sample will be spiked with each target analyte at a concentration equivalent to the RL or 2X the RL. This sample must undergo the routine sample preparation procedure including any routine sample cleanup steps. The sample is then analyzed and the recovery of each target analyte determined. The recovery for each target analyte must

meet the laboratories current control limits for an LCS. The annual LOQ verification is not required if the LOD was determined or verified annually on that instrument.

4.10.4. For DoD approved methods, the LOQ and LOD shall be verified quarterly and valid LOQ must be in place prior to sample analysis.

4.10.5. Additional information can be found in SOP PGH-C-035 **Determination of LOD and LOQ** or its equivalent revision or replacement.

4.11. Estimate of Analytical Uncertainty

4.11.1. PASI laboratories can provide an estimation of uncertainty for results generated by the laboratory. The estimate quantifies the error associated with any given result at a 95% confidence interval. This estimate does not include bias that may be associated with sampling. The laboratory has a procedure in place for making this estimation. In the absence of a regulatory or customer-specific procedure, PASI laboratories base this estimation on the recovery data obtained from the Laboratory Control Spikes. The uncertainty is a function of the standard deviation of the recoveries multiplied by the appropriate Student's t Factor at 95% confidence. Additional information pertaining to the estimation of uncertainty and the exact manner in which it is derived are contained in the SOP PGH-Q-046 **Estimation of Measurement Uncertainty** or its equivalent revision or replacement.

4.11.2. The measurement of uncertainty is provided only on request by the customer, as required by specification or regulation and when the result is used to determine conformance within a specification limit.

4.11.3. Radiological tests often report uncertainty and the manner in which it is derived are in accordance with Multi-Agency Radiological Laboratories Analytical Protocols Manual (MARLAP) and Evaluation of Measurement Data – Guide to the Expression of Uncertainty in Measurement (GUM). The means by which these criteria are applied can be found in the method SOPs.

4.12. Proficiency Testing (PT) Studies

4.12.1. PASI laboratories participate in the TNI defined proficiency testing program. PT samples are obtained from NIST approved providers and analyzed and reported at a minimum of two times per year for the relevant fields of testing per matrix.

4.12.2. PASI-Pittsburgh uses ERA for most of the environmental PT samples. PASI-PGH uses other TNI approved PT providers for those cases where PT samples are not available from ERA. PASI-PGH also participates in the MAPEP radiochemistry studies for nondrinking water matrices. Results of the studies are submitted to the appropriate state agencies as required to maintain and/or acquire accreditation and/or certification.

4.12.3. The laboratory initiates an investigation whenever PT results are deemed 'unacceptable' by the PT provider. All findings and corrective actions taken are reported to the SQM/QM or their designee. A corrective action plan is initiated and this report is sent to the appropriate state accreditation agencies for their review. Additional PTs will be analyzed and reported as needed for certification purposes.

4.12.4. PT samples are treated as typical customer samples, utilizing the same staff, methods, equipment, facilities, and frequency of analysis. PT samples are included in the laboratory's normal analytical processes and do not receive extraordinary attention due to their nature.

4.12.5. Comparison of analytical results with anyone participating in the same PT study is prohibited prior to the close of the study.

4.12.6. Additional information can be found in SOP PGH-C-031 **Proficiency Testing Program** or its equivalent revision or replacement.

4.13. Rounding and Significant Figures

4.13.1. In general, the PASI laboratories report data to no more than three significant digits. Therefore, all measurements made in the analytical process must reflect this level of precision. In the event that a parameter that contributes to the final result has less than three significant figures of precision, the final result must be reported with no more significant figures than that of the parameter in question. The rounding rules listed below are descriptive of the LIMS and not necessarily of any supporting program such as Excel.

4.13.2. Data is compared to the reporting limits and MDLs to determine if qualifiers are needed before the rounding step occurs.

4.13.3. **Rounding:** PASI-Pittsburgh follows the odd / even guidelines for rounding numbers:

- If the figure following the one to be retained is less than five, that figure is dropped and the retained ones are not changed (with three significant figures, 2.544 is rounded to 2.54).
- If the figure following the ones to be retained is greater than five, that figure is dropped and the last retained one is rounded up (with three significant figures, 2.546 is rounded to 2.55).
- If the figure following the ones to be retained is five and if there are no figures other than zeros beyond that five, then the five is dropped and the last figure retained is unchanged if it is even and rounded up if it is odd (with three significant figures, 2.525 is rounded to 2.52 and 2.535 is rounded to 2.54).

4.13.4. **Significant Digits**

4.13.4.1. PASI-Pittsburgh follows the following convention for reporting to a specified number of significant figures. Unless specified by federal, state, or local requirements or on specific request by a customer, the laboratory reports:

Values > 10 – Reported to 3 significant digits
Values ≤ 10 – Reported to 2 significant digits

4.14. Retention Time Windows

4.14.1. When chromatographic conditions are changed, retention times and analytical separations are often affected. As a result, two critical aspects of any chromatographic method are the determination and verification of retention times and analyte separation. Retention time

windows must be established for the identification of target analytes. The retention times of all target analytes in all calibration verification standards must fall within the retention time windows. If an analyte falls outside the retention time window in an ICV or CCV, new absolute retention time windows must be calculated, unless instrument maintenance fixes the problem. When a new column is installed, a new retention time window study must be performed.

4.14.2. One process for the production of retention time windows: Make 3 injections of all single component or multi-component analytes over a 72-hour period. Record the retention time in minutes for each analyte and surrogate to 3 decimal places. Calculate the mean and standard deviation of the three absolute retention times for each target analyte and surrogate. For multi-component analytes, choose 3-5 major peaks and calculate the mean and standard deviation for each of the peaks. If the standard deviation of the retention times of a target analyte is 0.000, the lab may use a default standard deviation of 0.01. The width of the retention time window for each analyte and surrogate and major peak in a multi-component analyte is defined as +/- 3 times the standard deviation of the mean absolute retention time established during that 72-hour period or 0.03 minutes, whichever is greater.

4.14.3. The center of the retention time window is established for each analyte and surrogate by using the absolute retention times from the CCV at the beginning of the analytical shift. For samples run with an initial calibration, use the retention time of the mid-point standard of the initial calibration curve.

4.14.4. For more information, please reference the local facility's analytical SOPs.

5.0. DOCUMENT MANAGEMENT AND CHANGE CONTROL

5.1. Document Management

5.1.1. Additional information can be found in SOP PGH-Q-043 **Document Control and Management** or its equivalent revision or replacement. Information on Pace's policy for electronic signatures can also be found in this SOP.

5.1.2. Pace Analytical Services, Inc. has an established procedure for managing documents that are part of the quality system. The list of managed documents includes, but is not limited to, Standard Operating Procedures (both technical and non-technical), Quality Assurance Manuals, quality policy statements, training documents, work-processing documents, charts, posters, memoranda, notices, forms, software, and any other procedures, tables, plans, etc. that have a direct bearing on the quality system (including applicable data records and non-technical documents).

5.1.3. A master list of all managed documents is maintained at each facility identifying the current revision status and distribution of the controlled documents. This establishes that there are no invalid or obsolete documents in use in the facility. All documents are reviewed periodically and revised if necessary. Obsolete documents are systematically discarded or archived for audit or knowledge preservation purposes. Copies of all quality systems documentation provided to DoD for review must be in English.

5.1.4. Each managed document is uniquely identified to include the date of issue, the revision identification, page numbers, the total number of pages and the issuing authorities. For complete information on document numbering, refer to SOP S-ALL-Q-003 Document Numbering.

5.1.5. SOPs, specifically, are available to all laboratory staff via the Learning Management System (LMS) which is a secure repository that is accessed through an internet portal. As a local alternative to the hard copy system of controlled documents, secured electronic copies of controlled documents may be maintained on the laboratory's local server. These document files can be read and printed. The most current version is always in the Learning Management system and in the local network directory. The QA department and the administrator have full access to the system. Other requirements for this system are as follows:

- Electronic documents must be readily accessible to all facility employees.
- All hardcopy SOPs must be obtained from the Quality Department. Electronic copies of SOPs are available for use in the Laboratory's network drive.

5.1.6. **Quality Assurance Manual (QAM):** The Quality Assurance Manual is the company-wide document that describes all aspects of the quality system for PASI. The base QAM template is distributed by the Corporate Quality Department to each of the SQMs/QMs. The local management personnel modify the necessary and permissible sections of the base template and submit those modifications to the Corporate Director of Quality for review. Once approved and signed by both the CEO and the Director of Quality; the SGM/GM/AGM/OM, the SQM/QM, and any Technical Directors sign the Quality Assurance Manual. Each SQM/QM is then in charge of distribution to employees, external customers or regulatory agencies and maintaining a distribution list of controlled document

copies. The Quality Assurance Manual template is reviewed on an annual basis by all of the PASI SQMs/QMs and revised accordingly by the Director of Quality.

5.1.7. **Standard Operating Procedures (SOPs)**

5.1.7.1. SOPs fall into two categories: company-wide documents and facility specific documents. Company-wide SOPs start with the prefix S-ALL- and local SOPs start with the individual facility prefix.

5.1.7.2. The purpose of the company-wide SOPs is to establish policies and procedure that are common and applicable to all PASI facilities. Company-wide SOPs are document-controlled by the corporate quality office and signed copies are distributed to all of the SQMs/QMs. The local management personnel sign the company-wide SOPs. The SQM/QM is then in charge of distribution to employees, external customers, or regulatory agencies and maintaining a distribution list of controlled document copies.

5.1.7.3. Local PASI facilities are responsible for developing facility-specific SOPs applicable to their respective facility. The local facility develops these facility-specific SOPs based on the corporate-wide SOP template. This template is written to incorporate a set of minimum method requirements and PASI best practice requirements. The local facilities may add to or modify the corporate-wide SOP template provided there are no contradictions to the minimum method or best practice requirements. Facility-specific SOPs are controlled by the applicable SQM/QM according to the corporate document management policies.

5.1.7.4. SOPs are reviewed every two years at a minimum although a more frequent review may be required by some state or federal agencies or customers. If no revisions are made based on this review, documentation of the review itself is made by the addition of new signatures on the cover page. If revisions are made, documentation of the revisions is made in the revisions section of each SOP and a new revision number is applied to the SOP. This provides a historical record of all revisions.

5.1.7.5. All copies of superseded SOPs are removed from general use and the original copy of each SOP is archived for audit or knowledge preservation purposes. This ensures that all PASI employees use the most current version of each SOP and provides the SQM/QM with a historical record of each SOP.

5.1.7.6. Additional information can be found in SOP S-ALL-Q-001 Preparation of SOPs or its equivalent revision or replacement.

5.1.7.7. For DoD approval, all technical SOPs are reviewed for accuracy and adequacy annually and whenever method procedures change and updated as appropriate. All such reviews are documented and made available for assessment. Non-technical SOPs that are not required elements of the quality system are considered administrative SOPs and are not required to be reviewed annually. Drinking water SOPs for Rad methods are required to be reviewed annually.

5.1.8. **Other Documentation:**

5.1.8.1. All training documents and or document designed to help aid in the implementation of SOPs or regulatory guidance shall be submitted to the Quality Department to be evaluated for possible distribution as a controlled document.

5.1.8.2. Any documents used to track, evaluate or otherwise document instrument, reagents or standard conditions/performance should be submitted to the Quality Department to be evaluated for distribution as a controlled document.

5.1.8.3. Spreadsheets used to evaluate or produce client results must be locked and secured by the Quality and IT Departments. All spreadsheets must be validated and approved by the QA and/or IT Department. All copies of superseded spreadsheets are removed from general use and the original copy of each spreadsheet is archived for audit or knowledge preservation purposes. Use of archived spreadsheets or the unauthorized alterations of locked and secured spreadsheets on the network is strictly prohibited.

5.2. Document Change Control

5.2.1. Changes to managed documents are reviewed and approved in the same manner as the original review. Any revision to a document requires the approval of the applicable signatories. After revisions are approved, a revision number is assigned and the previous version of the document is officially retired. Copies may be kept for audit or knowledge preservation purposes.

5.2.1.1. Archived copies of controlled documents are marked as RETIRED by the QA Department including the date they were retired and the initials of the person who archived the document. The hardcopy document is then segregated from the current controlled documents in the QA files.

5.2.1.2. Electronic copies of the archived documents are moved to the ARCHIVE file folder in the Quality Department section of the network.

5.2.2. All controlled copies of the previous document are replaced with controlled copies of the revised document and the superseded copies are destroyed or archived. All affected personnel are advised that there has been a revision and any necessary training is scheduled.

5.3. Management of Change

5.3.1. The process for documenting necessary changes within the laboratory network are not typically handled using the corrective or preventive action system as outlined in section 9.0. Management of Change is a proactive approach to dealing with change to minimize the potential negative impact of systematic change in the laboratory and to ensure that each change has a positive desired outcome. This process will primarily be used for the implementation of large scale projects and information system changes as a means to apply consistent systems or procedures within the laboratory network. The request for change is submitted by the initiator and subsequently assigned to an individual or team for development and planning. The final completion of the process culminates in final approval and verification that the procedure was effectively implemented. Additional information can be found in SOP PGH-Q-047 **Management of Change** or its equivalent revision or replacement.

6.0. EQUIPMENT AND MEASUREMENT TRACEABILITY

Each PASI facility is equipped with sufficient instrumentation and support equipment to perform the relevant analytical testing or field procedures performed by each facility. Support equipment includes chemical standards, thermometers, balances, disposable and mechanical pipettes, etc. This section details some of the procedures necessary to maintain traceability and to perform proper calibration of instrumentation and support equipment. See Attachment III for a list of equipment currently used at the PASI-Pittsburgh facility.

6.1. Standards and Traceability

6.1.1. Each PASI facility retains all pertinent information for standards, reagents, and chemicals to assure traceability to a national standard. This includes documentation of purchase, receipt, preparation, and use.

6.1.2. Upon receipt, all purchased standard reference materials are recorded into a standard logbook or database and assigned a unique identification number. The entries include the facility's unique identification number, the chemical name, manufacturer name, manufacturer's identification numbers, receipt date, and expiration date. Vendor's certificates of analysis for all standards, reagents, or chemicals are retained for future reference.

6.1.3. Subsequent preparations of intermediate or working solutions are also documented in a standard logbook or database. These entries include the stock standard name and lot number, the manufacturer name, the solvents used for preparation, the solvent lot number and manufacturer, the preparation steps, preparation date, expiration dates, preparer's initials, and a unique PASI identification number. This number is used in any applicable sample preparation or analysis logbook so the standard can be traced back to the standard preparation record. This process ensures traceability back to the national standard.

6.1.4. All prepared standard or reagent containers include the PASI identification number, the standard or chemical name, the date of preparation, the date of expiration, the concentration with units, and the preparer's initials. This ensures traceability back to the standard preparation logbook or database.

6.1.5. For containers that are too small to accommodate labels that list all of the above information associated with a standard, the minimum required information will be PASI standard ID, concentration, and expiration date. This assures that no standard will be used past its assigned expiration date.

6.1.6. If a second source standard is required to verify an existing calibration or spiking standard, this standard must be obtained from a different manufacturer or from a different lot unless client specific QAPP requirements state otherwise.

6.1.7. Additional information concerning standards and reagent traceability can be found in the SOP PGH-C-037 **Standard and Reagent Management and Traceability** or its equivalent revision or replacement.

6.2. General Analytical Instrument Calibration Procedures (Organic and Inorganic)

6.2.1. All support equipment and instrumentation are calibrated or checked before use to ensure proper functioning and verify that the laboratory's requirements are met. All calibrations are performed by, or under the supervision of, an experienced analyst at scheduled intervals against either certified standards traceable to recognized national standards or reference standards whose values have been statistically validated. All radionuclide sources shall be validated by counting the sources or dilutions of the sources and documenting that the results are within the established acceptance criteria.

6.2.2. Calibration standards for each parameter are chosen to establish the linear range of the instrument and must bracket the concentrations of those parameters measured in the samples. The lowest calibration standard is the lowest concentration for which quantitative data may be reported. Data reported below this level is considered to have less certainty and must be reported using appropriate data qualifiers or explained in a narrative. The highest calibration standard is the highest concentration for which quantitative data may be reported. Data reported above this level is considered to have less certainty and must be reported using appropriate data qualifiers or explained in the narrative. Any specific method requirement for number and type of calibration standards supersedes the general requirement. Instrument and method specific calibration criteria are explained within the specific analytical standard operating procedures for each facility.

6.2.2.1. Radiological calibrations may follow one of several methodologies based on technology of the counting; these can include efficiency curves, energy calibrations and quench curves. The various calibrations should ensure that the range chosen encompasses the activities expected in the client samples.

6.2.3. Results from all calibration standards analyzed must be included in constructing the calibration curve with the following exceptions:

6.2.3.1. The lowest level calibration standard may be removed from the calibration as long as the remaining number of concentration levels meets the minimum established by the method and standard operating procedure. For multi-parameter methods, this may be done on an individual analyte basis. The reporting limit must be adjusted to the lowest concentration included in the calibration curve;

6.2.3.2. The highest level calibration standard may be removed from the calibration as long as the remaining number of concentration levels meets the minimum established by the method and standard operating procedure. For multi-parameter methods, this may be done an individual analyte basis. The upper limit of quantitation must be adjusted to the highest concentration included in the calibration curve;

6.2.3.3. Multiple points from either the high end or the low end of the calibration curve may be excluded as long as the remaining points are contiguous in nature and the minimum number of levels remains as established by method or standard operating procedure. The reporting limit or quantitation range, whichever is appropriate, must be adjusted accordingly;

6.2.3.4. Results from a concentration level between the lowest and highest calibration levels can only be excluded from an initial calibration curve for a documentable and acceptable cause with approval from the responsible department supervisor and the local SQM/QM or their designee. An acceptable cause is defined as an obvious sample introduction issue that resulted in no response, documentation of an incorrectly prepared standard, or a documented response of a single standard that is greater than 2X the difference from the expected value of that standard. The results for all analytes are to be excluded and the

point must be replaced by re-analysis. Re-analysis of this interior standard must occur within the same method specified tune time period for GC/MS methodologies and within 8 hours of the initial analysis of that standard for non-GC/MS methodologies. All samples analyzed prior to the re-analyzed calibration curve point must be re-analyzed after the calibration curve is completed and re-processed against the final calibration curve.

6.2.4. Instrumentation or support equipment that cannot be calibrated to specification or is otherwise defective is clearly labeled as out-of-service until it has been repaired and tested to demonstrate it meets the laboratory's specifications. All repair and maintenance activities including service calls are documented in the maintenance log. Equipment sent off-site for calibration testing is packed and transported to prevent breakage and is in accordance with the calibration laboratory's recommendations.

6.2.5. In the event that recalibration of a piece of test equipment indicates the equipment may have been malfunctioning during the course of sample analysis, an investigation is performed. The results of the investigation along with a summary of the information reviewed are documented and maintained by the quality manager. Customers must be notified within 30 days after the data investigation is completed and the impact to final results is assessed. This allows for sufficient investigation and review of documentation to determine the impact on the analytical results. Instrumentation found to be consistently out of calibration is either repaired and positively verified or taken out of service and replaced.

6.2.6. Raw data records are retained to document equipment performance. Sufficient raw data is retained to reconstruct the instrument calibration and explicitly connect the continuing calibration verification to the initial calibration.

6.2.7. **General Organic Calibration Procedures**

6.2.7.1. Calibration standards are prepared at a minimum of five concentrations for organic analyses (unless otherwise stipulated in the method).

6.2.7.2. Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. Curves that do not meet the appropriate criteria require corrective action that may include re-running the initial calibration curve. Rounding to meet initial calibration criteria is not allowed, that is, 15.3 cannot be rounded down to meet a $\leq$ 15% RSD requirement. This also applies to linear and non-linear fit requirements. All initial calibrations are verified with an initial calibration verification standard (ICV) obtained from a second manufacturer or second lot from the same manufacturer if that lot can be demonstrated as prepared independently from other lots prior to the analysis of samples. Sample results are quantitated from the initial calibration unless otherwise required by regulation, method, or program.

6.2.7.3. The calibration curve is verified by the analysis of a mid-level continuing calibration verification (CCV) standard during the course of sample analysis. This standard is from the same source as the initial calibration unless otherwise specified in the source method to be from an alternate source material. Rounding to meet continuing calibration criteria is not allowed. Continuing calibration verification is performed at the beginning and end of each analytical batch except if an internal standard is used, then only one verification at the beginning of the batch is needed, whenever it is expected that the analytical system may be out of calibration, if the time period for calibration has expired, or for analytical systems that have specific calibration verification requirements. This verification standard must meet acceptance criteria in order for sample analysis to proceed.

6.2.7.4. In the event that the CCV does not meet the acceptance criteria, a second CCV may be injected as part of the diagnostic evaluation and corrective action investigation. If the second CCV is acceptable, the analytical sequence may be continued. If both CCVs fail, the analytical sequence is terminated and corrective action is initiated. Sample analysis cannot begin until after documented corrective action has been completed and either two consecutive passing CCVs have been analyzed or the instrument has successfully passed a new initial calibration. All samples analyzed since the last compliant CCV are re-analyzed for methodologies utilizing external calibration.

6.2.7.4.1. For DoD labs: the lab must re-analyze CCVs and all samples analyzed since the last successful calibration verification. If re-analysis is not possible, the lab must notify the client prior to reporting data associated with a non-compliant CCV. If these data are reported, the data must be qualified and explained in the case narrative. If the lab routinely analyzes two CCVs, then both CCVs must be evaluated. If either CCV fails, the lab must perform all required corrective actions and re-analyze all samples since the last acceptable calibration verification.

6.2.7.5. When instruments are operating unattended, autosamplers may be programmed to inject consecutive CCVs as a preventative measure against CCV failure with no corrective action. In this case, both CCVs must be evaluated to determine potential impact to the results. A summary of the decision tree and necessary documentation are listed below:

- If both CCVs meet the acceptance criteria, the analytical sequence is allowed to continue without corrective action. The method specified clock begins with the injection of the second CCV.
- If the first CCV does not meet the acceptance criteria and the second CCV is acceptable, the analytical sequence is continued and the results are reported.
- If the first CCV meets the acceptance criteria and the second CCV is out of control, the samples after the out of control CCV must be re-analyzed in a compliant analytical sequence.
- If both CCVs are out of control, all samples since the last acceptable CCV must be re-analyzed in a compliant analytical sequence.

6.2.7.6. Some analytical methods require that samples be bracketed by passing CCVs analyzed both before and after the samples. This is specific to each method but, as a general rule, all external calibration methods require bracketing CCVs. Most internal standard calibrations do not require bracketing CCVs.

6.2.7.7. Some analytical methods require verification based on a time interval; some methods require a frequency based on an injection interval. The type and frequency of the calibration verifications is dependent on both the analytical method and possibly on the quality program associated with the samples. The type and frequency of calibration verification will be documented in the method specific SOP employed by each laboratory.

6.2.8. General Inorganic Calibration Procedures

6.2.8.1. The instrument is initially calibrated with standards at multiple concentrations to establish the linearity of the instrument's response. A calibration blank is also included. Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. Rounding to meet initial calibration criteria is not allowed. This also

applies to linear and non-linear fit requirements. The number of calibration standards used depends on the specific method criteria or customer project requirements, although normally a minimum of three standards is used.

6.2.8.2. The ICP and ICP/MS can be standardized with a zero point and a single point calibration if:

- Prior to analysis, the zero point and the single point calibration are analyzed and a linear range has been established,
- Zero point and single point calibration standards are analyzed with each batch
- A standard corresponding to the LOQ is analyzed with the batch and meets the established acceptance criteria
- The linearity is verified at the frequency established by the method or manufacturer.

6.2.8.3. All initial calibrations are verified with an initial calibration verification standard (ICV) obtained from a second manufacturer or second lot from the same manufacturer if the lot can be demonstrated as prepared independently from other lots prior to the analysis of samples. Sample results are quantitated from the initial calibration unless otherwise required by regulation, method, or program.

6.2.8.4. During the course of analysis, the calibration curve is periodically verified by the analysis of calibration verification standards (CCV). A calibration verification standard is analyzed within each analytical batch at method/program specific intervals to verify that the initial calibration is still valid. The CCV is also analyzed at the end of the analytical batch.

6.2.8.5. A calibration blank is also run with each calibration verification standard to verify the cleanliness of the system. All reported results must be bracketed by acceptable CCVs. Instrument and method specific calibration acceptance criteria are explained within the specific analytical standard operating procedures for each facility.

6.2.8.6. Interference check standards are also analyzed per method requirements and must meet acceptance criteria for metals analyses.

6.2.9. **Radiological Equipment**

6.2.9.1. Radiological Equipment should be calibrated at the appropriate frequency and whenever the equipment undergoes maintenance. In the case of liquid scintillation counters the equipment shall be recalibrated when a significant move has taken place.

6.2.9.2. Calibrations can vary with equipment; in the case of gas flow proportional counters standards that range the expected residue range for gross alpha and beta shall be used, with efficiency curves developed to encompass the range of client sample residues. Any samples outside of this range shall be evaluated and the aliquot changed to accommodate the curve if necessary. Beta emitters, or isotopes that are shown to have less than a 2% efficiency change with residue that are known to not experience self attenuation may be calibrated by using a least 3 standards of known activity and comparing the efficiency results to ensure all agree to a relative standard deviation of less than 5%.

6.2.9.3. Quench factors for liquid scintillation counters shall be prepared by adding varied amounts of quenching agent. Any sample displaying a quench factor outside of the curve shall be evaluated. If the quench factors are shown to not vary in efficiency by greater than 2% then an efficiency calibration can be established using at least 3 standards of known activity and

comparing the efficiency results to ensure all agree to a relative standard deviation of less than 5%.

6.2.9.4. Cross talk factors must also be evaluated when samples are known to contain ore than one beta or an alpha and beta emitter.

6.2.9.5. All detectors must pass various daily tests depending upon the technology. The criteria of these various tests should be known to the analyst. Any detector that does not pass the daily check must be re-checked. If the daily test fails a second time the detector must be taken out of service for that day. Any detector that fails two daily checks must be evaluated and serviced if required. In most instances two passing daily checks are required to put a detector back into service

6.3. Support Equipment Calibration Procedures

6.3.1. All support equipment is calibrated or verified at least annually using NIST traceable references over the entire range of use. The results of calibrations or verifications must be within the specifications required or the equipment will be removed from service until repaired. The laboratory maintains records to demonstrate the correction factors applied to working thermometers.

6.3.2. On each day the equipment is used, balances, ovens, refrigerators (those used to keep samples and standards at required temperatures), freezers, and water baths are checked in the expected use range with NIST traceable references in order to ensure the equipment meets laboratory specifications and these checks are documented appropriately.

6.3.3. **Analytical Balances**

6.3.3.1. Each analytical balance is calibrated or verified at least annually by a qualified service technician. The calibration of each balance is verified each day of use with weights traceable to NIST bracketing the range of use. Calibration weights are ASTM Class 1 or other class weights that have been calibrated against a NIST standard weight and are re-certified every 5 years at a minimum against a NIST traceable reference. Some accrediting agencies may require more frequent checks. If balances are calibrated by an external agency, verification of their weights must be provided. All information pertaining to balance maintenance and calibration is recorded in the individual balance logbook and/or is maintained on file in the Quality department.

6.3.4. **Thermometers**

6.3.4.1. Certified, or reference, thermometers are maintained for checking calibration of working thermometers. Reference thermometers are provided with NIST traceability for initial calibration and are re-certified, at a minimum, every 3 years with equipment directly traceable to NIST.

6.3.4.2. Working thermometers are compared with the reference thermometers annually according to corporate metrology procedures. Each thermometer is individually numbered and assigned a correction factor based on the NIST reference source. In addition, working thermometers are visually inspected by laboratory personnel prior to use and temperatures are documented.

6.3.4.3. Laboratory thermometer inventory and calibration data are maintained in the Quality department.

6.3.5. **pH/Electrometers**

6.3.5.1. The meter is calibrated before use each day, using fresh buffer solutions. The range of pH that is used for calibration should bracket the pH measurements of the samples analyzed.

6.3.6. **Spectrophotometers**

6.3.6.1. During use, spectrophotometer performance is checked at established frequencies in analysis sequences against initial calibration verification (ICV) and continuing calibration verification (CCV) standards.

6.3.7. **Mechanical Volumetric Dispensing Devices**

6.3.7.1. Mechanical volumetric dispensing devices including bottle top dispensers (those that are critical in measuring a required amount of reagent), pipettes, and burettes, excluding Class A volumetric glassware, are checked for accuracy on a quarterly basis. Glass microliter syringes are checked for accuracy prior to initial use and reverified annually.

6.3.7.2. Additional information regarding calibration and maintenance of laboratory support equipment can be found in SOP PGH-C-032 **Support Equipment** or its equivalent revision or replacement.

6.4. Instrument/Equipment Maintenance

6.4.1. The objectives of the Pace Analytical maintenance program are twofold: to establish a system of instrument care that maintains instrumentation and equipment at required levels of calibration and sensitivity, and to minimize loss of productivity due to repairs.

6.4.2. The Operations Manager and/or department manager/supervisors are responsible for providing technical leadership to evaluate new equipment, solve equipment problems, and coordinate instrument repair and maintenance. Analysts have the primary responsibility to perform routine maintenance.

6.4.3. To minimize downtime and interruption of analytical work, preventative maintenance is routinely performed on each analytical instrument. Up-to-date instructions on the use and maintenance of equipment are available to staff in the department where the equipment is used.

6.4.4. Department manager/supervisors are responsible for maintaining an adequate inventory of spare parts required to minimize equipment downtime. This inventory includes parts and supplies that are subject to frequent failure, have limited lifetimes, or cannot be obtained in a timely manner should a failure occur.

6.4.5. All major equipment and instrumentation items are uniquely identified to allow for traceability. Equipment/instrumentation is, unless otherwise stated, identified as a system and not as individual pieces. The laboratory maintains equipment records that include the following:

- The name of the equipment and its software
- The manufacturer's name, type, and serial number
- Approximate date received and date placed into service
- Current location in the laboratory
- Condition when received (new, used, etc.)
- Copy of any manufacturer's manuals or instructions

- Dates and results of calibrations and next scheduled calibration (if known)
- Details of past maintenance activities, both routine and non-routine
- Details of any damage, modification or major repairs

6.4.6. All instrument maintenance is documented in maintenance logbooks that are assigned to each particular instrument or system.

6.4.7. The maintenance log entry must include a summary of the results of that analysis and verification by the analyst that the instrument has been returned to an in-control status. In addition, each entry must include the initials of the analyst making the entry, the dates the maintenance actions were performed, and the date the entry was made in the maintenance logbook, if different from the date(s) of the maintenance.

6.4.7.1. Return to control after maintenance may be demonstrated by the successful analysis of one or more QC samples depending upon the nature of the initial instrument problem.

6.4.8. Any equipment that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown to be defective, is taken out of service and clearly identified. The equipment shall not be used to analyze customer samples until it has been repaired and shown to perform satisfactorily. In the event of instrumentation failure, to avoid hold time issues, the lab may subcontract the necessary samples to another Pace lab or to an outside subcontract lab if possible.

7.0. CONTROL OF DATA

Analytical results processing, verification, and reporting are procedures employed that result in the delivery of defensible data. These processes include, but are not limited to, calculation of raw data into final concentration values, review of results for accuracy, evaluation of quality control criteria and assembly of technical reports for delivery to the data user.

All analytical data undergo a well-defined, well-documented multi-tier review process prior to being reported to the customer. This section describes procedures used by PASI for translating raw analytical data into accurate final sample reports as well as PASI data storage policies.

7.1. Analytical Results Processing

7.1.1. When analytical, field, or product testing data is generated, it is either recorded in a bound laboratory logbook (e.g., Run log or Instrument log) or copies of computer-generated printouts that are appropriately labeled and filed. These logbooks and other laboratory records are kept in accordance with each facility's Standard Operating Procedure for documentation storage and archival. If the laboratory chooses to minimize or eliminate its paper usage, these records can be kept on electronic media. In this case, the laboratory must ensure that there are sufficient redundant electronic copies so no data is lost due to unforeseen computer issues.

7.1.2. The primary analyst is responsible for initial data reduction and review. This includes confirming compliance with required methodology, verifying calculations, evaluating quality control data, noting non-conformances in logbooks or as footnotes or narratives, and uploading analytical results into the LIMS. The primary analyst must be clearly identified in all applicable logbooks, spreadsheets and LIMS fields.

7.1.3. The primary analyst then compiles the initial data package for verification. This compilation must include sufficient documentation for data review. It may include standard calibrations, chromatograms, manual integration documentation, electronic printouts, chain of custody forms, and logbook copies.

7.1.4. Some agencies or customers require different levels of data reporting. For these special levels, the primary analyst may need to compile additional project information, such as initial calibration data or extensive spectral data, before the data package proceeds to the verification step.

7.2. Data Verification

7.2.1. Data verification is the process of examining data and accepting or rejecting it based on pre-defined criteria. This review step is designed to ensure that reported data are free from calculation and transcription errors, that quality control parameters are evaluated, and that any non-conformances are properly documented.

7.2.2. Analysts performing the analysis and subsequent data reduction have primary responsibility for quality of the data produced. The primary analyst initiates the data verification process by reviewing and accepting the data, provided QC criteria have been met for the samples being reported. Data review checklists, either hardcopy or electronic, are used to document the data review process. The primary analyst is responsible for the initial input of the data into the LIMS. The primary analyst and reviewer must be clearly identified on all applicable data review checklists.

7.2.3. The completed data package is then sent to a designated qualified reviewer (this cannot be the primary analyst). The following criteria have been established to qualify someone as a data reviewer. To perform secondary data review, the reviewer must:

7.2.3.1. Have a current Demonstration of Capability (DOC) study on file and have an SOP acknowledgement form on file for the method/procedure being reviewed; or, See Note

7.2.3.2. Have a DOC on file for a similar method/technology (i.e., GC/MS) and have an SOP acknowledgment form on file for the method/procedure being reviewed; or, See Note

7.2.3.3. Supervise or manage a Department and have an SOP acknowledgment form on file for the method/procedure being reviewed; or,

7.2.3.4. Have significant background in the department/methods being reviewed through education or experience and have an SOP acknowledgment form on file for the method/procedure being reviewed.

7.2.4. **Note:** Secondary reviewer status must be approved personally by the SQM/QM or SGM/GM/AGM/OM in the event that this person has no prior experience on the specific method or general technology.

7.2.5. This reviewer provides an independent technical assessment of the data package and technical review for accuracy according to methods employed and laboratory protocols. This assessment involves a quality control review for use of the proper methodology and detection limits, compliance to quality control protocol and criteria, presence and completeness of required deliverables, and accuracy of calculations and data quantitation. The reviewer validates the data entered into the LIMS and documents approval of manual integrations.

7.2.6. Once the data have been technically reviewed and approved, authorization for release of the data from the analytical section is indicated by initialing and dating the data review checklist or otherwise initialing and dating the data (or designating the review of data electronically). The Operations or Project Manager examines the report for method appropriateness, detection limits and QC acceptability. Any deviations from the referenced methods are checked for documentation and validity, and QC corrective actions are reviewed for successful resolution. Alternately, final reports can be set to auto email to the client after the analytical results are final and have been run through the Data Checker program for errors. These are set up on a case-by-case basis.

7.2.7. Additional information regarding data review procedures can be found in SOP PGH-Q-037 Data Review or its equivalent revision or replacement, as well as in SOP PGH-Q-030 Manual Integration or its equivalent revision or replacement.

7.2.8. The Data Checker program will process validated data for a given project against a set of pre-determined requirements and known chemistry relationships. The program creates a report that includes a series of warnings and errors for any requirement or condition determined to be suspect or incorrect. These warnings and error counts are displayed on the “Project Inquiry by Client” screen and on the final Data Checker reports. For projects that have any number of warnings or errors, the Data Checker report will provide a message that identifies the source and condition of the error or warning. Data Checker is not applied to radiological reports due to the limitation of the LIMS.

7.2.9. Some reports and/or data packages may be reviewed by the QM or SQM or designee based on program requirements (e.g., DoD) or client requirements. In this case a thorough review for completeness and accuracy may include a compilation of raw data and QC summaries in

addition to the final report to produce a full deliverable package. In the case of DoD, 100% of all packages must have a final administrative review (to confirm that primary and secondary reviews were completed and documented and that data packages are complete) and 10% of all data packages must be reviewed by the Quality Manager for technical completeness/accuracy. This 10% review can be done after the data packages have been submitted to the clients. See SOP PGH-Q-040 **Internal and External Audits**, for full Quality department final report and raw data review requirements.

7.3. Data Reporting

7.3.1. Data for each analytical fraction pertaining to a particular PASI project number are delivered to the Project Manager for assembly into the final report. All points mentioned during technical and QC reviews are included in data qualifiers on the final report or in a separate case narrative if there is potential for data to be impacted.

7.3.2. Final reports are prepared according to the level of reporting required by the customer and can be transmitted to the customer via hardcopy or electronic deliverable. A standard PASI final report consists of the following components:

7.3.2.1. A title which designates the report as “Final Report”, “Laboratory Results”, “Certificate of Results”, etc.;

7.3.2.2. Name and address of laboratory (or subcontracted laboratories, if used);

7.3.2.3. Phone number and name of laboratory contact to where questions can be referred;

7.3.2.4. A unique identification number for the report. The pages of the report shall be numbered and a total number of pages shall be indicated;

7.3.2.5. Name and address of customer and name of project;

7.3.2.6. Unique identification of samples analyzed as well as customer sample IDs;

7.3.2.7. Identification of any sample that did not meet acceptable sampling requirements of the relevant governing agency, such as improper sample containers, holding times missed, sample temperature, etc.;

7.3.2.8. Date and time of collection of samples, date of sample receipt by the laboratory, dates of sample preparation and analysis, and times of sample preparation and analysis when the holding time for either is 72 hours or less;

7.3.2.9. Identification of the test methods used;

7.3.2.10. Identification of sampling procedures if sampling was conducted by the laboratory;

7.3.2.11. Deviations from, additions to, or exclusions from the test methods. These can include failed quality control parameters, deviations caused by the matrix of the sample, etc., and can be shown as a case narrative or as defined footnotes to the analytical data;

7.3.2.12. Identification of whether calculations were performed on a dry or wet-weight basis;

7.3.2.13. Reporting limits used;

7.3.2.14. Final results or measurements, supported by appropriate chromatograms, charts, tables, spectra, etc.;

7.3.2.15. A signature and title, electronic or otherwise, of person accepting responsibility for the content of the report;

7.3.2.16. Date report was issued;

7.3.2.17. A statement clarifying that the results of the report relate only to the samples tested or to the samples as they were received by the laboratory;

7.3.2.18. If necessary, a statement indicating that the report must not be reproduced except in full, without the written approval of the laboratory;

7.3.2.19. Identification of all test results provided by a subcontracted laboratory or other outside source;

7.3.2.20. Identification of results obtained outside of quantitation levels.

7.3.3. In addition to the requirements listed above, final reports shall also contain the following items when necessary for the interpretation of results:

7.3.3.1. Deviations from, additions to, or exclusions from the test method, and information on specific test conditions, such as environmental conditions;

7.3.3.2. Where relevant, a statement of compliance/non-compliance with requirements and/or specifications (e.g., the TNI standard);

7.3.3.3. Where applicable, a statement on the estimated uncertainty of measurement; information on uncertainty is needed in test reports when it is relevant to the validity or application of the test results, when a customer's instruction so requires, or when the uncertainty affects compliance to a specification limit;

7.3.3.4. Where appropriate and needed, opinions and interpretations, which may include opinions on the compliance/non-compliance of the results with requirements, fulfillment of contractual requirements, recommendations on how to use the results, and guidance to be used for improvement;

7.3.4. For DoD , in reference to item 7.3.2.8 listed above, both date and time of preparation and analysis are considered essential information, regardless of the length of the holding time, and shall be included as part of the laboratory report.

7.3.5. Any changes made to a final report shall be designated as "Revised" or equivalent wording. The laboratory must keep sufficient archived records of all laboratory reports and revisions. For higher levels of data deliverables, a copy of all supporting raw data is sent to the customer along with a final report of results. When possible, the PASI facility will provide electronic data deliverables (EDD) as required by contracts or upon customer request.

7.3.6. Customer data that requires transmission by telephone, telex, facsimile or other electronic means undergoes appropriate steps to preserve confidentiality.

7.3.7. The following positions are the only approved signatories for PASI final reports:

- Senior General Manager
- General Manager
- Assistant General Manager
- Senior Quality Manager
- Quality Manager
- Client Services Manager

- Project Manager
- Project Coordinator

7.4. Data Security

7.4.1. All data including electronic files, logbooks, extraction/digestion/distillation worksheets, calculations, project files and reports, QA and Administrative records/data and any other information used to produce the technical report are maintained secured and retrievable by the PASI facility.

7.5. Data Archiving

7.5.1. All records compiled by PASI are maintained legible and retrievable and stored secured in a suitable environment to prevent loss, damage, or deterioration by fire, flood, vermin, theft, and/or environmental deterioration. Records are retained for a minimum of five years unless superseded by federal, state, contractual, and/or accreditation requirements. These records may include, but are not limited to, customer data reports, calibration and maintenance of equipment, raw data from instrumentation, quality control documents, observations, calculations, and logbooks. These records are retained in order to provide for possible historical reconstruction including sampling, receipt, preparation, analysis, and personnel involved. TNI-related records will be made readily available to accrediting authorities. Access to archived data is documented and controlled by the SQM/QM or a designated Data Archivist.

7.5.2. Records that are computer generated have either a hard copy or electronic write protected backup copy. Hardware and software necessary for the retrieval of electronic data is maintained with the applicable records. Archived electronic records are stored protected against electronic and/or magnetic sources.

7.5.3. In the event of a change in ownership, accountability or liability, reports of analyses performed pertaining to accreditation will be maintained by the acquiring entity for a minimum of five years. In the event of bankruptcy, laboratory reports and/or records will be transferred to the customer and/or the appropriate regulatory entity upon request.

7.6. Data Disposal

7.6.1. Data that has been archived for the facility's required storage time may be disposed of in a secure manner by shredding, returning to customer, or utilizing some other means that does not jeopardize data confidentiality. Records of data disposal will be archived for a minimum of seven years unless superseded by federal, contractual, and/or accreditation requirements. Data disposal includes any preliminary or final reports that are disposed.

8.0. QUALITY SYSTEM AUDITS AND REVIEWS

8.1. Internal Audits

8.1.1. Responsibilities

8.1.1.1. The SQM/QM is responsible for managing and/or conducting internal audits in accordance with a predetermined schedule and procedure. Since internal audits represent an independent assessment of laboratory functions, the auditor must be functionally independent from laboratory operations to ensure objectivity. The auditor must be trained, qualified, and familiar enough with the objectives, principles, and procedures of laboratory operations to be able to perform a thorough and effective evaluation. The SQM/QM evaluates audit observations and verifies the completion of corrective actions. In addition, a periodic corporate audit will be conducted. The corporate audits will focus on the effectiveness of the Quality System as outlined in this manual but may also include other quality programs applicable to an individual laboratory.

8.1.2. Scope and Frequency of Internal Audits

8.1.2.1. The complete internal audit process consists of the following four sections:

- Raw Data Review audits- conducted according to a schedule per local SQM/QM. A certain number of these data review audits are conducted per quarter to accomplish this yearly schedule;
- Quality System audits- considered the traditional internal audit function and includes analyst interviews to help determine whether practice matches method requirements and SOP language;
- Final Report reviews;
- Corrective Action Effectiveness Follow-up.

8.1.2.2. Internal systems audits are conducted yearly at a minimum. The scope of these audits includes evaluation of specific analytical departments or a specific quality related system as applied throughout the laboratory.

8.1.2.3. Where the identification of non-conformities or departures cast doubt on the laboratory's compliance with its own policies and procedures, the lab must ensure that the appropriate areas of activity are audited as soon as possible. Examples of system-wide elements that can be audited include:

- Quality Systems documents, such as Standard Operating Procedures, training documents, Quality Assurance Manual, and all applicable addenda
- Data records and non-technical documents
- Personnel and training files.
- General laboratory safety protocols.
- Chemical handling practices, such as labeling of reagents, solutions, and standards as well as all associated documentation.
- Documentation concerning equipment and instrumentation, calibration/maintenance records, operating manuals.
- Sample receipt and management practices.
- Analytical documentation, including any discrepancies and corrective actions.

- General procedures for data security, review, documentation, reporting, and archiving.
- Data integrity issues such as proper manual integrations.

8.1.2.4. When the operations of a specific department are evaluated, a number of additional functions are reviewed including:

- Detection limit studies
- Internal chain of custody documentation
- Documentation of standard preparations
- Quality Control limits and Control charts

8.1.2.5. Certain projects may require an internal audit to ensure laboratory conformance to site work plans, sampling and analysis plans, QAPPs, etc.

8.1.2.6. A representative number of data audits are completed annually. Findings from these data audits are handled in the same manner as those from other internal and external audits.

8.1.2.7. The laboratory, as part of their overall internal audit program, ensures that a review is conducted with respect to any evidence of inappropriate actions or vulnerabilities related to data integrity. Discovery and reporting of potential data integrity issues are handled in a confidential manner. All investigations that result in findings of inappropriate activity are fully documented, including the source of the problem, the samples and customers affected the impact on the data, the corrective actions taken by the laboratory, and which final reports had to be re-issued. Customers must be notified within 30 days after the data investigation is completed and the impact to final results is assessed.

8.1.3. Internal Audit Reports and Corrective Action Plans

8.1.3.1. Additional information can be found in SOP PGH-Q-040 **Internal and External Audits** or its equivalent revision or replacement.

8.1.3.2. A full description of the audit, including the identification of the operation audited, the date(s) on which the audit was conducted, the specific systems examined, and the observations noted are summarized in an internal audit report. Although other personnel may assist with the performance of the audit, the SQM/QM writes and issues the internal audit report identifying which audit observations are deficiencies that require corrective action.

8.1.3.3. When audit findings cast doubt on the effectiveness of the operations or on the correctness of validity of the laboratory's environmental test results, the laboratory will take timely corrective action and notify the customer in writing within three business days, if investigations show that the laboratory results may have been affected.

8.1.3.4. Once completed, the internal audit report is issued jointly to the SGM/GM/AGM/OM and the manager(s)/supervisor(s) of the audited operation at a minimum. The responsible manager(s)/supervisor(s) responds within 14 days with a proposed plan to correct all of the deficiencies cited in the audit report. The SQM/QM may grant additional time for responses to large or complex deficiencies (not to exceed 30 days). Each response must include timetables for completion of all proposed corrective actions.

8.1.3.5. The SQM/QM reviews the audit responses. If the response is accepted, the SQM/QM uses the action plan and timetable as a guideline for verifying completion of the corrective action(s). If the SQM/QM determines that the audit response does not adequately address the correction of cited deficiencies, the response will be returned for modification.

8.1.3.6. To complete the audit process, the SQM/QM performs a re-examination of the areas where deficiencies were found to verify that all proposed corrective actions have been implemented. An audit deficiency is considered closed once implementation of the necessary corrective action has been audited and verified. This is usually within 60-90 days after implementation. If corrective action cannot be verified, the associated deficiency remains open until that action is completed.

8.2. External Audits

8.2.1. PASI laboratories are audited regularly by regulatory agencies to maintain laboratory certifications and by customers to maintain appropriate specific protocols.

8.2.2. Audit teams external to the company review the laboratory to assess the effectiveness of systems and degree of technical expertise. The SQM/QM and other QA staff host the audit team and assist in facilitation of the audit process. Generally, the auditors will prepare a formalized audit report listing deficiencies observed and follow-up requirements for the laboratory. In some cases, items of concern are discussed during a debriefing convened at the end of the on-site review process.

8.2.3. The laboratory staff and supervisors develop corrective action plans to address any deficiencies with the guidance of the SQM/QM. The SGM/GM/AGM/OM provides the necessary resources for staff to develop and implement the corrective action plans. The SQM/QM collates this information and provides a written response to the audit team. The response contains the corrective action plan and expected completion dates for each element of the plan. The SQM/QM follows-up with the laboratory staff to ensure corrective actions are implemented and that the corrective action was effective.

8.3. Quarterly Quality Reports

8.3.1. The SQM/QM is responsible for preparing a quarterly report to management summarizing the effectiveness of the laboratory Quality Systems. This status report will include:

- Overview of quality activities for the quarter
- Certification status
- Proficiency Testing study results
- SOP revision activities
- Internal audit (method/system) findings
- Manual integration audit findings (Mintminer)
- Raw Data and Final Report review findings
- MDL activities
- Other significant Quality System items

8.3.2. The Corporate Director of Quality utilizes the information from each laboratory to make decisions impacting the quality program compliance of the company as a whole. Each SGM/GM/AGM/OM utilizes the quarterly report information to make decisions impacting Quality Systems and operational systems at a local level.

8.3.3. Additional information can be found in SOP S-ALL-Q-014 **Quarterly Quality Report** or its equivalent revision or replacement.

8.4. Annual Managerial Review

8.4.1. A managerial review of Management and Quality Systems is performed on an annual basis at a minimum. This allows for assessing program effectiveness and introducing changes and/or improvements.

8.4.2. The managerial review must include the following topics of discussion:

- Suitability of quality management policies and procedures
- Manager/Supervisor reports
- Internal audit results
- Corrective and preventive actions
- External assessment results
- Proficiency testing studies
- Sample capacity and scope of work changes
- Customer feedback, including complaints
- Recommendations for improvement,
- Other relevant factors, such as quality control activities, resources, and staffing.

8.4.3. This managerial review must be documented for future reference by the SQM/QM and copies of the report are distributed to laboratory staff. Results must feed into the laboratory planning system and must include goals, objectives, and action plans for the coming year. The laboratory shall ensure that any actions identified during the review are carried out within an appropriate and agreed upon timescale. These Reviews may take place as separate events with separate reports.

8.5. Customer Service Reviews

8.5.1. As part of the annual managerial review listed previously, the sales staff is responsible for reporting on customer feedback, including complaints. The acquisition of this information is completed by performing surveys.

8.5.2. The sales staff continually receives customer feedback, both positive and negative, and reports this feedback to the laboratory management in order for them to evaluate and improve their management system, testing activities and customer service.

8.5.3. In addition, the labs must be willing to cooperate with customers or their representatives to clarify customer requests and to monitor the laboratory's performance in relation to the work being performed for the customers. This cooperation may include providing the customer reasonable access to relevant areas of the lab for the witnessing of tests being performed; or the preparation of samples or data deliverables to be used for verification purposes.

8.5.4. Customer service is an important aspect to Pace's overall objective of providing a quality product. Good communication should be provided to the customer's throughout projects. The lab should inform the customer of any delay or major deviations in the performance of analytical tests.

9.0. CORRECTIVE ACTION

Additional information can be found in SOP PGH-Q-039 **Corrective and Preventive Actions** or its equivalent revision or replacement.

During the process of sample handling, preparation, and analysis, or during review of quality control records, or during reviews of non-technical portions of the lab, certain occurrences may warrant the necessity of corrective actions. These occurrences may take the form of analyst errors, deficiencies in quality control, method deviations, or other unusual circumstances. The Quality System of PASI provides systematic procedures for the documentation, monitoring, completion of corrective actions, and follow-up verification of the effectiveness of these corrective actions. This can be done using PASI's LabTrack system or other system that lists among at a minimum, the deficiency by issue number, the deficiency source, responsible party, root cause, resolution, due date, and date resolved.

9.1. Corrective Action Documentation

9.1.1. The following items are examples of sources of laboratory deviations or non-conformances that warrant some form of documented corrective action:

- Internal Laboratory Non-Conformance Trends
- PE/PT Sample Results
- Internal and External Audits
- Data or Records Review (including non-technical records)
- Client Complaints
- Client Inquiries
- Holding Time violations

9.1.2. Documentation of corrective actions may be in the form of a comment or footnote on the final report that explains the deficiency (e.g., matrix spike recoveries outside of acceptance criteria) or it may be a more formal documentation (either paper system or computerized spreadsheet). This depends on the extent of the deficiency, the impact on the data, and the method or customer requirements for documentation.

9.1.3. The person who discovers the deficiency or non-conformance initiates the corrective action documentation on the Non-Conformance Corrective/ Preventive Action report and/or LabTrack. The documentation must include the affected projects and sample numbers, the name of the applicable Project Manager, the customer name, and the sample matrix involved. The person initiating the corrective action documentation must also list the known causes of the deficiency or non-conformance as well as any corrective/preventative actions that they have taken. Preventive actions must be taken in order to prevent or minimize the occurrence of the situation.

9.1.4. In the event that the laboratory is unable to determine the cause, laboratory personnel and management staff will start a root cause analysis by going through an investigative process. During this process, the following general steps must be taken into account: defining the non-conformance, assigning responsibilities, determining if the condition is significant, and investigating the root cause of the nonconformance. General non-conformance investigative techniques follow the path of the sample through the process looking at each individual step

in detail. The root cause must be documented within LabTrack or on the Corrective/Preventive Action Report.

9.1.5. After all the documentation is completed, the routing of the Corrective/Preventive Action Report and /or LabTrack will continue from the person initiating the corrective action, to their immediate supervisor or the applicable Project Manager and finally to the SQM/QM, if applicable, who may be responsible for final review and signoff of corrective/preventive actions.

9.1.6. In the event that analytical testing or results do not conform to documented laboratory policies or procedures, customer requirements, or standard specifications, the laboratory shall investigate the significance of the non-conformance and document appropriate corrective actions. The proper level of laboratory management will review any departure from these requirements for technical suitability. These departures are permitted only with the approval of the SGM/GM/AGM/OM or the SQM/QM. Where necessary, Project Management will notify the customer of the situation and will advise of any ramifications to data quality (with the possibility of work being recalled). The procedures for handling non-conforming work are detailed in SOP PGH-Q-039 **Corrective and Preventive Actions** or its equivalent revision or replacement.

9.2. Corrective Action Completion

9.2.1. Internal Laboratory Non-Conformance Trends

9.2.1.1. There are several types of non-conformance trends that may occur in the laboratory that would require the initiation of a corrective action report. Laboratories may choose to initiate a corrective action for all instances of one or more of these categories if they so choose, however the intent is that each of these would be handled according to its severity; one time instances could be handled with a footnote or qualifier whereas a systemic problem with any of these categories may require an official corrective action process. These categories, as defined in the Corrective Action SOP are as follows:

- Login error
- Preparation Error
- Contamination
- Calibration Failure
- Internal Standard Failure
- LCS Failure
- Laboratory accident
- Spike Failure
- Instrument Failure
- Final Reporting error

In the event that product testing of nuclear facility equipment results in a noncompliance it must be evaluated to determine if it is a 10CFR50 Appendix B/NQA-1 reportable non-conformance. All such instances must be documented and brought to the Project Manager and Quality Departments attention for resolution and reporting to the client and/or proper authorities.

9.2.2. PE/PT Sample Results

9.2.2.1. Any PT result assessed as “not acceptable” requires an investigation and applicable corrective actions. The operational staff is made aware of the PT failures and they are responsible for reviewing the applicable raw data and calibrations and list possible causes for error. The SQM/QM reviews their findings and initiates another external PT sample or an internal PT sample to try and correct the previous failure. Replacement PT results must be monitored by the SQM/QM and reported to the applicable regulatory authorities.

9.2.2.2. Additional information, such as requirements regarding time frames for reporting failures to states, makeup PTs, and notifications of investigations, can be found in SOP PGH-C-031 **Proficiency Testing Program** or its equivalent revision or replacement.

9.2.3. **Internal and External Audits**

9.2.3.1. The SQM/QM is responsible for documenting all audit findings and their corrective actions. This documentation must include the initial finding, the persons responsible for the corrective action, the due date for responding to the auditing body, the root cause of the finding, and the corrective actions needed for resolution. The SQM/QM is also responsible for providing any back-up documentation used to demonstrate that a corrective action has been completed.

9.2.4. **Data Review**

9.2.4.1. In the course of performing primary and secondary review of data or in the case of raw data reviews (e.g., by the SQM/QM), errors may be found which require corrective actions. Any finding that affects the quality of the data requires some form of corrective action, which may include revising and re-issuing of final reports.

9.2.5. **Client Complaints**

9.2.5.1. Project Managers are responsible for issuing corrective action forms, when warranted, for customer complaints. As with other corrective actions, the possible causes of the problem are listed and the form is passed to the appropriate analyst or supervisor for investigation. After potential corrective actions have been determined, the Project Manager reviews the corrective action form to ensure all customer needs or concerns are being adequately addressed.

9.2.6. **Client Inquiries**

9.2.6.1. When an error on the customer report is discovered, the Project Manager is responsible for initiating a formal corrective action form that describes the failure (e.g., incorrect analysis reported, reporting units are incorrect, or reporting limits do not meet objectives). The Project Manager is also responsible for revising the final report if necessary and submitting it to the customer.

9.2.7. **Holding Time Violations**

9.2.7.1. In the event that a holding time has been missed, the analyst or supervisor must complete a formal corrective action form. The Project Manager and the SQM/QM must be made aware of all holding time violations.

9.2.7.2. The Project Manager must contact the customer in order that appropriate decisions are made regarding the hold time excursion and the ultimate resolution is then documented and included in the customer project file.

9.3. Preventive Action Documentation

9.3.1. Pace laboratories can take advantage of several available information sources in order to identify needed improvements in all of their systems including technical, managerial, and quality. These sources may include:

- Management Continuous Improvement Plan (CIP) metrics which are used by all production departments within Pace. When groups compare performance across the company, ways to improve systems may be discovered. These improvements can be made within a department or laboratory-wide.
- Annual managerial reviews- part of this TNI-required and NVLAP-required review is to look at all processes and procedures used by the laboratory over the past year and to determine ways to improve these processes in the future.
- Quality systems reviews- any frequent checks of quality systems (monthly logbook reviews, etc.) can uncover issues that can be corrected or adjusted before they become a larger issue.

9.3.2. When improvement opportunities are identified or if preventive action is required, the laboratory can develop, implement, and monitor preventive action plans.

10.0. GLOSSARY

The source of some of the definitions is indicated previous to the actual definition (e.g., TNI, DoD).

Terms and Definitions	
3P Program	The Pace Analytical continuous improvement program that focuses on Process, Productivity, and Performance. Best Practices are identified that can be used by all PASI labs.
Acceptance Criteria	TNI- Specified limits placed on characteristics of an item, process, or service defined in requirement documents.
Accreditation	TNI- The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.
Accreditation Body	DoD- Entities recognized in accordance with the DoD-ELAP that are required to operate in accordance with ISO/IEC 17011, *Conformity assessment: General requirements for accreditation bodies accrediting conformity assessment bodies*. The AB must be a signatory, in good standing, to the International Laboratory Accreditation Cooperation (ILAC) mutual recognition arrangement (MRA) that verifies, by evaluation and peer assessment, that its signatory members are in full compliance with ISO/IEC 17011 and that its accredited laboratories comply with ISO/IEC 17025.
Accuracy	TNI- The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.
Aliquot	DoD- A discrete, measured, representative portion of a sample taken for analysis.
Analysis	DoD- A combination of sample preparation and instrument determination.
Analysis Code (Acode)	All the set parameters of a test, such as Analytes, Method, Detection Limits and Price.
Analysis Sequence	A compilation of all samples, standards and quality control samples run during a specific amount of time on a particular instrument in the order they are analyzed.
Analyst	TNI- The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.
Analyte	DoD- The specific chemicals or components for which a sample is analyzed; it may be a group of chemicals that belong to the same chemical family and are analyzed together.
Analytical Uncertainty	TNI- A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.

Terms and Definitions	
Assessment	TNI - The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its system to defined criteria (to the standards and requirements of laboratory accreditation). DoD- An all-inclusive term used to denote any of the following: audit, performance evaluation, peer review, inspection, or surveillance conducted on-site.
Atomic Absorption Spectrometer	Instrument used to measure concentration in metals samples.
Atomization	A process in which a sample is converted to free atoms.
Audit	TNI- A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives.
Batch	TNI- Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same quality systems matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed 20 samples. South Carolina- same definition as TNI except 24 hours should be changed to 8 hours.
Bias	TNI- The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).
Blank	TNI and DoD- A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. DoD- Blank samples are negative control samples, which typically include field blank samples (e.g., trip blank, equipment (rinsate) blank, and temperature blank) and laboratory blank samples (e.g., method blank, reagent blank, instrument blank, calibration blank, and storage blank).
Blind Sample	A sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Terms and Definitions	
BNA (Base Neutral Acid compounds)	A list of semi-volatile compounds typically analyzed by mass spectrometry methods. Named for the way they can be extracted out of environmental samples in an acidic, basic or neutral environment.
BOD (Biochemical Oxygen Demand)	Chemical procedure for determining how fast biological organisms use up oxygen in a body of water.
Calibration	TNI- A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. 1) In calibration of support equipment, the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI); 2) In calibration according to test methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.
Calibration Curve	TNI- The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.
Calibration Method	A defined technical procedure for performing a calibration.
Calibration Range	DoD- The range of values (concentrations) between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.
Calibration Standard	TNI- A substance or reference material used for calibration.
Certified Reference Material (CRM)	TNI- Reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute.
Chain of Custody	An unbroken trail of accountability that verifies the physical security of samples, data, and records.
Chain of custody Form (COC)	TNI- Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and type of containers; the mode of collection, the collector, time of collection; preservation; and requested analyses.
Chemical Oxygen Demand (COD)	A test commonly used to indirectly measure the amount of organic compounds in water.
Client (referred to by ISO as Customer)	Any individual or organization for whom items or services are furnished or work performed in response to defined requirements and expectations.

Terms and Definitions	
Code of Federal Regulations (CFR)	A codification of the general and permanent rules published in the Federal Register by agencies of the federal government.
Comparability	An assessment of the confidence with which one data set can be compared to another. Comparable data are produced through the use of standardized procedures and techniques.
Completeness	The percent of valid data obtained from a measurement system compared to the amount of valid data expected under normal conditions. The equation for completeness is: % Completeness = (Valid Data Points/Expected Data Points)*100
Confirmation	TNI- Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: second-column confirmation; alternate wavelength; derivatization; mass spectral interpretation; alternative detectors; or additional cleanup procedures. DoD- Includes verification of the identity and quantity of the analyte being measured by another means (e.g., by another determinative method, technology, or column). Additional cleanup procedures alone are not considered confirmation techniques.
Conformance	An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements.
Congener	A member of a class of related chemical compounds (e.g., PCBs, PCDDs).
Consensus Standard	DoD- A standard established by a group representing a cross-section of a particular industry or trade, or a part thereof.
Continuing Calibration Blank (CCB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method.
Continuing Calibration Check Compounds (CCC)	Compounds listed in mass spectrometry methods that are used to evaluate an instrument calibration from the standpoint of the integrity of the system. High variability would suggest leaks or active sites on the instrument column.
Continuing Calibration Verification	DoD- The verification of the initial calibration. Required prior to sample analysis and at periodic intervals. Continuing calibration verification applies to both external and internal standard calibration techniques, as well as to linear and non-linear calibration models.
Continuing Calibration Verification (CCV) Standard	Also referred to as a CVS in some methods, it is a standard used to verify the initial calibration of compounds in an analytical method. CCVs are analyzed at a frequency determined by the analytical method.
Continuous Emission Monitor (CEM)	A flue gas analyzer designed for fixed use in checking for environmental pollutants.

Terms and Definitions	
Contract Laboratory Program (CLP)	A national network of EPA personnel, commercial labs, and support contractors whose fundamental mission is to provide data of known and documented quality.
Contract Required Detection Limit (CRDL)	Detection limit that is required for EPA Contract Laboratory Program (CLP) contracts.
Contract Required Quantitation Limit (CRQL)	Quantitation limit (reporting limit) that is required for EPA Contract Laboratory Program (CLP) contracts.
Control Chart	A graphic representation of a series of test results, together with limits within which results are expected when the system is in a state of statistical control (see definition for Control Limit)
Control Limit	A range within which specified measurement results must fall to verify that the analytical system is in control. Control limit exceedances may require corrective action or require investigation and flagging of non-conforming data.
Correction	DoD- Action taken to eliminate a detected non-conformity.
Corrective Action	DoD- The action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation in order to prevent recurrence. A root cause analysis may not be necessary in all cases.
Corrective and Preventative Action (CAPA)	The primary management tools for bringing improvements to the quality system, to the management of the quality system's collective processes, and to the products or services delivered which are an output of established systems and processes.
Customer	DoD- Any individual or organization for which products or services are furnished or work performed in response to defined requirements and expectations.
Data Quality Objective (DQO)	Systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use or end user.
Data Reduction	TNI- The process of transforming the number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more usable form.
Definitive Data	DoD- Analytical data of known quantity and quality. The levels of data quality on precision and bias meet the requirements for the decision to be made. Data that is suitable for final decision-making.
Demonstration of Capability	TNI- A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. DoD- A procedure to establish the ability of the analyst to generate analytical results by a specific method that meet measurement quality objectives (e.g., for precision and bias).

Terms and Definitions	
Detection Limit (DL)	DoD- The smallest analyte concentration that can be demonstrated to be different than zero or a blank concentration at the 99% confidence. At the DL, the false positive rate (Type 1 error) is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific analyte in a specific matrix with a specific method with 99% confidence.
Diesel Range Organics (DRO)	A range of compounds that denote all the characteristic compounds that make up diesel fuel (range can be state or program specific).
Digestion	DoD- A process in which a sample is treated (usually in conjunction with heat and acid) to convert the sample to a more easily measured form.
Document Control	The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.
Documents	DoD- Written components of the laboratory management system (e.g., policies, procedures, and instructions).
Dry Weight	The weight after drying in an oven at a specified temperature.
Duplicate (also known as Replicate or Laboratory Duplicate)	The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results of duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.
Electron Capture Detector (ECD)	Device used in GC methods to detect compounds that absorb electrons (e.g., PCB compounds).
Electronic Data Deliverable (EDD)	A summary of environmental data (usually in spreadsheet form) which clients request for ease of data review and comparison to historical results.
Eluent	A solvent used to carry the components of a mixture through a stationary phase.
Elute	To extract, specifically, to remove (absorbed material) from an absorbent by means of a solvent.
Elution	A process in which solutes are washed through a stationary phase by movement of a mobile phase.
Environmental Data	DoD- Any measurements or information that describe environmental processes, locations, or conditions; ecological or health effects and consequences; or the performance of environmental technology.
Environmental Monitoring	The process of measuring or collecting environmental data.

Terms and Definitions	
Environmental Sample	A representative sample of any material (aqueous, non-aqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required. Environmental samples can generally be classified as follows: • Non Potable Water (Includes surface water, ground water, effluents, water treatment chemicals, and TCLP leachates or other extracts) • Drinking Water - Delivered (treated or untreated) water designated as potable water • Water/Wastewater - Raw source waters for public drinking water supplies, ground waters, municipal influents/effluents, and industrial influents/effluents • Sludge - Municipal sludges and industrial sludges. • Soil - Predominately inorganic matter ranging in classification from sands to clays. • Waste - Aqueous and non-aqueous liquid wastes, chemical solids, and industrial liquid and solid wastes
Equipment Blank	A sample of analyte-free media used to rinse common sampling equipment to check effectiveness of decontamination procedures.
Facility	A distinct location within the company that has unique certifications, personnel and waste disposal identifications.
False Negative	DoD- A result that fails to identify (detect) an analyte or reporting an analyte to be present at or below a level of interest when the analyte is actually above the level of interest.
False Positive	DoD- A result that erroneously identifies (detects) an analyte or reporting an analyte to be present above a level of interest when the analyte is actually present at or below the level of interest.
Field Blank	A blank sample prepared in the field by filling a clean container with reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken.
Field Measurement	Determination of physical, biological, or radiological properties, or chemical constituents that are measured on-site, close in time and space to the matrices being sampled/measured, following accepted test methods. This testing is performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory.
Field of Accreditation	TNI- Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Terms and Definitions	
Finding	TNI- An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement. DoD- An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive, negative, or neutral and is normally accompanied by specific examples of the observed condition. The finding must be linked to a specific requirement (e.g., this standard (DoD QSM), ISO requirements, analytical methods, contract specifications, or laboratory management systems requirements).
Flame Atomic Absorption Spectrometer (FAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the fact that ground state metals absorb light at different wavelengths. Metals in a solution are converted to the atomic state by use of a flame.
Flame Ionization Detector (FID)	A type of gas detector used in GC analysis where samples are passed through a flame which ionizes the sample so that various ions can be measured.
Gas Chromatography (GC)	Instrumentation which utilizes a mobile carrier gas to deliver an environmental sample across a stationary phase with the intent to separate compounds out and measure their retention times.
Gas Chromatograph/ Mass Spectrometry (GC/MS)	In conjunction with a GC, this instrumentation utilizes a mass spectrometer which measures fragments of compounds and determines their identity by their fragmentation patterns (mass spectra).
Gasoline Range Organics (GRO)	A range of compounds that denote all the characteristic compounds that make up gasoline (range can be state or program specific).
Graphite Furnace Atomic Absorption Spectrometry (GFAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the absorption of light at different wavelengths that are characteristic of different analytes.
High Pressure Liquid Chromatography (HPLC)	Instrumentation used to separate, identify and quantitate compounds based on retention times which are dependent on interactions between a mobile phase and a stationary phase.
Holding Time	TNI- The maximum time that can elapse between two specified activities. 40 CFR Part 136- The maximum time that samples may be held prior to preparation and/or analysis as defined by the method and still be considered valid or not compromised. For sample prep purposes, hold times are calculated using the time of the start of the preparation procedure. DoD- The maximum time that may elapse from the time of sampling to the time of preparation or analysis, or from preparation to analysis, as appropriate.
Homogeneity	The degree to which a property or substance is uniformly distributed throughout a sample.

Terms and Definitions	
Homologue	One in a series of organic compounds in which each successive member has one more chemical group in its molecule than the next preceding member. For instance, methanol, ethanol, propanol, butanol, etc., form a homologous series.
Improper Actions	DoD- Intentional or unintentional deviations from contract-specified or method-specified analytical practices that have not been authorized by the customer (e.g., DoD or DOE).
Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)	Analytical technique used for the detection of trace metals which uses plasma to produce excited atoms that emit radiation of characteristic wavelengths.
Inductively Coupled Plasma- Mass Spectrometry (ICP/MS)	An ICP-AES that is used in conjunction with a mass spectrometer so that the instrument is not only capable of detecting trace amounts of metals and non-metals but is also capable of monitoring isotopic speciation for the ions of choice.
Infrared Spectrometer (IR)	An instrument that uses infrared light to identify compounds of interest.
Initial Calibration (ICAL)	The process of analyzing standards, prepared at specified concentrations, to define the quantitative response relationship of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a calibration verification standard do not conform to the requirements of the method in use or at a frequency specified in the method.
Initial Calibration Blank (ICB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method. This blank is specifically run in conjunction with the Initial Calibration Verification (ICV) where applicable.
Initial Calibration Verification (ICV)	DoD- Verifies the initial calibration with a standard obtained or prepared from a source independent of the source of the initial calibration standards to avoid potential bias of the initial calibration.
Instrument Blank	A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination.
Instrument Detection Limits (IDLs)	Limits determined by analyzing a series of reagent blank analyses to obtain a calculated concentration. IDLs are determined by calculating the average of the standard deviations of three runs on three non-consecutive days from the analysis of a reagent blank solution with seven consecutive measurements per day.
Interference, spectral	Occurs when particulate matter from the atomization scatters incident radiation from the source or when the absorption or emission from an interfering species either overlaps or is so close to the analyte wavelength that resolution becomes impossible.

Terms and Definitions	
Interference, chemical	Results from the various chemical processes that occur during atomization and later the absorption characteristics of the analyte.
Internal Standards	TNI- A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.
Intermediate Standard Solution	Reference solutions prepared by dilution of the stock solutions with an appropriate solvent.
International System of Units (SI)	The coherent system of units adopted and recommended by the General Conference on Weights and Measures.
Ion Chromatography (IC)	Instrumentation or process that allows the separation of ions and molecules based on the charge properties of the molecules.
Isomer	One of two or more compounds, radicals, or ions that contain the same number of atoms of the same element but differ in structural arrangement and properties. For example, hexane (C6H14) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane.
Laboratory	A body that calibrates and/or tests.
Laboratory Control Sample (LCS)	TNI- (however named, such as laboratory fortified blank (LFB), spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes and taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to evaluate the performance of all or a portion of the measurement system.
Laboratory Duplicate	Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently.
Laboratory Information Management System (LIMS)	DoD- The entirety of an electronic data system (including hardware and software) that collects, analyzes, stores, and archives electronic records and documents.
LabTrack	Database used by Pace Analytical to store and track corrective actions and other laboratory issues.
Learning Management System (LMS)	A web-based database used by the laboratories to track and document training activities. The system is administered by the corporate training department and each laboratory's learn centers are maintained by a local administrator.

Terms and Definitions	
Legal Chain-of-Custody Protocols	TNI- Procedures employed to record the possession of samples from the time of sampling through the retention time specified by the client or program. These procedures are performed at the special request of the client and include the use of a Chain-of-Custody (COC) Form that documents the collection, transport, and receipt of compliance samples by the laboratory. In addition, these protocols document all handling of the samples within the laboratory.
Limit(s) of Detection (LOD)	TNI- A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. DoD- The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate (Type II error) is 1%. A LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method at 99% confidence.
Limit(s) of Quantitation (LOQ)	TNI- The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. DoD- The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.
Linear Dynamic Range	DoD- Concentration range where the instrument provides a linear response.
Liquid chromatography/ tandem mass spectrometry (LC/MS/MS)	Instrumentation that combines the physical separation techniques of liquid chromatography with the mass analysis capabilities of mass spectrometry.
Lot	A quantity of bulk material of similar composition processed or manufactured at the same time.
Management	Those individuals directly responsible and accountable for planning, implementing, and assessing work.
Management System	System to establish policy and objectives and to achieve those objectives.
Manager (however named)	The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual.
Matrix	TNI- The substrate of a test sample.
Matrix Duplicate	TNI- A replicate matrix prepared in the laboratory and analyzed to obtain a measure of precision.

Terms and Definitions	
Matrix Spike (MS) (spiked sample or fortified sample)	TNI- A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.
Matrix Spike Duplicate (MSD) (spiked sample or fortified sample duplicate)	TNI- A replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.
Measurement Performance Criteria (MPC)	DoD- Criteria that may be general (such as completion of all tests) or specific (such as QC method acceptance limits) that are used by a project to judge whether a laboratory can perform a specified activity to the defined criteria.
Measurement System	TNI and DoD- A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the sample preparation, test and the operator(s).
Measurement Uncertainty	DoD- An estimate of the error in a measurement often stated as a range of values that contain the true value, within a certain confidence level. The uncertainty generally includes many components which may be evaluated from experimental standard deviations based on repeated observations or by standard deviations evaluated from assumed probability distributions based on experience or other information. For DoD/DOE, a laboratory's Analytical Uncertainty (such as use of LCS control limits) can be reported as the minimum uncertainty.
Method	TNI- A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.
Method Blank	TNI- A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.
Method Detection Limit (MDL)	One way to establish a Detection Limit; defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.
Method of Standard Additions	A set of procedures adding one or more increments of a standard solution to sample aliquots of the same size in order to overcome inherent matrix effects. The procedures encompass the extrapolation back to obtain the sample concentration.

Terms and Definitions	
MintMiner	Program used by Pace Analytical to review large amounts of chromatographic data to monitor for errors or data integrity issues.
Mobile Laboratory	TNI- A portable enclosed structure with necessary and appropriate accommodation and environmental conditions for a laboratory, within which testing is performed by analysts. Examples include but are not limited to trailers, vans, and skid-mounted structures configured to house testing equipment and personnel.
National Institute of Standards and Technology (NIST)	TNI- A federal agency of the US Department of Commerce's Technology Administration that is designed as the United States national metrology institute (or NMI).
National Pollutant Discharge Elimination System (NPDES)	A permit program that controls water pollution by regulating point sources that discharge pollutants into U.S. waters.
Negative Control	Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.
Nitrogen Phosphorus Detector (NPD)	A detector used in GC analyses that utilizes thermal energy to ionize an analyte. With this detector, nitrogen and phosphorus can be selectively detected with a higher sensitivity than carbon.
Nonconformance	An indication or judgment that a product or service has not met the requirement of the relevant specifications, contract, or regulation; also the state of failing to meet the requirements.
Not Detected (ND)	The result reported for a compound when the detected amount of that compound is less than the method reporting limit.
Operator Aid	DoD- A technical posting (such as poster, operating manual, or notepad) that assists workers in performing routine tasks. All operator aids must be controlled documents (i.e., a part of the laboratory management system).
Performance Based Measurement System (PBMS)	An analytical system wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner.
Photo-ionization Detector (PID)	An ion detector which uses high-energy photons, typically in the ultraviolet range, to break molecules into positively charged ions.
Polychlorinated Biphenyls (PCB)	A class of organic compounds that were used as coolants and insulating fluids for transformers and capacitors. The production of these compounds was banned in the 1970's due to their high toxicity.
Positive Control	Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.
Post-Digestion Spike	A sample prepared for metals analyses that has analytes spike added to determine if matrix effects may be a factor in the results.

Terms and Definitions	
Power of Hydrogen (pH)	The measure of acidity or alkalinity of a solution.
Practical Quantitation Limit (PQL)	Another term for a method reporting limit. The lowest reportable concentration of a compound based on parameters set up in an analytical method and the laboratory's ability to reproduce those conditions.
Precision	TNI- The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.
Preservation	TNI and DoD- Any conditions under which a sample must be kept in order to maintain chemical, physical, and/or biological integrity prior to analysis.
Procedure	TNI- A specified way to carry out an activity or process. Procedures can be documented or not.
Proficiency Testing	TNI- A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.
Proficiency Testing Program	TNI- The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories.
Proficiency Testing Sample (PT)	TNI- A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within the specified acceptance criteria.
Protocol	TNI- A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) that must be strictly followed.
Qualitative Analysis	DoD- Analysis designed to identify the components of a substance or mixture.
Quality Assurance (QA)	TNI- An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.
Quality Assurance Manual (QAM)	A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality Assurance Project Plan (QAPP)	A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.

Terms and Definitions	
Quality Control (QC)	TNI- The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring that the results are of acceptable quality.
Quality Control Sample (QCS)	TNI- A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control.
Quality Manual	TNI- A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality System	TNI and DoD- A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance and quality control activities.

Terms and Definitions	
Quality System Matrix	TNI and DoD- These matrix definitions are to be used for purposes of batch and quality control requirements: • **Air and Emissions**: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device • **Aqueous**: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater effluents, and TCLP or other extracts. • **Biological Tissue**: Any sample of a biological origin such as fish tissue, shellfish or plant material. Such samples shall be grouped according to origin. • **Chemical Waste**: A product or by-product of an industrial process that results in a matrix not previously defined. • **Drinking Water**: Any aqueous sample that has been designated a potable or potentially potable water source. • **Non-aqueous liquid**: Any organic liquid with <15% settleable solids • **Saline/Estuarine**: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake. • **Solids**: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.
Quantitation Range	DoD- The range of values (concentrations) in a calibration curve between the LOQ and the highest successively analyzed initial calibration standard. The quantitation range lies within the calibration range.
Quantitative Analysis	DoD- Analysis designed to determine the amounts or proportions of the components of a substance.
Random Error	The EPA has established that there is a 5% probability that the results obtained for any one analyte will exceed the control limits established for the test due to random error. As the number of compounds measured increases in a given sample, the probability for statistical error also increases.
Raw Data	TNI- The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records.
Reagent Blank (method reagent blank)	A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.
Reagent Grade	Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents that conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

Terms and Definitions	
Records	DoD- The output of implementing and following management system documents (e.g., test data in electronic or hand-written forms, files, and logbooks).
Reference Material	TNI- Material or substance one or more of whose property values are sufficiently homogenized and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.
Reference Standard	TNI- Standard used for the calibration of working measurement standards in a given organization or at a given location.
Relative Percent Difference (RPD)	A measure of precision defined as the difference between two measurements divided by the average concentration of the two measurements.
Reporting Limit (RL)	The level at which method, permit, regulatory and customer-specific objectives are met. The reporting limit may never be lower than the Limit of Detection (i.e., statistically determined MDL). Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. There must be a sufficient buffer between the Reporting Limit and the MDL. DoD- A customer-specified lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.
Reporting Limit Verification Standard (or otherwise named)	A standard analyzed at the reporting limit for an analysis to verify the laboratory's ability to report to that level.
Representativeness	A quality element related to the ability to collect a sample reflecting the characteristics of the part of the environment to be assessed. Sample representativeness is dependent on the sampling techniques specified in the project work plan.
Requirement	Denotes a mandatory specification; often designated by the term "shall".
Retention Time	The time between sample injection and the appearance of a solute peak at the detector.
Sample	Portion of material collected for analysis, identified by a single, unique alphanumeric code. A sample may consist of portions in multiple containers, if a single sample is submitted for multiple or repetitive analysis.
Sample Condition Upon Receipt Form (SCURF)	Form used by Pace Analytical sample receiving personnel to document the condition of sample containers upon receipt to the laboratory (used in conjunction with a COC).
Sample Delivery Group (SDG)	A unit within a single project that is used to identify a group of samples for delivery. An SDG is a group of 20 or fewer field samples within a project, received over a period of up to 14 calendar days. Data from all samples in an SDG are reported concurrently.

Terms and Definitions	
Sample Receipt Form (SRF)	Letter sent to the client upon login to show the tests requested and pricing.
Sample Tracking	Procedures employed to record the possession of the samples from the time of sampling until analysis, reporting and archiving. These procedures include the use of a Chain of custody Form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples.
Sampling	TNI- Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.
Selected Ion Monitoring (SIM)	A mode of analysis in mass spectrometry where the detector is set to scan over a very small mass range, typically one mass unit. The narrower the range, the more sensitive the detector.
Selectivity	TNI- The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system.
Sensitivity	TNI- The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.
Serial Dilution	The stepwise dilution of a substance in a solution.
Shall	Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification as long as the requirement is fulfilled.
Should	Denotes a guideline or recommendation whenever noncompliance with the specification is permissible.
Signal-to-Noise Ratio (S/N)	DoD- S/N is a measure of signal strength relative to background noise. The average strength of the noise of most measurements is constant and independent of the magnitude of the signal. Thus, as the quantity being measured (producing the signal) decreases in magnitude, S/N decreases and the effect of the noise on the relative error of a measurement increases.
Spike	A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.
Standard (Document)	TNI- The document describing the elements of a laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies.

Terms and Definitions	
Standard (Chemical)	Standard samples are comprised of a known amount of standard reference material in the matrix undergoing analysis. A standard reference material is a certified reference material produced by US NIST and characterized for absolute content, independent of analytical test method.
Standard Blank (or Reagent Blank)	A calibration standard consisting of the same solvent/reagent matrix used to prepare the calibration standards without the analytes. It is used to construct the calibration curve by establishing instrument background.
Standard Method	A test method issued by an organization generally recognized as competent to do so.
Standard Operating Procedure (SOP)	TNI- A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks.
Standard Reference Material (SRM)	A certified reference material produced by the US NIST or other equivalent organization and characterized for absolute content, independent of analytical method.
Statement of Qualifications (SOQ)	A document that lists information about a company, typically the qualifications of that company to compete on a bid for services.
Stock Standard	A concentrated reference solution containing one or more analytes prepared in the laboratory using an assayed reference compound or purchased from a reputable commercial source.
Storage Blank	DoD- A sample of analyte-free media prepared by the laboratory and retained in the sample storage area of the laboratory. A storage blank is used to record contamination attributable to sample storage at the laboratory.
Supervisor	The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses.
Surrogate	DoD- A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.
Systems Audit	An on-site inspection or assessment of a laboratory's quality system.
Target Analytes	DoD- Analytes or chemicals of primary concern, identified by the customer on a project-specific basis.
Technical Director	Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory.

Terms and Definitions	
Technology	TNI- A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.
Test	A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate.
Test Method	DoD- A definitive procedure that determines one or more characteristics of a given substance or product.
Test Methods for Evaluating Solid Waste, Physical/ Chemical (SW-846)	EPA Waste's official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with RCRA regulations.
Total Petroleum Hydrocarbons (TPH)	A term used to denote a large family of several hundred chemical compounds that originate from crude oil. Compounds may include gasoline components, jet fuel, volatile organics, etc.
Toxicity Characteristic Leaching Procedure (TCLP)	A solid sample extraction method for chemical analysis employed as an analytical method to simulate leaching of compounds through a landfill.
Traceability	TNI- The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical conditions or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.
Training Document	A training resource that provides detailed instructions to execute a specific method or job function.
Trip Blank	This blank sample is used to detect sample contamination from the container and preservative during transport and storage of the sample. A cleaned sample container is filled with laboratory reagent water and the blank is stored, shipped, and analyzed with its associated samples.
Tuning	A check and/or adjustment of instrument performance for mass spectrometry as required by the method.
Ultraviolet Spectrophotometer (UV)	Instrument routinely used in quantitative determination of solutions of transition metal ions and highly conjugated organic compounds.
Uncertainty Measurement	The parameter associated with the result of a measurement that characterized the dispersion of the values that could be reasonably attributed to the measurand (i.e. the concentration of an analyte).

Terms and Definitions	
Unethical actions	DoD- Deliberate falsification of analytical or quality control results, where failed method or contractual requirements are made to appear acceptable.
Unregulated Contaminate Monitoring Rule (UCMR)	EPA program to monitor unregulated contaminates in drinking water.
Validation	DoD- The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
Verification	TNI- Confirmation by examination and objective evidence that specified requirements have been met. Note: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.
Whole Effluent Toxicity (WET)	The aggregate toxic effect to aquatic organisms from all pollutants contained in a facility's wastewater (effluent).

11.0. REFERENCES

11.1. "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act." Federal Register, 40 CFR Part 136.

11.2. "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846.

11.3. "Methods for Chemical Analysis of Water and Wastes", EPA 600-4-79-020, 1979 Revised 1983, U.S. EPA.

11.4. U.S. EPA Contract Laboratory Program Statement of Work for Organic Analysis.

11.5. U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis.

11.6. "Standard Methods for the Examination of Water and Wastewater." Current Edition APHA-AWWA-WPCF.

11.7. "Annual Book of ASTM Standards", Section 4: Construction, Volume 04.04: Soil and Rock; Building Stones, American Society of Testing and Materials.

11.8. "Annual Book of ASTM Standards", Section 11: Water and Environmental Technology, American Society of Testing and Materials.

11.9. "NIOSH Manual of Analytical Methods", Third Edition, 1984, U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health.

11.10. "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water", U.S. EPA, Environmental Monitoring and Support Laboratory – Cincinnati (September 1986).

11.11. Quality Assurance of Chemical Measurements, Taylor, John K.; Lewis Publishers, Inc. 1987.

11.12. Methods for Non-conventional Pesticides Chemicals Analysis of Industrial and Municipal Wastewater, Test Methods, EPA-440/1-83/079C.

11.13. Environmental Measurements Laboratory (EML) Procedures Manual, HASL-300, US DOE, February, 1992.

11.14. Requirements for Quality Control of Analytical Data, HAZWRAP, DOE/HWP-65/R1, July, 1990.

11.15. Requirements for Quality Control of Analytical Data for the Environmental Restoration Program, Martin Marietta, ES/ER/TM-16, December, 1992.

11.16. Quality Assurance Manual for Industrial Hygiene Chemistry, AIHA, 1988.

11.17. National Environmental Laboratory Accreditation Conference, Constitution, Bylaws, and Standards. Most recent version.

11.18. ISO/IEC 17025:2005, General requirements for the competence of testing and calibration laboratories.

11.19. Department of Defense Quality Systems Manual (QSM), version 4.2, October 25, 2010.

11.20. TNI (The NELAC Institute) Standards; most recent version.

11.21. UCMR3 Laboratory Approval Requirements and Information Document, version 2.0, January 2012.

12.0. REVISIONS

The PASI Corporate Quality Office files both a paper copy and electronic version of a Microsoft Word document with tracked changes detailing all revisions made to the previous version of the Quality Assurance Manual. This document is available upon request. All revisions are summarized in the table below.

Document Number	Reason for Change	Date
Quality Assurance Manual 16.0	Section 2.6.5: added VM/Duluth. Sections 2.7.1.3 and 2.7.2.2: added SOT references. Section 4.1.2: added parenthetical phrase directing the reader to the glossary section. Section 4.1.3: added language from old section 4.1.4 and deleted language in order to match current practices. Section 4.1.4: reworded for clarity. Also added last sentence in red text to allow labs to insert additional method blank requirements. Sections 4.1.7, 4.2.9, 4.4.4, and 6.2.7.8: revised wording per updated Ohio VAP requirements. Sections 4.5.2 and 4.6.1: added 'calibration standard' to list of QC items that require the addition of surrogates and internals. Also added red letter text for additional lab-specific information. Section 4.10.3: fixed LOQ verification language to match TNI standard (V1M4, section 1.5.2.2.c). Old section 4.12.2: deleted. Covered in reference in current section 4.12.5. Section 6.2.3: moved language that had been in the 'organic calibration only' section to this general calibration section. The language in this section applies to both organic and inorganic tests. Section 6.2.7.3: added clarification statement regarding the calibration verification standard. Section 6.3.7.1: reworded for clarity and added red letter text for calibration of micro-liter syringes. Section 7.2.5: added language specifying secondary reviewer documents approval of manual integrations. Section 7.2.7: added reference to the Manual Integration SOP. Section 7.2.8: added new red-letter text language to match Data Checker SOP. Section 7.2.9: added new red-letter text language to comply with DoD QSM 4.2. Section 8.3.1: deleted items in order to match current SOP S-ALL-Q-014. Added red-letter text to the following sections for Ohio VAP labs: 2.5.2.1, 4.5.2.1, 4.6.3, and 7.6.2. Attachment VI: added red letter text under title to satisfy AZ state requirement. Attachment VIII, Analyte Chart: changed holding times expressed as '6 Months' to '180 Days' to match actual practice as defined by LIMS acodes. Attachment VIII, Analyte Chart: added explanation under the header	05Feb2013

Document Number	Reason for Change	Date
	to explain the holding times expressed in the chart.	
Quality Assurance Manual 16.0	Updated the QAM to current Template to reflect the procedures used at the PASI-PGH laboratory including additions for radiochemistry and DOD QSM. Added page for Additional signatures (managers and technical directors) Section 1: 10CFR50/NQA1 Reference added (1.3), defining QA Requirements (1.6.1.3), assignment of deputies (1.7.4-1.7.7), minor additions to job descriptions, Addition of radiation safety officer (1.8.20), additional definition for confidentiality (DOD) (1.12.4). Section 2: DOD time definition (2.6.3), Project and ID definition for PGH (2.6.4), Identification of radioactive samples by clients (2.7.3.2). Section 3: Exceptionally permitting departures (3.3.1.1), Sensitivity evaluation for new methods (3.3.2), Drinking water evaluation for DOCs (3.4.3). Section 4: MB evaluation for DOD (4.1.5), LCS evaluation for DOD (4.2.9), MS evaluation for DOD (4.3.8), drinking water evaluation for DOC's (4.9.7), LOD definition by DOD (4.9.8), LOD/LOQ verification frequency for DOD (4.10.4), Radchem uncertainty (4.11.3), ERA PT's (4.12.2). Section 5: DOD Annual reviews for SOPS (5.1.7.7), Other Documentation (5.1.8), Document changes (5.2.1.1-5.2.1.2 and 5.2.2). Section 6: Rad calibration verifications (6.2.1), Rad instrument calibrations (6.2.2.1), DOD QSM requirement for failed CCVs (6.2.7.4.1), Radiological Equipment (6.2.9), Return to control (6.4.7.1). Section 7: Data Checker (7.2.8), frequency for review of DOD projects (7.2.9), Date & time requirements for DOD (7.3.2.8.1). Section 8: client notification requirement (8.1.3.3), QA System Review SOP reference added (8.4.4). Section 9: 10CFR50/NQA1 reporting requirements (9.2.1.1). Section 10: Added definitions for radiochemistry terms. Attachments: Added referenced information for the PASI-PGH lab Updated SOP list and Equipment list.	09Sep2013

Document Number	Reason for Change	Date
Quality Assurance Manual 17.0	Section 2.6.5: Updated facility codes. Section 6.2.3.4: Reworded language regarding calibrations. Section 6.3.7.1: Removed last sentence about syringes. Section 6.4.8: Added sentence about instrumentation failure. Section 7.2.6: Added language regarding auto email function. Section 7.5.1.1: Added red letter section for special data retention requirements. Section 9.2.7.2: Removed sentence regarding hold time reporting by QMs. Section 10: Updated DoD definitions per DoD/DOE QSM, revision 5.0. Also added definitions for LC/MS/MS and UCMR. Section 11: Revised DoD reference and added UCMR3 reference. Attachment VIII: added several drinking water methods and added note 4 regarding hexavalent holding time and preservation. Updated SOP references, SOP list and equipment list.	17Dec2014
Quality Assurance Manual 18.0	Header: Added wording “Effective date of last signature”. Sections 1.3.1 and 1.3.3: reworded to match ISO/TNI standards. Section 1.7.6.1: Added section requiring deputies for key personnel. Included specifics from DoD QSM. Section 1.12.2: changed Sample Custodian to titles listed in section 1.8. Section 2.5.3 note 3: clarified the temperature requirements for tissue samples. Sections 4.2.6 and 4.2.7: added red letter text regarding state of SC. Sections 6.2.3.4 and 6.2.7.5: changes “12 hour” to “method-specified”. Section 9.2.2.2: added new section referencing the PT SOT. Attachment IIA: updated lab org chart added. Attachment IIB: updated to April 2015 version.2.6.5: Updated facility codes. Attachment III : updated equipment list added. Attachment V: updated SOP list added. Attachment VI: updated certification list added. Attachment VIII (Analyses/Preservatives/etc.): made several updates based on QM input and method requirements.	08Feb2016

ATTACHMENT I- QUALITY CONTROL CALCULATIONS

PERCENT RECOVERY (%REC)

$$\%REC = \frac{(MSConc - SampleConc)}{TrueValue} * 100$$

NOTE: The SampleConc is zero (0) for the LCS and Surrogate Calculations

PERCENT DIFFERENCE (%D)

$$\%D = \frac{MeasuredValue - TrueValue}{TrueValue} * 100$$

where:
True Value = Amount spiked (can also be the $\overline{CF}$ or RF of the ICAL Standards)
Measured Value = Amount measured (can also be the CF or RF of the CCV)

PERCENT DRIFT

$$\%Drift = \frac{CalculatedConcentration - TheoreticalConcentration}{TheoreticalConcentrtion} * 100$$

RELATIVE PERCENT DIFFERENCE (RPD)

$$RPD = \frac{|(R1 - R2)|}{(R1 + R2)/2} * 100$$

where:
R1 = Result Sample 1
R2 = Result Sample 2

CORRELATION COEFFICIENT (R)

$$CorrCoeff = \frac{\sum_{i=1}^{N} W_i * (X_i - \overline{X}) * (Y_i - \overline{Y})}{\sqrt{\left(\sum_{i=1}^{N} W_i * (X_i - \overline{X})^2\right) * \left(\sum_{i=1}^{N} W_i * (Y_i - \overline{Y})^2\right)}}$$

With:		
	N	Number of standard samples involved in the calibration
	i	Index for standard samples
	Wi	Weight factor of the standard sample no. i
	Xi	X-value of the standard sample no. i
	X(bar)	Average value of all x-values
	Yi	Y-value of the standard sample no. i
	Y(bar)	Average value of all y-values

ATTACHMENT I- QUALITY CONTROL CALCULATIONS (CONTINUED)

STANDARD DEVIATION (S)

$$S = \sqrt{\sum_{i=1}^{n} \frac{(X_i - \overline{X})^2}{(n-1)}}$$

where:
n = number of data points
X_i = individual data point
$\overline{X}$ = average of all data points

AVERAGE ($\overline{X}$)

$$\overline{X} = \frac{\sum_{n=1}^{i} X_i}{n}$$

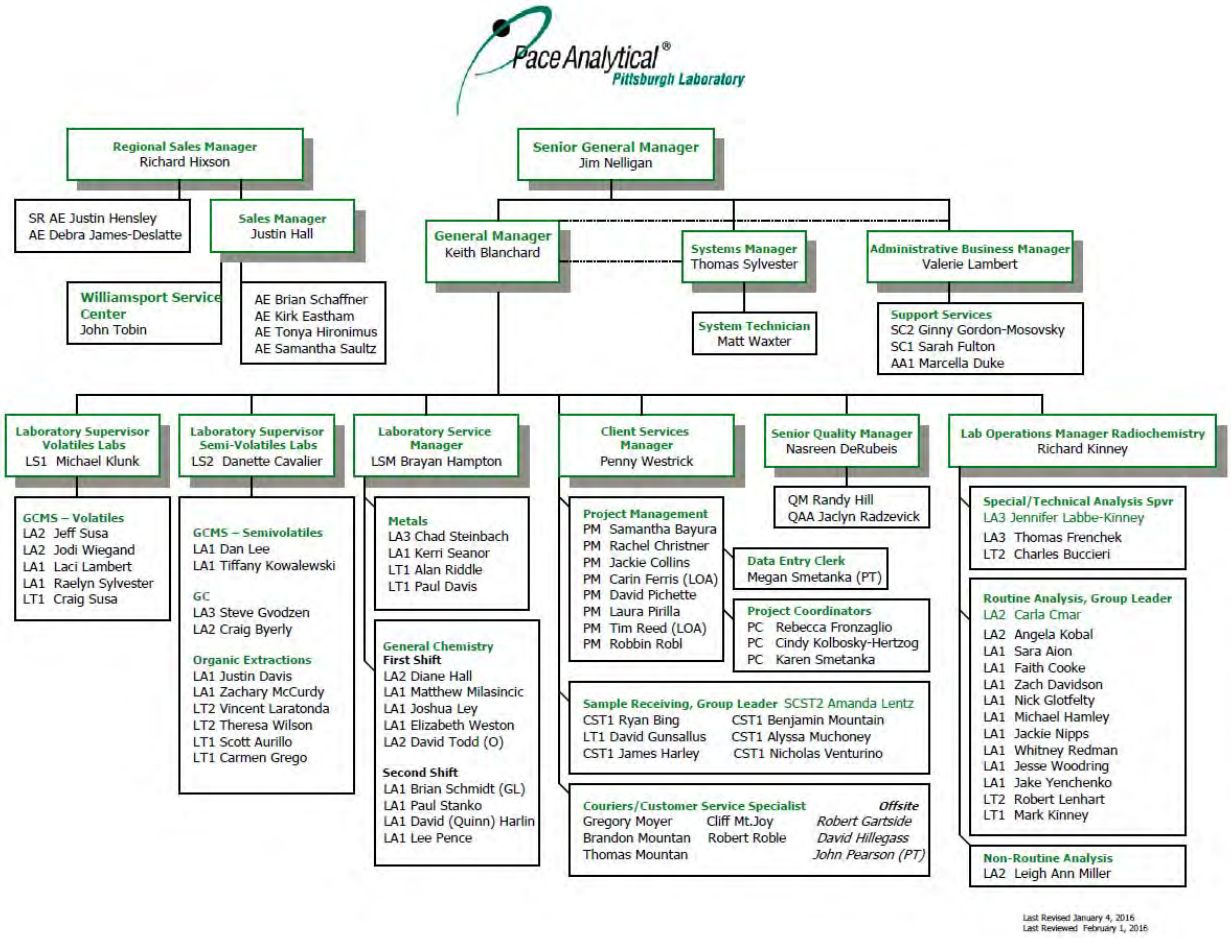
where:
n = number of data points
X_i = individual data point

RELATIVE STANDARD DEVIATION (RSD)

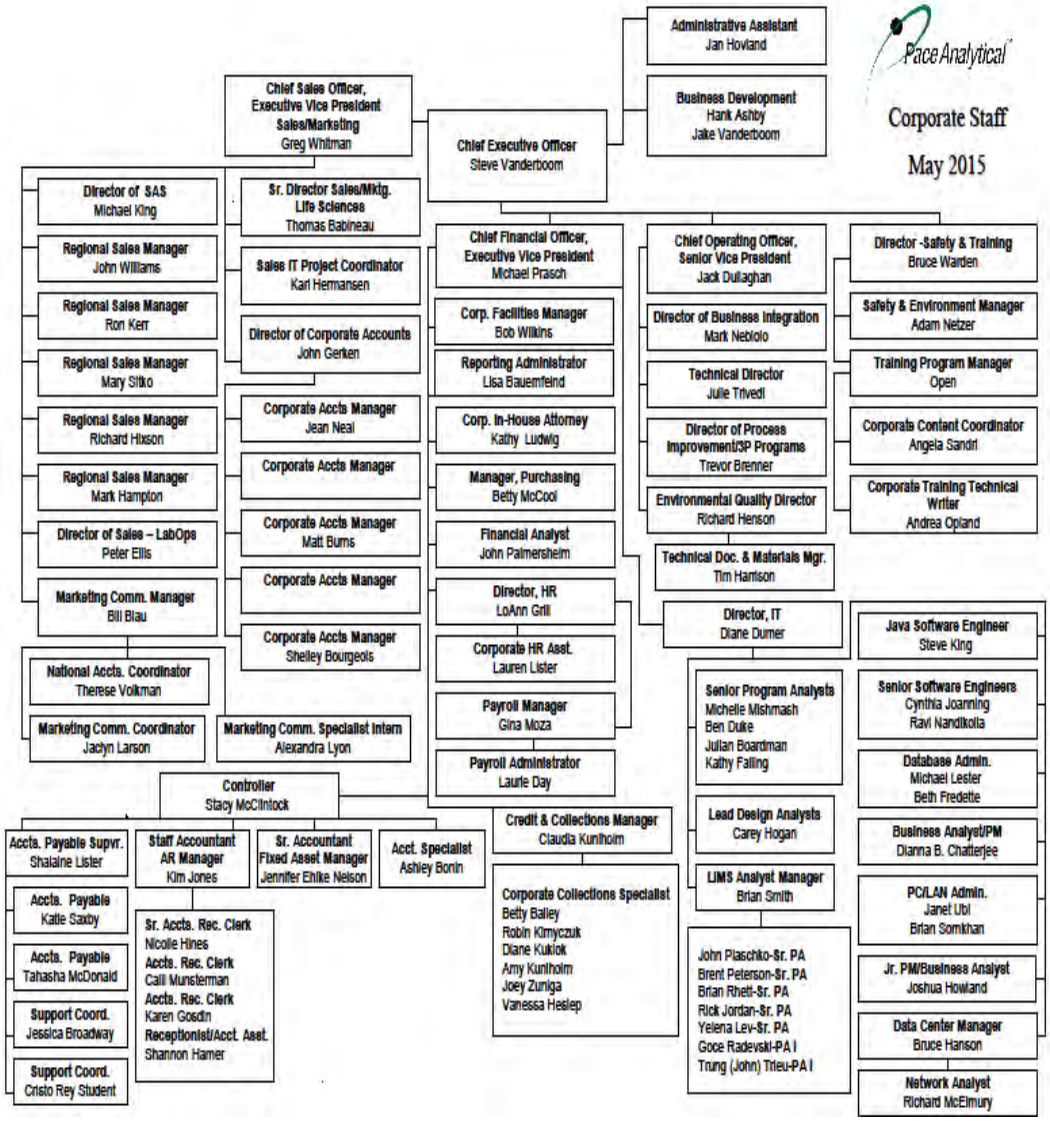
$$RSD = \frac{S}{\overline{X}} * 100$$

where:
S = Standard Deviation of the data points
$\overline{X}$ = average of all data points

ATTACHMENT IIA- LABORATORY ORGANIZATIONAL CHART (CURRENT AS OF ISSUE DATE)



ATTACHMENT IIB- CORPORATE ORGANIZATIONAL CHART (CURRENT AS OF ISSUE DATE)



ATTACHMENT III- EQUIPMENT LIST (CURRENT AS OF ISSUE DATE)

Instrument	Software & *Version #	Manufacturer	Model No.	Serial No.	Instrument ID	Epic Pro Instr. ID	Detector	Analysis
GC/MS	Chemstation 1701BA Rev2.0/Target RC-10	Hewlett-Packard	5973	US82321858; oven US00024152	MSS1	30MSS1	MSD	GCMS Semivolatile
GC/MS	Chemstation 1701EA Rev2.0/Target RC-10	Hewlett-Packard	5973	US01150089; oven US00035050	MSS2	30MSS2	MSD	GCMS Semivolatile
GC/MS	Chemstation 1701EA Rev2.0/Target RC-10	Agilent	5973	US43146815; oven CN10435024	MSS3	30MSS3	MSD	GCMS Semivolatile
GC/MS	Chemstation 1701EA Rev2.0/Target RC-10	Hewlett-Packard	5973	US52420703; oven US10248098	MSS4	30MSS4	MSD	GCMS Semivolatile
GC/MS	Chemstation 1701EA Rev2.0/Target RC-10	Hewlett-Packard	6890A	US62744417; oven US00037743	MSS5	30MSS5	MSD	GCMS Semivolatile
GC/MS	Chemstation 1701BA Rev2.0/Target RC-10	Hewlett-Packard	5973	US70820584	HPMS1	30MV1A-B	MSD	Volatiles

Instrument	Software & *Version #	Manufacturer	Model No.	Serial No.	Instrument ID	Epic Pro Instr. ID	Detector	Analysis
GC/MS	Chemstation 1701BA Rev2.0/Target RC-10	Hewlett-Packard	5973	US72821154	HPMS2	30MV2A-B	MSD	Volatiles
GC/MS	Chemstation 1701BA Rev2.0/Target RC-10	Hewlett-Packard	5973	US94223089	HPMS3	30MV3A-B	MSD	Volatiles
GC/MS	Chemstation 1701BA Rev2.0/Target RC-10	Hewlett-Packard	5973	US70820610	HPMS4	30MV4A-B	MSD	Volatiles
GC/MS	Chemstation 1701EA Rev2.0/Target RC-10	Hewlett-Packard	5975	US10050001	HPMS5	30MV5A-B	MSD	Volatiles
GC/MS	Chemstation 1701EA Rev2.0/Target RC-10	Hewlett-Packard	6890A/5973NMS	US00040634/US10360153	HPMS6	30MV6A-B	MSD	Volatiles
P&T Autosampler 30MSV1	NA	Archon	8100	11856-196A	HPMS1	30MSV1	NA	Volatiles
P&T Concentrator 1-A	NA	Tekmar	3000	94348006	HPMS1	30MSV1	NA	Volatiles
P&T Concentrator 1-B	NA	Tekmar	3000	98082011	HPMS1	30MSV1	NA	Volatiles
P&T Autosampler 30MSV2	NA	EST	Centurion	144061104	HPMS2	30MSV2	NA	Volatiles
P&T Concentrator 2-A	NA	EST	Evolution	EV674060115	HPMS2	30MSV2	NA	Volatiles
P&T Concentrator	NA	EST	Evolution	EV675060115	HPMS2	30MSV2	NA	Volatiles
P&T Autosampler 30MSV3	NA	EST	Centurion	CENT233040307	HPMS3	30MSV3	NA	Volatiles
P&T Concentrator 3-A	NA	Tekmar	3000	9924010	HPMS3	30MSV3	NA	Volatiles
P&T Concentrator 3-B	NA	Tekmar	3000	00060005	HPMS3	30MSV3	NA	Volatiles

Instrument	Software & *Version #	Manufacturer	Model No.	Serial No.	Instrument ID	Epic Pro Instr. ID	Detector	Analysis
P&T Autosampler 30MSV4	NA	EST	Centurion	CENT214101206	HPMS4	30MSV4	NA	Volatiles
P&T Concentrator 4-A	NA	Tekmar	3000	94259003	HPMS4	30MSV4	NA	Volatiles
P&T Concentrator 4-B	NA	Tekmar	3000	94264003	HPMS4	30MSV4	NA	Volatiles
P&T Autosampler 30MSV5	NA	EST	Centurion	CENTS397112514	HPMS5	30MSV5	NA	Volatiles
P&T Concentrator 5-A	NA	EST	Evolution	EV234122809	HPMS5	30MSV5	NA	Volatiles
P&T Concentrator 5-B	NA	EST	Evolution	EV623100614	HPMS5	30MSV5	NA	Volatiles
P&T Autosampler 30MSV6	NA	EST	Centurion	CENTS397112514	HPMS6	30MSV6	NA	Volatiles
P&T Concentrator 6-A	NA	EST	Evolution	EV690070915	HPMS6	30MSV6	NA	Volatiles
P&T Concentrator 6-B	NA	EST	Evolution	EV620092414	HPMS6	30MSV6	NA	Volatiles
GC	Chemstation 1701BA Rev2.0/Target RC-10	Hewlett-Packard	5890 Ser. II	3033A31116	GCV-1	30GCV1	PID/FID	GC Volatiles
GC	Chemstation 1701DA Rev2.0/Target RC-10	Hewlett-Packard	5891 Ser. II	US10608040	GCV-2	30GCV2	FID	Glycols
GC	Chemstation 1701BA Rev2.0/Target RC-10	Hewlett-Packard	3890 Ser. II	3121A35926	Screen	No ID	Dual PID	GC Volatiles
GC	Chemstation Rev B.04.02(118)	Hewlett-Packard	5890A	CN10041083	7	30GCS7	FID	DRO
GC	Chemstation Rev B.03.01(317)	Hewlett-Packard	5890A	2643A11529	8	30GCS8	Dual ECD	PCB, 8011
GC	Chemstation Rev B.03.01(317)	Hewlett-Packard	5890 Ser. II	3029A0193	9	30GCS9	Dual ECD	Pest
GC	Chemstation Rev C.00.00	Agilent	6890	US10250070	A	30GCSA	Dual ECD	PCB

Instrument	Software & *Version #	Manufacturer	Model No.	Serial No.	Instrument ID	Epic Pro Instr. ID	Detector	Analysis
GC (out of service)		Hewlett-Packard	5890 Ser. II	3108A34478	5	30GCS5	FID	-
Refrigerator #1	NA	Fisher Scientific	13-988-450RW	30330074	NA	NA	NA	GC & GCMS Semivolatiles
Refrigerator #2	NA	Fisher Scientific	TDX155NSBRHW	GH750959	NA	NA	NA	GC & GCMS Semivolatiles
Refrigerator / Freezer #23	NA	Isotemp	13-986-111A	168502701110627	NA	NA	NA	GC & GCMS Semivolatiles
Muffle Furnace	NA	Fisher Scientific	NA	NA	NA	NA	NA	O-Prep
TurboVap II #6	NA	Biotage	NA	NA	NA	NA	NA	O-Prep
TurboVap II #5	NA	Caliper Life Sciences	NA	NA	NA	NA	NA	O-Prep
TurboVap II #3	NA	Zymark	NA	NA	NA	NA	NA	O-Prep
TurboVap II #4	NA	Zymark	NA	NA	NA	NA	NA	O-Prep
Centrifuge	NA	IEC	IEC Centra 4B	23730529	NA	NA	NA	O-Prep
Microwave 1	NA	Mars Xpress	MARS 230/60/ 907501	MD9413	NA	NA	NA	O-Prep
Microwave 2	NA	CEM Mars	MARS 6 230/60/ 910900	MJ5218	NA	NA	NA	O-Prep
Ultrasonic Bath	NA			BX0041461710	NA	NA	NA	O-Prep
ICP	Iteva V2.8.096	CETAC	6500	20090207	ICP-2	ICP-2	PMT's	Trace Metals
ICP	Iteva V2.8.097	CETAC	6500	1665DC132619	ICP-3	ICP-3	PMT's	Trace Metals
Mercury Analysis	Quick Trace V1.7.6	CETAC	Cetac	Quicktrace M-6100		NA	30HG1	Metals
Microwave		CEM Corp	MDS2100	ZR8160		NA	NA	Metals
IC	Chromeleon 7	Dionex	ICS 1100	98100641E991001	IC	30WTA4	IC	Anions
IC	PeakNet V5.1	old IC	LC 20	99030583/97110530	IC			Anions
Automated Spectrometer	Omnion V2.0	Lachat	Quick Chem 8000	A8300-1369	NA		UV	Wet Chemistry
Automated Spectrometer	Omnion V 4.0	Lachat	8500	150700001870	NA		UV	Wet Chemistry

Instrument	Software & *Version #	Manufacturer	Model No.	Serial No.	Instrument ID	Epic Pro Instr. ID	Detector	Analysis
Automated Spectrometer	omnion V3.0	Lachat	8500	120400001408	NA		UV	Wet Chemistry
Automated Spectrometer	SmartChem V3.1.14	SmartChem	Discrete Analyzer	W0602083	NA		UV	Wet Chemistry
Spectrophotometer	NA	Milton-Roy	SPEC 21D	3156129024	NA		UV	Wet Chemistry
Spectrophotometer	Hach Lange:66	Milton-Roy	DR 5000	1259771	NA		UV	Wet Chemistry
Solvent Extractor	NA	Dionex	ASE-200	99090116	ASE-200		NA	Soil Extraction
Solid Phase Extractor	NA	Horizon	SPE-Dex 3000XL	00241	NA		NA	O & G (1664)
Dissolved O2 Meter	Hach Lab V2.1.0.713	Hach	Sension 8	110100050689	NA		Meter	BOD/CBOD
pH/Ion/Conductivity	NA	Accumet	50	C0021230	NA		Meter	Fluoride
pH/Ion/Conductivity	NA	Accumet	Accumet 50	AB92344269	NA		Meter	pH
pH/Ion/Conductivity	NA	Orion Star	A215	X05092	NA		Meter	pH
pH/Ion/Conductivity	NA	Precision	Flash Alert		NA	30WET6	NA	Flash Point
pH/Ion/Conductivity	NA	CEM	Marsxpress	MD9413	NA		NA	Soil Extraction
pH/Ion/Conductivity	NA	OI Analytical	1030	D750788365	NA	30WTA2	UV	TOC
TKN block (new)	SCP V1.4	SCP SCIENTIFIC	HTC 1014220373	TSA1014061434	NA		NA	TKN
Turbidimeter	NA	Hf Scientific	Micro 100	200802069			NA	Turbidity
COD block	NA	HACH	45600-00	910605052			NA	COD
COD block	NA	HACH	45600-00	940100010288			NA	COD
Autoclave	NA	Thermo Scientific	Sterile Max	86600	NA	NA	NA	Micro
Balance	NA	Mettler	ML802	B329563586	PJ3600	NA	NA	Wet Chemistry

Instrument	Software & *Version #	Manufacturer	Model No.	Serial No.	Instrument ID	Epic Pro Instr. ID	Detector	Analysis
Balance	NA	Sartorius	BS 2105	40248175	NA	NA	NA	Wet Chemistry
Balance (out of service)	NA	Mettler	BB2440	JE81950	BB2440		NA	Extra
Balance	NA	HRB	1002TL	HR1409140	HR1409140		NA	GCMS Volatiles
Balance	NA	Mettler	MS204S/03	B510684209	B510684209		NA	Wet Chemistry
Balance	NA	Mettler	AE240	K89959	AE240	30BAL1	NA	Volatiles
Balance	NA	Mettler-Toledo	XS203S	B08050503		30BAL6	NA	Metals
Balance	NA	Mettler-Toledo	PG503-S	1118153010	PG503-S	30BAL4	NA	IX Prep
Balance	NA	Mettler	LA3200	13407526			NA	O-Prep
Balance	NA	Mettler	ML802	B435978730			NA	O-Prep
Balance	NA			3788			NA	Extra
Oven #3	NA	Fisher Scientific	NA	NA				Wet Chemistry
Oven #9	NA	Thelco	NA	NA				Wet Chemistry
Oven #10	NA	Fisher Scientific	NA	NA				Wet Chemistry
Refrigerator #10	NA	Kenmore	253.6072101	WA14800568	NA	NA	NA	Wet Chemistry
Refrigerator # 26	NA	Beverage Air	C134	1515739	NA	NA	NA	Wet Chemistry
Refrigerator # 27	NA	Kool IT	KSM42	1200WAB20140926010	NA	NA	NA	Wet Chemistry
Refrigerator # 28	NA	Kool IT	KSM42	1200WAB20141228054	NA	NA	NA	Wet Chemistry
Refrigerator # 29	NA	Kool IT	KSM42	1200WAB20141228055	NA	NA	NA	Wet Chemistry
Refrigerator # 30	NA	Kool IT	KSM42	1200WAB20141228056	NA	NA	NA	Wet Chemistry
Refrigerator # 31	NA	Kool IT	KSM42	KSM42150723001	NA	NA	NA	Wet Chemistry

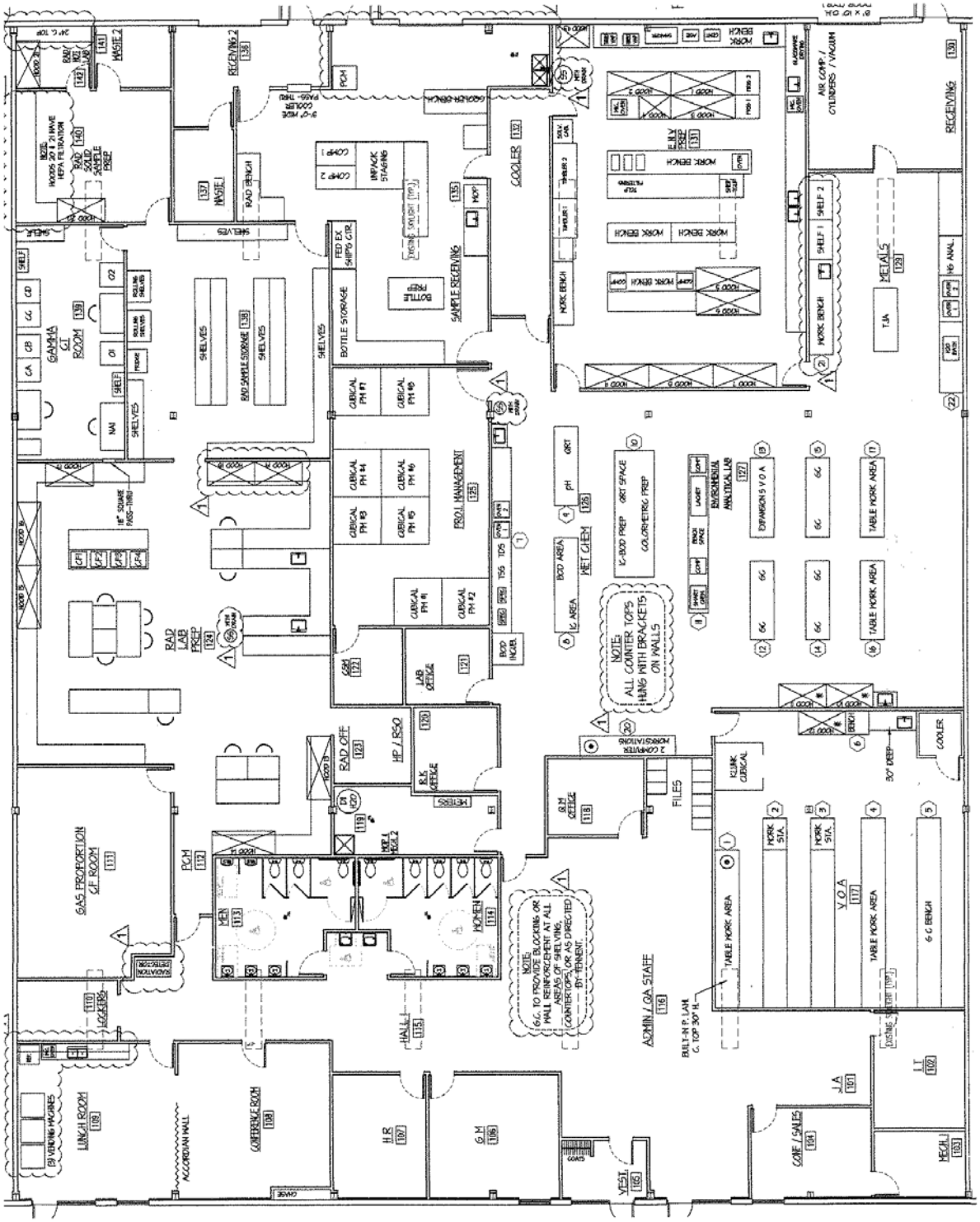
Instrument	Software & *Version #	Manufacturer	Model No.	Serial No.	Instrument ID	Epic Pro Instr. ID	Detector	Analysis
Refrigerator # 32	NA	Kool IT	KSM42	KSM42150719007	NA	NA	NA	Wet Chemistry
Refrigerator # 33	NA	Kool IT	KSM42	KSM42150723008	NA	NA	NA	Wet Chemistry
Refrigerator # 34	NA	Kool IT	KSM42	KSM42150723002	NA	NA	NA	Wet Chemistry
Refrigerator # 35	NA	Kool IT	KSM42	KSM42150719028	NA	NA	NA	Wet Chemistry
Refrigerator # 36	NA	Kool IT	KSM42	KGM42150527007	NA	NA	NA	Wet Chemistry
Refrigerator #4	NA	Fisher Scientific	K89959/ TB15SPFR	MG732472	NA	NA	NA	GCMS Volatiles
Refrigerator #18	NA	TRUE	GDM-47	4503580	NA	NA	NA	GCMS Volatiles
Refrigerator #20 (Walk-in)	NA	American Cooler Tech	NA	NA	NA	NA	NA	GCMS Volatiles
Freezer Chest #7	NA	Kelvinator	NA	NA	NA	NA	NA	GCMS Volatiles
Drying Oven		Fisher Scientific	500 Series	NA	NA	NA	NA	GCMS Volatiles
Oven #6B	NA	Isotemp	NA		NA	NA	NA	Radiological
Oven #7	NA	Fisher Scientific	NA		NA	NA	NA	Radiological
Oven 13	NA	Grieve	LR-271C		NA	NA	NA	Radiological
Refrigerator #22 (out of service)	NA	Haier	10954					Radiological
Refrigerator #37	NA	Haier	HC17SW20RB	BA0A6VM0100TRFSW0983				Radiological
Balance	NA	Mettler	AE163	D07537	88918		NA	Radiological
Balance (out of service)	NA	Mettler	AE163	D07547	7A-7879		NA	Radiological
Balance	NA	Denver Instruments	XP300	990366	XP300		NA	Radiological
Balance	NA	Mettler	AE163	88919	88919		NA	Radiological
Balance	NA	Mettler Toledo	MS3002S/03	B435969938			NA	Radiological
Balance	NA	Mettler	PE3600	D14486			NA	Radiological

Instrument	Software & *Version #	Manufacturer	Model No.	Serial No.	Instrument ID	Epic Pro Instr. ID	Detector	Analysis
Balance	NA	AND	GX8K	14900809			NA	Radiological
Balance	NA	AND	GX8K	14900804			NA	Radiological
Balance	NA	Denver Instrument Corp	A160	B034176			NA	Radiological
Liquid Scintillation Counter	PC SW 1.32, IS SW 2.14	Packard	Tricarb 2900TR	406670	#1		NA	Radiological
Liquid Scintillation Counter	Quantasmart V1.31	Packard	Tricarb 2900TR/LL	4CLC01	#2		NA	Radiological
Liquid Scintillation Counter	PC SW 1.32, IS SW 2.14	Packard	2550 TR/LL	A2550-401074	#3		NA	Radiological
Alpha/Beta Counter	UMS V 1.09o	Berthold	LB-770	145103-1058	Det 1-10		NA	Radiological
Alpha/Beta Counter	PIC Vista 2000 V1.007	Protean Instrument Corp	MPC9604	236529-BO	Det 11-14		NA	Radiological
Alpha/Beta Counter	PIC Vista 2000 V1.007	Protean Instrument Corp	MPC9604	236528-BO	Det 15-18		NA	Radiological
Alpha/Beta Counter	PIC Vista 2000 V1.007	Protean Instrument Corp	MPC9604	236527-BO	Det 19-22		NA	Radiological
Alpha/Beta Counter	PIC Vista 2000 V1.007	Protean Instrument Corp	MPC9604	521665	Det 23-26		NA	Radiological
Alpha/Beta Counter	PIC Vista 2000 V1.007	Protean Instrument Corp	MPC9604	521664	Det 27-30		NA	Radiological
Alpha/Beta Counter	PIC Vista 2000 V1.007	Protean Instrument Corp	MPC9604	521663	Det 31-34		NA	Radiological
Alpha/Beta Counter	PIC Vista 2000 V1.007	Protean Instrument Corp	MPC9604	521662	Det 35-38		NA	Radiological
Alpha/Beta Counter	PIC Vista 2000 V1.007	Protean Instrument Corp	NPC9604	15289409	Det 39-42		NA	Radiological
Alpha/Beta Counter	PIC Vista 2000 V1.007	Protean Instrument Corp	NPC9605	15289410	Det 43-46		NA	Radiological

Instrument	Software & *Version #	Manufacturer	Model No.	Serial No.	Instrument ID	Epic Pro Instr. ID	Detector	Analysis
Alpha/Beta Counter	PIC Vista 2000 V1.007	Protean Instrument Corp	NPC9606	15289411	Det 47-50		NA	Radiological
Alpha/Beta Counter	PIC Vista 2000 V1.007	Protean Instrument Corp	NPC9607	15289412	Det 51-54		NA	Radiological
Radium Analysis (Radon Emenation)	NA	Ludlum Measurements Inc.	Model 2200 Scaler	No tag (Detector A)	A		NA	Radiological
Radium Analysis (Radon Emenation)	NA	Ludlum Measurements Inc.	Model 2200 Scaler	245722 (Detector B)	B		NA	Radiological
Radium Analysis (Radon Emenation)	NA	Ludlum Measurements Inc.	Model 2200 Scaler	No tag (Detector C)	C		NA	Radiological
Radium Analysis (Radon Emenation)	NA	Ludlum Measurements Inc.	Model 2200 Scaler	245744 (Detector D)	D		NA	Radiological
Radium Analysis (Radon Emenation)	NA	Meter	Model 182	PR227468 (Detector A)	A			
Radium Analysis (Radon Emenation)	NA	Meter	Model 182	PR083007 (Detector B)	B			
Radium Analysis (Radon Emenation)	NA	Meter	Model 182	PR083010 (Detector C)	C			
Radium Analysis (Radon Emenation)	NA	Meter	Model 182	PR261260 (Detector D)	D			
KPA	KPA Win 128	ChemChek	KPA-11	92-45050031			NA	Radiological
Gamma Counter	Canberra VAX	Canberra	IGC-4019	2676	Detector 40% A		NA	Radiological
Gamma Counter (out of service)	Canberra VAX	Canberra	GX 5019	9005136	Detector 50% B		NA	Radiological
Gamma Counter (out of service)	Canberra VAX	Canberra	GC 6020	9983922	Detector 60% C		NA	Radiological
Gamma Counter	Canberra VAX	Canberra	GR 3521	2016166	Detector 35% D		NA	Radiological

Instrument	Software & *Version #	Manufacturer	Model No.	Serial No.	Instrument ID	Epic Pro Instr. ID	Detector	Analysis
Gamma Counter	Gammavision Windows XP/7	Ortec	GEM-100-S	46-P41426A	Detector #2		NA	Radiological
Gamma Counter	Gammavision Windows XP/7	Ortec	GEM-100P4-ST	46-TP41365A	Detector #5		NA	Radiological
Gamma Counter (out of service)	Gammavision Windows XP/7	Ortec Module	DSPEC Jr 2.0 V.046	10071606	Detector #3		NA	Radiological
Gamma Counter	Gammavision Windows XP/7	Ortec Module	DSPEC Jr 2.0 V.046	06116387	Detector #2		NA	Radiological
Gamma Counter	Gammavision Windows XP/7	Ortec Module	DSPEC Jr 2.0 V.046	06053268	Detector #5		NA	Radiological
Alpha Spec	Ortec Alphavision 5.3	Oxford Tennelec	S5HP	37959	Detectors 25 through 40		NA	Radiological
Alpha Spec (out of service)	Canberra VAX	Canberra	7200-04	6972152	Detectors 1 through 24, and 25C through 36C		NA	Radiological
Sodium Iodide Detectors	Maestro V 7.01	Ortec	Digibase Unispec	14346852 (Detector 1)	#1		NA	Radiological
Sodium Iodide Detectors	Maestro V 7.01	Ortec	Digibase Unispec	14346844 (Detector 2)	#2		NA	Radiological
Sodium Iodide Detectors	Maestro V 7.01	Ortec	Digibase Unispec	14346843 (Detector 3)	#3		NA	Radiological
Sodium Iodide Detectors	Maestro V 7.01	Ortec	Digibase Unispec	14346847 (Detector 4)	#4		NA	Radiological

ATTACHMENT IV- LABORATORY FLOOR PLAN (CURRENT AS OF ISSUE DATE)



ATTACHMENT V- LABORATORY SOP LIST (CURRENT AS OF EFFECTIVE/REVIEW DATE)

Lab Area	Pace SOP No.	Revision	Document Name	Effective Date	Date Reviewed
AD	PGH-C-001	6	Sample Management	11/25/2015	
AD	PGH-C-008	4	Subcontracting Samples	2/16/2015	
AD	PGH-C-009	4	Glassware Washing	9/9/2013	9/15/2015
AD	PGH-C-012	2	Customer Complaints	10/13/2011	8/14/2015
AD	PGH-C-016	4	Data Packages	1/6/2015	
AD	PGH-C-017	3	Waste Handling and Management	9/27/2013	10/16/2015
AD	PGH-C-025	2	PADEP-MA MCL Violation Reporting	2/5/2013	11/17/2014
AD	PGH-C-027	2	DI Water Quality & Suitability	6/14/2013	7/20/2015
AD	PGH-C-028	3	Bottle Prep	10/13/2015	
AD	PGH-C-033	1	Review of Analytical Requests	12/12/2014	
AD	WI-PGH-C-039	1	Documentation of Non-Compliances for Sample Receipt and Handling	12/16/2015	
AD	G-PGH-W-001	0	Sample Destruction Guide	6/23/2014	
GC	PGH-O-004	8	Diesel Range Organics (DRO) by EPA 8015B & 8015D	11/17/2015	
GC	PGH-O-006	5	Polychlorinated Biphenyls (608)	7/18/2014	
GC	PGH-O-009	10	Polychlorinated Biphenyls (8082-8082A)	7/6/2015	
GC	PGH-O-010	4	Sulfur Cleanup	7/12/2014	
GC	PGH-O-017	5	Sulfuric Acid Cleanup	4/23/2015	
GC	PGH-O-019	4	ETPH (Connecticut Method)	6/30/2015	
GC	PGH-O-021	4	OC Pesticide Analysis by GC (608)	7/18/2014	
GC	PGH-O-024	7	EDB & DBCP by Method 8011	11/14/2015	
GC	PGH-O-026	6	OC Pesticide Analysis by GC (8081A-8081B)	7/18/2014	
GC	WI-PGH-O-002	0	DRO (8015B) - Sparrows Point	8/14/2015	
GC	WI-PGH-O-038	0	Polychlorinated Biphenyls (8082-8082A) Sparrows Point	7/7/2015	
MT	PGH-M-008	16	Determination of Metals by ICP (200.7 and 6010B)	7/7/2015	
MT	PGH-M-011	6	Mercury Prep (Aq)	7/13/2014	
MT	PGH-M-012	8	Mercury Prep (Solid & Semi-solid)	7/13/2014	
MT	PGH-M-013	7	ICP Sample Digestion (Solids)	7/15/2014	
MT	PGH-M-014	7	Microwave Digestion of Organic Wastes	7/13/2014	
MT	PGH-M-015	9	ICP Sample Digestion (Aqueous)	8/21/2015	
MT	PGH-M-017	5	Mercury Analysis by CVAA Cetac	7/13/2014	
OX	PGH-M-003	8	TCLP/ZHE Extraction Procedure	6/29/2015	
OX	PGH-M-016	4	Measurement of Percent Moisture in Soils and Solids	7/11/2014	
OX	PGH-O-002	5	Extraction of PCBs from Wipes	7/12/2014	
OX	PGH-O-007	7	Solid Phase Extraction of TCLP Extractants for SemiVoa Compounds.	8/21/2015	
OX	PGH-O-011	7	Extraction of Organic Waste	7/12/2014	
OX	PGH-O-020	5	CT-ETPH - Extraction of Aqueous and Solid Samples	12/11/2014	
OX	PGH-O-022	6	Microwave Extraction of Organic Parameters	7/13/2014	
OX	PGH-O-028	6	Separatory Funnel Extraction	7/12/2014	
OX	PGH-O-034	3	SPLP & ZHE Extraction (1312)	7/14/2014	
OX	PGH-O-036	2	ASTM Leach Extraction	7/14/2014	
QA	PGH-C-020	4	Logbook of Logbooks	6/21/2013	7/20/2015
QA	PGH-C-023	6	Archiving Laboratory Documents	8/1/2012	9/23/2014
QA	PGH-C-031	1	PT Program	6/17/2013	7/20/2015
QA	PGH-C-032	3	Support Equipment	2/18/2015	
QA	PGH-C-036	1	Purchase of Laboratory Supplies	7/9/2015	
QA	PGH-C-037	0	Standard and Reagent Management and Traceability	9/9/2013	8/13/2015

Lab Area	Pace SOP No.	Revision	Document Name	Effective Date	Date Reviewed
QA	PGH-C-038	1	Receipt and Storage of Laboratory Supplies	8/14/2015	
QA	PGH-Q-022	3	Spreadsheet Validation	10/15/2014	
QA	PGH-Q-030	1	Manual Integrations	10/15/2014	
QA	PGH-Q-035	2	MDL/LOD/LOQ	9/16/2015	
QA	PGH-Q-037	3	Data Review Process	12/10/2014	
QA	PGH-Q-038	0	Laboratory Equipment	5/22/2014	
QA	PGH-Q-039	1	Corrective And Preventative Action	12/10/2014	
QA	PGH-Q-040	0	Internal and External Audits	9/23/2014	
QA	PGH-Q-041	0	Evaluation and Qualification of Vendors	9/23/2014	
QA	PGH-Q-042	1	Regulatory Limit Notification	10/20/2014	
QA	PGH-Q-043	1	Document Control and Management	11/21/2014	
QA	PGH-Q-044	0	Monitoring Storage Units	11/21/2014	
QA	PGH-Q-045	0	Control Charts & Acceptance Limits	7/16/2015	
QA	PGH-Q-046	0	Estimation of Measurement Uncertainty	7/20/2015	
QA	PGH-Q-047	0	Management of Change	8/14/2015	
QA	PGH-Q-048	0	Sample Homogenization and Sub-sampling	8/18/2015	
QA	S-ALL-Q-001	10	Preparation of Standard Operating Procedures	7/13/2011	813/15
QA	S-ALL-Q-003	8	Document Numbering Procedure	8/2/2013	8/13/2015
QA	S-ALL-Q-009	6	Laboratory Documentation	8/13/2015	
QA	S-ALL-Q-014	5	Quarterly Quality Report	8/14/2015	
QA	S-ALL-Q-015	2	Review of Laboratory Management System	1/8/2015	
QA	S-ALL-Q-020	6	Orientation and Training Procedures	7/20/2015	
QA	S-ALL-Q-022	4	3P Program: Continuous Process Improvement	8/14/2015	
QA	S-ALL-Q-028	4	Use and Operations of Lab Track System	8/14/2015	
QA	S-ALL-Q-029	3	MintMiner Data File Review for Data Integrity Monitoring	10/1614	
QA	S-ALL-Q-030	5	Data Checker	10/16/2014	
QA	S-ALL-Q-035	3	Data Recall	8/14/2015	
QA	WI-PGH-Q-001	0	Marathon Analysis Guide	6/11/2014	
QA	WI-PGH-Q-002	0	NJ Data of Known Quality Guide	4/15/2015	
QA	QA Manual	17	Quality Assurance Manual	12/19/2014	
QA	F-PGH-C-034	0	Internal COC Work Instruction	10/30/2012	9/30/2014
R	PGH-R-001	17	Analysis of samples for Gross Alpha and Gross Beta - 900.0	2/20/2015	
R	PGH-R-002	4	Gas Flow Proportional Counter Instrument Operations	7/13/2014	10/16/2015
R	PGH-R-003	17	Analysis of Water Samples for Ra-228 Content - 904.0	12/17/2015	
R	PGH-R-004	10	Analysis of Water Samples for Total Alpha Radium - 903.0, SM7500	02/036/16	
R	PGH-R-005	12	Analysis of Water Samples for Sr89/90 Content - 905.0	8/31/2015	
R	PGH-R-006	13	Analysis of Samples for Total Uranium in Drinking Water - 908.0	1/15/2016	
R	PGH-R-007	16	Analysis of Water Samples for Ra-226 Content - 903.1	12/14/2015	
R	PGH-R-008	10	Analysis of Samples for Alpha Emitting Actinides and Pu-241	7/27/2015	
R	PGH-R-010	6	Sr-89/90 by Extraction Chromatography	4/16/2014	
R	PGH-R-013	3	Ni-59/Ni-63 Analysis	11/21/2014	
R	PGH-R-014	2	Analysis of Iron-55	11/21/2014	
R	PGH-R-015	2	Analysis of samples for Technetium-99	11/21/2014	
R	PGH-R-018	3	Radioactive Standards Preparation	2/20/2015	
R	PGH-R-020	8	Alpha Spectroscopy Instrument Operation	2/20/2015	
R	PGH-R-021	12	Tritium in Water - Distillation - 906.0	7/27/2015	
R	PGH-R-022	5	Liquid Scintillation Counting	7/13/2014	10/16/2015
R	PGH-R-023	9	Gamma Spec Instrument Operations - 901.1	12/3/2015	
R	PGH-R-024	3	Rad Sample Preparation	12/31/2014	

Lab Area	Pace SOP No.	Revision	Document Name	Effective Date	Date Reviewed
R	PGH-R-027	2	Neutron Dosimeter Wires by Gamma Spec	6/26/2013	11/13/2015
R	PGH-R-028	3	Neutron Dosimeter Capsules for Cs-137	8/26/2015	
R	PGH-R-030	2	Analysis of samples for I-129	11/21/2014	
R	PGH-R-031	9	Total Uranium by KPA	02/03/16	
R	PGH-R-032	10	State of NJ 48Hr Gross Alpha Analysis	6/24/2015	
R	PGH-R-034	2	Analysis of C-14	11/21/2014	
R	PGH-R-037	9	Radon in Water	7/27/2015	
R	PGH-R-038	2	Dosimetry Foils for Niobium	11/21/2014	
R	PGH-R-040	4	Gamma Spectroscopy Analysis - Prep - 901.1	12/3/2015	
R	PGH-R-041	3	Analysis of Polonium-210	1/12/2016	
R	PGH-R-042	3	Analysis of samples for Pb-210	7/24/2015	
R	F-PGH-R-063	0	Radioactive Calibrations	4/13/2012	10/21/2014
R	PGH-R-064	0	Isotopic Radium Analysis in Water; Ra-226 and Ra-223/224 by Alpha Spec -Eichrom	10/27/2014	
R	PGH-R-065	0	Alpha Scintillation Counter Operations	11/25/2015	
R	WI-PGH-R-067	0	Rad Sample pH checks	12/11/2015	
R	WI-PGH-R-068	0	Receipt of Sample Packages Marked Radioactive	12/15/2015	
SV	PGH-O-001	8	Semivolatiles by GC/MS (8270C & 8270D)	8/14/2015	
SV	PGH-O-003	4	Semivolatiles by GC/MS (625)	7/18/2014	
SV	PGH-O-023	5	PAH's by SIM	7/12/2014	
SY	PGH-C-019	3	Hood Face Velocity Monitoring	1/14/2015	
SY	PGH-S-001	2	Rescue Alert System Operation	8/9/2010	9/30/2014
SY	S-ALL-S-001	4	Hazard Assessment	10/14/2014	
VO	PGH-O-012	2	Encore soil preparation (EPA Method 5035)	7/12/2014	
VO	PGH-O-015	9	Volatile Organic Compounds by EPA Methods 8260B & 8260C	8/14/2015	
VO	PGH-O-016	9	Gasoline Range Organics (GRO) by EPA Method 8015B & 8015D	8/21/2015	
VO	PGH-O-033	4	Volatile Organic Compounds by EPA Method 624	7/13/2014	
VO	WI-PGH-O-003	0	GRO (8015B) - Sparrows Point	8/14/2015	
WC	PGH-I-003	5	pH in Water, Soil & Waste	10/15/2014	
WC	PGH-I-004	8	Phenolics	10/2/2015	
WC	PGH-I-009	10	BOD/CBOD	7/10/2014	
WC	PGH-I-010	6	Sulfide	12/3/2015	
WC	PGH-I-011	7	Orthophosphate	7/10/2014	
WC	PGH-I-012	11	Hexavalent Chromium	11/23/2015	
WC	PGH-I-013	12	Filterable Residue (Total Suspended Solids, TSS)	12/3/2015	
WC	PGH-I-014	9	Fecal Coliform	7/28/2014	
WC	PGH-I-015	7	Alkalinity	7/11/2014	
WC	PGH-I-016	4	Acidity - Titrimetric	7/11/2014	
WC	PGH-I-017	4	Reactive Cyanide and Sulfide	9/19/2014	
WC	PGH-I-019	5	Paint Filter Liquids Test	7/11/2014	
WC	PGH-I-020	9	Nonfilterable Residue (TDS)	7/11/2014	
WC	PGH-I-021	5	Pensky-Martens Closed-Cup Method for Determining Ignitability	7/11/2014	
WC	PGH-I-024	7	Turbidity	8/11/2015	
WC	PGH-I-025	7	Fluoride	7/11/2014	
WC	PGH-I-027	5	Total Kjeldahl Nitrogen (TKN)	4/17/2015	
WC	PGH-I-028	8	Color	8/5/2015	
WC	PGH-I-030	8	Nitrate/Nitrite	7/31/2015	
WC	PGH-I-031	8	Chloride (by Lachat)	7/24/2015	
WC	PGH-I-033	6	Chemical Oxygen Demand	4/22/2015	
WC	PGH-I-035	9	Ammonia	6/16/2015	

Lab Area	Pace SOP No.	Revision	Document Name	Effective Date	Date Reviewed
WC	PGH-I-037	4	Sulfite	7/28/2015	
WC	PGH-I-038	6	Residual Chlorine	7/15/2015	
WC	PGH-I-039	10	Total Solids (TS) and Total Volatile Solids (TVS)	8/21/2015	
WC	PGH-I-042	11	Oil & Grease in water by SPE (EPA 1664)	1/12/2016	
WC	PGH-I-045	5	Dissolved Oxygen	7/11/2014	
WC	PGH-I-047	5	Settleable Material	7/11/2014	
WC	PGH-I-049	10	Total Coliform	7/28/2015	
WC	PGH-I-050	7	Methylene Blue Activated Substances (MBAS)	7/11/2014	
WC	PGH-I-052	7	O&G/TPH Soxhlet (hexane)	7/11/2014	
WC	PGH-I-053	13	Cyanide: Free, Total and Amenable	11/20/2015	
WC	PGH-I-054	5	Nitrite - Smartchem	7/11/2014	
WC	PGH-I-055	5	Thiocyanate	8/5/2015	
WC	PGH-I-056	9	Sulfate - Smartchem	7/24/2015	
WC	PGH-I-057	10	Phosphorus & Orthophosphate - SmartChem	8/17/2015	
WC	PGH-I-058	4	Ferrous Iron -SmartChem	7/12/2014	
WC	PGH-I-059	8	Anions by Ion Chromatography	8/21/2015	
WC	PGH-I-060	7	Total Organic Carbon	7/16/2015	
WC	PGH-I-062	2	Specific Conductance	6/29/2015	
WC	PGH-I-063	1	Anions by Ion Chromatography - Westinghouse	8/21/2015	
WC	PGH-I-065	0	Fluoroborate	9/17/2014	
WC	PGH-I-066	1	Hexavalent Chromium in Soil Methods 3060A & 7196A	7/6/2015	

ATTACHMENT VI- LABORATORY CERTIFICATION LIST (CURRENT AS OF ISSUE DATE)
SCOPE AND APPLICATION CERTIFICATES ARE MAINTAINED AND FILED IN THE LOCAL QUALITY DEPARTMENT

Laboratory: Pittsburgh Environmental Certifications

Accrediting Authority	Program Category	Accrediting Agency	Certification #/ Lab ID
Connecticut	Waste Water & Hazardous Waste - Solid	DOPH	PH-0694
Maine	Waste Water	DOH&HS	PA01457
New Hampshire	Waste Water & Hazardous Waste - Solid	DES	2976
New Jersey	Waste Water & Hazardous Waste - Solid	DEP	PA-051
New York	Waste Water & Hazardous Waste - Solid	DOH - ELAP	10888
Pennsylvania	Drinking Water (RAD)	DEP	65-00282
Pennsylvania	Waste Water & Hazardous Waste - Solid	DEP	65-00282
PA Rad License	Materials License	NRC	PA-1057
USDA	Soil Permit	USDA	P330-14-00213
West Virginia	Waste Water & Hazardous Waste - Solid	DEP	143

Laboratory: Pittsburgh Radiological Certifications

Alabama	Drinking Water	DEM	41590
Arizona	Drinking Water	DOHS	AZ0734
Arkansas	Drinking Water	DEQ	NA
California	Drinking Water & Hazardous Waste	DOH	04222CA
Colorado	Drinking Water	DPH&E	N/A
Connecticut	Drinking Water, Waste Water and Hazardous Waste	DPH	PH-0694
EPA Region 5	Drinking Water	US EPA	NA
Delaware	Drinking Water	H&SS	NA
DoD	Waste Water & Hazardous Waste	L-A-B	L2417
Florida	Drinking Water & Waste Water	DOH	E87683
Georgia	Drinking Water	DNR	C040
Guam	Drinking Water	EPA	NA
Hawaii	Drinking Water	DOH	NA
Idaho	Drinking Water	DOH&W	NA

Laboratory: Pittsburgh Environmental Certifications

Accrediting Authority	Program Category	Accrediting Agency	Certification #/ Lab ID
Illinois	Drinking Water	DEP	NA
Indiana	Drinking Water	DEP	NA
Iowa	Drinking Water	DNR	391
Kansas	Drinking Water	DOH&EC	E-10358
Kentucky DW	Drinking Water	DEP	90133
Kentucky WW	Waste Water	DEP	90133
Los Angeles Sanitation	Waste Water	Sanitation District	10257
Louisiana	Drinking Water	DHH	LA140008/TNI02141
Louisiana	Waste Water & Hazardous Waste - Solid	DEQ	04086/AI 115223
Maine	Drinking Water & Waste Water	DH & HS	PA01457
Maryland	Drinking Water	DOH&MH	308
Massachusetts	Drinking Water	DEP	M-PA1457
Michigan	Drinking Water	DEQ	NA
Missouri	Drinking Water	DONR	235
Montana	Drinking Water	DOPH&HS	Cert0092
Nebraska	Drinking Water	DOH&HS	NE-OS-29-14
Nevada	Drinking Water, Waste Water & Hazardous Waste	DOC&NR	PA014572016-1
New Hampshire	Drinking Water, Waste Water	DES	2967
New Jersey	Drinking Water	DEP	PA051
New Mexico	Drinking Water, Waste Water and Hazardous Waste	DPNR	NA
New York	Drinking Water, Waste Water	DOH	10888
North Carolina	Drinking Water	DOH&HS	42706
North Dakota	Drinking Water, Waste Water & Hazardous Waste	ND DOH	R-190
Oregon	Drinking Water, Waste Water and Hazardous Waste	ORELAP	PA200002-013
Pennsylvania	Drinking Water, Waste Water and Hazardous Waste	DEP	65-00282
Puerto Rico	Drinking Water	DOH	PA01457
Rhode Island	Drinking Water	DOH	LAO00342
South Dakota	Drinking Water	DOE&NR	NA
Tennessee	Drinking Water	DEC	TN02867
Texas	Drinking Water	COEQ	T104704188-15-10

Laboratory: Pittsburgh Environmental Certifications

Accrediting Authority	Program Category	Accrediting Agency	Certification #/ Lab ID
US Virgin Islands	Drinking Water	DPNR	NA
Utah	Drinking Water, Waste Water and Hazardous Waste	DOH	PA014572015-5
Vermont	Drinking Water	DOH	VT-0282
Virginia (VELAP)	Drinking Water, Waste Water and Hazardous Waste	DGS	460198
Washington	Drinking Water	DOE	C868
West Virginia	Drinking Water	DOH	9964C
West Virginia	Waste Water & Hazardous Waste	DEP	143
Wisconsin	Drinking Water	DOH	NA
Wyoming	Drinking Water	DEP	8TMS-L

ATTACHMENT VII- PACE CHAIN-OF-CUSTODY (CURRENT AS OF ISSUE DATE)

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Pace Analytical www.pacelabs.com

Page: of

Section A — Required Client Information: Company: Address: Email To: Phone: Fax: Requested Due Date/TAT:

Section B — Required Project Information: Report To: Copy To: Purchase Order No.: Project Name: Project Number:

Section C — Invoice Information: Attention: Company Name: Address: Pace Quote Reference: Pace Project Manager: Pace Profile #:

REGULATORY AGENCY: NPDES GROUNDWATER DRINKING WATER; UST RCRA OTHER

Site Location — STATE:

Section D — Required Client Information

Matrix Codes (MATRIX / CODE): Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

ITEM #	SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved; H_2SO_4; HNO_3; HCl; NaOH; $Na_2S_2O_3$; Methanol; Other	Analysis Test Y/N	Requested Analysis Filtered (Y/N)	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														

ADDITIONAL COMMENTS

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed (MM/DD/YY):

SAMPLE CONDITIONS				
Temp in °C				
Received on Ice (Y/N)				
Custody Sealed Cooler (Y/N)				
Samples Intact (Y/N)				

ATTACHMENT VIII- METHOD HOLD TIME, CONTAINER AND PRESERVATION GUIDE (CURRENT AS OF ISSUE DATE)

THE HOLDING TIME INDICATED IN THE CHART BELOW IS THE MAXIMUM ALLOWABLE TIME FROM COLLECTION TO EXTRACTION AND/OR ANALYSIS PER THE ANALYTICAL METHOD. FOR METHODS THAT REQUIRE PROCESSING PRIOR TO ANALYSIS, THE HOLDING TIME IS DESIGNATED AS 'PREPARATION HOLDING TIME/ANALYSIS HOLDING TIME'.

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Acidity	SM2310B	Water	Plastic/Glass	$\leq 6^oC$	14 Days
Actinides	HASL-300	Water		pH<2 HNO_3	180 Days
Actinides	HASL-300	Solid		None	180 Days
Alkalinity	SM2320B/310.2	Water	Plastic/Glass	$\leq 6^oC$	14 Days
Alkylated PAHs		Water		$\leq 6^oC$; pH<2 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved
Alkylated PAHs		Solid		$\leq 10^oC$	1 Year/40 Days
Total Alpha Radium (see note 3)	9315/903.0	Water	Plastic/Glass	pH<2 HNO_3	180 days
Total Alpha Radium (see note 3)	9315	Solid		None	180 days
Anions (Br, Cl, F, NO_2, NO_3, o-Phos, SO_4 , bromate, chlorite, chlorate)	300.0/300.1/SM4110B	Water	Plastic/Glass	$\leq 6^oC$; EDA if bromate or chlorite run	All analytes 28 days except: NO_2, NO_3, o-Phos (48 Hours); chlorite (immediately for 300.0; 14 Days for 300.1). NO_2/NO_3 combo 28 days.
Anions (Br, Cl, F, NO_2, NO_3, o-Phos, SO_4 , bromate, chlorite, chlorate)	300.0	Solid	Plastic/Glass	$\leq 6^oC$	All analytes 28 days except: NO_2, NO_3, o-Phos (48 hours); chlorite (immediately). NO_2/NO_3 combo 28 days.
Anions (Br, Cl, F, NO_2, NO_3, o-Phos, SO_4	9056	Water/ Solid	Plastic/Glass	$\leq 6^oC$	28 days
Aromatic and Halogenated Volatiles (see note 1)	8021	Solid	5035 vial kit	See note 1	14 days
Aromatic and Halogenated Volatiles	602/8021	Water	40mL vials	pH<2 HCl; $\leq 6^oC$; $Na_2S_2O_3$ if Cl present	14 Days (7 Days for aromatics if unpreserved)
Acid Volatile Sulfide	Draft EPA 1629	Solid	8oz Glass	$\leq 6^oC$	14 Days
Bacteria, Total Plate Count	SM9221D	Water	Plastic/WK	$\leq 6^oC$; $Na_2S_2O_3$	24 Hours
Base/Neutrals and Acids	8270	Solid	8oz Glass	$\leq 6^oC$	14/40 Days
Base/Neutrals and Acids	625/8270	Water	1L Amber Glass	$\leq 6^oC$; $Na_2S_2O_3$ if Cl present	7/40 Days
Base/Neutrals, Acids & Pesticides	525.2	Water	1L Amber Glass	pH<2 HCl; $\leq 6^oC$; Na sulfite if Cl present	14/30 Days
Biomarkers		Water	$\leq 6^oC$; pH<2 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved	$\leq 6^oC$; pH<2 1:1 HCl (optional)
Biomarkers		Solid	$\leq 10^oC$	1 Year/40 Days	$\leq 10^oC$
BOD/cBOD	SM5210B	Water	Plastic/Glass	$\leq 6^oC$	48 hours

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
BTEX/Total Hydrocarbons	TO-3	Air	Summa Canister	None	14 Days
BTEX/Total Hydrocarbons	TO-3	Air	Tedlar Bag or equivalent	None	48 Hours
Carbamates	531.1	Water	Glass	$Na_2S_2O_3$, Monochloroacetic acid pH <3; $\leq 6^oC$	28 Days
Cation/Anion Balance	SM1030E	Water	Plastic/Glass	None	None
Cation Exchange	9081	Solid	8oz Glass	None	unknown
Chloride	SM4500Cl-C,E	Water	Plastic/Glass	None	28 Days
Chlorine, Residual	SM4500Cl-D,E,G/330.5/Hach 8167	Water	Plastic/Glass	None	15 minutes
Chlorophyll	SM10200H	Water	Opaque bottle or aluminum foil	$\leq 6^oC$	48 Hours to filtration
COD	SM5220C, D/410.4/Hach 8000	Water	Plastic/Glass	pH<2 H_2SO_4; $\leq 6^oC$	28 Days
Coliform, Fecal	SM9222D	Water	100mL Plastic	$\leq 6^oC$	8 Hours
Coliform, Fecal	SM9222D	Solid	100mL Plastic	$\leq 6^oC$	8 Hours
Coliform, Fecal	SM9221E	Water	100mL Plastic	$\leq 6^oC$	8 Hours
Coliform, Fecal	SM9221E	Solid	100mL Plastic	$\leq 6^oC$	24 Hours
Coliform, Total	SM9222B	Water	100mL Plastic	$\leq 6^oC$	8 Hours
Coliform, Total	SM9221B	Solid	100mL Plastic	$\leq 6^oC$	8 Hours
Coliform, Total and E. coli	SM9223B	Drinking Water	100mL Plastic	$\leq 10^oC$	30 Hours after collection
Color	SM2120B,E	Water	Covered Plastic/Acid Washed Amber Glass	$\leq 6^oC$	24 Hours
Condensable Particulate Emissions	EPA 202	Air	Solutions	None	180 Days
Cyanide, Reactive	SW846 chap.7	Water	Plastic/Glass	None	28 Days
Cyanide, Reactive	SW846 chap.7	Solid	Plastic/Glass	None	28 Days
Cyanide, Total and Amenable	SM4500CN-A,B,C,D,E,G,I,N/9010/9012/335.4	Water	Plastic/Glass	pH$\geq$12 NaOH; $\leq 6^oC$; ascorbic acid if Cl present	14 Days (24 Hours if sulfide present- applies to SM4500CN only)
Diesel Range Organics- Alaska DRO	AK102	Solid	8oz Glass	$\leq 6^oC$	14/40 Days
Diesel Range Organics- Alaska DRO	AK102	Water	1L Glass	pH<2 HCl; $\leq 6^oC$	14/40 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Diesel Range Organics- TPH DRO	8015	Solid	8oz Glass Jar	$\leq 6^oC$	14/40 Days
Diesel Range Organics- TPH DRO	8015	Water	1L Amber Glass	$\leq 6^oC$; $Na_2S_2O_3$ if Cl present	7/40 Days
Diesel Range Organics- TPH DRO	8015	Tissue	1L Amber Glass	$\leq -10^oC$	1 Year if frozen/40 Days
Diesel Range Organics- NwTPH-Dx	Nw-TPH-Dx	Solid	8oz Glass Jar	$\leq 6^oC$	14/40 Days
Diesel Range Organics- NwTPH-Dx	Nw-TPH-Dx	Water	1L Amber Glass	pH <2 HCl; $\leq 6^oC$	14/40 Days; 7 Days from collection to extraction if unpreserved
Diesel Range Organics- Wisconsin DRO	WI MOD DRO	Solid	Tared 4oz Glass Jar	$\leq 6^oC$	10/47 Days
Diesel Range Organics- Wisconsin DRO	WI MOD DRO	Water	1L Amber Glass	$\leq 6^oC$; pH <2 HCl	14/40 Days
Dioxins and Furans	1613B	Solid	8oz Glass	$\leq 6^oC$	1 year
Dioxins and Furans	1613B	Water	1L Amber Glass	$\leq 6^oC$; $Na_2S_2O_3$ if Cl present	1 year
Dioxins and Furans	1613B	Fish/ Tissue	Aluminum foil	$\leq 6^oC$	1 year
Dioxins and Furans	8290	Water	1L Amber Glass	$\leq 6^oC$; $Na_2S_2O_3$ if Cl present	30/45 Days
Dioxins and Furans	8290	Solid	8oz Glass	$\leq 6^oC$	30/45 Days
Dioxins and Furans	8290	Fish/ Tissue	Not specified	$< -10^oC$	30/45 Days
Dioxins and Furans	TO-9	Air	PUF	None	30/45 Days
Diquat/Paraquat	549.2	Water	Amber Plastic	$\leq 6^oC$; $Na_2S_2O_3$	7/21 Days
EDB/DBCP (8011) EDB/DBCP/1,2,3-TCP (504.1)	504.1/8011	Water	40mL vials	$\leq 6^oC$; $Na_2S_2O_3$ if Cl present	14 Days
Endothall	548.1	Water	Amber Glass	$\leq 6^oC$; $Na_2S_2O_3$	7/14 Days
Enterococci	EPA 1600	Water	100mL Plastic	$\leq 6^oC$	8 Hours
Explosives	8330/8332	Water	1L Amber Glass	$\leq 6^oC$	7/40 Days
Explosives	8330/8332	Solid	8oz Glass Jar	$\leq 6^oC$	14/40 Days
Extractable Petroleum Hydrocarbons (aliphatic and aromatic)	MA-EPH	Water	1L Amber Glass	pH<2 HCl; $\leq 6^oC$	14/40 Days
Extractable Petroleum Hydrocarbons (aliphatic and aromatic)	MA-EPH	Solid	4oz Glass Jar	$\leq 6^oC$	7/40 Days
Fecal Streptococci	SM9230B	Water	100mL Plastic	$\leq 6^oC$	8 Hours
Ferrous Iron	SN3500Fe-D; Hach 8146	Water	Glass	None	Immediate
Flashpoint/Ignitability	1010	Liquid	Plastic/Glass	None	28 Days
Florida PRO	FL PRO DEP (11/1/95)	Liquid	Glass, PTFE lined cap	$\leq 6^oC$; pH <2 H_2SO_4 or HCl	7/40 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Fluoride	SM4500Fl-C,D	Water	Plastic	None	28 Days
Gamma Emitting Radionuclides	901.1	Water	Plastic/Glass	pH<2 HNO_3	180 days
Gasoline Range Organics	8015	Water	40mL vials	pH<2 HCl	14 Days
Gasoline Range Organics	8015	Solid	5035 vial kit	See note 1	14 days
Gasoline Range Organics- Alaska GRO	AK101	Solid	5035 vial kit	See 5035 note*	28 Days if GRO only (14 Days with BTEX)
Gasoline Range Organics- Alaska GRO	AK101	Water	40mL vials	pH<2 HCl; $\leq 6^oC$	14 Days
Gasoline Range Organics- NwTPH-Gx	Nw-TPH-Gx	Water	40mL vials	pH<2 HCl; $\leq 6^oC$	7 Days unpreserved; 14 Days preserved
Gasoline Range Organics- NwTPH-Gx	Nw-TPH-Gx	Solid	40mL vials	$\leq 6^oC$; packed jars with no headspace	14 Days
Gasoline Range Organics-Wisconsin GRO	WI MOD GRO	Water	40mL vials	pH<2 HCl; $\leq 6^oC$	14 Days
Gasoline Range Organics-Wisconsin GRO	WI MOD GRO	Solid	40mL MeOH vials	$\leq 6^oC$ in MeOH	21 Days
Glyphosate	547	Water	Glass	$\leq 6^oC$; $Na_2S_2O_3$	14 Days (18 Months frozen)
Gross Alpha (NJ 48Hr Method)	NJAC 7:18-6	Water	Plastic/Glass	pH<2 HNO_3	48 Hrs
Gross Alpha and Gross Beta	9310/900.0	Water	Plastic/Glass	pH<2 HNO_3	180 Days
Gross Alpha and Gross Beta	9310	Solid	Glass	None	180 Days
Haloacetic Acids	552.1/552.2	Water	40mL Amber vials	NH_4Cl; $\leq 6^oC$	14/7 Days if extracts stored $\leq 6^oC$ or 14/14 Days if extracts stored at $\leq -10^oC$
Hardness, Total ($CaCO_3$)	SM2340B,C/130.1	Water	Plastic/Glass	pH<2 HNO_3	6 Months
Heterotrophic Plate Count (SPC/HPC)	SM9215B	Water	100mL Plastic	$\leq 6^oC$	24 Hours
Heterotrophic Plate Count (SPC/HPC)	SimPlate	Water	100mL Plastic	$\leq 6^oC$	8 Hours
Herbicides, Chlorinated	8151	Solid	8oz Glass Jar	$\leq 6^oC$	14/40 Days
Herbicides, Chlorinated	8151	Water	1L Amber Glass	$\leq 6^oC$; $Na_2S_2O_3$ if Cl present	7/40 Days
Herbicides, Chlorinated	515.1/515.3	Water	1L Amber Glass	$\leq 6^oC$; $Na_2S_2O_3$ if Cl present	14/28 Days
Hexavalent Chromium	7196/218.6/SM3500Cr-B, C, D	Water	Plastic/Glass	$\leq 6^oC$	24 Hours (see note 4)
Hexavalent Chromium	7196/218.6/SM3500Cr-B, C, D	Water	Plastic/Glass	Ammonium Buffer pH 9.3-9.7	28 Days (see note 4)
Hexavalent Chromium	218.6/218.7	Drinking Water	Plastic/Glass	Ammonium Buffer pH >8	14 Days (see note 4)

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Hexavalent Chromium	7196 (with 3060A)	Solid	Plastic/Glass	≤ 6°C	30 days from sample collection. 7 days after extraction from soil.
Hydrogen Halide and Halogen Emissions	EPA 26	Air	Solutions	None	6 Months
Ignitability of Solids	1030	Non-liquid Waste	Plastic/Glass	None	28 Days
Lead Emissions	EPA 12	Air	Filter/Solutions	None	6 Months
Lipids	Pace Lipids	Tissue	Plastic/Glass	≤ -10°C	1 Year if frozen
Mercury, Low-Level	1631E	Solid	Glass	None	28 Days
Mercury, Low-Level	1631E	Water	Fluoropolymer bottles (Glass if Hg is only analyte being tested)	12N HCl or BrCl	48 Hours for preservation or analysis; 28 Days to preservation if sample oxidized in bottle; 90 Days for analysis if preserved
Mercury, Low-Level	1631E	Tissue	Plastic/Glass	≤ - 10°C	28 Days if frozen
Mercury	7471	Solid	8oz Glass Jar	≤ 6°C	28 Days
Mercury	7470/245.1/245.2	Water	Plastic/Glass	pH<2 HNO_3	28 Days
Mercury	7471/245.6	Tissue	Plastic/Glass	≤ - 10°C	28 Days if frozen
Metals (GFAA)	7000/200.9	Water	Plastic/Glass	pH<2 HNO_3	180 Days
Metals (ICP)	NIOSH 7300A/7303	Air	Filters	None	180 Days
Metals (ICP/ICPMS)	6010/6020	Solid	8oz Glass Jar	None	180 Days
Metals (ICP/ICPMS)	6010/6020/200.7/200.8	Water	Plastic/Glass	pH<2 HNO_3	180 Days
Metals (ICP/ICPMS)	6020	Tissue	Plastic/Glass	≤ -10°C	180 Days if frozen
Methane, Ethane, Ethene	8015 modified	Water	40mL vials	HCl	14 Days
Methane, Ethane, Ethene	RSK-175	Water	40mL vials	HCl	14 Days
Methane, Ethane, Ethene	EPA 3C	Air	Summa Canister	None	14 Days
Methane, Ethane, Ethene	EPA 3C	Air	Tedlar Bag or equivalent	None	48 Hours
Methanol, Ethanol	8015 modified	Water	40mL vials	≤ 6°C	14 Days
Methanol, Ethanol	8015 modified	Solid	2oz Glass	≤ 6°C	14 Days
Nitrogen, Ammonia	SM4500NH3/350.1	Water	Plastic/Glass	pH<2 H_2SO_4; ≤ 6°C	28 Days
Nitrogen, Kjeldahl (TKN)	351.2	Solid	Plastic/Glass	≤ 6°C	28 Days
Nitrogen, Kjeldahl (TKN)	SM4500-Norg/351.2	Water	Plastic/Glass	pH<2 H_2SO_4; ≤ 6°C	28 Days
Nitrogen, Nitrate	SM4500-NO3/352.1	Water	Plastic/Glass	≤ 6°C	24 Hours preferred
Nitrogen, Nitrate & Nitrite combination	353.2	Solid	Plastic/Glass	≤ 6°C	28 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Nitrogen, Nitrate & Nitrite combination	SM4500-NO3/353.2	Water	Plastic/Glass	pH<2 H_2SO_4; ≤ 6°C	28 Days
Nitrogen, Nitrite or Nitrate separately	SM4500-NO2/353.2	Water	Plastic/Glass	≤ 6°C	48 Hours
Nitrogen, Organic	SM4500-Norg/351.2	Water	Plastic/Glass	pH<2 H_2SO_4; ≤ 6°C	28 Days
Non-Methane Organics	EPA 25C	Air	Summa Canister	None	14 Days
Non-Methane Organics	EPA 25C	Air	Tedlar Bag or equivalent	None	48 Hours
Odor	SM2150B	Water	Glass	≤ 6°C	24 Hours
Oil and Grease/HEM	1664A/SM5520B/9070	Water	Glass	pH<2 H_2SO_4 or HCl; ≤ 6°C	28 Days
Oil and Grease/HEM	9071	Solid	Glass	≤ 6°C	28 Days
PBDEs	1614	Water	1L Amber Glass	≤ 6°C	1 Year/1 Year
PBDEs	1614	Solid	Wide Mouth Jar	≤ 6°C	1 Year/1 Year
PBDEs	1614	Tissue	Aluminum Foil	≤ -10°C	1 Year/1 Year
PCBs and Pesticides, Organochlorine (OC)	TO-4/TO-10	Air	PUF	None	7/40 Days
PCBs and Pesticides, Organochlorine (OC)	608	Water	1L Amber Glass		Pest: 7/40 Days; PCB: 1 Year/1 Year
PCBs, Pesticides (OC), Herbicides	508.1	Water	Glass	Na2SO3; pH<2 HCl; ≤ 6°C	14/30 Days
Perchlorate	331	Water	Plastic/Glass	>0-6°C	28 Days
Pesticides, Organochlorine (OC)	8081	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	7/40 Days
Pesticides, Organochlorine (OC)	8081	Solid	8oz Glass Jar	≤ 6°C	14/40 Days
Pesticides, Organochlorine (OC)	8081	Tissue	8oz Glass Jar	≤ -10°C	1 Year if frozen/40 Days
Pesticides, Organophosphorous (OP)	8141	Solid	8oz Glass Jar	≤ 6°C	14/40 Days
Pesticides, Organophosphorous (OP)	8141	Water	1L Amber Glass	pH 5-8 with NaOH or H_2SO_4; ≤ 6°C; $Na_2S_2O_3$ if Cl present	7/40 Days
PCBs (Aroclors)	8082	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	1 Year/1 Year
PCBs (Aroclors)	8082	Solid	8oz Glass Jar	≤ 6°C	1 Year/1 Year
PCBs (Aroclors)	8082	Tissue	Plastic/Glass	≤ -10°C	1 Year if frozen/1 Year
PCB Congeners	1668A	Water	1L Amber Glass	≤ 6°C but above freezing	1 Year/1 Year
PCB Congeners	1668A	Solid	4-8oz Glass Jar	≤ 6°C but above freezing	1 Year/1 Year
PCB Congeners	1668A	Tissue	4-8oz Glass Jar	≤ -10°C	1 Year/1 Year
Oil Range Organics- ORO					
Oxygen, Dissolved (Probe)	SM4500-O	Water	Glass	None	15 minutes
Paint Filter Liquid Test	9095	Water	Plastic/Glass	None	N/A
Particulates	PM-10	Air	Filters	None	180 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Permanent Gases	EPA 3C	Air	Summa Canister	None	14 Days
Permanent Gases	EPA 3C	Air	Tedlar Bag or equivalent	None	48 Hours
pH	SM4500H+B/9040	Water	Plastic/Glass	None	15 minutes
pH	9045	Solid	Plastic/Glass	None	
Phenol, Total	420.1/420.4/9065/9066	Water	Glass	pH<2 H_2SO_4; $\leq 6^oC$	28 Days
Phosphorus, Orthophosphate	SM4500P/365.1/365.3	Water	Plastic	Filter; $\leq 6^oC$	Filter within 15 minutes, Analyze within 48 Hours
Phosphorus, Total	SM4500P/ 365.1/365.3/365.4	Water	Plastic/Glass	pH<2 H_2SO_4; $\leq 6^oC$	28 Days
Phosphorus, Total	365.4	Solid	Plastic/Glass	$\leq 6^oC$	28 Days
Polynuclear Aromatic Hydrocarbons (PAH)	TO-13	Air	PUF	None	7/40 Days
Polynuclear Aromatic Hydrocarbons (PAH)	8270 SIM	Solid	8oz Glass Jar	$\leq 6^oC$	14/40 Days
Polynuclear Aromatic Hydrocarbons (PAH)	8270 SIM	Water	1L Amber Glass	$\leq 6^oC$; $Na_2S_2O_3$ if Cl present	7/40 Days
Polynuclear Aromatic Hydrocarbons (PAH)	8270 SIM	Tissue	Plastic/Glass	$\leq -10^oC$	1 Year if frozen/40 Days
Radioactive Strontium	905.0	Water	Plastic/Glass	pH<2 HNO_3	180 days
Radium-226	903.0/903.1	Water	Plastic/Glass	pH<2 HNO_3	180 days
Radium-228 (see note 3)	9320/904.0	Water	Plastic/Glass	pH<2 HNO_3	180 days
Radium-228 (see note 3)	9320	Solid			
Residual Range Organics- Alaska RRO	AK103	Solid	8oz Glass	$\leq 6^oC$	14/40 Days
Saturated Hydrocarbons		Water	$\leq 6^oC$; pH<2 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved	$\leq 6^oC$; pH<2 1:1 HCl (optional)
Saturated Hydrocarbons		Solid	$\leq 10^oC$	1 Year/40 Days	$\leq 10^oC$
Silica, Dissolved	SM4500Si-D	Water	Plastic	$\leq 6^oC$	28 Days
Solids, Settleable	SM2540F	Water	Glass	$\leq 6^oC$	48 Hours
Solids, Total	SM2540B	Water	Plastic/Glass	$\leq 6^oC$	7 Days
Solids, Total	SM2540G	Solid	Plastic/Glass	$\leq 6^oC$	7 Days
Solids, Total (FOC, OM, Ash)	ASTM D2974	Solid	Plastic/Glass	$\leq 6^oC$	7 Days
Solids, Total Dissolved	SM2540C	Water	Plastic/Glass	$\leq 6^oC$	7 Days
Solids, Total Suspended	SM2540D/USGS I-3765-85	Water	Plastic/Glass	$\leq 6^oC$	7 Days
Solids, Total Volatile	160.4/SM2540E	Water	Plastic/Glass	$\leq 6^oC$	7 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Solids, Total Volatile	160.4	Solid	Plastic/Glass	$\leq 6^oC$	7 Days
Specific Conductance	SM2510B/9050/120.1	Water	Plastic/Glass	$\leq 6^oC$	28 Days
Stationary Source Dioxins and Furans	EPA 23	Air	XAD Trap	None	30/45 Days
Stationary Source Mercury	EPA 101	Air	Filters	None	180 Days, 28 Days for Hg
Stationary Source Metals	EPA 29	Air	Filters	None	180 Days, 28 Days for Hg
Stationary Source PM10	EPA 201A	Air	Filters	None	180 Days
Stationary Source Particulates	EPA 5	Air	Filter/Solutions	None	180 Days
Sulfate	SM4500SO4/9036/ 9038/375.2/ASTM D516	Water	Plastic/Glass	$\leq 6^oC$	28 Days
Sulfide, Reactive	SW-846 Chap.7	Water	Plastic/Glass	None	28 Days
Sulfide, Reactive	SW-846 Chap.7	Solid	Plastic/Glass	None	28 Days
Sulfide, Total	SM4500S/9030	Water	Plastic/Glass	pH>9 NaOH; ZnOAc; $\leq 6^oC$	7 Days
Sulfite	SM4500SO3	Water	Plastic/Glass	None	15 minutes
Surfactants (MBAS)	SM5540C	Water	Plastic/Glass	$\leq 6^oC$	48 Hours
Total Organic Carbon (TOC)	SM5310B,C,D/9060	Water	Glass	pH<2 H_2SO_4 or HCl; $\leq 6^oC$	28 Days
Total Organic Carbon (TOC)	9060/Walkley Black	Solid	Glass	$\leq 6^oC$	14 Days
Total Organic Halogen (TOX)	SM5320/9020/9021	Water	Glass; no headspace	$\leq 6^oC$	14 Days
Tritium	906.0	Water	Glass	None	180 days
Turbidity	SM2130B/180.1	Water	Plastic/Glass	$\leq 6^oC$	48 Hours
Total Uranium	908.0/ASTM D5174-97	Water	Plastic/Glass	pH<2 HCl	180 days
Volatile Petroleum Hydrocarbons (aliphatic and aromatic)	MA-VPH	Water	40mL vials	pH<2 HCl; $\leq 6^oC$	14 Days preserved
Volatile Petroleum Hydrocarbons (aliphatic and aromatic)	MA-VPH	Solid	4-8oz Glass Jar	$\leq 6^oC$; packed jars with no headspace	7/28 Days
Volatiles	TO-14	Air	Summa Canister	None	30 Days
Volatiles	TO-14	Air	Tedlar Bag or equivalent	None	48 Hours
Volatiles	TO-15	Air	Summa Canister	None	30 Days
Volatiles	TO-18/8260	Air	Tedlar Bag or equivalent	None	72 Hours
Volatiles	8260	Solid	5035 vial kit	See note 1	14 days
Volatiles	8260	Water	40mL vials	pH<2 HCl; $\leq 6^oC$; $Na_2S_2O_3$ if Cl present	14 Days
Volatiles	8260	Conc. Waste	5035 vial kit or 40mL vials	$\leq 6^oC$	14 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Volatiles	624	Water	40mL vials	pH<2 HCl; ≤ 6°C; $Na_2S_2O_3$ if Cl present	14 Days (7 Days for aromatics if unpreserved)
Volatiles (see note 2)	524.2	Water	40mL vials (in duplicate)	pH<2 HCl; ≤ 6°C; Ascorbic acid or $Na_2S_2O_3$ if Cl present[2]	14 Days
UCMR3 Metals	200.8	Water	Plastic or glass	pH<2 HNO_3	28 Days
UCMR3 Hexavalent Chromium	218.7	Water	HDPE or propylene	Na_2CO_3/$NaHCO_3$/$(NH_4)_2SO_4$; pH>8	14 Days
UCMR3 Chlorate	300.1	Water	Plastic or glass	EDA	28 Days
UCMR3 Hormones	539	Water	Amber glass	$Na_2S_2O_3$, 2-mercaptopyridine-1-oxide, sodium salt	28 Days
UCMR3 Perfluorinated Compounds	537	Water	Polypropylene	Trizma	14 Days
UCMR3 Volatiles	524.3	Water	40 mL amber glass vials	Ascorbic acid. Maleic acid pH~2	14 Days
UCMR3 1, 4 Dioxane	522	Water	Glass	Na_2SO_3, $NaHSO_4$; pH<4	28 Days
UV254	SM5910B	Water	Glass	≤ 6°C	48 Hours

[1] **5035/5035A Note**: 5035 vial kit typically contains 2 vials water, preserved by freezing **or**, 2 vials aqueous sodium bisulfate preserved at 4°C, **and** one vial methanol preserved at ≤6°C **and** one container of unpreserved sample stored at ≤6°C.

[2] Method 524.2 lists ascorbic acid as the preservative when residual chlorine is suspected, unless gases or Table 7 compounds are NOT compounds of interest and then sodium thiosulfate is the preservative recommended.

[3] Methods 9315 and 9320 both state that if samples are unpreserved, the samples should be brought to the lab within 5 days of collection, preserved in the lab, and then allowed to sit for a minimum of 16 hours before sample preparation/analysis.

[4] The holding time for hexavalent chromium may be extended by the addition of the ammonium buffer listed in EPA 218.6 per the 2012 EPA Method Update Rule. Although Method 218.6 stipulates a different pH range (9.0 to 9.5) for buffering, this method requirement was modified in the Method Update Rule to a pH range of 9.3 to 9.7.For non-potable waters, adjust the pH of the sample to 9.3 to 9.7 during collection with the method required ammonium sulfate buffer to extend the holding time to 28 days. For potable waters, addition of the buffer during collection will extend the holding time for 14 days per EPA 218.7 and the EPA UCMR3 program.

Note: Refer to the applicable SOPs for the most current preservation and holding time requirements.

MONITORING WELL CONSTRUCTION LOGS

GeoLogic NY, Inc.
P.O. Box 5080
Cortland, NY 13045
607-836-4400
607-836-4403 (fax)

SUBSURFACE LOG

Boring No.: B-9 (MW-3)
Project No.: 99011
Date Started: 12-6-00
Date Completed: 12-6-00

Reference Elevation: 899.75

Project: Triple Cities Metal Finishing Corp.
Location: Nowlan Road, Binghamton, New York

Depth (ft)	Number	Type	SPT Blows (6")	N-Value	Recovery (ft)	MATERIAL DESCRIPTION	PID Readings (ppm)	Well Installation	Remarks
0						Ground Surface			
						Asphalt 0.4'			
1	1	SS	5 9 7	16	0.7	Brown SILT, Some coarse-fine Sand, little gravel, damp	0		Curbbox and Locking Cap
2									
3	2	SS	8 5 4 5	9	1.3		0		
4									
5	3	SS	8 10 8 8	18	1.2	Brown coarse-fine GRAVEL, SAND and SILT moist	1.1		Grout, 2'-24'
6									
7	4	SS	12 10 8 9	18	0.8		0.5		2" dia. PVC Riser Pipe
8									
9	5	SS	8 4 5 4	9	0.6		3.3		
10									
11	6	SS	15 10 15 18	25	0.7		3.1		
12									
13	7	SS	15 18 30 50	48	0.7	Brown coarse-fine GRAVEL and SAND, Some Silt, cobbles, dry	5.0		
14									
15	8	SS	25 31 30 24	61	0.9		4.2		
16									
17	9	SS	35 45 40 50	85	1.3	similar with a layer of medium-fine SAND, little silt, dry	4.7		
18									
19	10	SS	35 60 100-.3		1.1		3.2		
20									

Sampling Method: ASTM D-1586

Notes: 4 1/4" I.D. Hollow Stem Augers

Visually Classified by: S. Cummins

File: 99011/tech/mw3

GeoLogic NY, Inc.
P.O. Box 5080
Cortland, NY 13045
607-836-4400
607-836-4403 (fax)

SUBSURFACE LOG

Boring No.: B-9 (MW-3)
Project No.: 99011
Date Started: 12-6-00
Date Completed: 12-6-00
Page: 2 of 2
Reference Elevation: 899.75

Project: Triple Cities Metal Finishing Corp.
Location: Nowlan Road, Binghamton, New York

Depth (ft)	Number	Type	SPT Blows (6")	N-Value	Recovery (ft)	MATERIAL DESCRIPTION	PID Readings (ppm)	Well Installation	Remarks
21	11	SS	45 60 100-.2		0.7	Brown coarse-fine GRAVEL and SAND, Some Silt, cobbles, dry	3.1		
22									
23	12	SS	60 50-.1		0.6		2.9		
24									
25	13	SS	70 50-.3		0.5		3.1		Bentonite Seal, 24'-27'
26									
27	14	SS	56 50-.1		0.6		3.7		
28									
29	15	SS	100-.2		0		-		Sandpack, 27'-40'
30									
31	16	SS	25 12 16 28	38	0.6		5.3		
32						becomes saturated			2" dia. PVC Well Screen 0.020" slots, 30'-40'
33	17	SS	37 41 25 18	66	0.2		7.2		
34									
35	18	SS	13 15 15 16	30	0.3		9.9		
36									
37	19	SS	10 6 4 6	10	0.4		6.7		
38									At completion, augers at 40', water at 32.3'
39	20	SS	27 14 25 32	39	1.2		5.0		
40						Boring Terminated			

Sampling Method: ASTM D-1586

Notes: 4 1/4" I.D. Hollow Stem Augers

Visually Classified by: S. Cummins

File: 99011/tech/mw3

GeoLogic NY, Inc.
P.O. Box 5080
Cortland, NY 13045
607-836-4400
607-836-4403 (fax)

SUBSURFACE LOG

Boring No.: B-10 (MW-4)
Project No.: 99011
Date Started: 12-7-00
Date Completed: 12-8-00
Page: 1 of 2
Reference Elevation: 899.70

Project: Triple Cities Metal Finishing Corp.
Location: Nowlan Road, Binghamton, New York

Depth (ft)	Number	Type	SPT Blows (6")	N-Value	Recovery (ft)	MATERIAL DESCRIPTION	PID Readings (ppm)	Well Installation	Remarks
0						Ground Surface			
1	1	SS	1 4 5 12	9	0.9	Brown coarse-fine SAND and GRAVEL, Some Silt, moist	0.7		Curbbox and Locking Cap
3	2	SS	8 7 6 5	13	1.1	Brown SILT, moist	4.2		
5	3	SS	8 10 9 10	19	1.4	Brown coarse-fine GRAVEL and SAND, little silt, dry	6.1		Grout, 2'-22'
7	4	SS	11 6 7 5	13	1.2		5.2		2" dia. PVC Riser Pipe
9	5	SS	30 19 11 12	30	0.4		3.3		
11	6	SS	17 17 20 22	37	1.4		3.5		
13	7	SS	42 44 43 40	87	1.2	Brown coarse-fine GRAVEL and SAND, Some Silt, cobbles, dry	4.2		
15	8	SS	18 55 65 61	120	1.7		2.8		
17	9	SS	70 61 65 60	126	1.5		2.2		
19	10	SS	60 65 50-.2		1.2		2.7		
20									

Sampling Method: ASTM D-1586

Notes: 4 1/4" I.D. Hollow Stem Augers

Visually Classified by: S. Cummins

File: 99011/tech/mw4

GeoLogic NY, Inc.
P.O. Box 5080
Cortland, NY 13045
607-836-4400
607-836-4403 (fax)

SUBSURFACE LOG

Boring No.: B-10 (MW-4)
Project No.: 99011
Date Started: 12-7-00
Date Completed: 12-8-00
Page: 2 of 2
Reference Elevation: 899.70

Project: Triple Cities Metal Finishing Corp.
Location: Nowlan Road, Binghamton, New York

Depth (ft)	Number	Type	SPT Blows (6")	N-Value	Recovery (ft)	MATERIAL DESCRIPTION	PID Readings (ppm)	Well Installation	Remarks
21	11	SS	75 100-.3'		0.8	Brown coarse-fine GRAVEL and SAND,	3.7		
22						Some Silt, cobbles, dry			
23	12	SS	65 50-.1		0.3		3.7		
24									Bentonite Seal, 22'-25'
25	13	SS	75 50-.3		0.6		4.4		
26									
27	14	SS	50-.1		0		-		
28									
29	15	SS	25 50 60 60	110	1.6		3.1		Sandpack, 25-38'
30									
31	16	SS	31 31 33 23	64	1.1	becomes wet	4.5		
32									
33	17	SS	11 7 8 8	15	0.6	Brown SILT, Some fine Sand, saturated	5.1		2" dia. PVC Well Screen 0.020" slots, 28'-38'
34									
35	18	SS	2 3 3 3	6	2.0		4.7		
36									
37	19	SS	5 9 9 9	18	2.0		4.3		
38						Brown varved SILT and CLAY, saturated			
39						Boring Terminated			At completion, augers at 38', water at 35'
40									

Sampling Method: ASTM D-1586

Notes: 4 1/4" I.D. Hollow Stem Augers

Visually Classified by: S. Cummins

File: 99011/tech/mw4

GeoLogic
PO Box 350, Homer, NY 13077
607-749-5000 / 607-749-5063 (fax)

SUBSURFACE LOG

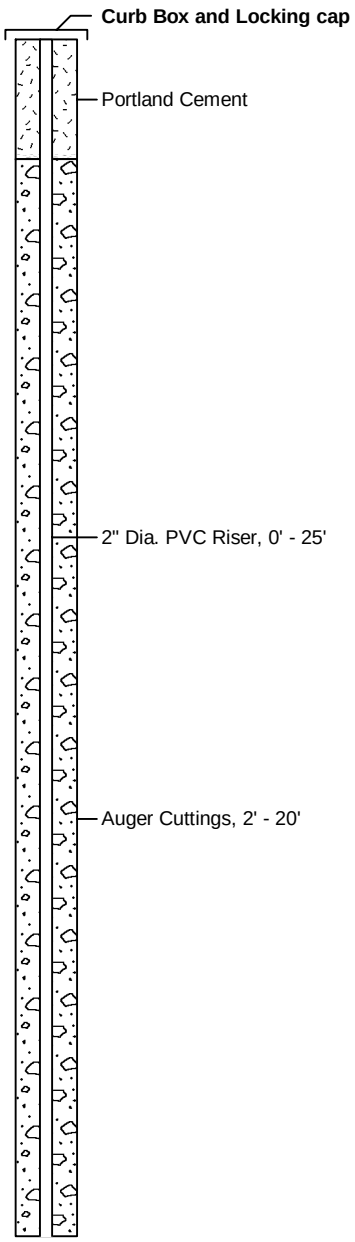
Triple Cities Metal Finishing Corporation

Nowlan Road

Binghamton, New York

Boring No: : MW-5R
Project No.: : 99011A
Date Started: : 03/28/16
Date Completed: : 03/29/16
Reference Elevation: :

Depth (ft)	Sample No.	Blow Count	N-Value	Recovery (ft)	PID Reading (ppm)	DESCRIPTION
0						FILL: Brown SILT, SAND and GRAVEL, moist
	1	3 5 2	7	-	0	
2						Brown SILT, Some fine Sand, trace gravel, moist
	2	2 3 3 2	6	-	0.9	
4						
	3	2 1 2 1	3	-	4.7	
6						Brown coarse-fine SAND and GRAVEL, Some Silt, cobbles, moist
	4	3 3 5 6	8	-	6.1	
8						
	5	6 11 9 4	20	-	0	
10						similar, little silt, damp
	6	12 16 21 17	37	-	0.8	
12						
	7	17 20 20 26	40	-	1.7	
14						
	8	30 27 38 34	65	-	2.1	
16						
	9	36 40 48 60	88	-	0	
18						
	10	15 36 48 50/.4	84	-	0.3	
20						



Sampling Method: ASTM D-1586, unless otherwise noted.
Notes: 4 1/4" ID Hollow Stem Augers
Visually Classified by: S. Cummins
File: 99011A/tech/MW-5R

04-12-2016 P:\PROJECTS\1999\99011A\Logs\MW-5R.bor

GeoLogic
PO Box 350, Homer, NY 13077
607-749-5000 / 607-749-5063 (fax)

SUBSURFACE LOG

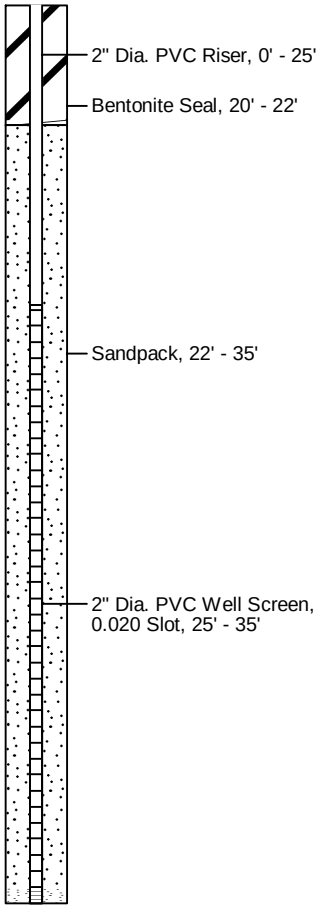
Triple Cities Metal Finishing Corporation

Nowlan Road

Binghamton, New York

Boring No: : MW-5R
Project No.: : 99011A
Date Started: : 03/28/16
Date Completed: : 03/29/16
Reference Elevation: :

Depth (ft)	Sample No.	Blow Count	N-Value	Recovery (ft)	PID Reading (ppm)	DESCRIPTION
20						
22						
24						
26	11	50/.4	-	-	0.1	
28						
30	12	9 10 16 11	26	-	-	
32						
34						Brown SILT, saturated
36	13	8 6 5 5	11	-	0	
						BORING TERMINATED AT 37.0'
38						
40						



Sampling Method: ASTM D-1586, unless otherwise noted.
Notes: 4 1/4" ID Hollow Stem Augers
Visually Classified by: S. Cummins
File: 99011A/tech/MW-5R

04-12-2016 P:\PROJECTS\1999\99011A\Logs\MW-5R.bor

GeoLogic NY, Inc.
P.O. Box 5080
Cortland, NY 13045
607-836-4400
607-836-4403 (fax)

SUBSURFACE LOG

Boring No.: B-12 (MW-6)
Project No.: 99011
Date Started: 9-05-01
Date Completed: 9-05-01
Page: 1 of 2
Reference Elevation: 887.71

Project: Triple Cities Metal Finishing Corp.
Location: Nowlan Road, Binghamton, New York

Depth (ft)	Number	Type	SPT Blows (6")	N-Value	Recovery (ft)	MATERIAL DESCRIPTION	PID Readings (ppm)	Well Installation	Remarks
0						Ground Surface			
1	1	SS	11 9 8 7	17	1.5	Asphalt at surface FILL:Brown coarse-fine GRAVEL, SAND and SILT, cobbles, concrete, damp	1.7		Curbbox and Locking Cap
2									
3	2	SS	9 4 3 3	7	0.1		2.2		
4									
5	3	SS	4 6 7 6	13	0.6		1,9		Grout, 2'-19'
6									
7	4	SS	2 1 1 1	2	0.1		4.8		2" dia. PVC Riser Pipe
8									Sample 8'-12' analyzed
9	5	SS	3 3 6 7	9	0.7	Brown coarse-fine SAND and GRAVEL, Some Silt, moist	5.1		
10									
11	6	SS	10 11 11 12	22	1.7		3.6		
12									
13									
14									
15									
16	7	SS	15 25 21 19	46	1.4		1.9		
17									
18									
19									
20							2.1		

Sampling Method: ASTM D-1586
Notes: 4 1/4" I.D. Hollow Stem Augers

Visually Classified by: S. Cummins
File: 99011/tech/mw6

GeoLogic NY, Inc.
P.O. Box 5080
Cortland, NY 13045
607-836-4400
607-836-4403 (fax)

SUBSURFACE LOG

Boring No.: B-12 (MW-6)
Project No.: 99011
Date Started: 9-05-01
Date Completed: 9-05-01
Page: 2 of 2
Reference Elevation: 887.71

Project: Triple Cities Metal Finishing Corp.
Location: Nowlan Road, Binghamton, New York

Depth (ft)	Number	Type	SPT Blows (6")	N-Value	Recovery (ft)	MATERIAL DESCRIPTION	PID Readings (ppm)	Well Installation	Remarks
	8	SS	100/.4		0.4	Brown coarse-fine SAND and GRAVEL,			
21						Some Silt, cobbles, damp			Bentonite Seal, 19'-22'
22									
23									
24	9	SS	100/.4		0.4		1.1		
25									Sandpack, 22'-35'
26									
27									
28									
29									2" dia. PVC Well Screen
30									0.020" slots, 25'-35'
31	10	SS	14 15 22 20	37	0.8	similar with little silt, saturated	5.1		
32									
33	11	SS	7 4 6 5	10	1.1		3.8		
34									Sample 34'-38' analyzed
35	12	SS	10 10 8 6	18	1.4		3.1		
36									At completion, augers at
37	13	SS	14 13 10 12	23	1.7		4.8		34, water at 30'
38						Boring Terminated			
39									
40									

Sampling Method: ASTM D-1586
Notes: 4 1/4" I.D. Hollow Stem Augers

Visually Classified by: S. Cummins
File:

DRILLING SUMMARY

Geologist:
John Hilton

Drilling Company:
Geologic, Inc.

Driller:
Steve Laramee

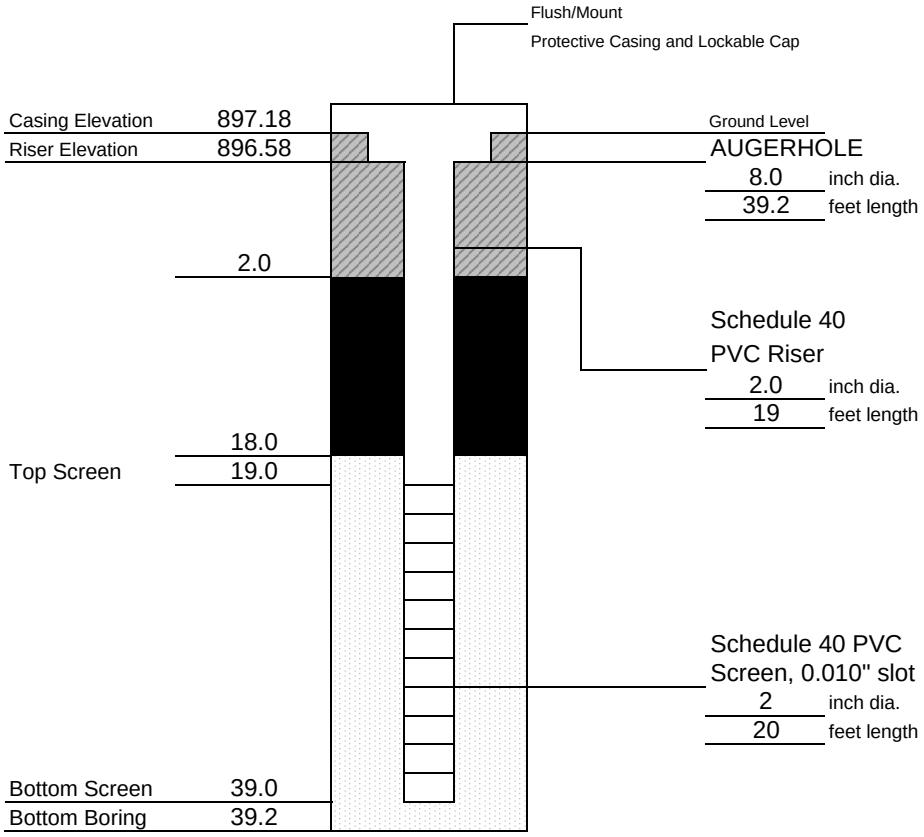
Rig Make/Model:
Trailer mounted CME-55

Date:
6/24/2014

GEOLOGIC LOG

DEPTH

Depth(ft.)	Description
0,0 - 2.3	Fill: asphalt w/ fine black-gray sand, fine gravel
2.3 - 4.0	Sand, brown, fine, trace fine gravel and silt
4.0 - 14.0	Sand and Gravel, gray-brown, f-med., w/ f-crs. gravel
14.0 - 16.0	Sand, dark brown, fine, little f-crs. gravel
16.0 - 22.0	Gravel, f-crs., little dark gray sand
22.0 - 24.0	Sand and Gravel, dark gray, fine , w/ f-crs. gravel
24.0 - 34.0	Gravel, f-crs., w/ f-med. Olive-gray sand
34.0 - 38.0	Sand and Gravel, gray, med. Crs grain, f-crs. Gravel
38.0 - 38.2	Sand, dark gray, f-med.
38.2 - 40.0	Silt, light gray-brown, trace clay



WELL DESIGN

CASING MATERIAL		*SCREEN MATERIAL*		*FILTER MATERIAL*
Surface:	8"-Flush Mount Roadbox	Type:	2"-Schedule 40 PVC	Type: Fill Pro #1 sand — Setting: 18.0'- 39.2
Monitor	2"-Schedule 40 PVC	Slot Size:	0.010"	*SEAL MATERIAL* Type: Bentonite Chips — Setting: 2.0'-18.0' Type: Concrete/ Bentonite Grout — Setting: 0.0-2.0'

COMMENTS:
MW-7R well screen was positioned across the top of the silt unit and its length extended from 15' to 20' to straddle the water table.

LEGEND
- Cement/Bentonite Grout
- Bentonite Seal
- Silica Sandpack

Client:	**NYSDEC**	**Location:**	**C.A.E. Hillcrest Site Binghamton, NY**
Project No.:	**11176919**		
URS Corporation		**MONITORING WELL CONSTRUCTION DETAILS**	
Well Number:	**MW-7R**		

GeoLogic
PO Box 350, Homer, NY 13077
607-749-5000 / 607-749-5063 (fax)

SUBSURFACE LOG

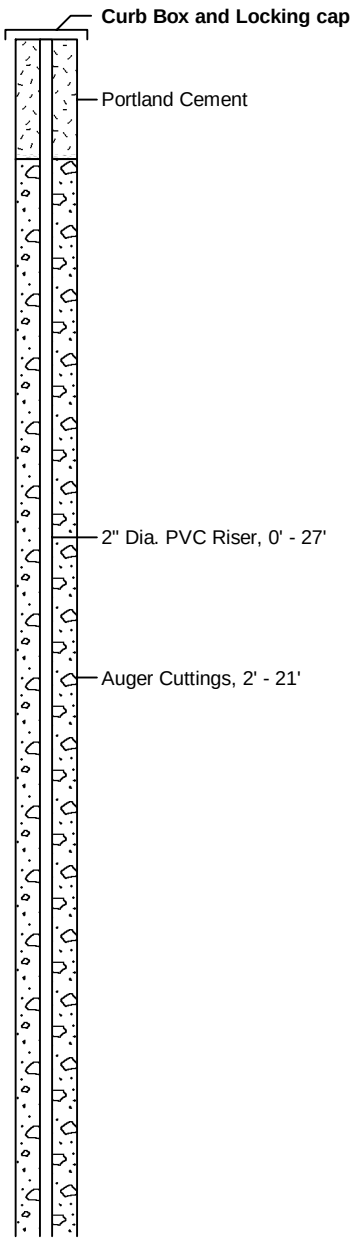
Triple Cities Metal Finishing Corporation

Nowlan Road

Binghamton, New York

Boring No: : MW-8
Project No.: : 99011A
Date Started: : 03/29/16
Date Completed: : 03/30/16
Reference Elevation: :

Depth (ft)	Sample No.	Blow Count	N-Value	Recovery (ft)	PID Reading (ppm)	DESCRIPTION
0	1	3 6 6 7	12	-	0	FILL: Brown SAND, GRAVEL and SILT, moist
2	2	4 2 2 2	4	-	0.3	
4	3	3 3 3 3	6	-	5.1	Possible FILL: Brown SILT, SAND and GRAVEL, moist
6	4	6 4 5 9	9	-	4.3	Brown coarse-fine GRAVEL and SAND, Some Silt, cobbles, damp
8	5	4 4 2 4	6	-	6.9	
10	6	2 2 4 5	6	-	0.3	
12	7	5 5 6 8	11	-	2.5	
14	8	6 10 8 6	18	-	1.8	layer of fine SAND, trace silt grading with Some fine Gravel, damp
16	9	9 18 23 25	41	-	2.4	Brown coarse-fine GRAVEL and SAND, little silt, cobbles, damp
18	10	3 23 50/.4	-	-	2.1	
20						



Sampling Method: ASTM D-1586, unless otherwise noted.
Notes: 4 1/4" ID Hollow Stem Augers
Visually Classified by: S. Cummins
File: 99011A/tech/MW-8

04-26-2016 P:\PROJECTS\1999\99011A\Logs\MW-8.bor

GeoLogic
PO Box 350, Homer, NY 13077
607-749-5000 / 607-749-5063 (fax)

SUBSURFACE LOG

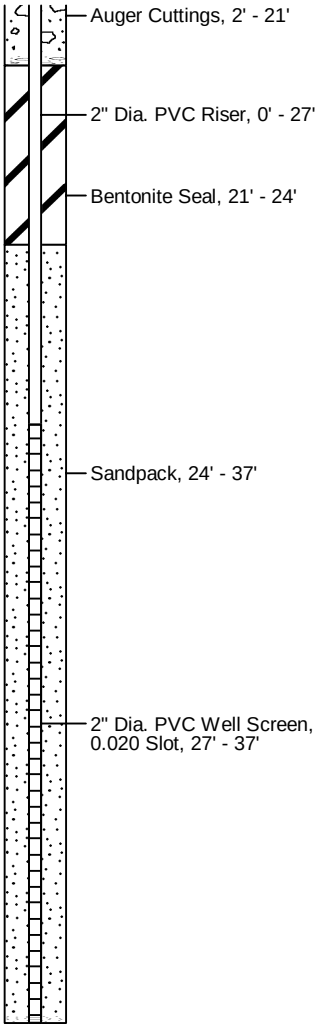
Triple Cities Metal Finishing Corporation

Nowlan Road

Binghamton, New York

Boring No: : MW-8
Project No.: : 99011A
Date Started: : 03/29/16
Date Completed: : 03/30/16
Reference Elevation: :

Depth (ft)	Sample No.	Blow Count	N-Value	Recovery (ft)	PID Reading (ppm)	DESCRIPTION
20						
22						
24						
						similar, damp
26	11	50/.3	-	-	0.8	
28						
30		50				
	12	30	50	-	1.9	
		20				
32		10				similar, saturated
34						
						similar, saturated
36	13	35	30	-	2.6	
		18				
		12				
		14				
						BORING TERMINATED AT 37.0'
38						
40						



Sampling Method: ASTM D-1586, unless otherwise noted.
Notes: 4 1/4" ID Hollow Stem Augers
Visually Classified by: S. Cummins
File: 99011A/tech/MW-8

04-26-2016 P:\PROJECTS\1999\99011A\Logs\MW-8.bor

GeoLogic
PO Box 350, Homer, NY 13077
607-749-5000 / 607-749-5063 (fax)

SUBSURFACE LOG

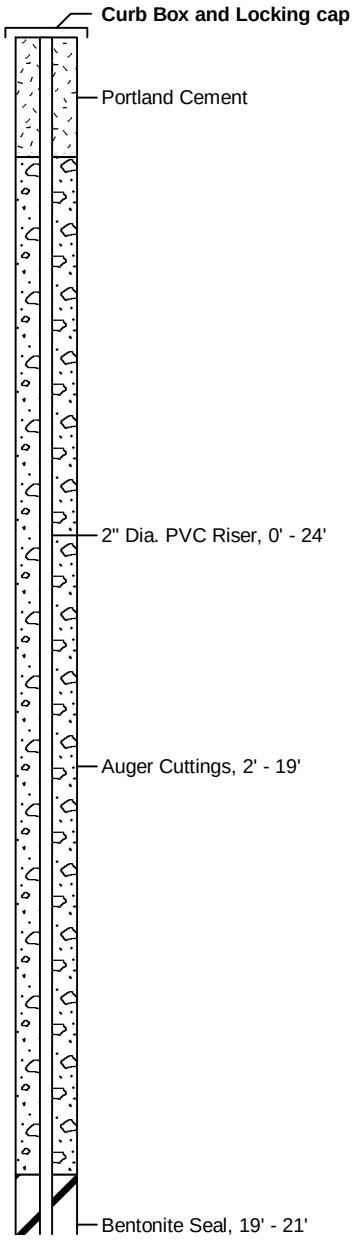
Triple Cities Metal Finishing Corporation

Nowlan Road

Binghamton, New York

Boring No: : MW-9
Project No.: : 99011A
Date Started: : 03/30/16
Date Completed: : 03/31/16
Reference Elevation: :

Depth (ft)	Sample No.	Blow Count	N-Value	Recovery (ft)	PID Reading (ppm)	DESCRIPTION
0						**No sampling except for auger cuttings.**
	1	-	-	-	6.9	FILL: Brown Clayey SILT, SAND and GRAVEL, moist
5						Brown coarse-fine GRAVEL and SAND, Some Clayey Silt, moist
	2	-	-	-	2.5	
10						
	3	-	-	-	1.9	
15						Brown coarse-fine GRAVEL and SAND, little silt, cobbles, damp
	4	-	-	-	2.8	
20						



Sampling Method: ASTM D-1586, unless otherwise noted.
Notes: 4 1/4" ID Hollow Stem Augers
Visually Classified by: S. Cummins
File: 99011A/tech/MW-9

04-26-2016 P:\PROJECTS\1999\99011A\Logs\MW-9.bor

GeoLogic
PO Box 350, Homer, NY 13077
607-749-5000 / 607-749-5063 (fax)

SUBSURFACE LOG

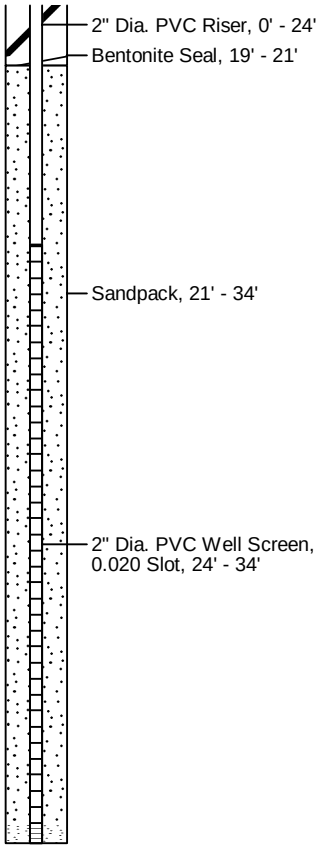
Triple Cities Metal Finishing Corporation

Nowlan Road

Binghamton, New York

Boring No: : MW-9
Project No.: : 99011A
Date Started: : 03/30/16
Date Completed: : 03/31/16
Reference Elevation: :

Depth (ft)	Sample No.	Blow Count	N-Value	Recovery (ft)	PID Reading (ppm)	DESCRIPTION
20						similar, damp
	5	-	-	-	1.8	
25						similar, damp
30						Brown coarse-fine GRAVEL and SAND, little silt, cobbles, saturated
	6	-	-	-	2.7	
35						BORING TERMINATED AT 35.0'
40						



Sampling Method: ASTM D-1586, unless otherwise noted.
Notes: 4 1/4" ID Hollow Stem Augers
Visually Classified by: S. Cummins
File: 99011A/tech/MW-9

04-26-2016 P:\PROJECTS\1999\99011A\Logs\MW-9.bor

APPENDIX D – EXCAVATION WORK PLAN (EWP)

D-1 INTRODUCTION

The Site soils have been remediated for commercial use (land use is subject to local zoning laws). Any future intrusive work that will encounter or disturb remaining contaminants will be performed in compliance with the Excavation Work Plan (EWP) that is attached as Appendix D to this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) prepared for the Site. An example of a previous approved HASP that includes a CAMP is attached as Appendix F. This HASP was utilized for completion of the RI/RAR for the Site that was approved by NYSDEC. It should be noted that the specifics for this HASP may require modification to cover the specific excavation or other intrusive work requirements. Based on specific methods employed by future contractors, the HASP and CAMP will be updated and re-submitted with the notification provided in the EWP. Any intrusive construction or demolition work will be performed in compliance with the EWP, HASP and CAMP, and will be included in the Periodic Review Reports.

The site owner and associated parties preparing the remedial documents submitted to the Department, and parties performing this work, are completely responsible for the safety performance of all intrusive work, the structural integrity of the excavations, proper disposal of the excavated materials, control of runoff from open excavations, and structures that may be affected by the excavations. The site owner will ensure that all site re-development activities will not interfere with, or otherwise impair or compromise the engineering controls describe in this SMP without prior approval by the Department.

D-2 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the NYSDEC. Table D-1 includes contact information for the above notification. The information on this

table will be updated as necessary to provide accurate contact information. A full listing of site related contact information is provided in Appendix A.

Table D-1: Notifications

Gary Priscott, NYSDEC Project Manager	607.775.2545; gary.priscott@dec.ny.gov
Harry Warner, NYSDEC Regional HW Engineer	315.426.7400; harry.warner@dec.ny.gov
Kelly Lewandowski, NYSDEC Site Control	518.402.9569; Kelly.lewandowski@de.ny.gov

* Note: Notifications are subject to change and will be updated as necessary.

This notification will include:

- Demolition of Site buildings;
- A detailed description of the work to be performed, including the location and areal extent of building demolition, excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix F of this SMP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

D-3 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided in Section D-7 and D-8 of this Appendix.

D-4 SOIL STAGING METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC.

D-5 MATERIALS EXCAVATION AND LOAD-OUT

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

A truck wash will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete. Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

D-6 MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Truck transport routes will be determined at the time of the planned excavation work. Truck routes from the site to disposal facility(s) will be dependent upon the location of the disposal facility. All trucks loaded with Site material will exit the vicinity of the Site using only the approved truck routes. These are the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport;

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

D-7 MATERIALS DISPOSAL OFF-SITE

All material excavated and removed from the site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of material from this site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C/D recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

D-8 MATERIALS REUSE ON-SITE

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as

backfill for subsurface utility lines. Material reuse on-site will comply with the requirements of NYSDEC DER-10 Section 5.4(e) 4.

Material excavated within the stabilization areas will not be reused on-site; these materials will be removed from the Site in the manner discussed in Section D-6.

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site will not be reused on-site.

D-9 FLUIDS MANAGEMENT

All liquids to be removed from the site, including but not limited to, excavation dewatering, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, and will be managed off-site, unless prior approval is obtained from NYSDEC.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

D-10 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the decision document. The existing cover system is comprised of a minimum of 12 inches of clean soil, asphalt pavement, concrete covered sidewalks and concrete building floor slabs. The demarcation layer, consisting of orange snow fencing material, white geotextile or equivalent material, etc. will

be replaced to provide a visual reference to the top of the remaining contamination zone, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt) this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP.

D-11 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the site. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

D-12 STORMWATER POLLUTION PREVENTION

The entire Site is approximately 0.953 acres in size; therefore, a Stormwater Pollution Prevention Plan will not be required. The following stormwater pollution prevention measures may be considered during excavation activities.

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

D-13 EXCAVATION CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

D-14 COMMUNITY AIR MONITORING PLAN

Air sampling stations based on generally prevailing wind conditions will be placed upwind and downwind of the work zone. These locations will be adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least two downwind monitoring stations. Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

D-15 DUST CONTROL PLAN

A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable

of spraying water directly onto off-road areas including excavations and stockpiles.

- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.

- Gravel will be used on roadways to provide a clean and dust-free road surface.

- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

APPENDIX E
RESPONSIBILITIES of
OWNER and REMEDIAL PARTY

Responsibilities

The responsibilities for implementing the Site Management Plan ("SMP") for the Triple Cities Metals Finishing Corporation site (the "Site"), Site number 704045 will be the Site owner(s), as defined below. The owner is currently listed as Binghamton Realty, Inc. (the "owner") located at 349 Industrial Park Drive, Binghamton, NY 13904.

Solely for the purposes of this document and based upon the facts related to a particular site and the remedial program being carried out, the term Remedial Party ("RP") refers to any of the following: certificate of completion holder, volunteer, applicant, responsible party, and, in the event the New York State Department of Environmental Conservation ("NYSDEC") is carrying out remediation or site management, the NYSDEC and/or an agent acting on its behalf. The RP is Binghamton Realty, Inc.

Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the site.

Site Owner's Responsibilities:

1) The owner shall follow the provisions of the SMP as they relate to future construction and excavation at the site.

2) In accordance with a periodic time frame determined by the NYSDEC, the owner shall periodically certify, in writing, that all Institutional Controls set forth in an Environmental Easement remain in place and continue to be complied with. The owner shall provide a written certification to the RP, upon the RP's request, in order to allow the RP to include the certification in the site's Periodic Review Report (PRR) certification to the NYSDEC.

3) In the event the Site is delisted, the owner remains bound by the Environmental Easement and shall submit, upon request by the NYSDEC, a written certification that the Environmental Easement is still in place and has been complied with.

4) The owner shall grant access to the Site to the NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.

5) The owner is responsible for assuring the security of the remedial components located on the Site to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify the NYSDEC in accordance with the timeframes indicated in Section 1.3 - Notifications.

6) In the event some action or inaction by the owner adversely impacts the Site, the owner must notify the NYSDEC in accordance with the time frame indicated in Section 1.3 - Notifications and (ii) coordinate the performance of necessary corrective actions with the RP.

7) The owner must notify the NYSDEC of any change in ownership of the site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the Site property. 6 NYCRR Part contains notification requirements applicable to any construction or activity changes and changes in ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 1.3 of the SMP. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

8) The owner remains ultimately responsible for maintaining the engineering controls.

9) Until such time as the NYSDEC deems the sub-slab depressurization system unnecessary, the owner shall operate the system, pay for the utilities for the system's operation, and report any maintenance issues to the RP and the NYSDEC.

10) In accordance with the tenant notification law, within 15 days of receipt, the owner must supply a copy of any vapor intrusion data, that is produced with respect to structures and that exceeds NYSDOH or OSHA guidelines on the site, whether produced by the NYSDEC, RP, or owner, to the tenants on the property. The owner must otherwise comply with the tenant and occupant notification provisions of Environmental Conservation Law Article 27, Title 24.

Future site owners and RPs and their successors and assigns are required to carry out the activities set forth above.

APPENDIX F – HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN (HASP)

The HASP takes into account the specific hazards inherent to this project and presents procedures for the exclusive use of GeoLogic NY, Inc., and its employees. Due to the potential hazards of this Site and the activities occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards, which may be encountered. Strict adherence to the health and safety guidelines set forth herein, will reduce, but may not eliminate, the potential for injury at this Site.

PROJECT NAME:	Former Triple Cities Metals Finishing	**CLIENT ORGANIZATION:**	Binghamton Realty, Inc.
SITE ADDRESS:	4 Nowlan Road, Binghamton, New York	**CLIENT ADDRESS:**	349 Industrial Park Drive Binghamton, NY 13904
NYSDEC REGION:	7	**CLIENT CONTACT:**	Joseph and Charles Morgan
PROJECT NUMBER:	NYSDEC ID #C704045	**CLIENT PHONE:**	607-722-3431
ORIGINAL HASP DATE:	5-1-16	**CONTACT:**	Charles Morgan
REVISED DATE:	-	**CONTACT PHONE:**	607-722-3431
REVISION NUMBER:	-		

Table of Contents

1. SITE DESCRIPTION AND FEATURES:

The 27,000-square foot industrial building is located on a 0.953-acre parcel and the office building (former residential structure) is located on a 0.26-acre parcel. The industrial building was used primarily for production work with offices in the northern portion of the building and warehousing in the east and west additions. The former residential structure housed the corporate offices.

Nature and Extent of Contamination: The primary contaminants of concern at TCMF are cadmium, and chromium.

Groundwater is in excess of 25 feet below ground surface. Maximum concentrations of contaminants in groundwater are: cadmium (480 ug/L), chromium (850 ug/L) zinc (4,220 ug/L), TCE (22 ug/L).

2. SITE HISTORY:

The site is an industrially-zoned parcel with residential properties to the north and south, and an industrial facility to the east, an automotive service station, a residence, an electrical contractor and restaurant to the west. The site is partially occupied by Square Deal Machining, Inc. and Parts Channel Inc. The remainder of the site is either unoccupied or used for miscellaneous storage by the property owner.

Historical Use: The site was formerly an industrial metal plating business.

Site Geology and Hydrogeology: TCMF is located on the terrace above the Chenango River channel. The geology of the terrace consists of glacial meltwater (outwash) deposits of sand and gravel with variable silt content that range in thickness from approximately 30 to 55 feet. Lacustrine silt, sands and clay deposits underlie the outwash sand and gravel unit ranging in thickness from 130 to 160 feet. Underlying the lacustrine deposit is a sand and gravel deposit. The Town of Fenton Water Supply Wells are screened in this lower sand and gravel deposit.

3. HASP-SPECIFIC TASKS:

TBD

4. SITE TYPE:

STATUS		TYPE	
Active	X	Monitoring wells	X
Inactive		Landfill	
Secure (Building)	X	Industrial	X
Unsecure	X	Petroleum	
Enclosed space		Unknown	
Remediation	X	Military	
Other		Other	

5. POTENTIAL HAZARDOUS MATERIAL SUMMARY: [Potential hazard –Shaded]

CHEMICALS	SOLIDS	SLUDGES	SOLVENTS	OILS	OTHER
Acids	Fly ash	Paints	Ketones	Oily wastes	Laboratory
Pickling Liquors	Mill or mine tailings	Pigments	Aromatics	Gasoline	Pharmaceutical
Caustics	Asbestos	Heavy Metal	Hydrocarbons	Diesel fuel	Hospital
Pesticides	Ferrous smelter	Aluminum	Alcohols	Lubricants	Radiological
Dyes / Inks	Non-ferrous smelter	Other-*specify*	Halogenated (chloroethenes)	Polynuclear aromatics	Municipal
Cyanides	Metals		Esters	PCB's	Construction
Phenols	Dioxins		Ethers	Heating oil	Munitions
Halogens	Other-semi-volatile coal ash related compounds		Other-*specify*	Other-*specify*	Other-Industrial Solid Waste
Other-*specify*					

WASTE TYPES:

	Liquid (groundwater)		**Solid** (soils)		**Sludge**		**Gas**		**Unknown**		**Other-*specify*** **None**

WASTE CHARACTERISTICS:

	Corrosive		**Toxic**		**Inert Gas**		**Flammable**		**Volatile**		**Reactive**		**Other-**Unknown

MATERIALS TO BE BROUGHT ON SITE FOR THE IDENTIFIED SPECIFIC TASKS: To Be Determined

Preservatives	Decontamination	Calibration	Remediation	Others
HCL	Liquinox™	100ppm isobutylene	Sodium permanganate	Bentonite/Cement Grout
Other-*specify*	Alconox™	pH standards	Hydrogen peroxide	
	Other-*specify*	Conductivity standards	Metal Fixing Reagent	Diesel Fuel (equipment)
		Other-*Specify*		Gasoline (equipment)

KNOWN CONTAMINANTS: No location-specific information was provided to GeoLogic

CONTAMINANT	HIGHEST KNOWN CONCENTRATION / MEDIA (Prior to Remedial Activities)	PEL / TLV	IDLH	EXPOSURE ROUTES	PHYSICAL CHARACTERISTICS SYMPTOMS
Cadmium	Groundwater: 480 ug/L Soil: 650 mg/kg	PEL: 0.005 mg/m^3 ACGIH/TLV: 0.01 mg/m^3	9 mg/m^3	Inhalation, Ingestion, Absorption	Odorless, silver white powder in pure form, irritant to eyes, mouth and throat, dermatitis, headache, nausea
Chromium	Groundwater: 850 ug/L Soil: 7,100 mg/kg	PEL:1 mg/m^3 ACGIH/TLV: 0.5 mg/m^3	250 mg/m^3	Inhalation, Ingestion, Absorption	Odorless, silver grey solid in pure form, irritant to eyes, mouth and throat, dermatitis, headache, nausea

6. SITE HAZARD ASSESSMENT:

#	HAZARD	SITE-SPECIFIC CONDITIONS	MITIGATION METHODS	WARNINGS/SYMPTOMS	RESPONSE TO EXPOSURE
A	Heat Stress	-Vigorous physical work associated with excavation and soil staging activities -Warm temperatures -Confining personal protective equipment (PPE) such as tyvek.	-Regulate pace of work -Take regular breaks -Use shade when possible -Regular intake of cool fluids -Dress for task & conditions -Buddy system monitoring	Heat stress/heat stoke -Heavy perspiration -Dizziness -Nausea -Headache -Vertigo -Weakness and thirst -Heat stroke may include hot dry skin and confusion	-Rest in a cool place -Drink cool fluids -Seek immediate medical attention for heat stroke symptoms
B	Cold Stress	-Freezing temperatures during excavation activities -Exposure and wet clothing and gloves from working below the water table and during decontamination activities.	-Dress accordingly for task and conditions -Regulate clothing layers to keep body temp comfortable, avoid perspiration -Take breaks in warm areas -Buddy system monitoring	Hypothermia and frostbite -Shivering, tingling, numbness -Apathy or sleepiness, blanching or whitening of skin -Unconsciousness, tissue becomes pale and hard, frozen extremities	-Get out of the cold during the first stages of hypothermia or frostbite -Seek immediate medical attention if frostbite or advanced hypothermia is suspected
C	Explosive Flammable	N/A			
D	Oxygen Deficient	N/A			
E	Noise	-Excavator, Geoprobe®	-Keep a reasonable distance from noisy equipment -Hearing protection PPE -Buddy system monitoring	-Difficulty hearing normal conversation 2-3 feet away -Increased heart rate -Muscle fatigue	-Move away from noise -Use hearing protection PPE
F	Inorganic Chemicals	Cadmium, chromium, zinc	Avoid physical contact/ exposure when possible -Stay up-wind of work zone -Review work plans and MSDS -Use proper PPE -Monitor for exposure -Remove potentially exposed PPE and wash hands whenever leaving the work zone -Buddy system monitoring	Monitoring indicates unprotected exposure above exposure limit occurred -There is physical evidence of exposure (visual or odors) -Exposure symptoms occur (see Hazardous Material Summary-Known Contaminants above)	
G	Chemical Exposure	N/A	-Avoid physical contact / exposure when possible -Stay up-wind of work zone -Review work plans and MSDS -Use proper PPE -Monitor for exposure -Remove potentially exposed PPE and wash hands whenever leaving the work zone -Buddy system monitoring		-Stop work and leave the work zone if possible exposure is suspected. -Reevaluate exposure mitigation methods (PPE level, Methodologies, etc.) -If exposure symptoms have occurred seek medical attention immediately

SITE HAZARD ASSESSMENT CONT'D:

#	HAZARD	SITE-SPECIFIC CONDITIONS	MITIGATION METHODS	WARNINGS/SYMPTOMS	RESPONSE TO EXPOSURE
H	Motorized Traffic	Not anticipated			
I	Heavy Equipment	Excavator: -Crush points -Entrapment in the machinery -Hitting overhead or underground utilities	-Only operators of the equipment are allowed in the work zone unless the operator is aware of another person and is maintaining eye contact -Operators must be familiar with equipment procedures for safe operation/ emergency stop features and test daily -Equipment not attended by the operator should be shut down and locked out from operation -Proper PPE must be used	-If mitigation methods are not followed -Close calls	-Review safety procedures with all job site personnel -Seek first aid or immediate medical attention as appropriate
J	Slips & Falls	-Uneven ground surface -Drill rig tools	-Keep known walking areas free of obstructions / hazards -Identify potential hazards (cones, signage, paint, etc.) -Walk slowly, surveying the ground ahead -Wear appropriate PPE	-If mitigation methods are not followed -Close calls	-Review safety procedures with all job site personnel -Seek first aid or immediate medical attention as appropriate
K	Power and hand tools	-Electric shocks - high pressure water stream (steam cleaner) -Burns (steam cleaner) -Cuts from blades	-Only operators of the tool are allowed in the work zone unless the operator is aware of another person and is maintaining eye contact -Operators must be familiar with equipment procedures for safe operation and inspect tool, cords and GFI operation before use -Equipment not attended by the operator should be unplugged and locked out from operation -Proper PPE must be used, including safety glasses, hearing protection and appropriate gloves	-If mitigation methods are not followed -Close calls	-Review safety procedures with all job site personnel -Seek first aid or immediate medical attention as appropriate
L	Waste Handling	-Drum moving and lifting -Pinch-point -Spillage	-Use of appropriate equipment/hand carts for the moving and staging of drums -Follow proper lifting procedures -Proper PPE must be used for the handling and staging of waste		-Review safety procedures with all job site personnel -Seek first aid or immediate medical attention as appropriate

7. LEVELS OF PROTECTION: *Shade minimum PPE for each level of protection used*

*See section 10 for a summary of levels of protection for each activity. If monitoring in Section 8 dictates **C-level** of protection, a respirator use review meeting and inspection will be conducted by the Site Health & Safety coordinator prior to work in level C to review respirator equipment, use, care, and storage for all level C workers.*

	D-level		***D modified-level (D-M)***		***C-level***		***B-level***
	Steel Toe Boots		*All D Items Selected*		*All D Modified Selected*		*Not Used*
	Work Gloves		*Rubber Boots*		*Rubber Boots*		
	Hard Hat		*Latex/Vinyl Disposable Gloves*		*Half-face APR*		
	Safety Glasses		*Nitrile Gloves*		*Full-Face APR*		
	Hearing Protection		*Tyvek Coverall*		*Tyvek Coverall*		
			Splash Suit		*Splash Suit*		
			Safety Glasses		*Face shield*		
			Face Shield		*Other*		
			Hearing Protection				
			Other				

8. SITE WORKER & COMMUNITY AIR MONITORING PLAN (CAMP):

This air monitoring plan provides minimum information to comply with NYSDOH requirements identified in Appendix 1A of DER-10.

Real-time fugitive dust monitoring will be conducted during excavation activities at the site, upwind and downwind of the work zone. The atmosphere (background and breathing zones) will be monitored for volatile compounds.

WORK ZONE:	For the purpose of this HASP, the Work Zones (WZ) will be defined as the area within a 10-foot radius of ongoing excavation work. All Work Zones are mobile, should be established in consideration of prevailing wind direction and will be moved as the work crew advances to new locations within the Project Site.		
SUPPORT ZONE:	Support Zones will be all areas outside of current Work Zones.		
INTRUSIVE:	For the purpose of this HASP, intrusive activities will be those that have the ability to unearth identified impacted soils.		
NON-INTRUSIVE:	Any activity, which is not defined as intrusive.		
PERIODIC MONITORING:	Monitoring at regular intervals with periods of time in between where no monitoring takes place (recording a PID reading at half-hour intervals).		
CONTINUOUS MONITORING:	Non-stop real time monitoring with equipment capable of calculating a running average over no less than 15-minute intervals and log monitoring data over no less than an 8-hour work day, which can be downloaded or printed.		
MONITORING REQUIREMENTS:	**VOC MONITORING**		**FUGITIVE DUST & PARTICULATE MONITORING**
INTRUSIVE	Photoionization detector (10.6 ev lamp)		Reasonable fugitive dust suppression techniques must be employed during all site activities, which may generate fugitive dust. Dust suppression techniques may include covering soil piles, wetting of haul pathways, and the use of potable water spray during intrusive activities. Particulate concentrations will be measured continuously at the upwind and downwind perimeters of the Work Zone at temporary particulate monitoring stations. Real time monitoring equipment will be utilized, capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating a 15-minute period for comparison to the particulate action level. The action level is 150 micrograms-per-cubic-meter (ug/m^3) (15 minutes average). If the downwind PM-10 level is 100 ug/m^3 greater than background (upwind perimeter) for the 15-minute period or if air-borne 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 mg/m^3 above background. Should the action level of 150 ug/m^3 continue to be exceeded, work must stop until dust suppression techniques prove adequate or weather conditions change.
	CONDITION	**RESPONSE**	
	<5ppm over background	-PPE Level D-M -Continuous monitoring, downwind perimeter of WZ -Continue working	
	>5 to 25ppm for less than 15 minutes	-PPE Level D-M -Continuous monitoring, downwind perimeter of WZ -Stop work, move upwind of WZ and monitor downwind concentrations	
	>5 to 25ppm for 15 minutes or more	-PPE Level C -Continuous monitoring, downwind perimeter of WZ -Respirator use review meeting -Resume work in level C	
	>25ppm	-PPE Level C -Continuous monitoring, downwind perimeter of WZ -Stop work, move upwind of WZ and monitor downwind concentrations	
NON-INTRUSIVE	<5ppm over background	-PPE Level D or D-M (see Work Task Summary) -Periodic monitoring, downwind perimeter of WZ (not required for survey work) -Continue working	Not required.
	>5ppm over background	Revert to intrusive conditions and responses	

9. DECONTAMINATION:

TYPE	METHOD	CONTAINMENT & DISPOSAL
HEAVY EQUIPMENT	Steam clean	If deemed necessary, construction of equipment decontamination pad(s) for the excavator and Geoprobe equipment that comes into contact with impacted materials during excavation activities will be the same design as soil staging area(s). All water must be collected in secondary containment and containerized for classification and disposal. Soil from steam cleaned equipment will be containerized if there is evidence of contamination. If there is no apparent evidence of contamination (PID>5ppm over background, odor, sheen) then soil will be stockpiled on and covered with 10 mil polyethylene plastic for characterization and disposal.
SAMPLING EQUIPMENT	Liquinox solution and tap water rinse	All decontamination water from sampling equipment will be containerized on-site and classified for disposal. All purge water from sampling equipment will be containerized on-site and classified for disposal. Auger cuttings and all soil from sampling will be containerized for characterization and disposal.
PERSONNEL	-Remove PPE avoiding contact with skin -Wash hands first and then face with soap and warm water	Wash water for personnel will be directed to the sanitary sewer. All one-time use PPE will be discarded into disposable garbage bags for disposal in the Site dumpster. Multiple use PPE will be inspected daily and decontaminated prior to starting work each day using disposable bio-degradable wipes.

10. WORK TASK SUMMARY:

This Section summarizes information from Sections 6-9 for each site specific Task.

TASK	PPE LEVEL See section 7	MONITORING	HAZARDS See Section 6	DECONTAMINATION See Section 9
1. Groundwater Sampling	D	**See Section 8**	E, I, J	Personnel

11. SITE EMERGENCY / CONTINGENCY PLAN:

The following Site Emergency / Contingency Plan provide responses and contact information if an accident or injury should occur. All accidents or injuries must be reported within a 24-hour period to the Health and Safety Officer. This includes even minor cuts and abrasions. Failure to immediately report accidents and injuries sustained on the job may result in the loss of workers compensation and disability benefits. All employees reporting an accident or injury will be required to fill out an accident report form.

All on-site workers must become familiar with the provisions of this HASP and sign the attached Training and Acknowledgement section.

Should any worker observe hazards that are not addressed in this plan or that they are unprepared for, they should withdraw immediately and consult with the Health & Safety Officer before resuming work.

SITE EMERGENCY / CONTINGENCY PLAN CONT'D:

FIRST AID:

The safety of employees working around construction/sampling equipment should be maintained at all times. In the event that an injury or accident occurs, a first aid kit must be kept on the site within a reasonable distance of personnel at all times. GeoLogic employees will have basic first aid and basic CPR training.

Seek emergency medical attention as soon as possible when appropriate. Directions to the nearest emergency medical facility and emergency phone numbers are provided below.

FIRE:

Emergency contact information for fire response is provided below.

SITE SECURITY:

None

EMERGENCY CONTACT	DESCRIPTION	PHONE
Police		911
Fire Department		911
Ambulance		911
Hospital	UHS/Wilson General Hospital	607-762-2200
Poison Control Center	Nationwide	800-222-1222
NYSDEC Spill Hotline	Spills must be reported within 2 hours of their discovery	800-457-7362
Medical Consultant	Industrial Medical Associates	315-478-1977

MEDICAL EMERGENCY:

UHS/Wilson General Hospital, 10-42 Mitchell Avenue, Binghamton, NY the closest acute care facility to the site. Directions are provided below and a map is provided in Section 12.

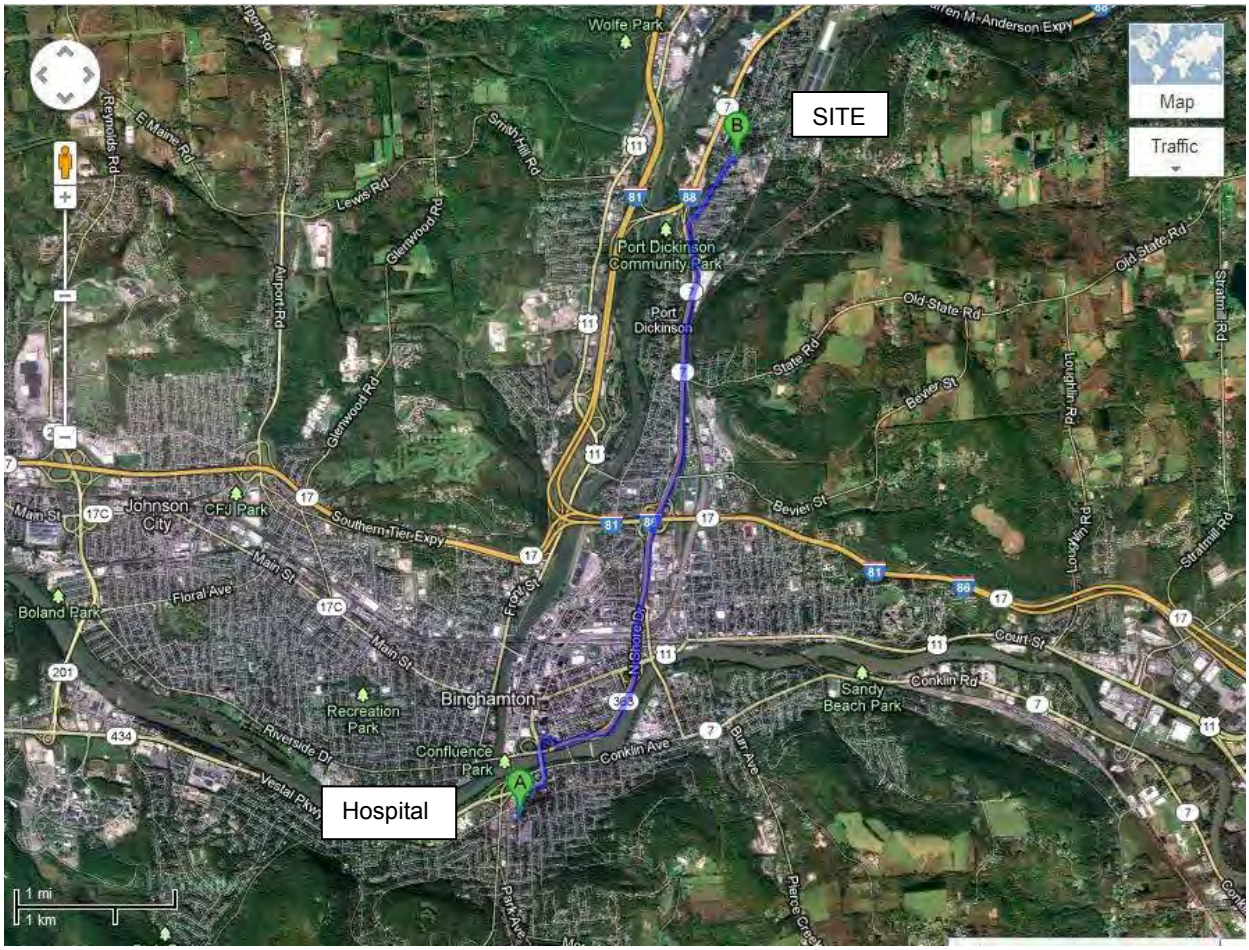
1. Direction to Hospital:
2. Exit Site on to Nowlan Road, heading west
3. Turn left on to Chenango Street at stop sign, proceeding about 0.6 miles to traffic signal.
4. Proceed straight through traffic signal taking first left hand turn onto West Service Road.
5. Stay straight on W. Service Road through intersection with stop sign
6. Enter onto NYS Route 7, heading south.
7. Merge left onto Route 363
8. Merge left on to Route 434W toward Vestal
9. Take a left onto S. Washington Street
10. Take first right onto Vestal Avenue
11. Take first left onto Mitchell Avenue
12. Follow signage into emergency care unit of hospital.

EVACUATION:

In the event of a situation requiring emergency evacuation of the site such as a contaminant release above the highest action levels or an underground gas line break, the following procedures should be followed:

1. Activate emergency stop feature on operating equipment
2. Notify all personnel of the need to leave the site immediately
3. Immediately walk up wind, if a contaminate release has occurred.
4. Contact emergency services / personnel

12. MAP TO HOSPITAL: UHS/Wilson General Hospital
10-42 Mitchell Avenue
Binghamton, New York



13. TRAINING AND PLAN ACKNOWLEDGEMENT:

Any GeoLogic personnel working at this Site, that is involved in the identified tasks must have completed the basic 40-hour OSHA health and safety training course with respirator fit testing and, if applicable, the supplemental yearly 8-hour refresher courses.

GeoLogic personnel authorized to work at this Site include:

CREW MEMBER	RESPONSIBILITIES	SIGNATURE

14. SITE MAP: